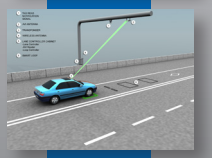
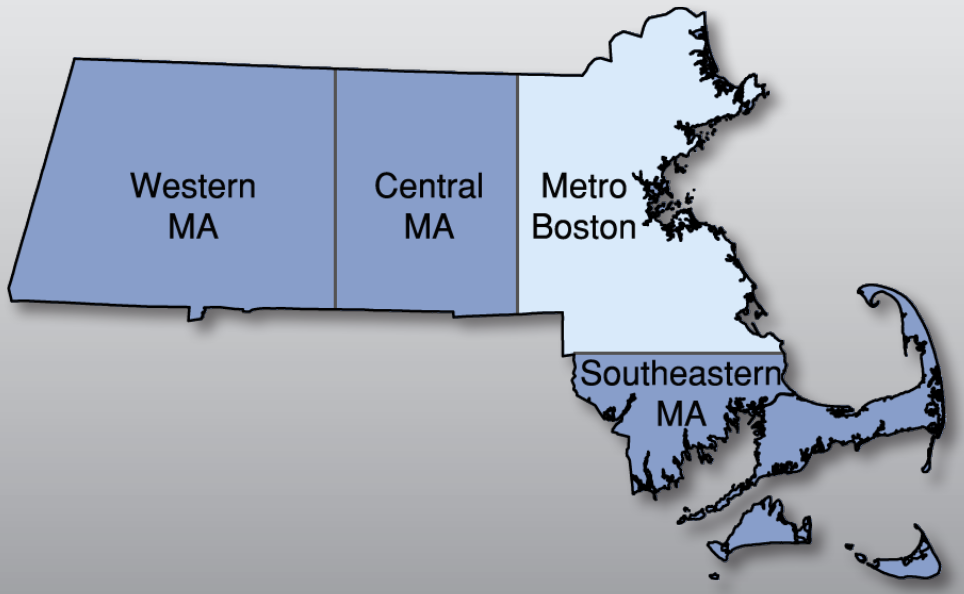


Commonwealth of Massachusetts

REGIONAL ITS ARCHITECTURE FOR METROPOLITAN BOSTON



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FINAL REPORT

December 2011

DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

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16. Abstract

This Final Report describes the Regional Intelligent Transportation System (ITS) Architecture for Metropolitan Boston. This Architecture was initially developed in 2005 to meet federal regulatory requirements. This report is the outcome of a periodic formal update to the Architecture defined as part of its required ongoing maintenance process. The discussion provides background information on ITS and ITS architectures, explains the collaborative process used in Metropolitan Boston to update the architecture, and presents the important outcomes of this initiative.

Intelligent Transportation Systems (ITS) encompass a broad range of advanced technologies in the field of transportation. ITS improves transportation safety, enhances productivity, and increases personal mobility through the integrated application of these technologies. To fully maximize the potential of ITS technologies, ITS deployment requires an approach to planning, implementation, and operations that emphasizes collaboration between relevant entities and compatibility/interoperability of individual systems. At the core of this process is an architecture that provides overall guidance to ensure coordination and integration of individual ITS deployment projects, without limiting stakeholder design options.

Key transportation stakeholders in the region provided extensive input in the update process. Their involvement included participating in meetings, reviewing project deliverables, and providing comments. Stakeholders identified several key changes to the architecture, including: changes reflecting the reorganization of state agencies into the Massachusetts Department of Transportation, changes to the National ITS Architecture, the addition of new stakeholders and initiatives, and changes reflecting evolving transportation needs and priorities. Out of this process, with the help of these stakeholders, came an up-to-date architecture that represents a vision of an advanced and integrated transportation system for the Metropolitan Boston region. This Regional ITS Architecture is available on the Commonwealth's website at http://www.mass.gov/RegionalITSArchitecture.

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The Project Team would like to acknowledge the efforts of the regional stakeholders and thank them for their ongoing support and participation throughout the architecture update process. With the many organizations represented at project meetings, this endeavor demonstrated the region's overwhelming commitment to improving transportation coordination in Metropolitan Boston. The Project Team greatly appreciates the work that was involved in updating the Metropolitan Boston Regional ITS Architecture to ensure its continued relevance and usefulness.

Disclaimer

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Massachusetts Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

TABLE OF CONTENTS (CONT'D)

LIST OF EXHIBITS (CONT'D)

EXECUTIVE SUMMARY

Introduction

This Final Report describes the Regional Intelligent Transportation System (ITS) Architecture for Metropolitan Boston. This Architecture was initially developed in 2005 to meet federal regulatory requirements. This report is the outcome of a periodic formal update to the Architecture defined as part of its required ongoing maintenance process. The discussion provides background information on ITS and ITS architectures, explains the collaborative process used in Metropolitan Boston to update the architecture, and presents the important outcomes of this initiative.

Intelligent Transportation Systems (ITS) encompass a broad range of advanced technologies in the field of transportation. ITS improves transportation safety, enhances productivity, and increases personal mobility through the integrated application of these technologies. Consistent with MassDOT's GreenDOT policy directive, ITS can also play an important role in fostering sustainability, by collecting the data necessary to inform transportation decision-making. To fully maximize the potential of ITS technologies, ITS deployment requires an approach to planning, implementation, and operations that emphasizes collaboration between relevant entities and compatibility and interoperability of individual systems. At the core of this process is an architecture that provides overall guidance to ensure coordination and integration of individual ITS deployment projects, without limiting stakeholder design options. This ITS architecture is a framework that defines the component systems and their interconnections. In addition, developing an ITS architecture offers three important benefits to the region: improved interagency coordination, cost savings for transportation operations, and better services to the traveling public.

The Commonwealth of Massachusetts, through the Massachusetts Department of Transportation (MassDOT), Office of Transportation Planning, has undertaken the development and maintenance of the Regional Intelligent Transportation Systems Architecture for Metropolitan Boston. The Project Team for this effort included the Office of Transportation Planning (OTP) assisted by its consultant, IBI Group.

Key transportation stakeholders in the region provided extensive input in the update process. Their involvement included participating in meetings, reviewing project deliverables, and providing comments. Many of these stakeholders also served on the Metropolitan Boston Regional ITS Planning and Coordination Committee, established at the start of this project. Stakeholders identified several key changes to the architecture, including: changes reflecting the reorganization of state agencies into the Massachusetts Department of Transportation, changes to the National ITS Architecture, the addition of new stakeholders and initiatives, and changes reflecting evolving transportation needs and priorities. Out of this process, with the help of these stakeholders, came an up-to-date architecture that represents a vision of an advanced and integrated transportation system for the Metropolitan Boston region. This Regional ITS Architecture is available on the Commonwealth's website at http://www.mass.gov/RegionalITSArchitecture.

Background

Technology has influenced almost every facet of modern living, and transportation is no exception. By now, most drivers have seen electronic tolling that allows appropriately equipped vehicles to speed through toll plazas instead of waiting in line to collect a ticket or pay a toll. Drivers are also familiar with electronic signs on highways that provide information, such as warnings of accidents and delays. In many areas, travelers are able to obtain information on traffic conditions and transit operations via the internet or by phone.

These are just a few examples of what are referred to as *Intelligent Transportation Systems*, or *ITS*. Other examples of ITS are less obvious to the everyday commuter: Traffic signal operators, transit

authorities, and public safety agencies have agreed to deploy compatible equipment so that buses and emergency vehicles can have priority when approaching a signalized intersection. Transit and other vehicles are equipped with Global Positioning Systems (GPS) so that their location can be known at all times. Some roadways have sensors installed so that potential icy conditions can be detected by a centralized monitoring system and appropriate measures can be implemented. All of these various examples have one thing in common: the use of technology to enhance productivity.

With the enactment of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), there was a policy shift from building roadways to seeking multimodal solutions to congestion and other problems. ISTEA specifically promoted ITS as a tool in the transportation planning toolbox. By 1998, however, when ISTEA was to be reauthorized, there was a concern that the deployment of ITS initiatives lacked coordination, leading to the duplication of efforts and incompatibility of systems. The new law, the Transportation Equity Act for the 21st Century (TEA-21), included a provision that called for the coordination of ITS investments.

In 2001, the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) issued guidance on how this federal law was to be implemented across the country. FHWA's rule, "Intelligent Transportation System Architecture and Standards" and FTA's "National ITS Architecture Policy on Transit Projects" established that any ITS project funded by the Highway Trust Fund, including the Mass Transit Account, has to be consistent with a *Regional ITS Architecture*, which is to be adapted from a national template.

In this context, the word "architecture" refers not to a plan of physical construction, such as the architecture of a building or city, but instead to the relationship between transportation-related systems and institutions. An ITS architecture covers how systems interface and interact, as well as the institutional relationships that are required to support these interfaces. A regional ITS architecture, therefore, describes how a set of stakeholders will share responsibility and information for the vast array of technologies and systems deployed in a region.

As an example, a traffic signal may be owned and maintained by the municipality in which it is located, but it may be operated by a state highway department if it is adjacent to a roadway in the state's jurisdiction. At the same time, the municipality may agree to allow fire trucks, police cars, ambulances, or transit vehicles to use technology that enables such vehicles to trigger a green light at the appropriate time. Quickly, one can see that the technical and institutional issues surrounding this single traffic signal involve a variety of interfaces, interactions, and responsibilities. Should the signal happen to be on or near the boundary with another municipality, it is easy to see how the complexity would increase dramatically. A regional ITS architecture is intended to help all of these institutions collaborate on the deployment and management of these systems.

Since 2001, the United States Department of Transportation (USDOT) has continued to provide guidance on the use and maintenance of Regional ITS Architectures and the application of systems engineering practices to transportation projects. Additionally, the Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU), signed in 2005, further supported ITS and ITS coordination through an emphasis on real-time systems management, surface transportation congestion relief, expansion of the Commercial Vehicle Information Systems and Network (CVISN) program, and extension of the Intelligent Transportation Infrastructure Program (ITIP). Given the investment in transportation technology and the benefits of coordination, maintaining and improving the regional ITS architectures remains a priority for local, state and federal transportation agencies.

Architecture Development and Update

As the traffic signal example illustrates, the architecture of a single element or system can be quite complex, and this complexity quickly escalates when all systems within a region are considered. To address this challenge, the USDOT created the *National ITS Architecture* as a resource for ITS

planning and implementation. The FHWA Rule and FTA Policy requires the use of the National ITS Architecture as a template in the development of regional ITS architectures.

The National ITS Architecture is not a system design or a plan for deployment; instead it is a model that provides a framework for ITS planning and integration. The building block of the National Architecture is a *market package*, which includes the set of components related to a specific function or "market," such as work zone management, parking facility management, demand-responsive transit operations, or emergency routing. For each of these market packages, the National Architecture includes all of the interagency linkages, or *interfaces*, considered likely. Because the National Architecture was designed to be comprehensive, a regional architecture should be a subset, including only those market packages and interfaces relevant to that region.

CONSTRUCTING THE ARCHITECTURE

Developing a regional ITS architecture involves customizing the National ITS Architecture to reflect regional circumstances. This includes generating an inventory of local ITS elements, both existing and planned, and identifying relevant market packages and interfaces. In Massachusetts, the process also requires addressing the complex question: what is *regional*? As Exhibit ES-1 illustrates, in 2005 the Commonwealth's 13 Metropolitan Planning Organization (MPO) planning areas were grouped into four regions for the purpose of creating regional ITS architectures.

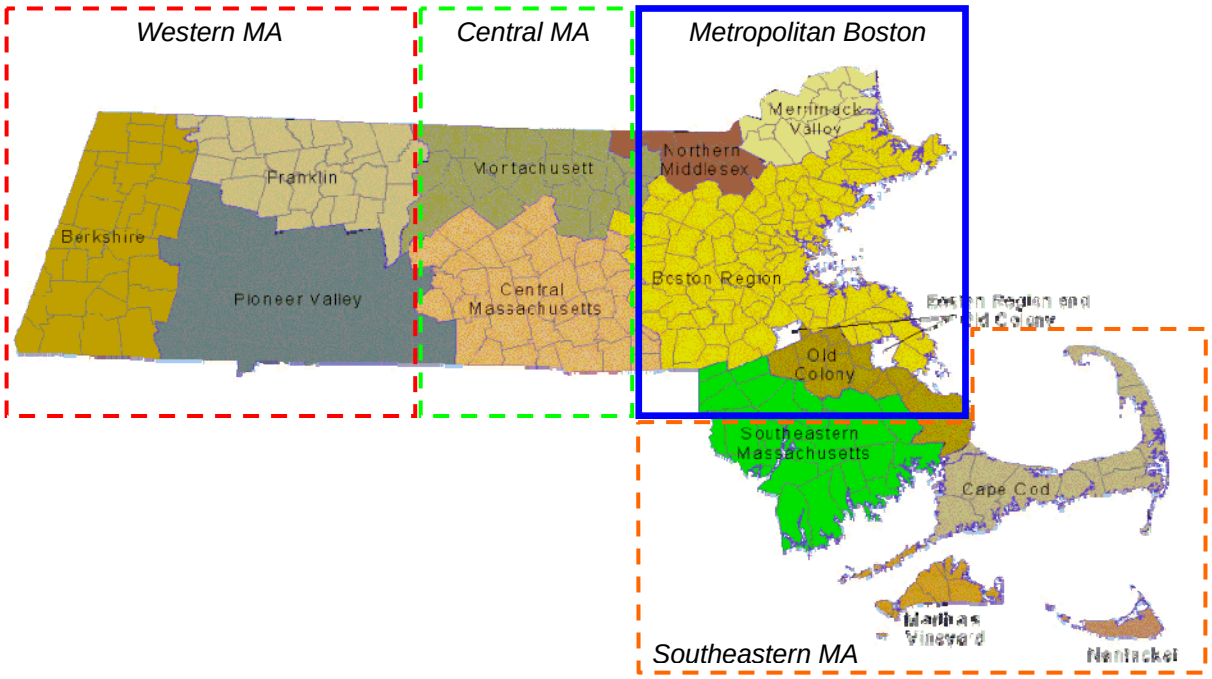

Exhibit ES-1: Study Regions

Metropolitan Boston was defined as the area generally within I-495, Boston's outer circumferential highway. Covering approximately 2,000 square miles, the region included the Boston, Northern Middlesex, and Merrimack Valley MPO planning areas, as well as portions of the Old Colony and Southeastern Massachusetts MPO planning areas.

In Metropolitan Boston, and the other three regions, regional transportation stakeholders collaborated in 2005 to simultaneously develop four regional ITS architectures encompassing the entire state. In each region, stakeholders provided extensive input in identifying regional

transportation needs, creating an inventory of existing and planned ITS elements, assembling relevant market packages and interfaces, and customizing the National ITS Architecture to fit the regional context. This information was then assembled into an architecture and made accessible via an interactive website. Thanks to stakeholder participation, each Regional ITS Architecture reflected the unique characteristics of its region and stakeholders.

In order to maintain the currency and relevance of the Regional ITS Architectures, OTP and stakeholders also developed an architecture maintenance plan. This maintenance plan identified methods for making minor interim modifications to the architecture to reflect evolving ITS implementation efforts. The maintenance plan also specified the need for periodic formal updates of the architecture. These maintenance procedures are described in greater detail in the "Working with the Architecture" section.

UPDATING THE ARCHITECTURE

In 2010, as part of its federally required ongoing maintenance process, OTP initiated its formal periodic update of the Regional ITS Architectures for all four regions including Metropolitan Boston. This formal update entailed a comprehensive review of the existing architecture and identification of the updates necessary to reflect changes in the National ITS Architecture, the reorganization of transportation agencies in Massachusetts, updated Regional Transportation Plans (RTPs), Transportation Improvement Programs (TIPs), and new transportation projects, plans, policies, procedures, and infrastructure implemented since 2005.

Expanding on the inclusiveness of the original architecture development process, the architecture update process invited additional stakeholders to participate in this effort. The Project Team also solicited the support and input of the recently established Regional ITS Planning and Coordination Committee for Metropolitan Boston. These regional transportation stakeholders were invited to participate by providing input, reviewing documents created by the Project Team, and providing guidance on the necessary updates to the architecture.

In the Metropolitan Boston region, numerous stakeholders were invited to participate in the update to the Regional ITS Architecture. These included regional planning agencies, regional transit authorities from the MassDOT – Rail and Transit Division, as well as other municipal, regional, state and federal agencies. These stakeholders are listed in Exhibit ES-2. In this report, the transit authorities from the MassDOT – Rail and Transit Division are referred to individually.

Exhibit ES-2: Regional ITS Architecture Stakeholders

Regional Planning Agencies ▪ Metropolitan Area Planning Council (MAPC) ▪ Merrimack Valley Planning Commission (MVPC) ▪ Northern Middlesex Council of Governments (NMCOG) ▪ Old Colony Planning Council (OCPC) ▪ Southeastern Regional Planning & Economic Development District (SRPEDD) **MassDOT Rail and Transit Division – Regional Transit Authorities** ▪ Brockton Area Transit (BAT) ▪ Cape Ann Transportation Authority (CATA) ▪ Greater Attleboro-Taunton Regional Transit Authority (GATRA) ▪ Lowell Regional Transit Authority (LRTA) ▪ Massachusetts Bay Transportation Authority (MBTA) ▪ Merrimack Valley Regional Transit Authority (MVRTA) ▪ MetroWest Regional Transit Authority (MWRTA) **Municipal/Regional Agencies, Authorities, Commissions, and Organizations** ▪ Boston Emergency Management Agency (BEMA) ▪ Boston Region Metropolitan Planning Organization (MPO) ▪ Boston Transportation Department (BTD) ▪ City of Boston ▪ City of Brockton ▪ City of Brookline ▪ City of Cambridge ▪ City of Newton ▪ Town of Framingham	**State Agencies** ▪ Department of Conservation and Recreation (DCR) ▪ Massachusetts Department of Transportation (MassDOT) ▪ Massachusetts Emergency Management Agency (MEMA) ▪ MassDOT – Highway Division ▪ Massachusetts Port Authority (Massport) ▪ Massachusetts State Police (MSP) ▪ MassDOT - Registry of Motor Vehicles (RMV) **Federal Agencies** ▪ Federal Highway Administration (FHWA) ▪ Federal Transit Administration (FTA) ▪ Federal Motor Carrier Safety Administration (FMCSA) ▪ United States Coast Guard

As part of the update process, the latest version of each MPO's RTP and TIP was reviewed and changes to the Regional ITS Architecture identified. A series of meetings were held to allow stakeholders to comprehensively update the region's ITS inventory, identifying the ITS-related initiatives that have already been deployed, those ready for implementation, and those still in the planning stages. During this needs analysis step, stakeholders also re-examined the region's broad transportation needs and priorities.

Based on this input, the Project Team began assembling recommended updates to the region's ITS elements and relevant market packages, and began customizing the latest version of the National ITS Architecture to regional circumstances. These recommended updates were reviewed at a meeting with regional transportation stakeholders that included a discussion of how input from the previous meetings had been distilled into the recommended updates. This prompted extensive

feedback from project stakeholders, both at the meeting and during the subsequent review period. The Project Team incorporated stakeholder comments into a finalized set of recommended updates to the Regional ITS Architecture. These updates were then implemented both to the architecture and to the architecture's interactive website. This formal update was completed in Fall 2011.

Needs Analysis Outcomes

During the needs analysis step, regional transportation stakeholders identified key regional needs for the Regional ITS Architecture. These findings helped shape the architecture to the unique circumstances of the Metropolitan Boston region.

Regional Needs

- Safety and Security
- Mobility Management
- Transit Management
- Information Sharing
- Communications Infrastructure
- Operations and Management
- Maintenance and Asset Management
- Access to ITS Data

The most significant changes that resulted from the comprehensive review of the 2005 architecture reflect the following:

- **Changes to the National ITS Architecture and Turbo Architecture**
  Since 2005, the National ITS Architecture has been updated to Version 6.1. This includes changes to existing market packages and information flows, new market packages and information flows, as well as a new version of the Turbo Architecture software (Version 5.0). For example, new market packages that are included in the updated Regional ITS Architectures include the following:
    - *APTS09 - Transit Signal Priority*
    - *APTS10 - Transit Passenger Counting*
    - *MC12 - Infrastructure Monitoring*

  Further information on the National ITS Architecture and its requirements is available online from the FHWA's ITS Architecture Implementation Program, which is located at http://www.ops.fhwa.dot.gov/its_arch_imp/index.htm.

- **The Creation of MassDOT**
  In 2009, Governor Deval Patrick signed a bill to create the new Massachusetts Department of Transportation (MassDOT) to consolidate and oversee the former highway, mass transit, aeronautics, and Registry of Motor Vehicles agencies. Because of the institutional reorganization, many elements of the regional architectures have been combined and renamed. For example, the MassHighway Traffic Operations Center (TOC) and the MassPike Operations Control Center (OCC) have been combined and renamed the MassDOT – Highway Division Highway Operations Center (HOC).

- **Addition of Stakeholders**
  Expanding on the inclusiveness of the original architecture development process, the update process involved inviting additional stakeholders to participate in this effort. For example, MetroWest Regional Transit Authority (MWRTA), which was established in 2006, has been added as a new stakeholder. The support and input of the recently established Regional ITS Planning and Coordination Committee for Metropolitan Boston was also solicited. These regional transportation stakeholders provided input, reviewed documents, and provided guidance on the necessary updates to the architecture.

- **Refined Needs**
  The Needs Analysis, which identified the regional ITS-related projects and needs, was revisited to ensure that the updated architecture would remain consistent with the evolving

needs and priorities of the region. Planning documents from the region, including RTPs and TIPs, were reviewed as part of the needs analysis. Further information was obtained through a series of meetings with regional transportation stakeholders.

- **Additional ITS Information**
  Updates to the architecture reflect information gathered from research on documents such as RTPs and TIPs, and stakeholder input on new transportation projects, plans, policies, procedures, and infrastructure implemented since 2005. Several additional market packages have also been identified for inclusion to the Regional ITS Architectures, including:
  - *CVO06 - Weigh-In-Motion*
  - *CVO07 - Roadside CVO Safety*
  - *EM05 - Transportation Infrastructure Protection*

  Stakeholder participation was critical in identifying updates. An initial draft of recommended updates to the architecture was developed based on a revised inventory of ITS elements and from stakeholder input at project meetings. These recommendations were reviewed at a meeting with regional transportation stakeholders, prompting extensive feedback that was incorporated into a finalized set of recommended updates to the Regional ITS Architecture.

This report also includes a chapter on an updated Operational Concept for the region reflecting changes in interagency interfaces. The Implementation Plan chapter in this report has been updated to reflect the current status of planned ITS initiatives. The architecture and the Final Report will continue to serve as an important input into future regional and statewide ITS strategic planning efforts.

Throughout this update process, transportation stakeholders have focused on producing an ITS architecture that accurately reflects regional needs and priorities. For ease of use and reference, the Regional ITS Architecture for Metropolitan Boston has been made available in an interactive format on the internet. The interface allows a user to view the architecture in multiple ways and varying levels of detail. The architecture is available on the Commonwealth's website at http://www.mass.gov/RegionalITSArchitecture.

BUILDING ON THE ARCHITECTURE

The Regional ITS Architecture for Metropolitan Boston was constructed with extensive input from stakeholders throughout the region. Having an architecture, however, is often only the first step in planning, deploying and coordinating regional ITS initiatives. Building on the architecture, regional stakeholders have also developed an *Operational Concept* and an *Implementation Plan.*

Operational Concept

An Operational Concept describes the institutional relationships that must be established in order to address the interagency interfaces defined in the architecture. The purpose of the Operational Concept is to define the roles and responsibilities of stakeholders in the implementation and operation of component systems of the architecture. The Operational Concept details the requirements of each interagency interface defined in the architecture, addressing the information to be exchanged, the roles of interfacing stakeholders, and the operational agreements that will be required.

The Final Report presents the Operational Concept as an inventory of all the interagency interfaces. Because there are hundreds of interfaces, the inventory is organized by function, such as roadway management or emergency management. The Operational Concept chapter of this report also

includes an analysis of current and future interagency relationships that might benefit from formalization through interagency agreements, samples of which are included in Appendix F.

Implementation Plan

The Implementation Plan provides a strategy for achieving the integrated transportation system envisioned by the architecture. The Implementation Plan addresses the planned components of the architecture, identifying a series of initiatives that can be undertaken to implement these components. The Implementation Plan also considers prioritization of identified multi-agency initiatives, identifying candidates for near-term and longer-term implementation. This prioritization is based on the needs analysis, the input received from the stakeholders throughout the architecture development process, and interdependencies among the initiatives.

In 2005, stakeholders identified several near-term initiatives for implementation. Some of these initiatives, such as the Event Reporting System, the expansion of MIVIS, and the 511 Traveler Information System, have already been implemented. Other initiatives, such as the interagency communications network, transit signal priority for the MBTA buses, and Electronic Toll Collection (ETC) integration at MBTA parking facilities have also progressed since 2005. The need for some of these recommended near-term initiatives have also changed since 2005. For example, the interface between the MassHighway and MassPike Operations Centers is no longer necessary since these two control centers have since been combined into the consolidated MassDOT – Highway Division Highway Operations Center (HOC). The Implementation Plan chapter of this report updates the current status of these recommended initiatives. The updated Regional ITS Architecture will also serve as an important input into future regional and statewide ITS strategic planning efforts.

WORKING WITH THE ARCHITECTURE

The FHWA Rule and FTA Policy include two important provisions that focus on how ITS and the Regional ITS Architecture can be integrated into the mainstream transportation planning process. First, the FHWA Rule and FTA Policy state that federal approval and funding cannot be given to a project with ITS elements unless it is consistent with the architecture. Second, the FHWA Rule and FTA Policy require that before the architecture is completed, there must be a process put in place for maintaining the architecture in the future, as needs evolve and implementation continues. To address these requirements, plans for ensuring project consistency and for maintaining the architecture have been developed.

Consistency

The United States Department of Transportation is responsible for ensuring that federal transportation dollars are used in a manner that is consistent with federal laws and regulations, including the Clean Air Act, the Americans with Disabilities Act, and others. As stated in the 2001 FHWA Rule and FTA Policy:

> "The final design of all ITS projects funded with highway trust funds shall accommodate the interface requirements and information exchanges as specified in the regional ITS architecture. If the final design of the ITS project is inconsistent with the regional ITS architecture, then the regional ITS architecture shall be updated."[1]

In plain terms, this regulatory language means that if a stakeholder makes a commitment in the architecture, such as sharing the data generated by a system it plans to deploy in the future, then when it actually begins developing that element as a part of a project, the project should be consistent with the architecture. Consistency may be a matter of technical design or a matter of institutional coordination but the requirement essentially says that commitments should be honored.

[1] Federal Highway Administration "Intelligent Transportation System Architecture and Standards; Final Rule" and Federal Transit Administration "National ITS Architecture Policy on Transit Projects; Notice" in Federal Register volume 66 number 5, Monday, January 8, 2001.

The language is very clear, however, that if there is a conflict, the architecture should be updated to accommodate the project.

Based on the FHWA Rule and FTA Policy, the Project Team and project stakeholders developed a process for ensuring that consistency between projects with ITS elements and the Regional ITS Architecture would be addressed in the course of the existing regional transportation planning process. This process reflects the intent of the FHWA Rule and FTA Policy that the relationship between a project and the architecture should be considered early and often and that collaboration and cooperation among partners should be maximized.

As noted, a major objective in addressing the consistency requirement was to develop a process that could be integrated seamlessly into the mainstream transportation planning process. As such, the process relies on existing collaborative relationships between each MPO and its local planning partners. This approach ensures that before a project reaches the TIP, the FHWA Rule and FTA Policy's intent of examining consistency early and often and maximizing collaboration will be fulfilled. In turn, when each MPO submits its TIP to the Massachusetts Department of Transportation and when MassDOT submits the Statewide TIP to FHWA and FTA, all parties will be comfortable that the consistency requirement has been addressed.

In addition to this initial review in the early stages of the project development process, consistency with the architecture must be revisited as a project develops further in order to ensure that it has not been affected by changes to the scope of the project. Moreover, as a project progresses into the design stage, it must undergo a systems engineering analysis, as is typical of ITS projects and as is required by the FHWA Rule and FTA Policy.

The bottom line is that by examining consistency early and often during the planning process and by maximizing collaboration and cooperation – all within the context of existing practices – the region can avoid any delays to federal funding and approval.

Maintenance

The Regional ITS Architecture is a vision of the future transportation system, documented at one point in time. The architecture, like an MPO's RTP, reflects the current situation and documents planned changes or investments. However, in order to remain relevant, the architecture has to be maintained. As regional needs evolve, as planned elements are deployed, and as other changes occur, the architecture must be updated to reflect those developments. Maintenance of the architecture is also motivated by federal requirements that require consistency between all federally funded projects with ITS elements and the Regional ITS Architecture.

The OTP is responsible for the maintenance of the architecture. However, other stakeholders continue to be involved, as they have been throughout the development process. The maintenance strategy relies on two elements:

- Periodic Architecture Updates

  The maintenance strategy calls for the Regional ITS Architecture to be formally assessed at the same frequency as an MPO's RTP (currently a four-year cycle). Since the RTPs will provide valuable input to the architecture, assessing the architecture will be staggered to occur after the RTP update. In this way, it is expected that the assessment of the architecture can incorporate new ideas and/or projects that are included in an updated RTP.

  The OTP will formally assess the Regional ITS Architecture to determine whether significant changes in ITS deployment in the region merit a formal update to the architecture. Based on this assessment, OTP may initiate a formal update to the architecture with a request for information from stakeholders in the region regarding new ITS-related projects, initiatives, or needs. OTP may also gather information from the stakeholders in order to evaluate the status

of the architecture's implementation, identifying, for example, ITS elements or interfaces that have evolved from "planned" to "existing" or that are no longer relevant and should be removed.

Based on the information gathered through this process, OTP will generate a draft list of architecture modifications and distribute it to the stakeholders for review. OTP can then call a stakeholder meeting for the region to review the draft list. This meeting can also provide an opportunity to discuss emerging ITS issues. After the stakeholder review of the draft list, OTP will make any modifications necessary and release the updated architecture. It was as part of this periodic update process that the Regional ITS Architecture for Metropolitan Boston was formally updated.

- Interim Architecture Modifications

The strategy also calls for interim architecture modifications that may occur at any point in the update cycle, outside of the periodic update process. Just as project developments necessitate TIP amendments, it is anticipated that some modifications to the architecture will be needed during the interval between periodic updates. Therefore, on the basis of project developments or other circumstances that require modifications, the project proponent will be responsible for drafting an architecture modification proposal and submitting it to OTP. The proposal will then be circulated to affected stakeholders for their review. It is expected that most architecture modifications, whether periodic or interim, will involve adding new ideas, dimensions, or stakeholders to existing market packages, interfaces, or functions.

Conclusion

The Regional ITS Architecture for Metropolitan Boston is the result of the significant efforts and contributions of the participants in the process and it provides a strong foundation and opportunity for moving forward with ITS planning, implementation, and coordination in the region. The process of developing and updating the architecture was motivated by federal requirements and by the benefits of having a regional ITS architecture.

The first of these benefits is improved interagency coordination. The architecture development process represents a significant step towards coordinating ITS planning in the region by bringing together a diverse stakeholder group. The subsequent architecture update stakeholder meetings and the recent establishment of the Regional ITS Planning and Coordination Committee have continued to demonstrate the benefits of interagency information exchange regarding ongoing ITS initiatives occurring throughout the Commonwealth.

The second benefit is cost savings. For example, coordination of investments and consideration of standards for interagency interfaces offer opportunities for cost savings, especially in terms of long-term maintenance and operational costs.

The third benefit is better services for the traveling public. The public has the potential to benefit from this process, as the architecture addresses needs and priorities that cut across jurisdictional lines and that are not able to be addressed through single-agency initiatives. The framework outlined by the architecture is for a regional transportation system that can provide the public with a seamless and consistent travel experience across multiple jurisdictions.

To fully maximize the benefits of the regional ITS architecture, the architecture must remain current, relevant, and useful to transportation stakeholders.

RECOMMENDATIONS

Through the process of updating the Regional ITS Architecture, a number of recommendations should be considered as the region continues to move forward with deployment of ITS:

- The stakeholder organizations that are represented in the Regional ITS Planning and Coordination Committee, as well as other relevant ITS stakeholders, should continue to meet and remain involved, not only in the maintenance of the architecture, but also in planning and coordinating ITS in the region. The benefits that this group has realized in working together on the architecture should be built upon and expanded to other regional and statewide ITS planning and coordination efforts.

- The Regional ITS Architecture should continue to be regularly updated to reflect the changing needs and priorities of the region. Because the initial architecture was forward-looking, few interim changes were necessary between 2005 and 2011. However, cumulative changes at the local, state, and national level have required a significant level of effort to be expended in formally updating the architecture. To make this work with the existing transportation planning process, it is recommended that the architecture be regularly assessed to determine if a formal update is necessary to reflect the needs identified in RTPs in the region. In addition, informal updates to ensure consistency with newly proposed projects should be done on an as-needed basis.

- Many of the multi-agency ITS initiatives identified by regional stakeholders in 2005 have progressed, while others are no longer relevant. The Regional ITS Architecture should serve as an important input to future local, regional, and statewide ITS strategic planning efforts. In particular, the architecture should be used to help identify multi-agency ITS initiatives that reflect the current needs and priorities of the region.

- Transportation stakeholders should continue to be trained and educated regarding ITS architecture consistency. While the understanding of and familiarity with the architecture has grown considerably in recent years, new transportation stakeholders and changes in organizational personnel necessitate ongoing education and outreach efforts. The Regional ITS Planning and Coordination Committees may be able to assist in identifying areas of education and outreach that should be pursued. This education and outreach effort will help further mainstream ITS architecture consistency into the existing MPO transportation planning process.

- Formal agreements should be established for the existing and planned interagency interfaces identified in the architecture. Existing informal agreements should be formalized in order to ensure that their benefits are maintained. Operational agreements for new interfaces should be drawn up as these new interfaces are established. Additionally, existing operational agreements should be reexamined in light of the reorganization of state transportation agencies to ensure that these agreements remain relevant. Proper documentation of interagency agreements helps facilitate interagency coordination and the successful long term operation of the transportation network.

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1. INTRODUCTION

This Final Report describes the Regional Intelligent Transportation System (ITS) Architecture for Metropolitan Boston. This Architecture was initially developed in 2005 to meet federal regulatory requirements. This report is the outcome of a periodic formal update to the Architecture defined as part of its required ongoing maintenance process. The discussion provides background information on ITS and ITS architectures, explains the collaborative process used in Metropolitan Boston to update the architecture, and presents the important outcomes of this initiative.

Intelligent Transportation Systems (ITS) encompass a broad range of advanced technologies in the field of transportation. ITS improves transportation safety, enhances productivity, and increases personal mobility through the integrated application of these technologies. Consistent with MassDOT's GreenDOT policy directive, ITS can also play an important role in fostering sustainability, by collecting the data necessary to inform transportation decision-making. To fully maximize the potential of ITS technologies, ITS deployment requires an approach to planning, implementation, and operations that emphasizes collaboration between relevant entities and compatibility/interoperability of individual systems. At the core of this process is an architecture that provides overall guidance to ensure coordination and integration of individual ITS deployment projects, without limiting stakeholder design options. This ITS architecture is a framework that defines the component systems and their interconnections. In addition, developing an ITS architecture offers three important benefits to the region: improved interagency coordination, cost savings for transportation operations, and better services to the traveling public.

The Commonwealth of Massachusetts, through the Massachusetts Department of Transportation, Office of Transportation Planning, has undertaken the development and maintenance of the Regional Intelligent Transportation Systems Architecture for Metropolitan Boston. The Project Team for this effort included the Office of Transportation Planning (OTP) assisted by its consultant, IBI Group.

Key transportation stakeholders in the region provided extensive input in the update process. Their involvement included participating in meetings, reviewing project deliverables, and providing comments. Many of these stakeholders also served on the Metropolitan Boston Regional ITS Planning and Coordination Committee, established at the start of this project. Stakeholders identified several key changes to the architecture, including: changes reflecting the reorganization of state agencies into the Massachusetts Department of Transportation, changes to the National ITS Architecture, the addition of new stakeholders and initiatives, and changes reflecting evolving transportation needs and priorities. Out of this process, with the help of these stakeholders, came an up-to-date architecture that represents a vision of an advanced and integrated transportation system for the Metropolitan Boston region. This Regional ITS Architecture is available on the Commonwealth's website at http://www.mass.gov/RegionalITSArchitecture.

One of the most significant changes impacting the regional architectures has been the institutional reorganization of major statewide transportation agencies including the former highway, mass transit, aeronautics, and Registry of Motor Vehicles agencies into the new Massachusetts Department of Transportation (MassDOT). The primary result is that many elements of the regional architectures have been combined and renamed.

This report documents the Regional ITS Architecture for Metropolitan Boston, including both its process and its outcome. The report serves as a complement to the CD-ROM included in Appendix A, which presents the architecture in an interactive format. More information on the CD, including instructions on navigating the architecture, is provided in Chapter 4 of this report.

1.1 Background

The development of a regional ITS architecture is part of the federal requirements meant to encourage regional integration of transportation systems. ITS has a history that predates the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA), but that landmark federal legislation ushered in an era of transportation planning and programming that placed greater emphasis on regional systems analysis, interagency collaboration, and multimodal thinking. It also explicitly marked the end of the interstate highway era, which had produced over 40,000 miles of interstate since the mid-1950s. With limited ability to expand capacity, many metropolitan areas began looking for ways to better utilize existing infrastructure, a task for which ITS is ideally suited.

Throughout the 1990s, the U.S. Department of Transportation (USDOT) guided the development of ITS through the National ITS Program, which addressed three main areas: research, field testing, and deployment support. The first two of these areas covered specific projects and initiatives. Research initiatives included projects such as ITS analysis and technology development efforts, while field projects included operational tests such as the ITS Priority Corridors Program. In contrast, deployment support focused more generally on ITS planning, specifically through the Early Deployment Planning Program. This program assisted in the development of numerous strategic deployment plans, which provided recommended approaches for deployment of ITS to address regional needs.

Building on the initiatives established in ISTEA, the Transportation Equity Act for the 21st Century (TEA-21) was enacted in 1998. TEA-21 included a requirement for ITS projects funded through the highway trust fund, including the mass transit account, to conform to the National ITS Architecture and applicable standards. In January 2001, an FHWA Rule and FTA Policy were published that implemented the ITS architecture requirement of TEA-21. The FHWA Rule and FTA Policy require that any ITS project funded with highway trust funds, including the mass transit fund, be consistent with the relevant regional ITS architecture.

In this context, the word “architecture” refers not to a plan of physical construction, such as the architecture of a building or city, but instead to the relationship between transportation-related systems and institutions. An ITS architecture covers how systems interface and interact, as well as the institutional relationships that are required to support these interfaces. A regional ITS architecture, therefore, describes how a set of stakeholders will share responsibility and information for the vast array of technologies and systems deployed in a region.

The FHWA Rule and FTA Policy also require that all ITS projects be based on a systems engineering analysis. Such an analysis is typical of any transportation engineering project involving the application of advanced technology. For reference, including further information on the systems engineering requirement, the FHWA Rule and FTA Policy are attached in Appendices B and C, respectively.

Since 2001, the United States Department of Transportation (USDOT) has continued to provide guidance on the use and maintenance of Regional ITS Architectures and the application of systems engineering practices to transportation projects. Additionally, the Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU), signed in 2005, further supported ITS and ITS coordination through an emphasis on real-time systems management, surface transportation congestion relief, expansion of the Commercial Vehicle Information Systems and Network (CVISN) program, and extension of the Intelligent Transportation Infrastructure Program (ITIP). Given the investment in transportation technology and the benefits of coordination, maintaining and improving the regional ITS architectures remains a priority for local, state and federal transportation agencies.

The Regional ITS Architecture for Metropolitan Boston was originally developed in 2005. This most recent update of the architecture was completed in Fall 2011 and is based on Version 6.1 of the

National ITS Architecture. Further information on the National ITS Architecture and its requirements is available online from the FHWA's ITS Architecture Implementation Program, which is located at http://www.ops.fhwa.dot.gov/its_arch_imp/index.htm. As a further aid, Appendix D provides a glossary of architecture terms from the National ITS Architecture.

1.2 Benefits

Although the Metropolitan Boston Regional ITS Architecture was developed to satisfy federal requirements, there are a number of other benefits that result from having this architecture for the region:

- **Improved Interagency Coordination:** One important benefit is improved interagency coordination, which is essential for integration of ITS within the region and for the transportation system as a whole. The architecture development and its subsequent updates provide an opportunity for stakeholder organizations to find out what others are doing in terms of ITS. The architecture process also includes the definition of operational concepts for interagency interfaces, as well as recommendations for agreements among organizations.

- **Cost Savings:** Cost savings are another potential benefit of the regional architecture. The primary means of lowering costs is the coordination of capital investment among stakeholder organizations, which reduces duplication of effort and allows more efficient investment. This coordination can result in lower overall costs for the stakeholder organizations in the region. Another means is through adherence to standards. Adoption of standards can result in long-term maintenance cost savings, since standards allow competition among ITS industry suppliers, leading to lower costs for operating agencies. Use of standards also facilitates future system upgrades and expansion by reducing the potential for obsolescence.

- **Improved Services to the Public:** The regional architecture will help agencies in the region provide better services to the public, specifically in terms of consistency across agency jurisdictions. An example of this is provision of multimodal traveler information, which requires coordination by multiple agencies. Another example is interoperability of electronic toll collection systems or transit fare cards, which requires technical and institutional agreements. The role of the architecture is to define the requirements for this institutional coordination, with the goal of a seamless transportation experience for the end user.

1.3 Definition of the Region

This Regional ITS Architecture for Metropolitan Boston covers the study area shown in Exhibit 1-1. In addition to the Metropolitan Boston region, regional ITS architectures were also developed for the regions of Southeastern, Central, and Western Massachusetts, ensuring that all parts of the Commonwealth are covered by a regional ITS architecture.

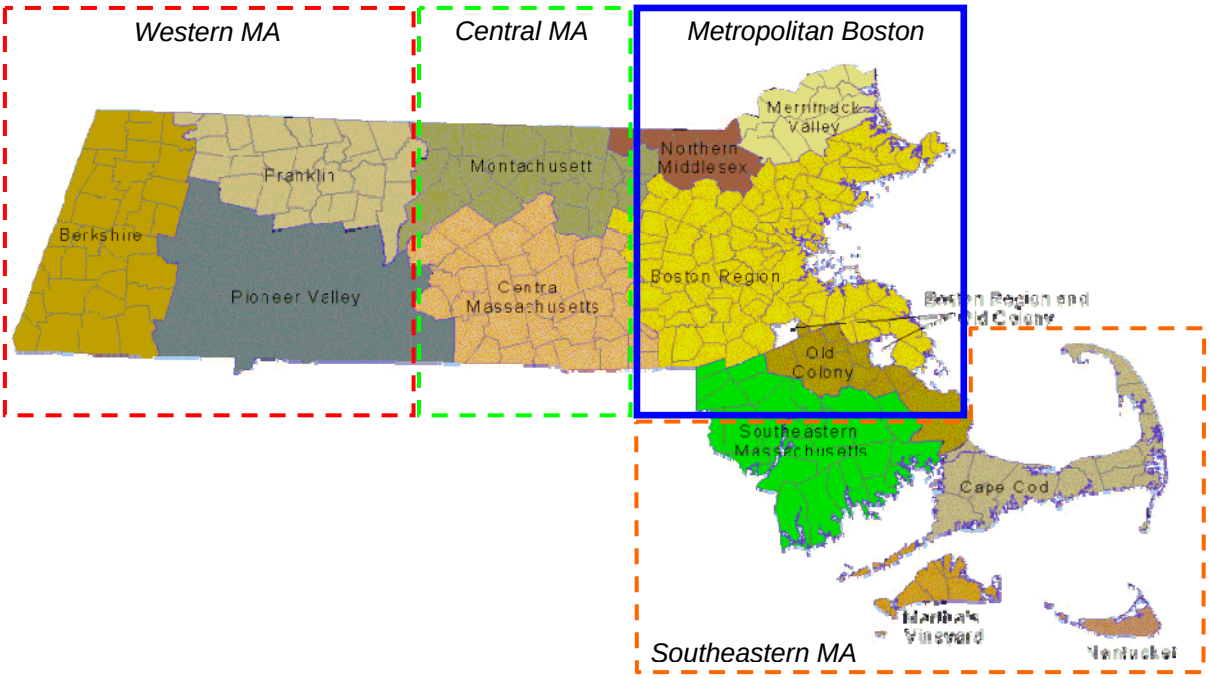

Exhibit 1-1: Study Region

For the purposes of this study, Metropolitan Boston was defined as the area generally within I-495, Boston's outer circumferential highway. Covering approximately 2,000 square miles, the study region includes Boston, Northern Middlesex, and Merrimack Valley Metropolitan Planning Organization (MPO) planning areas, as well as portions of the Old Colony and Southeastern Massachusetts MPO planning areas.

1.4 Development Process

The process undertaken for the original development of the Regional ITS Architecture for Metropolitan Boston is illustrated in Exhibit 1-2.

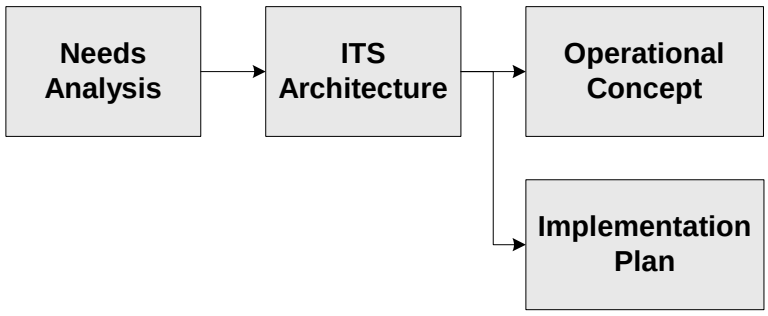

Exhibit 1-2: Architecture Development Process

The first step of this process was the ***Needs Analysis***, which identified the ITS-related projects and needs of the operating and planning agencies in the region. This analysis served as the basis for the development of the functional requirements of the ITS Architecture and its component systems, developed in the following step.

The next step in the process was the development of the ***ITS Architecture***, which defines the existing and planned component systems and interfaces among them.

Following completion of the architecture, an ***Operational Concept*** was developed. The Operational Concept described the institutional relationships that must be established in order to address the interagency interfaces defined in the architecture. The Operational Concept detailed the requirements of each interagency interface in the architecture, and addressed the information to be exchanged, the roles of the interfacing agencies, and the operational agreements that will be required.

The final piece of the architecture development process was the development of the ***Implementation Plan***, which identified a series of initiatives that could be undertaken to implement components of the architecture. The Implementation Plan also considered prioritization of the identified multi-agency initiatives, identifying candidates for near-term and longer-term implementation.

1.5 Update Process

In 2010, as part of its federally required ongoing maintenance process, OTP initiated its formal periodic update of the Regional ITS Architectures for Metropolitan Boston. This formal update entailed a comprehensive review of the existing architecture and identification of the updates necessary to reflect changes in the National ITS Architecture, the reorganization of transportation agencies in Massachusetts, updated RTPs, TIPs, and new transportation projects, plans, policies, procedures, and infrastructure implemented since 2005.

Expanding on the inclusiveness of the original architecture development process, the architecture update process invited additional stakeholders to participate in this effort. The Project Team also solicited the support and input of the recently established Regional ITS Planning and Coordination Committee for Metropolitan Boston. These regional transportation stakeholders were invited to participate by providing input, reviewing documents created by the Project Team, and providing guidance on the necessary updates to the architecture.

The update process revisited the ***Needs Analysis***, which identified the broad transportation needs of the operating and planning agencies in the region. This approach ensured that the updated architecture would remain consistent with the evolving needs and priorities of the region. Planning documents from the region, including Regional Transportation Plans (RTPs) and Transportation Improvement Programs (TIPs), were reviewed as part of the needs analysis. Further information was obtained through a series of meetings with regional transportation stakeholders.

In the Metropolitan Boston region, numerous stakeholders were invited to participate in the update to the Regional ITS Architecture. These included regional planning agencies, regional transit authorities from the MassDOT – Rail and Transit Division, as well as other municipal, regional, state and federal agencies. Stakeholder involvement is further discussed in Chapter 2.

The next step in the update process was the development of recommended updates to the ***ITS Architecture***. Based on input from the Needs Analysis, the Project Team began assembling recommended updates to the region's ITS elements, relevant market packages, and customizing the latest version of the National ITS Architecture to regional circumstances. These recommended updates were reviewed at a meeting with regional transportation stakeholders that included a discussion of how input from the previous meetings had been distilled into the recommended updates. This prompted extensive feedback from project stakeholders, both at the meeting and during the subsequent review period. The Project Team incorporated stakeholder comments into a finalized set of recommended updates to the Regional ITS Architecture. These updates were then implemented both to the architecture and to the architecture's interactive website. This formal update was completed in Fall 2011.

As part of the update process, this report includes a chapter on an updated ***Operational Concept*** for the region reflecting changes in interagency interfaces. The ***Implementation Plan*** chapter in this report has also been updated to reflect the current status of planned ITS initiatives. The architecture and this Final Report will continue to serve as an important input into future regional and statewide ITS strategic planning efforts.

1.6 Organization of the Report

This Final Report details the process undertaken in the development and update of the Regional ITS Architecture for Metropolitan Boston, and provides the results and recommendations from each of the steps of this process. The remainder of the report is structured as follows:

- Chapter 2 discusses the stakeholder involvement process.
- Chapter 3 presents the results of the updated Needs Analysis.
- Chapter 4 discusses the Regional ITS Architecture and website.
- Chapter 5 presents the Operational Concept.
- Chapter 6 presents the Implementation Plan.
- Chapter 7 discusses architecture maintenance and project consistency.
- Finally, Chapter 8 presents conclusions from the architecture update process.

2. STAKEHOLDER INVOLVEMENT

To ensure that a regional ITS architecture fully addresses the needs of a region, the architecture development process requires input and participation from numerous agencies, organizations, and other stakeholders. The stakeholders in this process include entities involved in planning or operating transportation systems in the region. This chapter identifies these stakeholders and describes their involvement in the architecture update process.

2.1 Project Stakeholders

Expanding on the inclusiveness of the original architecture development process, the architecture update process invited additional stakeholders to participate in the effort. The Project Team also solicited the support and input of the recently established Regional ITS Planning and Coordination Committee for Metropolitan Boston. These regional transportation stakeholders were invited to participate by providing input, reviewing documents created by the Project Team, and providing guidance on the necessary updates to the architecture. For reference, Appendix E lists the names and affiliations of the meeting attendees from the 2010 update process.

In the Metropolitan Boston region, numerous stakeholders were invited to participate in the update to the Regional ITS Architecture. These included regional planning agencies, regional transit authorities from the MassDOT – Rail and Transit Division, as well as other municipal, regional, state and federal agencies. In this report, the transit authorities from the MassDOT – Rail and Transit Division are referred to individually. The following stakeholders were invited to participate in the update process:

- **Regional Planning Agencies**
  - Metropolitan Area Planning Council (MAPC)
  - Merrimack Valley Planning Commission (MVPC)
  - Northern Middlesex Council of Governments (NMCOG)
  - Old Colony Planning Council (OCPC)
  - Southeastern Regional Planning & Economic Development District (SRPEDD)
- **MassDOT – Rail and Transit Division: Regional Transit Authorities**
  - Brockton Area Transit (BAT)
  - Cape Ann Transportation Authority (CATA)
  - Greater Attleboro-Taunton Regional Transit Authority (GATRA)
  - Lowell Regional Transit Authority (LRTA)
  - Massachusetts Bay Transportation Authority (MBTA)
  - Merrimack Valley Regional Transit Authority (MVRTA)
  - MetroWest Regional Transit Authority (MWRTA)
- **State Agencies**
  - Department of Conservation & Recreation (DCR)
  - MassDOT – Office of Transportation Planning (OTP)
  - Massachusetts Emergency Management Agency (MEMA)
  - Massachusetts Port Authority (Massport)
  - Massachusetts State Police (MSP)
  - MassDOT - Registry of Motor Vehicles (RMV)
  - MassDOT – Highway Division
- **Municipal/Regional Agencies, Authorities, Commissions, and Organizations**
  - Boston Emergency Management Agency (BEMA)
  - Boston Transportation Department (BTD)
  - Central Transportation Planning Staff (CTPS), technical staff to the Boston MPO

- City of Boston
- City of Brockton
- City of Brookline
- City of Cambridge
- City of Newton
- Town of Framingham

- **Federal Agencies**
  - Federal Highway Administration (FHWA)
  - Federal Transit Administration (FTA)
  - Federal Motor Carrier Safety Administration (FMCSA)
  - U.S. Coast Guard

2.2 Participant Meetings

Regional stakeholder meetings were held to review and provide input for each phase of the update process. While participation by the invited stakeholders varied, the participants in the meetings represented a broad cross-section of the organizations listed above. At each stage the stakeholders reviewed project documents and provided input. In addition, a number of smaller group meetings with organizations and individuals were also held during the update process to assist in information collection. The following meetings were held as part of the architecture update process:

- **Architecture Input Meeting:** The purpose of this meeting, attended by regional transportation stakeholders, was to introduce the architecture update process, identify and discuss overarching transportation needs for the region, and update the ITS inventory for Metropolitan Boston. The input from this meeting was used to develop draft recommendations for updates to the Regional ITS Architecture.

- **Architecture Review Meeting:** In this meeting, stakeholders reviewed proposed updates to relevant portions of the architecture and provided feedback. Stakeholders provided additional input on regional transportation needs, updates to specific ITS elements, market package instances, and interagency interfaces. The input from this meeting and subsequent stakeholder comments were used to refine the recommendations for updates to the Regional ITS Architecture. These refined update recommendations were then implemented both to the architecture's Final Report, and its interactive website.

- **Additional Stakeholder Meetings:** Throughout the update process, additional meetings were held with individual stakeholders and/or stakeholder groups to review preliminary information received and to clarify questions related to the architecture update. Meetings were held with MassPike and MassHighway (prior to the creation of MassDOT), the MassDOT – Highway Division, the Massachusetts Bus Association, the Massachusetts Association of Regional Transit Authorities (MARTA), and MBTA.

3. NEEDS ANALYSIS

The update of a regional architecture is based on a re-assessment of needs among the architecture's stakeholders. Documents, studies, and reports, including the most recent Transportation Plans and TIPs for each planning region, provided initial information about regional transportation needs and certain ITS deployments in the region. This assessment was reviewed by regional stakeholders as part of the update process. Further information was collected through additional stakeholder meetings, resulting in an inventory of existing or planned ITS elements and regional needs. These needs will continue to evolve and be refined throughout the architecture update process. This chapter summarizes the results of the needs analysis. The first section presents general needs identified for the region through the architecture update process. The second section presents the inventory of existing and planned systems and initiatives relating to ITS, as well as stakeholder-specific needs that were raised. The final section discusses how the results of the needs analysis were used in moving forward with the architecture update process.

3.1 Regional Needs

As part of the original regional ITS architecture development process in 2005, the following general regional transportation needs were identified:

- Safety and Security
- Congestion Management
- Transit Demand
- Paratransit Efficiency
- Information Sharing
- Communications Infrastructure
- Operations and Maintenance
- Access to ITS Data

While many of these general needs remain, several have evolved or progressed since 2005. The following general regional transportation needs were identified:

- **Safety and Security –** Safety and security remain a primary concern for many organizations in the region. Specific needs that were identified included increased surveillance capabilities (via Closed Circuit Television [CCTV], for example) for public areas and key infrastructure elements, improved coordination with emergency management personnel coordinators, and securing and providing redundancy in the communications infrastructure.

- **Mobility Management –** Throughout the region, improving and managing mobility for both people and goods was identified as a priority. Specifically, stakeholders identified the need for managing recurring and non-recurring congestion, incident management, construction management, freight management, intermodal coordination, increased support for bicycle and pedestrian modes, improved transit accessibility, and integrated corridor management. The ability of ITS to support informed decision-making by the region's travelers was highlighted.

- **Transit Management –** Transit management was identified as an ongoing regional priority. In particular, stakeholders focused on the need for increased operational efficiency and improved coordination of transit services for both fixed route and demand responsive transit. The need for increased transit service to meet growing demand was also seen as an issue in many parts of the region.

- **Information Sharing –** The need for improved information sharing among organizations remained a priority for the region. Specifically, stakeholders identified a need for formalizing and maintaining interagency agreements, especially in the wake of the recent reorganization of key transportation organizations in the region. Stakeholders also expressed the need to increase interagency coordination, primarily in the realms of incident and emergency management. Stakeholders also identified the evolving need to improve information dissemination to the general public through a variety of media.

- **Communications Infrastructure –** Regional stakeholders identified the need to continue to expand and update key communications infrastructure to support field equipment installations and to facilitate interagency coordination. There remain gaps in the regional communications infrastructure that should be addressed in order to support a robust and redundant communications network.

- **Operations and Management –** Stakeholders discussed the need to develop ongoing programs to coordinate, operate, manage, and maintain key transportation infrastructure and systems. Stakeholders specifically discussed the need for programs to address ongoing air quality considerations, sustainable transportation practices, and strategies for optimizing and updating traffic signal coordination. The region may also benefit from increased discussion and awareness of standard transportation equipment and communications protocols.

- **Maintenance and Asset Management –** Maintaining ITS and communications assets was identified as an emerging regional transportation need. As ITS matures, the need to maintain a state of good repair and actively manage and coordinate resources was a concern raised by multiple stakeholders.

- **Access to ITS Data –** Regional stakeholders confirmed that access to ITS data remains a regional transportation need. The ITS already in place in the region offer a significant resource for transportation data. This includes both real-time data that can be used for operations, as well as archived data that can be used for planning purposes. Several stakeholders also expressed the desire to make this data more readily available to third parties and the general public.

It should be noted that several of these needs identified by regional stakeholders also represent potential barriers to ITS implementation. For example, the need for improved information sharing through the formalization and maintenance of interagency agreements is intended to address potential institutional barriers to multiagency ITS deployments. Likewise, stakeholders identified the challenge of improving communications infrastructure across the region to support future ITS initiatives. By identifying these needs and potential obstacles, the region's stakeholders can help prioritize efforts to meet and address these implementation challenges.

3.2 ITS Inventory

Many of the needs identified by regional transportation stakeholders are presently being addressed through ongoing and planned ITS initiatives in the region. In addition to considering regional transportation issues and concerns, the needs assessment process also considered the existing and planned ITS initiatives in the region. Exhibit 3-1 through 3-4 present a high-level ITS Inventory for the region, organized by the functional areas: Emergency Management, Roadway, Transit, and Commercial Vehicle Operations. In these tables, specific organizations have identified their own existing ITS systems and ongoing ITS initiatives. Systems were considered "existing" or "ongoing" if system design was completed and implementation had commenced. Organizations have also identified their own planned and proposed ITS initiatives that they expect to implement within the next ten years. These tables also include a listing of organizational issues and priorities.

Exhibit 3-1: ITS Inventory – Emergency Management

Existing Systems and Ongoing Initiatives:	**Coast Guard** ☐ Incident Command System (ICS) for coordinating response with MEMA and other emergency management agencies **Local City/Town*** ☐ Signal preemption for emergency vehicles **Massachusetts Emergency Management Agency (MEMA)** ☐ ICS ☐ Emergency Operations Center (EOC) and Web-EOC system ☐ Remote workstation for limited access to MassDOT Highway Operations Center systems ☐ Massachusetts 211 System ☐ Resource Management Database System ☐ Low band communications network **Massachusetts State Police** ☐ Wireless 911 ☐ Amber Alert ☐ Crash Data System ☐ Video from MassDOT and Massport ☐ MSP Airwing link to MIVIS ☐ 800 MHz trunked radio system
Planned and Proposed Initiatives:	**Massachusetts State Police** ☐ Integrated Computer-Aided Dispatching (CAD) system
Organizational Issues and Priorities:	**Coast Guard** ☐ Safety and security ☐ Anti-terrorism measures **MEMA** ☐ Information coordination and dissemination ☐ Resource coordination **Massachusetts State Police** ☐ Video surveillance of roadways ☐ Increased speed of accident reconstruction

*Please note that this includes, but is not limited to, the communities of Boston, Brockton, Brookline, Cambridge, Framingham, Newton, Somerville, and Wellesley.

Exhibit 3-2: ITS Inventory – Roadway

Existing Systems and Ongoing Initiatives:	**City of Boston** ☐ Traffic Management Center (TMC) ☐ Centralized signal control ☐ Closed Circuit Television (CCTV) monitoring ☐ Signal priority for transit ☐ Signal timing coordination with MBTA ☐ Traffic coordination with MassDOT – Highway Division ☐ Incident notification via pager **City of Brockton** ☐ Traffic signal coordination **City of Newton** ☐ Traffic signal coordination **Department of Conservation & Recreation (DCR)** ☐ Traffic signals connected to Boston Transportation Department (BTD) signal system **MassDOT - Highway Division** ☐ 511 Traveler Information System ☐ Highway Operations Center (HOC) ☐ Integrated Project Control System (IPCS) ☐ Massachusetts Traffic and Emergency Response System (MassTERS) Advanced Traffic Management System (ATMS) ☐ Event Reporting System (ERS) ☐ Southeast Expressway HOV lane ☐ Massachusetts Interagency Video Information System (MIVIS) ☐ CCTV cameras ☐ Citilog video/incident detection initiative ☐ Variable Message Signs (VMS) ☐ Highway Advisory Radio (HAR) ☐ Roadway service patrols ☐ Weather stations ☐ MassDOT security system ☐ 800 MHz radio conversion (compatible with State Police) ☐ Fiber-optic communications network ☐ FAST LANE electronic toll collection ☐ Coordination with BTD on traffic signals ☐ Emergency motorist call boxes ☐ Amber Alert ☐ Regional Transportation Operations Strategies initiative ☐ ITS Performance Measures initiative ☐ MassDOT Website ☐ Upgrade of wireless communications network ☐ XML data feed available on MassDOT website **Massachusetts Port Authority** ☐ Logan Airport Travel Information Website (in development) ☐ Logan Parking Management / Revenue Control System ☐ Logan Airport Automated Traffic Monitoring System (permanent traffic count stations) **Town of Framingham** ☐ VMS

Planned and Proposed Initiatives:	**City of Boston** ☐ Expansion of traffic signal system ☐ Communications network expansion/upgrade ☐ Communications infrastructure sharing with MBTA ☐ Establishment of center-to-center connection with the MBTA to facilitate transit signal priority ☐ Implementation of an event reporting system **City of Brockton** ☐ Traffic Operations Center (TOC) ☐ Downtown video surveillance ☐ GPS on all DPW vehicles **MassDOT - Highway Division** ☐ Enhancement of 511 Traveler Information System ☐ Expansion of MIVIS ☐ Updating the Unified Response Manual (URM) **Massachusetts Port Authority** ☐ Logan Airport Parking Management System enhancements (e.g. parking space wayfinding system, FAST LANE payment) (long-term) ☐ Automatic Vehicle Location (AVL) and Automatic Passenger Counter (APC) equipment on Massport shuttles and Logan Express buses (near-term) **Town of Framingham** ☐ TOC
Organizational Issues and Priorities:	**City of Boston** ☐ Expansion of CCTV deployment ☐ Remote access to MassDOT Highway Operations Center ☐ Sharing of video with other agencies ☐ Traffic and event information from other agencies ☐ Identifying a suitable backup facility for BTD operations **City of Cambridge** ☐ Connecting existing signals to central location ☐ Collecting classification data ☐ Communications with BTD, DCR, and MassDOT **DCR** ☐ Traffic and event management **MassDOT - Highway Division** ☐ Expansion of communications infrastructure ☐ Communications infrastructure redundancy ☐ Increased traffic detector coverage ☐ Increased surveillance coverage (video) ☐ Centralization of ITS functions statewide at the HOC ☐ Backup/remote facilities for emergency operation ☐ Interagency coordination for emergency management ☐ Systems integration ☐ Performance measures ☐ AM/FM Override for tunnels ☐ Expansion of HAR **Massachusetts Port Authority** ☐ En-route travel information (including parking availability) ☐ Subway and Silver Line coordination with MBTA ☐ Video/data from adjacent roadways and tunnels ☐ Traffic/incident management coordination with other agencies

Exhibit 3-3: ITS Inventory – Transit

Existing Systems and Ongoing Initiatives:	**Brockton Area Transit (BAT):** ☐ Transit Operations Center (TOC) ☐ BAT Website ☐ Parking Management System ☐ Automatic Fare Collection (AFC) System ☐ Onboard Security ☐ Automatic Vehicle Location (AVL)/GPS for paratransit vehicles ☐ AFC coordination ☐ Transit Signal Priority (TSP) **Cape Ann Transportation Authority (CATA)** ☐ AFC System ☐ CATA Website **Greater Attleboro-Taunton Regional Transit Authority (GATRA)** ☐ AVL for fixed route and paratransit vehicles ☐ Attleboro Intermodal Transportation Center ☐ Onboard video and audio monitoring **Lowell Regional Transit Authority (LRTA)** ☐ AFC System and fareboxes ☐ Gallagher Terminal VMS ☐ Onboard cameras ☐ LRTA Website ☐ Demand Response Scheduling System **Massachusetts Bay Transportation Authority (MBTA)** ☐ Control Centers ☐ Computer Aided Dispatch (CAD)/AVL for fixed route and paratransit vehicles ☐ AFC, Phase 1 ☐ Automatic Vehicle Identification (AVI) for Green Line vehicles ☐ Silver Line ITS ☐ Transit Signal Priority (coordinated with BTD) ☐ Customer information system ☐ Open Data Initiative ☐ MBTA Website ☐ Customer Public Address (PA) system and VMS upgrades ☐ Automatic Stop Annunciation ☐ Automatic Passenger Counter (APC) pilot project ☐ Onboard video with live look-in feature ☐ Electronic bike caging ☐ FAST LANE payment at garages ☐ System-wide radio upgrade ☐ Subway signal system upgrades ☐ South Station travel information kiosks ☐ Travel information website ☐ Interoperability project (communications) ☐ Station management video ☐ IRIS (Incident Reporting Information System) ☐ Fiber Wide Area Network (WAN) ☐ Customer WiFi ☐ Silver Line Barrier Control System

Existing Systems and Ongoing Initiatives (Continued):	**Massachusetts Bay Transportation Authority (MBTA) (cont'd)** ☐ Maintenance Control and Reporting System (MCRS) ☐ Smart Bus Mart Project ☐ Automatic Stop Annunciation for Commuter Rail ☐ Station/stop information systems **Merrimack Valley Regional Transit Authority (MVRTA)** ☐ AVL for fixed route and paratransit services ☐ Onboard security systems ☐ Automated Voice Announcement System (AVAS) ☐ AFC system **MetroWest Regional Transit Authority (MWRTA)** ☐ CAD system for paratransit ☐ AVL for fixed route and paratransit services ☐ Onboard cameras ☐ Transit website with real-time bus locations ☐ CharlieCard integration for AFC ☐ Archive database **Private Traveler Information Service Providers** ☐ Private Traveler Information Websites (e.g., Google Transit) **Private Surface Transportation Providers** ☐ AVL systems
Planned and Proposed Initiatives:	**Brockton Area Transit (BAT):** ☐ AVL/GPS System for fixed route vehicles ☐ Additional TSP, especially near the BAT TOC **Greater Attleboro-Taunton Regional Transit Authority (GATRA)** ☐ Improved radio communications system ☐ AFC coordination ☐ TSP **Lowell Regional Transit Authority (LRTA)** ☐ CAD/AVL for fixed route and paratransit ☐ Automatic Voice Annunciation (AVA) ☐ APC ☐ Real-time arrival information at stations ☐ Fixed Route Scheduling System ☐ Upgraded Voice Communications **Massachusetts Bay Transportation Authority (MBTA)** ☐ Expansion of AFC system, Phase 2 ☐ APC ☐ Positive train control (light rail and commuter rail) ☐ Secure Stations Initiative ☐ New vehicle procurements with onboard ITS ☐ New Supervisory Control and Data Acquisition (SCADA) system ☐ CAD for Transit Police ☐ TSP and Center to Center (C2C) connection with BTD **Merrimack Valley Regional Transit Authority (MVRTA)** ☐ Transit kiosk at McGovern Transportation Center ☐ CharlieCard integration for AFC **MetroWest Regional Transit Authority (MWRTA)** ☐ CAD system for fixed route

Organizational Issues and Priorities:	**Greater Attleboro Taunton Regional Transit Authority (GATRA)** ☐ Safety and security **Lowell Regional Transit Authority (LRTA)** ☐ Upgrading communications systems ☐ Improved real-time transit information ☐ Vehicle location monitoring **Massachusetts Bay Transportation Authority (MBTA)** ☐ Customer service ☐ Safety and security ☐ CCTV deployment on vehicles ☐ Improved paratransit dispatching ☐ Signal Priority (repair of Green Line system, expansion to bus system) ☐ Expansion of station/stop information systems **Merrimack Valley Regional Transit Authority (MVRTA)** ☐ Resources to export real-time GPS-enabled system data to cell phones and desktop computers **MetroWest Regional Transit Authority (MWRTA)** ☐ Improved customer service ☐ Traveler training ☐ Coordinated AVL

Exhibit 3-4: ITS Inventory – Commercial Vehicle Operations (CVO)

Existing Systems and Ongoing Initiatives:	**MassDOT - Highway Division** ☐ Weigh-In-Motion (WIM) ☐ Oversize and Overweight (OS/OW) Permitting **MassDOT - RMV** ☐ Electronic Credentialing Systems ☐ Driver Verification System with various transit authorities **City of Boston** ☐ OS/OW Permitting
Planned and Proposed Initiatives:	**MassDOT - RMV** ☐ Upgrade Electronic Credentialing Systems ☐ New Commercial Vehicle Operators (CVO) web portal ☐ Massachusetts Commercial Vehicle Information Exchange Window (CVIEW) **Massachusetts State Police** ☐ Mobile Screening Unit
Organizational Issues and Priorities:	**MassDOT - Highway Division** ☐ Height restrictions on roadways **MassDOT - RMV** ☐ Updating legacy systems ☐ Improved system compatibility **Massachusetts State Police** ☐ Mobile enforcement and information queries

3.3 Basis for the Regional ITS Architecture

The next step in the architecture update process uses the results of the needs analysis as an initial basis for updating the architecture. The ITS inventory presented in the previous section is the primary basis, as it holds the existing and planned elements that must be included in the updated architecture. For the purposes of the architecture, elements are classified as "existing" if their interface design is complete, regardless of whether the actual element is deployed. Elements are classified as planned if their interfaces have not yet been designed. In addition, the architecture considers a time horizon of up to fifteen years, with a focus on elements that are likely to be implemented within the next ten years. This timeframe helps ensure that the elements included in the architecture are relevant to the region and are not just a long-term "wish list" for the future.

In addition to the identified inventory elements that must be included in the architecture, the identified needs must also be considered. The needs help determine what new elements the stakeholders may want to consider, and they also help determine what new interfaces between existing systems may be useful to consider.

Based on regional transportation needs, stakeholders identified four major themes as especially important to the region:

- **All-Hazards Emergency Management** – In addition to an ongoing focus on transportation safety and security, several organizations expressed the need for improved interagency coordination in response to emergencies. This may include identifying opportunities to improve interagency communications, data exchange, retention and accessibility of video images, historic travel data, and other initiatives.

- **Information Sharing** – Stakeholders in the region have a need for better sharing of information among each other. This includes both real-time data such as traffic conditions and events, as well as more static data such as planned events and response plans. Multiple organizations also identified the need to share more information with the general public, particularly with regards to providing "open data" that could be shared with the public and third party applications.

- **Communications Infrastructure** – Many organizations are in the process of building a communications network for operations, but there are missing portions of their network. Several organizations also indicated a desire to reduce their reliance on leased lines for their operations, thereby reducing operating costs. Opportunities may exist for taking advantage of geographic overlap of the networks, allowing for joint implementation and cost savings.

- **Operations and Maintenance** – A frequent concern expressed was the need for resources to support ITS. This included both financial resources as well as staffing resources required for operations and ongoing maintenance of ITS deployments. This illustrates the need for considering operations in the planning of ITS for the region. Stakeholders also identified that future ITS implementation efforts in the region may benefit from the development of regional standards/lists regarding approved equipment, software, data storage and accessibility, metadata, and documentation. This was particularly emphasized with regards to video switching and recording efforts.

These four themes were considered throughout the remainder of the architecture update process. These four themes are also consistent with the Core Themes identified in the *youMove Massachusetts* statewide transportation planning effort. Specifically, both include themes recognizing the importance of focusing on transportation maintenance, shared use of infrastructure, and creating a more user-friendly transportation system.

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4. ITS ARCHITECTURE

At the core of the architecture update process is the identification of existing and planned component systems and the interfaces among them. Collectively, these components and interfaces define the architecture. Pursuant to Federal requirements, the Regional ITS Architecture must be developed using the National ITS Architecture. As such, the regional architecture builds on the national architecture, incorporating functions that are relevant to the region and calling out specific ITS elements that exist in the region.

Turbo Architecture, a software program created by FHWA to facilitate development of regional ITS architectures, was used to develop and update the architecture. Specifically, Version 5.0 of Turbo Architecture, which provides consistency with Version 6.1 of the National ITS Architecture, was used to update the architecture.

The architecture is presented in an interactive format that provides users with an accessible way to view the architecture. The interface allows a user to view the architecture in multiple ways and in varying levels of detail. The architecture is provided on the CD-ROM included in Appendix A. As discussed in Chapter 7, the architecture is not a static document and instead must be maintained so that it remains current and relevant to the region. Therefore, it should be noted that the architecture as presented on the CD is current as of the date of this document. The latest version of the architecture is accessible at http://www.mass.gov/RegionalITSArchitecture.

The first section of this chapter provides a summary of various elements of the Regional ITS Architecture. Following this summary is a guide to navigating the interactive architecture. The final section discusses ITS standards and their applicability.

4.1 Summary of the Regional Architecture

In its most basic form, the architecture is a collection of ITS elements and the interfaces between them. However, due to their sheer number, it is impossible to display all these elements and interfaces in an understandable way in a single view. The architecture therefore provides a number of ways of approaching this information.

One approach is by the ITS inventory, which is a listing of the component elements. The inventory can be considered either by stakeholder (e.g. all elements held by MassDOT – Highway Division) or by function (e.g. all elements relating to Emergency Management). Each element in the inventory has a number of interfaces with other elements, both of the same stakeholder as well as of others. Another approach is by market packages, which group elements and interfaces by function. These approaches to viewing the architecture are described further in the following subsections.

4.1.1 STAKEHOLDERS AND ENTITIES

In the context of the architecture, a stakeholder is any entity that holds or is responsible for an element in the architecture. Exhibit 4-1 presents the stakeholders holding existing or planned elements in the updated Metropolitan Boston Regional ITS Architecture. This includes public agencies that operate transportation systems, private organizations that have transportation-related functions, as well as the traveling public who interacts with the transportation network.

The list also includes a number of “generic” stakeholders, such as “Local City/Town” or “Local Transit Agencies.” These are included to account for stakeholders that are not specifically called out in the architecture, and they serve as a placeholder for future additions. For example, consider a town not currently deploying ITS. This town is not included in the architecture as a stakeholder because it does not hold any ITS elements. However, if that town later decides to implement an ITS project, it can consider the generic “Local City/Town” stakeholder as an example for how this

might be done. Once the project design is more complete, the town can then be added to the list of stakeholders through the architecture update process, discussed in Chapter 7.

Exhibit 4-1: Stakeholders with Elements in the Regional ITS Architecture

- Amtrak
- Anderson Regional Transportation Center
- BAT - Brockton Area Transit Authority
- BEMA - Boston Emergency Management Agency
- BPWD - Boston Public Works Department
- BTD - Boston Transportation Department
- CATA - Cape Ann Transportation Authority
- City of Boston
- City of Brockton
- City of Cambridge
- CVO Information Requestor
- DCR - Department of Conservation & Recreation
- Financial Institution
- GATRA - Greater Attleboro-Taunton Regional Transit Authority
- Greater Boston Convention and Visitors Bureau
- Greater Merrimack Valley Convention and Visitors Bureau
- Hospitals
- Local City/Town
- Local City/Town Shuttle Services
- Local City/Town/County Public Safety
- Local Human Service Transit Providers
- Local Media
- Local/Regional School Districts
- LRTA - Lowell Regional Transit Authority
- MAPC - Metropolitan Area Planning Council
- MassDOT – Highway Division
- MassDOT - Office of Transportation Planning
- MassDOT – Registry of Motor Vehicles (RMV)
- Massport - Massachusetts Port Authority
- MBTA - Massachusetts Bay Transportation Authority
- MCCA - Massachusetts Convention Center Authority
- MEMA - Massachusetts Emergency Management Agency
- MSP - Massachusetts State Police
- MVPC - Merrimack Valley Planning Commission
- MVRTA - Merrimack Valley Regional Transit Authority
- MWRTA – MetroWest Regional Transit Authority
- NMCOG - Northern Middlesex Council of Governments
- NOAA - National Oceanic and Atmospheric Administration
- North of Boston Convention and Visitors Bureau
- OCPC - Old Colony Planning Council
- Other CVAS – Commercial Vehicle Administration Services
- Other Toll Agencies
- Private Motor Carriers
- Private Surface Transportation Providers
- Private Traveler Information Service Providers
- Private Weather Service Providers
- Rail Operators
- Regional Event Promoters
- Regional Fare Card Agencies
- SRPEDD - Southeastern Regional Planning and Economic Development District
- TMA - Transportation Management Associations
- Town of Framingham
- Travelers

Associated with each of these stakeholders are a number of ITS elements in the inventory. For example, elements in the architecture belonging to MassDOT – Highway Division include existing elements, such as its Highway Operations Center (HOC), District Offices, and field equipment, as well as planned elements, such as advanced work zone equipment.

Exhibit 4-2 presents the ITS entities from the National ITS Architecture that have been included in the Metropolitan Boston Regional ITS Architecture. The types of entities included in the regional architecture represent only a portion of those that exist in the National ITS Architecture. The ones included are only those that were determined by the stakeholders to be relevant to the region.

The entities are divided into “subsystems” and “terminators.” Subsystems are the component systems of the overall ITS architecture representing the general functional areas that are addressed

by ITS. Included within each subsystem are the real-world ITS components that are part of the transportation system, such as operations centers or transit vehicles. Terminators define the boundary of the architecture, and represent the components that interface with these subsystems. Terminators can include components without ITS functions that interface with ITS components, such as hospitals or the media, or can include ITS components that are external to the region.

Exhibit 4-2: National ITS Architecture Entities Included in the Regional Architecture

Subsystems:	*Terminators:*
▪ Archived Data Management Subsystem ▪ Commercial Vehicle Administration ▪ Commercial Vehicle Check ▪ Emergency Management ▪ Emergency Vehicle Subsystem ▪ Emissions Management ▪ Fleet and Freight Management ▪ Information Service Provider ▪ Maintenance and Construction Management ▪ Maintenance and Construction Vehicle ▪ Parking Management ▪ Personal Information Access ▪ Remote Traveler Support ▪ Roadway Subsystem ▪ Security Monitoring Subsystem ▪ Toll Administration ▪ Toll Collection ▪ Traffic Management ▪ Transit Management ▪ Transit Vehicle Subsystem ▪ Vehicle	▪ Archived Data User Systems ▪ Basic Commercial Vehicle ▪ Care Facility ▪ CVO Information Requestor ▪ CVO Inspector ▪ Department of Motor Vehicles ▪ Equipment Repair Facility ▪ Event Promoters ▪ Financial Institution ▪ Intermodal Freight Depot ▪ Media ▪ Multimodal Crossings ▪ Multimodal Transportation Service Provider ▪ Other Commercial Vehicle Administration Subsystem ▪ Other Emergency Management ▪ Other Maintenance and Construction Management ▪ Other Toll Administration ▪ Other Traffic Management ▪ Other Vehicle ▪ Rail Operations ▪ Storage Facility ▪ Traffic Operations Personnel ▪ Traveler Card ▪ Wayside Equipment ▪ Weather Service

Associated with each of these entities are a number of ITS elements in the inventory. For example, the Traffic Management Subsystem includes all operations centers with roadway management functions, including the MassDOT – Highway Division HOC and Local City/Town Traffic Management Centers (TMCs). As an example of a terminator, the Archived Data User Systems entity includes planned data archives for the MassDOT – Office of Transportation Planning, as well as planned data archives for regional planning agencies and regional transit authorities.

4.1.2 MARKET PACKAGES

Another way of approaching the architecture is by considering Market Packages. These are groupings of elements and interfaces that address a specific functional area (e.g. maintenance vehicle tracking). Market Packages represent collections of subsystems and terminators that exchange information to provide a specific service. A market package can cut across stakeholders, including all elements and interfaces required to support a function.

Exhibit 4-3 presents the market packages for the Metropolitan Boston region, grouped by service area (e.g. Traffic Management). As with the entities, not all of the market packages in the National ITS Architecture are included here. Instead, only the market packages that are relevant to the region are included.

Exhibit 4-3: Regional ITS Architecture Market Packages

Traffic Management
- Network Surveillance
- Traffic Probe Surveillance
- Surface Street Control
- Freeway Control
- HOV Lane Management
- Traffic Information Dissemination
- Regional Traffic Management
- Incident Management System
- Electronic Toll Collection
- Emissions Monitoring and Management
- Standard Railroad Grade Crossing
- Railroad Operations Coordination
- Parking Facility Management
- Drawbridge Management
- Roadway Closure Management

Maintenance & Construction Management
- Maintenance and Construction Vehicle and Equipment Tracking
- Maintenance and Construction Vehicle Maintenance
- Road Weather Data Collection
- Weather Information Processing and Distribution
- Roadway Automated Treatment
- Winter Maintenance
- Roadway Maintenance and Construction
- Work Zone Management
- Work Zone Safety Monitoring
- Maintenance and Construction Activity Coordination
- Infrastructure Monitoring

Public Transportation
- Transit Vehicle Tracking
- Transit Fixed-Route Operations
- Demand Response Transit Operations
- Transit Fare Collection Management
- Transit Security
- Transit Fleet Maintenance
- Multi-modal Coordination
- Transit Traveler Information
- Transit Signal Priority
- Transit Passenger Counting

Traveler Information
- Interactive Traveler Information
- ISP Based Trip Planning and Route Guidance
- Dynamic Ridesharing

Commercial Vehicle Operations
- CV Administrative Processes
- Weigh-In-Motion
- Roadside CVO Safety

Emergency Management
- Emergency Call-Taking and Dispatch
- Emergency Routing
- Mayday and Alarms Support
- Roadway Service Patrols
- Transportation Infrastructure Protection
- Disaster Response and Recovery
- Evacuation and Reentry Management

Archived Data Management
- ITS Data Mart
- ITS Virtual Data Warehouse

4.2 Navigating the Regional ITS Architecture

This section provides an overview of the architecture as included on the CD-ROM in Appendix A. Exhibit 4-4 depicts the architecture homepage, located online at http://www.mass.gov/RegionalITSArchitecture.

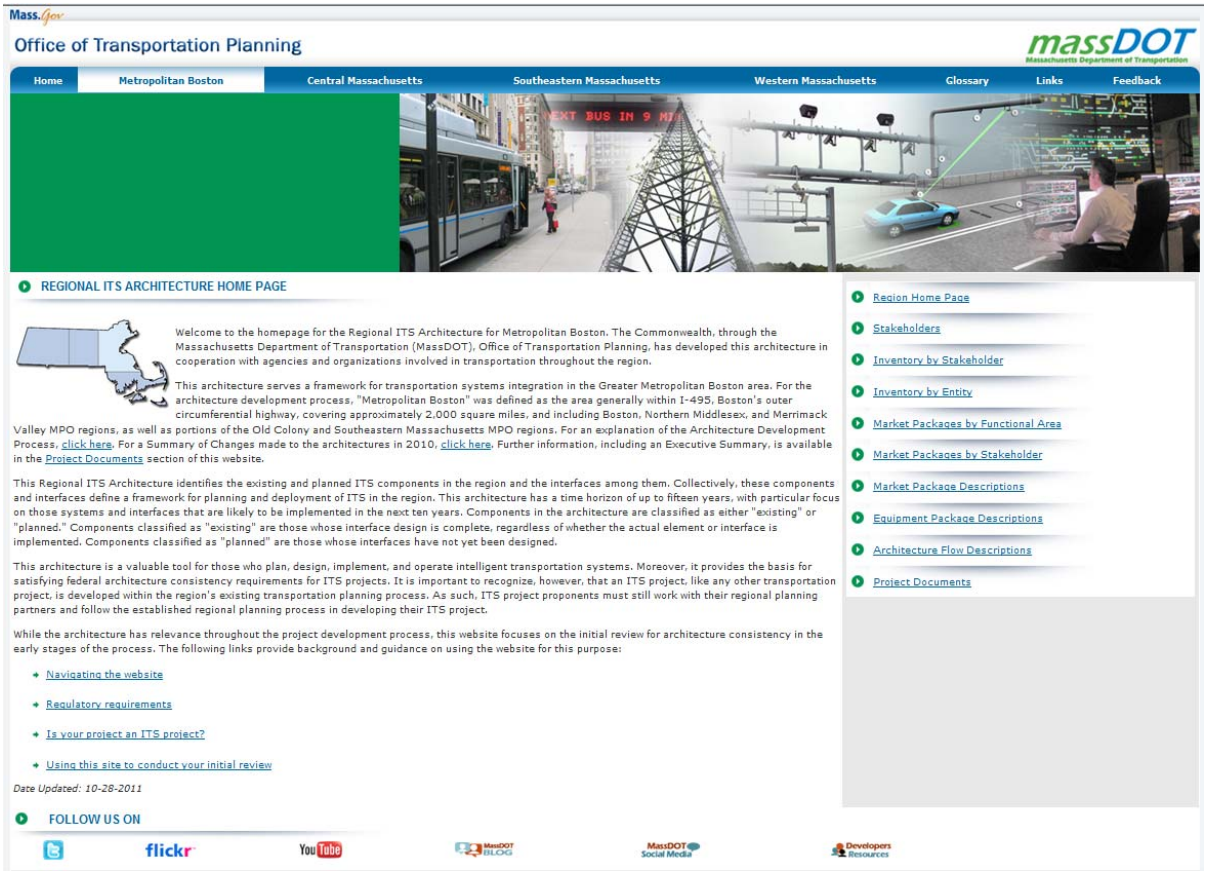

Exhibit 4-4: Regional ITS Architecture Homepage

Along the top of the page are a series of buttons that link to different pages of the architecture. The pages to which each of these buttons leads are described below.

- **Home:** This button takes the user to the homepage for all four of the Massachusetts Regional ITS Architectures.
- **Metropolitan Boston, Central Massachusetts, Southeastern Massachusetts, Western Massachusetts:** These buttons take the user to the homepage of the Metropolitan Boston, Central Massachusetts, Southeastern Massachusetts, and Western Massachusetts Regional ITS Architectures, respectively.
- **Glossary:** This page presents a glossary of useful ITS architecture terms, as defined in the National ITS Architecture.
- **Links:** This page provides useful links to other transportation organization websites.
- **Feedback:** This button launches the user's email application, allowing the user to send comments to OTP.

Along the right side of the page are a series of buttons that link to different pages of the architecture. The pages to which each of these buttons leads are described below.

- **Stakeholders:** This page presents the full list of regional stakeholders, along with descriptions for each.

- **Inventory by Stakeholder:** This page presents the inventory of ITS elements, arranged by stakeholder. This allows all the elements held by a single stakeholder to be viewed simultaneously. Clicking on an element name links to a detail page for the element that provides more information, including a listing of all interfacing elements.

- **Inventory by Entity:** This page presents the inventory of ITS elements, arranged by entity (subsystems and terminators). This allows all elements with related functions to be viewed simultaneously. Clicking on an element name links to a detail page for that element.

- **Market Packages by Functional Area:** This page presents a table of the relevant market packages for the region. Clicking on the market package number links to a series of customized diagrams for each package. These market package diagrams illustrate the elements and interfaces that are contained in that market package. Each subsystem or terminator in a market package diagram is labeled with both its generic National ITS Architecture name and the name of the local stakeholder instance that participates in the customized market package. In this way, the market package identifies the information exchange (using architecture flows) between specific elements in the region to achieve a particular service or set of services.

- **Market Packages by Stakeholder:** This page presents a list of market packages for each stakeholder. Clicking on a market package links to the customized diagram in which that stakeholder's element appears.

- **Market Package Descriptions:** This page presents descriptions for each of the market packages included in the architecture.

- **Equipment Package Descriptions:** This page presents descriptions of the relevant equipment packages from the architecture. Equipment packages represent specific functions carried out by the subsystems.

- **Architecture Flow Descriptions:** This page presents descriptions of the relevant architecture flows from the architecture. Architecture flows appear in the interface diagrams and indicate the information that is exchanged between two components.

- **Project Documents:** This page contains documents generated through the architecture development process, including the deliverables reviewed by regional stakeholders.

4.3 Applicable Standards

Standards are technical specifications established by consensus that provide rules, guidelines or characteristics for data interfaces. ITS standards, in particular, govern the interfaces of transportation system components. They contain and specify the technical details on how to build and integrate ITS systems and components in a way that facilitates interoperability. Standards provide the technical detail that enables the design and deployment of an integrated ITS system. Standards allow different systems to speak to each other in a common language, using common data elements, well-defined data structures or "messages," and well-understood protocols or rules for data exchange and sharing.

ITS standards are being developed by several working groups composed of public and private sector stakeholders within Standards Development Organizations (SDOs). The process is partially supported by the US Department of Transportation. There are seven SDOs actively participating in ITS standards development activities:

- AASHTO (American Association of State Highway and Transportation Officials)
- ANSI (American National Standards Institute)
- ASTM (American Society for Testing and Materials)
- IEEE (Institute of Electrical and Electronics Engineers)
- ITE (Institute of Transportation Engineers)
- NEMA (National Electrical Manufacturers Association)
- SAE (Society of Automotive Engineers)

It is important to note that ITS standards do not specify specific products or designs to use. Instead, standards help ensure that components from different manufacturers can easily exchange and interpret data. By using standards-based ITS, organizations can help facilitate interoperability and thereby more easily realize the benefits of coordinated transportation systems.

To date, USDOT has not yet adopted any specific ITS standards. However, several ITS standards, such as the National Transportation Communications for Intelligent Transportation System (ITS) Protocol (NTCIP) family of standards, are becoming more commonplace in the industry. Despite not being mandatory, it makes good sense for organizations to utilize approved ITS standards in system design and implementation. This approach has little risk and facilitates future integration opportunities.

The Regional ITS Architecture also does not recommend a specific standard for each interface. Because standards continue to evolve, it would be premature for the architecture to dictate what standards to use when a project or initiative is only in the conceptual stage. Instead, the architecture presents the standards that are relevant for each architecture flow, with the expectation that they will be considered in the project design. These relevant standards can be found on each architecture flow detail page on the website, which contains a description of the architecture flow and a list of relevant communications, message, and data standards.

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5. OPERATIONAL CONCEPT

In the initial development of the architecture, stakeholder interviews, workshops, and working sessions determined the technical components of the architecture and identified the many interagency relationships needed to plan, operate, and maintain those systems. These interagency relationships were then incorporated into an operational concept for the Metropolitan Boston Regional ITS Architecture. As part of the architecture update process, this operational concept was updated to reflect the changing organizational and institutional environment of the region.

The Operational Concept focuses on the institutional aspects of the Regional ITS Architecture. It defines the relationships among the organizations in the region required for the deployment and operation of an integrated transportation system. The purpose of the operational concept is to define the roles and responsibilities of the stakeholders in the implementation and operation of the systems that make up the architecture.

The first section of this chapter, Operational Coordination, discusses the different levels of interaction and types of information exchange that may be required for operation of interagency interfaces. The second section, Interagency Interfaces, presents a detailed operational concept for each of the interagency interfaces that the architecture identifies. Finally, the third section, Institutional Coordination, covers the key institutional issues, including interagency agreements.

5.1 Operational Coordination

ITS initiatives that involve cross-jurisdictional relationships will require a detailed operational concept. In some cases, multiple organizations will need to form relationships with each other to define specific roles and responsibilities for the deployment and operation of the system.

Operational relationships between organizations are defined by two main components: 1) the roles/responsibilities of each organization in the relationship, and 2) the types of information that each organization shares. Exhibit 5-1 identifies seven types of agency-to-agency relationships, spanning the range of potential institutional interactions that might occur between two organizations in the operation and maintenance of an ITS application. The exhibit lists the relationships from lowest to highest level of interaction and provides definitions and examples for each of the identified relationships.

Each of these relationships implies some exchange of information between two organizations. The information being exchanged can be classified into one of six types of information flows. Exhibit 5-2 provides definitions and examples for these information flows.

As these exhibits illustrate, the extent of interaction and information exchange between organizations can vary greatly. Relationships can vary from consultation and cooperation, where electronic information is not exchanged, to full transfer of operational responsibility. The extent of the interaction will depend on many factors, including the nature of the information being exchanged, the technical capabilities of the organizations, and the institutional relationships already in place. A different relationship may therefore be appropriate for each particular interagency interface. The next section discusses all of the interagency interfaces in the architecture and proposes an operational concept for each, based on the relationships and information flows identified by the participants.

Exhibit 5-1: Agency-to-Agency Relationships

Relationship	Definition	Example
Consultation	One party confers with another party, in accordance with an established process, about an anticipated action and then keeps that party informed about the actions taken. Information is exchanged through traditional means of communication, such as phone or face-to-face meetings.	Agency A provides information on activities to Agency B.
Cooperation	The parties involved in carrying out the planning, project development and operations processes work together to achieve common goals or objectives. Information is exchanged through traditional means of communication.	Both agencies cooperate in the development and execution of common plans, projects, and operational procedures.
Information Sharing	The electronic exchange of data and device status information between parties for the purposes of coordinated operations, planning, and analysis.	Agency A will provide status, data, and/or video information from Agency A's field devices (e.g. detectors) to Agency B.
Control Sharing	The ability, through operational agreements, to allow for one party to control another party's field devices to properly respond to incident, event, weather, or traffic conditions.	Agency A is allowed by Agency B to control Agency B's field devices (e.g. VMS, select signal timing patterns) for specified defined occurrences.
Operational Responsibility Shifted	One party operates the field equipment of a second party on a full time basis.	Agency A will operate the field devices of Agency B (e.g. County operates a City's traffic signals but the City is responsible for maintenance and repairs.)
Maintenance Responsibility Shifted	One party maintains the field equipment of a second party.	Agency A maintains the field devices of Agency B, but the Agency B is responsible for operations.
Full Responsibility Shifted	One party has full responsibility for the field equipment of a second party including operations and preventative and emergency maintenance.	Agency A operates and maintains the field devices of Agency B.

Exhibit 5-2: Information Flow Definitions

Information Flow	Definition	Example
Data	The dissemination of raw, unprocessed data gathered from one party's field devices or systems to another party. Data can include, but is not limited to, traffic, weather, parking, transit data, etc. Video images are not included in this information flow.	Agency A sends data from its field devices to Agency B.
Video	The dissemination of live video and still images from one party's field camera's to another party	Agency A sends live video and still images to Agency B.
Event Information	The dissemination of event/incident information or other processed data from one party to another party.	Agency A sends processed data to Agency B.
Device Status	The ability for one party to monitor another party's field devices, and to receive such information as current signal timing, response plan, current message sets, etc.	Agency A sends status information on its devices to Agency B.
Request	The ability for one party to solicit either information or a command change, such as Variable Message Sign (VMS) or signal timing changes, from another party.	Agency A requests information or action from Agency B.
Control	The ability for one party to control another party's field devices. Control can include but is not limited to, changing VMS messages, changing traffic signal timings, camera control, etc.	Agency A issues control instruction to Agency B's field devices.

5.2 Interagency Interfaces

Of the hundreds of interfaces included in the architecture, the ones considered in the Operational Concept are those that involve multiple organizations. The interagency interfaces called for in the Regional ITS Architecture are identified and defined in this section. The interfaces are addressed within the following categories:

- Roadway Management
- Transit Management
- Emergency Management
- Data Archives
- Electronic Fare Payment
- Electronic Toll Collection

It should be noted that these categories are not the same as the functional areas used in the "Market Packages by Functional Area" section of the architecture and as defined by the National ITS Architecture. Instead, these categories have been defined in order to help in the discussion of the large number of interfaces. They do not directly correspond to the market package functional areas because the interfaces of interest do not necessarily fall under a single market package or even a single functional area. For example, the interface supporting the provision of traffic information from a traffic management center to a bus control center falls under both the "Traffic Information Dissemination" and "Transit Fixed-Route Operations" market packages. The interface might also support the provision of traffic signal priority for buses, which would fall under the "Transit Signal Priority" market package.

To reduce this overlap, the following subsections group the interfaces under the more basic categories defined above. Within each category, operational concepts have been defined for either

individual interfaces or groups of similar interfaces. The intent of the discussion of each interface is to outline how the interface will be addressed by the two organizations, including what information will be exchanged and how this exchange will occur. Defining these interfaces serves as the initial step in the development of agreements between the interfacing organizations, as it starts the process of identifying the content and the issues that must be addressed in the interagency agreements.

5.2.1 ROADWAY MANAGEMENT

Exhibit 5-3 illustrates the interagency interfaces required to support regional roadway management functions. There are numerous interfaces between the various traffic management centers in the region. An additional set of interfaces exists between each of the traffic management centers and private traveler information service providers to support traveler information functions.

Exhibit 5-3: Interagency Interfaces – Roadway Management

	Traffic Management					Trav. Info.
	BTD	Local Cities and Towns	MassDOT – Highway Division	Massport	DCR	Private Traveler Information Service Providers
BTD		✓	✓	✓	✓	✓
Local Cities and Towns			✓	✓	✓	✓
MassDOT - Highway Division				✓	✓	✓
Massport						✓
DCR						

Each of these interfaces is addressed by an operational concept. The following operational concepts are defined for Roadway Management:

- Center-to-Center
  - BTD and MassDOT – Highway Division
  - BTD and Massport
  - Massport and MassDOT – Highway Division
  - Other
- Traffic Signal Operation
- Private Traveler Information

Note that a separate Center-to-Center operational concept is defined between each of the major control centers in the region. This is due to the specialized nature of the major control centers in the region (i.e. those of BTD, MassDOT – Highway Division, and Massport) and the need to recognize preexisting relationships established among them. These operational concepts are presented in Exhibit 5-4 through Exhibit 5-9.

Exhibit 5-4: Operational Concept: Roadway Management – Center-to-Center (BTD and MassDOT – Highway Division)

Operational Concept:	**Center-to-Center (BTD and MassDOT – Highway Division)**
Functional Area:	Roadway Management
The interface between BTD and MassDOT – Highway Division will be implemented between their respective traffic control centers, namely the BTD Traffic Management Center and the MassDOT – Highway Division Highway Operations Center (HOC). The interface will support a number of functions, including traffic management, maintenance management, and traveler information. Some of the interfaces covered by this operational concept already exist, such as the interface to exchange video through the Massachusetts Interagency Video Information System (MIVIS).	
Interfacing Agencies:	▪ BTD and MassDOT – Highway Division

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* As part of MIVIS, video images are exchanged between the two control centers, allowing operator viewing of select CCTV cameras from the other agency. Pan/tilt/zoom control of the camera remains in the control of the agency owning the camera, but requests for camera repositioning can be made via voice communications (e.g. phone or radio).
Event Information:	*Information Sharing:* Event information, such as accident, delay, and construction information, will be exchanged between the two control centers through a shared connection to a centralized database. Each agency will enter event information for roadways within its jurisdiction into the database. For MassDOT – Highway Division, the central software will automatically send event information to the database. For BTD, entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for its traffic management software. Similarly, event information will be received by each traffic management center either through an automated link with the central software or through operator monitoring of a web-based interface.
Device Status:	*Consultation:* Exchange of device status information, including incident response measures such as VMS messages, will occur via voice communications. Coordination via phone or radio will be essential when incident response on one agency's roadways will affect operations on the other agency's roadways. Automated exchange of device status information, such as the ability to monitor messages displayed on the other agency's VMSs, is recommended for future implementation.
Request:	*Consultation:* Requests for CCTV camera repositioning, as mentioned above, will be made via voice communications. All other requests, such as placement of messages on the other agency's VMSs, will also be made via voice communications.
Control:	*Independent:* Direct control of the other agency's field equipment will not be permitted. All control will remain with the agency that owns the equipment. Indirect control is possible via requests to the other agency, as discussed above.

Exhibit 5-5: Operational Concept: Roadway Management – Center-to-Center (BTD and Massport)

Operational Concept:	**Center-to-Center (BTD and Massport)**
Functional Area:	Roadway Management
The interface between BTD and Massport will be implemented between their respective traffic control centers, namely the BTD Traffic Management Center and the Massport Landside Operations Control Center.	
Interfacing Agencies:	▪ BTD and Massport

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* Video images will be exchanged between the two control centers to allow operator viewing of select CCTV cameras from the other agency. Pan/tilt/zoom control of the camera will remain in the control of the agency owning the camera, but requests for camera repositioning may be made via voice communications (e.g. phone or radio).
Event Information:	*Information Sharing:* Event information, such as accident, delay, and construction information, will be exchanged between the two control centers through a shared connection to a centralized database. Each agency will enter event information for roadways within its jurisdiction into the database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the traffic management software at each control center. Similarly, event information will be received by each traffic management center either through an automated link with the central software or through operator monitoring of a web-based interface.
Device Status:	*Consultation:* Exchange of device status information, including incident response measures such as VMS messages, will occur via voice communications. Coordination via phone or radio will be essential when incident response on one agency's roadways will affect operations on the other agency's roadways. Automated exchange of device status information, such as the ability to monitor messages displayed on the other agency's VMSs, is recommended for future implementation.
Request:	*Coordination:* Requests for CCTV camera repositioning, as mentioned above, will be made via voice communications. All other requests, such as placement of messages on the other agency's VMSs, will also be made via voice communications.
Control:	*Independent:* Direct control of the other agency's field equipment will not be permitted. All control will remain with the agency that owns the equipment. Indirect control is possible via requests to the other agency, as discussed above.

Exhibit 5-6: Operational Concept: Roadway Management – Center-to-Center (Massport and MassDOT – Highway Division)

Operational Concept:	**Center-to-Center (Massport and MassDOT – Highway Division)**
Functional Area:	Roadway Management
The interface between Massport and MassDOT – Highway Division will be implemented between their respective traffic control centers, namely the Massport Landside Operations Control Center and the MassDOT – Highway Division Highway Operations Center (HOC). The interface will support a number of functions, including traffic management, maintenance management, and traveler information.	
Interfacing Agencies:	▪ Massport and MassDOT – Highway Division

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* Video images will be exchanged between the two control centers to allow operator viewing of select CCTV cameras from the other agency. Pan/tilt/zoom control of the camera will remain in the control of the agency owning the camera, but requests for camera repositioning may be made via voice communications (e.g. phone or radio).
Event Information:	*Information Sharing:* Event information, such as accident, delay, and construction information, will be exchanged between the two control centers through a shared connection to a centralized database. Each agency will enter event information for roadways within its jurisdiction into the database. For MassDOT – Highway Division, the central software will automatically send event information to the database. For Massport, entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for its traffic management software. Similarly, event information will be received by each traffic management center either through an automated link with the central software or through operator monitoring of a web-based interface.
Device Status:	*Consultation:* Exchange of device status information, including incident response measures such as VMS messages, will occur via voice communications. Coordination via phone or radio will be essential when incident response on one agency's roadways will affect operations on the other agency's roadways. Automated exchange of device status information, such as the ability to monitor messages displayed on the other agency's VMSs, is recommended for future implementation.
Request:	*Coordination:* Requests for CCTV camera repositioning, as mentioned above, will be made via voice communications. All other requests, such as placement of messages on the other agency's VMSs, will also be made via voice communications.
Control:	*Independent:* Direct control of the other agency's field equipment will not be permitted. All control will remain with the agency that owns the equipment. Indirect control is possible via requests to the other agency, as discussed above.

Exhibit 5-7: Operational Concept: Roadway Management – Center-to-Center (Other)

Operational Concept:	**Center-to-Center (Other)**
Functional Area:	Roadway Management
This operational concept covers interfaces between major traffic control centers and smaller dispatch/operation centers (such as those of the DCR and some local cities/towns). The interfaces included in this operational concept will support a number of functions, including traffic management, maintenance management, and traveler information.	
Interfacing Agencies:	▪ Local Cities/Towns and BTD ▪ Local Cities/Towns and MassDOT – Highway Division ▪ Local Cities/Towns and Massport ▪ DCR and Local Cities/Towns ▪ DCR and MassDOT – Highway Division ▪ DCR and Massport

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* If the smaller operation has capability for video, video images will be exchanged between the two control centers to allow operator viewing of select CCTV cameras from the other agency. Pan/tilt/zoom control of the camera will remain in the control of the agency owning the camera, but requests for camera repositioning may be made via voice communications (e.g. phone or radio).
Event Information:	*Information Sharing:* Event information, such as accident, delay, and construction information, will be exchanged between the two centers through a shared connection to a centralized database. Each agency will enter event information into the database for roadways within its jurisdiction. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the central software (if applicable). Similarly, event information will be received by each traffic management center either through operator monitoring of a web-based interface or through an automated link with the central software.
Device Status:	*Consultation:* Exchange of device status information, including incident response measures such as VMS messages, will occur via voice communications. Coordination via phone or radio will be essential when incident response on one agency's roadways will affect operations on the other agency's roadways. Automated exchange of device status information, such as the ability to monitor messages displayed on the other agency's VMSs, is recommended for future implementation.
Request:	*Coordination:* Requests for CCTV camera repositioning, as mentioned above, will be made via voice communications. All other requests, such as placement of messages on the other agency's VMSs, will also be made via voice communications.
Control:	*Independent:* Direct control of the other agency's field equipment will not be permitted. All control will remain with the agency that owns the equipment. Indirect control is possible via requests to the other agency, as discussed above.

Exhibit 5-8: Operational Concept: Roadway Management – Traffic Signal Operation

Operational Concept:	**Traffic Signal Operation**
Functional Area:	Roadway Management
This operational concept applies to the interface between BTD and DCR. This interface is implemented between the BTD Traffic Management Center and select DCR traffic signal controllers within the City of Boston.	
Interfacing Agencies:	▪ BTD and DCR

Information Flow	*Relationship*
Data:	Not applicable.
Video:	Not applicable.
Event Information:	Not applicable.
Device Status:	Not applicable.
Request:	Not applicable.
Control:	*Operational Responsibility Shifted:* Traffic signals and signal controllers owned by DCR will be monitored and operated by BTD as part of the central traffic signal system at the Traffic Management Center. DCR will be responsible for maintenance of all field equipment, but BTD will have full operational control.

Exhibit 5-9: Operational Concept: Roadway Management – Private Traveler Information

Operational Concept:	**Private Traveler Information**
Functional Area:	Roadway Management
This operational concept applies to the interfaces between Private Traveler Information Service Providers' control centers and traffic management agency control centers.	
Interfacing Agencies:	▪ Private Traveler Information Service Providers and BTD ▪ Private Traveler Information Service Providers and Local Cities/Towns ▪ Private Traveler Information Service Providers and MassDOT – Highway Division ▪ Private Traveler Information Service Providers and Massport

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* Video images will be exchanged between the two control centers (and/or the corresponding agency website) to allow operator viewing of select CCTV cameras from the other agency. Pan/tilt/zoom control of the camera will remain in the control of the agency owning the camera, but requests for camera repositioning may be made via voice communications (e.g. phone or radio).
Event Information:	*Information Sharing:* Event information, such as accident, delay, and construction information, will be exchanged between the two control centers through a shared connection to a centralized database. Each agency will enter event information for roadways within its jurisdiction or coverage area into the database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the central software at each control center. Similarly, event information will be received by each control center either through an automated link with the central software or through operator monitoring of a web-based interface.
Device Status:	*Independent:* No exchange of device status information is planned. However, automated exchange of device status information, such as VMS states, is recommended for future implementation, so that information provided by the private service provider is consistent with agency messages.
Request:	*Coordination:* Requests for CCTV camera repositioning, as mentioned above, will be made via voice communications.
Control:	*Independent:* Direct control of the other agency's field equipment will not be permitted. All control will remain with the agency that owns the equipment. Indirect control is possible via requests to the other agency, as discussed above.

5.2.2 TRANSIT MANAGEMENT

Exhibit 5-10 illustrates the interagency interfaces required to support regional transit management functions. These interfaces include center-to-center interfaces among transit control centers, interfaces between transit control centers and traffic control centers, and interfaces with private traveler information service providers.

Exhibit 5-10: Interagency Interfaces – Transit Management

	Transit Management													Traffic Management				Trav. Info.
	Amtrak	Local City/Town Shuttle Services	Local Human Service Transit Providers	Massport	MBTA	Private Surface Transportation Providers	BAT	CATA	GATRA	LRTA	MVRTA	MWRTA	TMAs	BTD	Local Cities and Towns (Traffic)	MassDOT - Highway Division	Massport (Traffic)	Private Traveler Information Service Providers
Amtrak					✓										✓			✓
Local City/Town Shuttle Services					✓										✓	✓		✓
Local Human Service Transit Providers					✓										✓	✓		✓
Massport (Transit)					✓									✓	✓	✓		✓
MBTA						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Private Surface Transportation Providers														✓	✓	✓		✓
BAT								✓	✓	✓	✓	✓			✓	✓		✓
CATA									✓	✓	✓	✓			✓	✓		✓
GATRA										✓	✓	✓			✓	✓		✓
LRTA											✓	✓			✓	✓		✓
MVRTA												✓			✓	✓		✓
MWRTA															✓	✓		✓
TMAs															✓	✓		✓

Each of these interfaces is addressed by one of the following operational concepts:

- Center-to-Center
- Traffic Coordination
- Traffic Coordination and Signal Priority
- Grade Crossings
- Private Traveler Information

These operational concepts are presented in Exhibit 5-11 through Exhibit 5-15, respectively.

Exhibit 5-11: Operational Concept: Transit Management – Center-to-Center

Operational Concept:	**Center-to-Center**
Functional Area:	Transit Management
This operational concept applies to the interfaces among the various transit operations control centers. The interfaces included in this operational concept will support transit management and traveler information functions.	
Interfacing Agencies:	▪ MBTA and Amtrak ▪ MBTA and Local City/Town Shuttle Services ▪ MBTA and Local Human Service Transit Providers ▪ MBTA and Massport (transit) ▪ MBTA and Private Surface Transportation Providers ▪ MBTA and BAT ▪ MBTA and CATA ▪ MBTA and GATRA ▪ MBTA and LRTA ▪ MBTA and MVRTA ▪ MBTA and MWRTA ▪ MBTA and TMAs ▪ BAT and CATA ▪ BAT and GATRA ▪ BAT and LRTA ▪ BAT and MVRTA ▪ BAT and MWRTA ▪ CATA and GATRA ▪ CATA and LRTA ▪ CATA and MVRTA ▪ CATA and MWRTA ▪ GATRA and LRTA ▪ GATRA and MVRTA ▪ GATRA and MWRTA ▪ LRTA and MVRTA ▪ LRTA and MWRTA ▪ MVRTA and MWRTA

Information Flow	*Relationship*
Data:	Not applicable.
Video:	Not applicable.
Event Information:	*Information Sharing:* Event information such as service updates will be exchanged through a shared connection to a centralized database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the central software at each control center. Event information will be received by each control center either through an automated link with the central software or through operator monitoring of a web-based interface. *Consultation:* Exchange of response status information, including incident response measures such as service modifications, will occur via voice communications. Coordination via phone or radio will be essential when incident response by one agency affects operations by the other.
Device Status:	Not applicable.
Request:	*Coordination:* Requests, such as those for service modifications such as vehicle holding or rerouting, will be made via voice communications. An automated system and protocol is recommended for situations where requests are frequent.
Control:	Not applicable.

Exhibit 5-12: Operational Concept: Transit Management – Traffic Coordination

Operational Concept:	**Traffic Coordination**
Functional Area:	Transit Management
This operational concept applies to the interfaces between transit operations control centers and traffic management control centers. The interfaces included in this operational concept will support a number of functions, including traffic management, transit management, and traveler information (e.g. the 511 Traveler Information System).	
Interfacing Agencies:	▪ BTD and Massport (transit) ▪ BTD and Private Surface Transportation Providers ▪ Local Cities/Towns (traffic) and Local City/Town Shuttle Services ▪ Local Cities/Towns (traffic) and Local Human Service Transit Providers ▪ Local Cities/Towns (traffic) and Massport (transit) ▪ Local Cities/Towns (traffic) and Private Surface Trans. ▪ Massport (traffic) and MBTA ▪ MassDOT – Highway Division and Local City/Town Shuttle Services ▪ MassDOT – Highway Division and Local Human Service Transit Providers ▪ MassDOT – Highway Division and Massport (transit) ▪ MassDOT – Highway Division and MBTA ▪ MassDOT – Highway Division and Private Surface Transportation Providers ▪ MassDOT – Highway Division and BAT ▪ MassDOT – Highway Division and CATA ▪ MassDOT – Highway Division and GATRA ▪ MassDOT – Highway Division and LRTA ▪ MassDOT – Highway Division and MVRTA ▪ MassDOT – Highway Division and MWRTA ▪ MassDOT – Highway Division and TMAs

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* The transit authority will have access to video feeds from select traffic cameras to support dispatching operations. Pan/tilt/zoom control of the camera will remain in the control of the traffic operations center, but requests for camera repositioning by the transit authority may be made via voice communications (e.g. phone or radio). This interface already exists between MassDOT – Highway Division and the MBTA through MIVIS.

Event Information:	*Information Sharing:* Event information from the traffic operations center, such as accident, delay, and construction information, will be provided to the transit authority through a shared connection to a centralized database. The traffic operations center will enter event information for roadways within its jurisdiction into the database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the traffic management software at the control center. The transit authority will receive event information through operator monitoring of a web-based interface. *Consultation:* Exchange of response status information, including incident response measures such as street closures or service modifications, will occur via voice communications. Coordination via phone or radio will be essential when incident response by the traffic operations center affects operations by the transit authority, and vice versa.
Device Status:	Not applicable.
Request:	Consultation: Requests from the transit authority to the traffic operations center for CCTV camera repositioning, as discussed above, will be made via voice communications.
Control:	Independent: Direct control of roadway field equipment will not be permitted, as all control will remain with the traffic operations center. Indirect control by the transit authority is possible via requests to the traffic operations center, as discussed above.

Exhibit 5-13: Operational Concept: Transit Management – Traffic Coordination and Signal Priority

Operational Concept:	**Traffic Coordination and Signal Priority**
Functional Area:	Transit Management
As with the "Traffic Coordination" operational concept described in Exhibit 5-12, this operational concept applies to the interfaces between transit operations control centers and traffic management control centers. However, this operational concept also includes the provision of signal priority for transit vehicles.	
Interfacing Agencies:	▪ BTD and MBTA ▪ Local Cities/Towns (traffic) and MBTA ▪ Local Cities/Towns (traffic) and BAT ▪ Local Cities/Towns (traffic) and CATA ▪ Local Cities/Towns (traffic) and GATRA ▪ Local Cities/Towns (traffic) and LRTA ▪ Local Cities/Towns (traffic) and MVRTA ▪ Local Cities/Towns (traffic) and MWRTA ▪ Local Cities/Towns (traffic) and TMAs

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* The transit authority will have access to video feeds from select traffic cameras to support dispatching operations. Pan/tilt/zoom control of the camera will remain in the control of the traffic operations center, but requests for camera repositioning by the transit authority may be made via voice communications (e.g. phone or radio).
Event Information:	*Information Sharing:* Event information from the traffic operations center, such as accident, delay, and construction information, will be provided to the transit authority through a shared connection to a centralized database. The traffic operations center will enter event information for roadways within its jurisdiction into the database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the traffic management software at each control center. The transit authority will receive event information through operator monitoring of a web-based interface. *Consultation:* Exchange of response status information, including incident response measures such as street closures or service modifications, will occur via voice communications. Coordination via phone or radio will be essential when incident response by the traffic operations center affects operations by the transit authority, and vice versa.
Device Status:	*Information Sharing:* Relevant status information for field devices will include traffic signal status and information about transit priority calls. Field device status will be reported to the transit authority from the traffic management center by means of a direct connection between the central systems.
Request:	*Information Sharing:* Requests for traffic signal priority for buses or light rail vehicles will be made to the traffic signal system controlled by the traffic operations center. This may occur locally at the signal controller or through a request to the central system. If the request is to the central system, the traffic operations center will make the determination of whether or not to grant priority. *Consultation:* Requests from the transit authority to the traffic operations center for CCTV camera repositioning, as mentioned above, will be made via voice communications.
Control:	*Independent:* Direct control of roadway field equipment will not be permitted, as all control will remain with the traffic operations center. Indirect control by the transit authority is possible via requests to the traffic operations center, as discussed above.

Exhibit 5-14: Operational Concept: Transit Management – Grade Crossings

Operational Concept:	**Grade Crossings**
Functional Area:	Transit Management
This operational concept applies to the interfaces between rail operations control centers and traffic management control centers, specifically for coordination of activity at at-grade rail crossings.	
Interfacing Agencies:	▪ Amtrak and Local Cities/Towns ▪ Rail Operators and Local Cities/Towns ▪ Rail Operators and MassDOT – Highway Division

Information Flow	*Relationship*
Data:	Not applicable.
Video:	Not applicable.
Event Information:	*Information Sharing:* Event information, such as construction activity affecting a grade crossing or rail schedule information, will be exchanged between the two control centers through a shared connection to a centralized database. Each agency will enter event information into the database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the software at each control center. Similarly, event information will be received by each control center either through an automated link with the central software or through operator monitoring of a web-based interface.
Device Status:	Not applicable.
Request:	Not applicable.
Control:	Not applicable.

Exhibit 5-15: Operational Concept: Transit Management – Private Traveler Information

Operational Concept:	**Private Traveler Information**
Functional Area:	Transit Management
This operational concept applies to the interfaces between transit authority control centers and control centers of Private Traveler Information Service Providers (ISPs).	
Interfacing Agencies:	▪ Private Traveler ISPs and Amtrak ▪ Private Traveler ISPs and Local Cities and Towns (transit) ▪ Private Traveler ISPs and Local Human Service Transit Providers ▪ Private Traveler ISPs and Massport (transit) ▪ Private Traveler ISPs and MBTA ▪ Private Traveler ISPs and Private Surface Transportation Providers ▪ Private Traveler ISPs and BAT ▪ Private Traveler ISPs and CATA ▪ Private Traveler ISPs and GATRA ▪ Private Traveler ISPs and LRTA ▪ Private Traveler ISPs and MVRTA ▪ Private Traveler ISPs and MWRTA ▪ Private Traveler ISPs and TMAs

Information Flow	*Relationship*
Data:	Not applicable.
Video:	Not applicable.
Event Information:	*Information Sharing:* Service updates from the transit operations center will be provided to the private service provider through a shared connection to a centralized database. The transit operations center will enter event information into the database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the software at the control center. The private service provider will receive event information through operator monitoring of a web-based interface. *Information Sharing:* Exchange of response status information, including incident response measures such as service modifications, will occur through a shared connection to a centralized database or by via voice communications in urgent situations.
Device Status:	Not applicable.
Request:	Not applicable.
Control:	Not applicable.

5.2.3 EMERGENCY MANAGEMENT

Exhibit 5-16 illustrates the interagency interfaces required to support regional emergency management functions. These interfaces include center-to-center interfaces among the emergency management centers, as well as interfaces between emergency management centers and traffic control centers.

Exhibit 5-16: Interagency Interfaces – Emergency Management

	Emergency Management					Traffic Management					Transit Management							
	BEMA	Local City/Town/County Public Safety	MBTA (police)	MEMA	State Police	BTD	Local Cities and Towns	MassDOT - Highway Division	Massport	DCR	BAT	CATA	GATRA	LRTA	MBTA	MVRTA	MWRTA	Local City/Town Shuttle Services
BEMA		✓	✓	✓	✓	✓	✓	✓	✓	✓								
Local City/Town/County Public Safety			✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
MBTA (police)				✓	✓	✓	✓											
MEMA					✓	✓	✓	✓	✓	✓								
State Police						✓	✓	✓	✓	✓								

Each of these interfaces is addressed by one of the following operational concepts:

- Center-to-Center
- Traffic Coordination
  - Local
  - MEMA
  - MEMA and MassDOT – Highway Division
  - State Police
- Transit Coordination

These operational concepts are presented in Exhibit 5-17 through Exhibit 5-22, respectively.

Exhibit 5-17: Operational Concept: Emergency Management – Center-to-Center

Operational Concept:	**Center-to-Center**
Functional Area:	Emergency Management
This operational concept applies to the interfaces among the various emergency management control centers.	
Interfacing Agencies:	▪ BEMA and Local Cities/Towns ▪ BEMA and MBTA ▪ BEMA and MEMA ▪ BEMA and State Police ▪ Local Cities/Towns and MBTA ▪ Local Cities/Towns and MEMA ▪ Local Cities/Towns and State Police ▪ MBTA (police) and MEMA ▪ MBTA (police) and State Police ▪ MEMA and State Police

Information Flow	*Relationship*
Data:	Not applicable.
Video:	No video exchange will be made between the two agencies.
Event Information:	*Cooperation:* Emergency event information, such as reports of accidents and other major incidents, will be exchanged by voice communication (phone or radio). The critical nature of such communication requires this direct person-to-person interface. *Information Sharing:* Non-emergency event information will be exchanged through a shared connection to a centralized database. Entering and viewing of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the control center software.
Device Status:	*Consultation:* Exchange of device status information, including incident response measures, will occur via voice communications. Automated exchange of device status information, such as the ability for one agency to monitor information being disseminated by another, is recommended for future implementation.
Request:	*Cooperation:* All requests, such as emergency operations procedures or dissemination of information via the other agency's equipment, will be made via voice communications.
Control:	Not applicable.

Exhibit 5-18: Operational Concept: Emergency Management – Traffic Coordination (Local)

Operational Concept:	**Traffic Coordination (Local)**
Functional Area:	Emergency Management
This operational concept applies to the interfaces between local or regional emergency management control centers and traffic management centers.	
Interfacing Agencies:	▪ BEMA and BTD ▪ BEMA and Local Cities/Towns ▪ BEMA and MassDOT – Highway Division ▪ BEMA and Massport ▪ BEMA and DCR ▪ MBTA and BTD ▪ MBTA and Local Cities/Towns ▪ Local City/Town/County Public Safety and Local Cities/Towns (traffic) ▪ Local City/Town/County Public Safety and MassDOT – Highway Division ▪ Local City/Town/County Public Safety and Massport ▪ Local City/Town/County Public Safety and DCR

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* The emergency operations center will have access to video feeds from select traffic cameras to support incident management operations. Pan/tilt/zoom control of the camera will remain in the control of the traffic management center, but requests for camera repositioning by the emergency operations center may be made via voice communications (e.g. phone or radio).
Event Information:	*Cooperation:* Emergency event information, such as reports of accidents and other major incidents, will be exchanged by voice communication (phone or radio). The critical nature of such communication requires this direct person-to-person interface. *Information Sharing:* Non-emergency event information from the traffic management center, such as traffic and construction information, will be provided to the emergency operations center through a shared connection to a centralized database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the traffic management center software. The emergency operations center will receive event information through operator monitoring of a web-based interface.
Device Status:	*Consultation:* Exchange of device status information, including incident response measures such as road closures and detours, will occur via voice communications. Coordination via phone or radio will be essential when incident response by the emergency operations center affects operations by the traffic management center, and vice versa. Automated exchange of device status information, such as the ability for the emergency operations center to monitor event responses by the traffic management center, is recommended for future implementation.
Request:	*Cooperation:* Emergency operations center requests for CCTV camera repositioning, as mentioned above, will be made via voice communications. All other requests, such as placement of messages on VMSs controlled by the traffic management center, will also be made via voice communications.
Control:	*Independent:* Direct control of traffic field equipment will not be permitted, as all control will remain with the traffic management center. Indirect control by the emergency operations center is possible via requests to the traffic management center, as discussed above.

Exhibit 5-19: Operational Concept: Emergency Management – Traffic Coordination (MEMA)

Operational Concept:	**Traffic Coordination (MEMA)**
Functional Area:	Emergency Management
This operational concept applies to the interfaces between the MEMA control center and traffic management control centers.	
Interfacing Agencies:	▪ MEMA and BTD ▪ MEMA and Local Cities/Towns ▪ MEMA and Massport ▪ MEMA and DCR

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* MEMA will have access to video feeds from select traffic cameras to support incident management operations. Pan/tilt/zoom control of the camera will remain in the control of the traffic operations center, but requests for camera repositioning by MEMA may be made via voice communications (e.g. phone or radio).
Event Information:	*Cooperation:* Emergency event information, such as reports of accidents and other major incidents, will be exchanged by voice communication (phone or radio). The critical nature of such communication requires this direct person-to-person interface. *Information Sharing:* Non-emergency event information from the traffic operations center, such as traffic and construction information, will be provided to MEMA through a shared connection to a centralized database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the traffic operations center software. MEMA will receive event information through operator monitoring of a web-based interface.
Device Status:	*Consultation:* Exchange of device status information, including incident response measures such as road closures and detours, will occur via voice communications. Coordination via phone or radio will be essential when incident response by MEMA affects operations by the traffic operations center, and vice versa. Automated exchange of device status information, such as the ability for MEMA to monitor messages displayed on VMSs controlled by the traffic operations center, is recommended for future implementation.
Request:	*Cooperation:* MEMA requests for CCTV camera repositioning, as mentioned above, will be made via voice communications. All other requests, such as placement of messages on VMSs, will also be made via voice communications.
Control:	*Independent:* Direct control of traffic field equipment will not be permitted, as all control will remain with the traffic operations center. Indirect control by MEMA is possible via requests to the traffic operations center, as discussed above.

Exhibit 5-20: Operational Concept: Emergency Management – Traffic Coordination (MEMA and MassDOT – Highway Division)

Operational Concept:	**Traffic Coordination (MEMA and MassDOT – Highway Division)**
Functional Area:	Emergency Management
This operational concept applies to the interface between MEMA and MassDOT – Highway Division. This interface differs from the other "Traffic Coordination" interfaces in that direct control of some of MassDOT – Highway Division's central software and field equipment by MEMA may be possible under certain circumstances. The interface will be implemented between the MEMA Operations Center and the MassDOT – Highway Division HOC.	
Interfacing Agencies:	▪ MEMA and MassDOT – Highway Division

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* MEMA will have access to video feeds from select MassDOT – Highway Division cameras to support incident management operations. In non-critical conditions, pan/tilt/zoom control of the camera will remain in the control of MassDOT – Highway Division, but requests for camera repositioning by MEMA may be made via voice communications (e.g. phone or radio). *Control Sharing:* A back-up operator workstation for the MassDOT – Highway Division HOC will be located at the MEMA Operations Center. This workstation will have the some of the same functionality as workstations in the HOC, allowing some control of some MassDOT – Highway Division field equipment. In critical circumstances, MEMA may be able to view and control some MassDOT – Highway Division cameras via the remote HOC workstation.
Event Information:	*Cooperation:* Emergency event information, such as reports of accidents and other major incidents, will be exchanged by voice communication (phone or radio). The critical nature of such communication requires this direct person-to-person interface. *Information Sharing:* Non-emergency event information from MassDOT – Highway Division, such as traffic and construction information, will be provided to MEMA through a shared connection to a centralized database. The MassDOT – Highway Division central software will automatically send event information to the database. MEMA will receive event information through operator monitoring of a web-based interface.
Device Status:	*Information Sharing:* Automated exchange of some of MassDOT – Highway Division device status information will be provided through the remote HOC workstation. This will provide MEMA with the ability to monitor response measures, such as messages displayed on some MassDOT – Highway Division VMSs.
Request:	*Cooperation:* MEMA requests for CCTV camera repositioning, as mentioned above, will be made via voice communications. All other requests, such as placement of messages on MassDOT – Highway Division VMSs, will also be made via voice communications.
Control:	*Control Sharing:* As mentioned above, MEMA may be able to take direct control of some MassDOT – Highway Division field equipment under critical circumstances. The back-up HOC workstation will have some of the same functionality as workstations in the HOC, allowing some control of MassDOT – Highway Division field equipment.

Exhibit 5-21: Operational Concept: Emergency Management – Traffic Coordination (State Police)

Operational Concept:	**Traffic Coordination (State Police)**
Functional Area:	Emergency Management
This operational concept applies to the interfaces between the State Police and the various traffic management control centers.	
Interfacing Agencies:	▪ State Police and BTD ▪ State Police and Local Cities/Towns ▪ State Police and MassDOT – Highway Division ▪ State Police and Massport ▪ State Police and DCR

Information Flow	*Relationship*
Data:	Not applicable.
Video:	*Information Sharing:* The State Police will have access to video feeds from select traffic cameras to support dispatching and event management operations. Pan/tilt/zoom control of the camera will remain in the control of the traffic operations center, but requests for camera repositioning by the State Police may be made via voice communications (e.g. phone or radio).
Event Information:	*Cooperation:* Emergency event information, such as reports of accidents and other major incidents, will be exchanged by voice communication (phone or radio). The critical nature of such communication requires this direct person-to-person interface. *Information Sharing:* Non-emergency event information from the traffic operations center, such as traffic and construction information, will be provided to the State Police through a shared connection to a centralized database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the traffic operations center software. The State Police will receive event information through operator monitoring of a web-based interface.
Device Status:	*Consultation:* Exchange of device status information, including incident response measures such as road closures and detours, will occur via voice communications. Coordination via phone or radio will be essential when incident response by the State Police affects operations by the traffic operations center, and vice versa. Automated exchange of device status information, such as the ability for the State Police to monitor messages displayed on VMSs controlled by the traffic operations center, is recommended for future implementation.
Request:	*Cooperation:* State Police requests for CCTV camera repositioning, as mentioned above, will be made via voice communications. All other requests, including the use of VMSs for displaying emergency messages (such as Amber Alert messages), will also be made via voice communications.
Control:	*Independent:* Direct control by the State Police of roadway field equipment will not be permitted, as all control will remain with the traffic operations center. Indirect control by the State Police is possible via requests to the traffic operations center, as discussed above.

Exhibit 5-22: Operational Concept: Emergency Management – Transit Coordination

Operational Concept:	**Transit Coordination**
Functional Area:	Emergency Management
This operational concept applies to the interfaces between local or regional emergency management control centers and transit management centers.	
Interfacing Agencies:	▪ Local City/Town/County Public Safety and BAT ▪ Local City/Town/County Public Safety and CATA ▪ Local City/Town/County Public Safety and GATRA ▪ Local City/Town/County Public Safety and LRTA ▪ Local City/Town/County Public Safety and MBTA ▪ Local City/Town/County Public Safety and MVRTA ▪ Local City/Town/County Public Safety and MWRTA ▪ Local City/Town/County Public Safety and Local City/Town Shuttle Services

Information Flow	*Relationship*
Data:	Not applicable.
Video:	Not applicable.
Event Information:	*Cooperation:* Emergency event information, such as reports of major incidents or incident response measures such as service modifications, will be exchanged by voice communication (e.g. phone or radio). The critical nature of such communication requires this direct person-to-person interface. *Information Sharing:* Non-emergency event information from the transit management center, such as service updates, will be provided to the emergency operations center through a shared connection to a centralized database. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the central software at the transit management center. The emergency operations center will receive event information through operator monitoring of a web-based interface.
Device Status:	Not applicable.
Request:	*Coordination:* Requests, such as those for service modifications such as vehicle holding or rerouting, will be made via voice communications. An automated system and protocol is recommended for situations where requests are frequent.
Control:	Not applicable.

5.2.4 DATA ARCHIVES

Exhibit 5-23 illustrates the interagency interfaces required to support regional data archive management functions. These include interfaces with the Office of Transportation Planning (proposed as the hub of an integrated data archive system), as well as an interface between the RMV and state/local police for crash reporting.

Exhibit 5-23: Interagency Interfaces – Data Archives

	Data Warehouse		Traffic Mgt.			Transit Mgt.							Planning					Emer. Mgt.		Other		
	MassDOT - OTP	MassDOT - RMV	BTD	MassDOT - Highway Division	Massport	MBTA	GATRA	BAT	CATA	LRTA	MVRTA	MWRTA	MAPC	MVPC	NMCOG	OCPC	SRPEDD	State Police	Local Public Safety	Greater Boston Convention and Visitor Bureau	Greater Merrimack Convention and Visitor Bureau	North of Boston Convention and Visitor Bureau
MassDOT - OTP		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓
MassDOT - RMV																		✓	✓			

Each of these interfaces is addressed by one of the following operational concepts:

- Planning Archives
- Crash Data System

These operational concepts are presented in Exhibit 5-24 and Exhibit 5-25, respectively.

Exhibit 5-24: Operational Concept: Data Archives – Planning Archives

Operational Concept:	**Planning Archives**
Functional Area:	Data Archives
This operational concept addresses the interfaces between the MassDOT - Office of Transportation Planning (OTP) and other organizations holding data archives. As envisioned by the architecture, OTP will serve as the regional archived data management system hub, holding information managed by OTP as well as providing a portal to the information held by other organizations.	
Interfacing Agencies:	▪ OTP and RMV ▪ OTP and BTD ▪ OTP and MassDOT – Highway Division ▪ OTP and Massport ▪ OTP and MBTA ▪ OTP and GATRA ▪ OTP and BAT ▪ OTP and CATA ▪ OTP and LRTA ▪ OTP and MVRTA ▪ OTP and MWRTA ▪ OTP and MAPC ▪ OTP and MVPC ▪ OTP and NMCOG ▪ OTP and OCPC ▪ OTP and SRPEDD ▪ OTP and Greater Boston Convention and Visitors Bureau ▪ OTP and Greater Merrimack Convention and Visitors Bureau ▪ OTP and North of Boston Convention and Visitors Bureau

Information Flow	*Relationship*
Data:	*Information Sharing:* As the regional archived data management system hub, the Office of Transportation Planning archive will hold key data collected and reported by other organizations. However, data exchange will also be possible between OTP and each of the other organizations' archives, allowing OTP to serve as a portal to other data held by other organizations. This will provide OTP with access to data held by the other organizations, and will provide the other organizations with access to data held by OTP. Moreover, this will also provide participating organizations with access to each others' data, allowing one RPA, for example, to access data held by an adjacent RPA through the system maintained by OTP. This data exchange will occur over a link between the databases at each location. Access to data on the other systems will be initiated by the organizations requesting the information.
Video:	Not applicable.
Event Information:	Not applicable.
Device Status:	Not applicable.
Request:	*Information Sharing:* As noted above, data exchange will occur between the databases following a request by the initiating organization.
Control:	Not applicable.

Exhibit 5-25: Operational Concept: Data Archives – Crash Data System

Operational Concept:	**Crash Data System**
Functional Area:	Data Archives
This operational concept applies to the interface between the RMV and state/local police, which supports the exchange of information between police systems and the RMV Crash Data System.	
Interfacing Agencies:	▪ RMV and State Police ▪ RMV and Local Public Safety

Information Flow	*Relationship*
Data:	*Information Sharing:* Data exchange will occur over a link between the police and the RMV database. This interface will allow submission of records to the RMV database by state or local police.
Video:	Not applicable.
Event Information:	Not applicable.
Device Status:	Not applicable.
Request:	*Information Sharing:* Data exchange will occur between the databases following a request by the initiating organization.
Control:	Not applicable.

5.2.5 ELECTRONIC FARE PAYMENT

Exhibit 5-26 illustrates the interagency interfaces required to support regional implementation of Electronic Fare Payment (EFP). The plan for EFP in the region is based on a Regional Fare Card that will be interoperable among the various transit authorities. It is envisioned that this regional fare card will be interoperable with the fare card that is currently in use by the MBTA, the CharlieCard. This regional fare card may be established as an expansion of the MBTA's CharlieCard or through a separate interoperable fare card. Currently there is a consortium of RTAs, working to procure new fareboxes and equipment that will accept smart card media interoperable with the MBTA's CharlieCard.

For the purposes of the architecture, the regional fare card will be considered as a separate entity managed by a generic "Regional Fare Card Agency."

Exhibit 5-26: Interagency Interfaces – Electronic Fare Payment

	Transit Management										
	Local Cities and Towns	MBTA	Private Surface Transportation Providers	BAT	CATA	GATRA	LRTA	MVRTA	MWRTA	TMAs	Regional Fare Card Agency
Local Cities and Towns											✓
MBTA				✓	✓	✓	✓	✓	✓		✓
Private Surface Transportation Providers											✓
BAT											✓
CATA											✓
GATRA											✓
LRTA											✓
MVRTA											✓
MWRTA											✓
TMAs											✓
Regional Fare Card Agency											

The interfaces to support electronic fare payment are addressed by a single operational concept, as presented in Exhibit 5-27.

Exhibit 5-27: Operational Concept: Electronic Fare Payment

Operational Concept:	**Electronic Fare Payment**
Functional Area:	Electronic Fare Payment
This operational concept applies to the interagency interfaces required to support regional implementation of electronic fare payment. This operational concept covers acceptance of the planned Regional Fare Card (envisioned in the architecture to be interoperable with the MBTA's automated fare collection system). This may be established as an expansion of the MBTA's CharlieCard or through a separate interoperable fare card.	
Interfacing Agencies:	▪ Regional Fare Card Agency and Local City/Town Shuttle Services ▪ Regional Fare Card Agency and MBTA ▪ Regional Fare Card Agency and Private Surface Transportation Providers ▪ Regional Fare Card Agency and BAT ▪ Regional Fare Card Agency and CATA ▪ Regional Fare Card Agency and GATRA ▪ Regional Fare Card Agency and LRTA ▪ Regional Fare Card Agency and MVRTA ▪ Regional Fare Card Agency and MWRTA ▪ Regional Fare Card Agency and TMAs ▪ MBTA and BAT ▪ MBTA and CATA ▪ MBTA and GATRA ▪ MBTA and LRTA ▪ MBTA and MVRTA ▪ MBTA and MWRTA

Information Flow	*Relationship*
Data:	*Information Sharing:* The Regional Fare Card Agency will hold all administrative and financial data related to the fare cards. In order for the fare card to be used on services by the transit providers in the region, data exchange is required between the fare collection systems of the transit providers and the Regional Fare Card Agency. Two primary data exchanges are required. The first data exchange occurs when the fare card is used on a transit provider's fare-box. At that time, the fare card information is sent to the Regional Fare Card Agency for validation, ensuring that the balance on the card is adequate and deducting the fare from the balance. The second data exchange occurs when the transit provider's account is reconciled with the Regional Fare Card Agency. This is usually done periodically, e.g. at the end of each service day. At that time, the total value of the transit provider's fares paid by fare cards is transferred from the Regional Fare Card Agency to the transit provider.
Video:	Not applicable.
Event Information:	Not applicable.
Device Status:	Not applicable.
Request:	*Information Sharing:* The data exchange occurring during the validation of the fare card will be performed following a request of the transit provider. This request will be initiated upon the use of the fare card in the transit provider's farebox.
Control:	Not applicable.

5.2.6 ELECTRONIC TOLL COLLECTION

Exhibit 5-28 illustrates the interagency interfaces required to support regional implementation of Electronic Toll Collection (ETC). As MassDOT – Highway Division is the ETC system provider for the region, these consist of the interfaces between the MassDOT – Highway Division Account Processing Center and other organizations accepting the toll transponders. These organizations include other toll agencies outside of the region (e.g. E-ZPass Inter-Agency Group members) as well as parking facility operators.

Exhibit 5-28: Interagency Interfaces – Electronic Toll Collection

	Tolls		Parking										
	MassDOT - Highway Division	Other Toll Agencies	BTD	Local Cities and Towns	MBTA	MCCA	Massport (Logan)	BAT	CATA	GATRA	LRTA	MVRTA	MWRTA
MassDOT - Highway Division		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Other Toll Agencies													

These interfaces are addressed by a single operational concept, as presented in Exhibit 5-29.

Exhibit 5-29: Operational Concept: Electronic Toll Collection

Operational Concept:	**Electronic Toll Collection**
Functional Area:	Electronic Toll Collection
As the MassDOT – Highway Division is the ETC system provider for the region, this operational concept applies to the interfaces between the MassDOT – Highway Division Account Processing Center (APC) and other organizations accepting the toll transponders, including parking facility operators.	
Interfacing Agencies:	▪ MassDOT – Highway Division and Massport (Tobin) ▪ MassDOT – Highway Division and Other Toll Agencies ▪ MassDOT – Highway Division and BTD ▪ MassDOT – Highway Division and Local Cities/Towns ▪ MassDOT – Highway Division and Massachusetts Convention Center Authority (MCCA) ▪ MassDOT – Highway Division and MBTA ▪ MassDOT – Highway Division and Massport (Logan) ▪ MassDOT – Highway Division and BAT ▪ MassDOT – Highway Division and CATA ▪ MassDOT – Highway Division and GATRA ▪ MassDOT – Highway Division and LRTA ▪ MassDOT – Highway Division and MVRTA ▪ MassDOT – Highway Division and MWRTA

Information Flow	*Relationship*
Data:	*Information Sharing:* As the lead agency in the implementation of ETC, the MassDOT – Highway Division will hold all administrative and financial data related to the toll transponders. In order for the toll transponders to be used at non-Turnpike facilities in the region, data exchange is required between the toll collection system of the other operator and the MassDOT – Highway Division. Two primary data exchanges are required. The first data exchange occurs when the transponder is used at the other operator's toll facility. At that time, the other operator's toll system sends the transaction information to the MassDOT – Highway Division, which deducts the appropriate amount from the customer's account. The second data exchange occurs when the other toll operator's account is reconciled with the MassDOT – Highway Division. At that time, the total value of the ETC transactions at the other toll facility is transferred from the MassDOT – Highway Division to the other operator.
Video:	Not applicable.
Event Information:	Not applicable.
Device Status:	Not applicable.
Request:	*Information Sharing:* The data exchange occurring during the toll transaction will be performed following a request of the other operator's toll system. This request will be initiated upon the reading of a MassDOT – Highway Division toll transponder by the other organization's toll system.
Control:	Not applicable.

5.3 Institutional Coordination

The Regional ITS Architecture provides both a technical and institutional framework for the deployment of ITS in the Metropolitan Boston region. This involves coordination between various organizations and jurisdictions to achieve seamless operations or interoperability. The existing and recommended operational concepts defined in the previous section provide guidance for the functional requirements of inter-jurisdictional interactions. These inter-jurisdictional operational concepts in turn point directly to the types of agreements that may be required between individual organizations in order to define the organizational roles and responsibilities for each of these interactions. This section discusses considerations for developing inter-jurisdictional agreements for implementing the operational concepts, achieving the information flows, and operating the systems defined in the regional architecture.

The recent reorganization of state transportation agencies into the Massachusetts Department of Transportation should have a positive effect on future institutional coordination efforts. With many previously separated agencies now combined into a single institution, coordination efforts should be simpler and easier to accomplish.

5.3.1 EXISTING AGREEMENTS

Interagency coordination already occurs among the operating organizations in the Metropolitan Boston region. In some cases, the responsibilities of the coordinating organizations are detailed in interagency agreements or Memoranda of Understanding (MOUs), which provide formal documentation of organizational roles, procedures, and responsibilities. In many cases, however, such as where jurisdictions meet or overlap, coordination occurs without formal agreements. In these cases, protocols may have been developed at the operating level, and the cooperating organizations rely on informal arrangements.

This section documents information regarding formal and informal interagency agreements relevant to the Regional ITS Architecture. This information was obtained from the architecture input meetings and subsequent contact with stakeholders. Exhibit 5-30 summarizes the operational agreements identified by the stakeholders in the region. Each of the agreements is discussed in the following subsections. Also, if in the future additional Regional Transit Authorities (RTAs) in the region want to add transit signal priority capabilities to a traffic signal under MassDOT's jurisdiction, an operational agreement may be needed between the RTAs and MassDOT – Highway Division. Frequently, a local municipality would also be included in the agreement since municipalities often own and/or maintain the optical pre-emption equipment at State Highway traffic signal locations.

Exhibit 5-30: Existing Operational Agreements

Function	*Participants*	*Agreement*	*Status*
Traffic Management	BTD, MassDOT – Highway Division, MBTA, State Police	Video and information sharing (MIVIS)	Formalized (2004). Currently expired and is in process of being updated.
	BTD, DCR	DCR traffic signal operation (Boston)	Not formalized
	BTD, Massport	Massport traffic signal control operation (S. Boston)	Not formalized
Incident Management	MassDOT – Highway Division, State Police, et al.	Unified Response Manual (URM) for Roadway Traffic Incidents	Formalized (1998), Updated (2003), In process of being updated.
	MassDOT – Highway Division, State Police	Accident Response/Quick Clearance Agreement	Formalized (2003), In process of being renewed as part of URM update.
	MassDOT – Highway Division, Massport, et al.	Tunnel Incident Management & Communication Agreement	Formalized (1995), Updated (2001)
	MassDOT – Highway Division, Massport, BFD	Mutual aid (Tobin Bridge and Ted Williams Tunnel)	Not formalized
Multimodal Coordination	BTD, MBTA	Transit Signal Priority	Not formalized
Transit Coordination	MBTA, MWRTA	Interoperability Program	Formalized (2010)
Electronic Toll Collection	MassDOT – Highway Division, Massport, E-ZPass Interagency Group (IAG)	E-ZPass toll coalition	Formalized (coalition members)
	MassDOT – Highway Division, MBTA	ETC parking facility payment	Formalized
Emergency Management	BEMA et al.	Boston emergency management plans	Formalized
	MEMA, State Police, et al.	Massachusetts Amber Alert Plan	Formalized (2002)
	MassDOT – Highway Division, State Police	Amber Alert Notifications	Not formalized

5.3.1.1 Traffic Management

Agreements regarding traffic management fall into two primary categories: control center coordination and traffic signal control. Agreements regarding control center coordination are the following:

- BTD, MassDOT – Highway Division, and the MBTA have signed an agreement to share information among the BTD Traffic Management Center, the MBTA's Operations Control Center, and the MassDOT – Highway Division HOC. This agreement includes video sharing, established through the Massachusetts Interagency Video Information System (MIVIS), as well as data sharing and communications network expansion.

For traffic signal operations, no formal agreements are in place. However, existing coordination is described below:

- Several signalized intersections on DCR roadways within the city of Boston are linked with BTD's central system and are operated from its TMC. No formal agreement has been established.

- BTD has an informal agreement to operate Massport traffic signals in South Boston.

5.3.1.2 Incident Management

The following formal agreements have been established for incident management:

- The *Unified Response Manual (URM) for Roadway Traffic Incidents* establishes a statewide traffic management plan for roadway incidents. The scope of the manual is limited to incidents on designated National Highway System (NHS) roadways and other principal arterials. The URM was developed by the Massachusetts Operations Action Group, which consisted of representatives from the following organizations:

  - Massachusetts Highway Department
  - Massachusetts Turnpike Authority
  - Massachusetts Department of Public Health
  - Federal Highway Administration
  - Massachusetts State Police
  - Fire Chiefs' Association of Massachusetts
  - Massachusetts Department of Environmental Protection
  - Statewide Towing Association

  The original agreement was approved and signed in December 1998. The URM was updated in 2003. It is currently in the process of being updated again, this time to include the recently formed MassDOT – Highway Division.

- An "Accident Response / Quick Clearance Agreement" between MassHighway and the State Police, originally signed in April 1993 was updated in August 2003. This agreement is also in the process of being updated along with the URM to be between MSP and MassDOT – Highway Division.

- As part of the CA/T project, an Incident Management and Communication Agreement was developed by and among the following agencies:

  - Massachusetts Highway Department
  - Massachusetts Turnpike Authority
  - Massachusetts Port Authority
  - Massachusetts State Police
  - Boston Fire Department
  - Boston Emergency Medical Services
  - Boston Police Department
  - Boston Transportation Department

  An initial agreement was developed and approved for the opening of the Ted Williams Tunnel in December 1995. The document was revised in 2001 in anticipation of opening additional portions of the project, but this revised draft has not been formally approved. Updating this agreement is a topic under consideration.

Informal mutual-aid agreements also exist between agencies for incident response. For example, BFD and MassDOT – Highway Division coordinate response to incidents in the Ted Williams Tunnel and its approaches without formal written agreements.

5.3.1.3 Multimodal Coordination

Agreements for multimodal coordination in the region relate to traffic signal priority for MBTA transit vehicles. BTD and the MBTA have implemented transit signal priority on Washington Street as part of the Silver Line project. Signal priority is also provided to Green Line vehicles on Commonwealth Avenue. Both BTD and MBTA are working to expand transit signal priority system-wide throughout the City of Boston. However, as yet, no formal agreements have been established for this coordination.

5.3.1.4 Transit Coordination

The MBTA and MWRTA have developed an MOU regarding the interoperability of the MBTA CharlieCard on existing MetroWest bus routes. This MOU is the first developed for the fare card interoperability and may be relevant to the RTAs in the process of procuring and deploying fareboxes and equipment to have smart card fare media that is interoperable with the MBTA's CharlieCard.

5.3.1.5 Electronic Toll Collection

MassDOT – Highway Division operates the "Fast Lane" electronic toll collection (ETC) system for use at its toll plazas across the state. MassDOT is now a member of the Inter-Agency Group (IAG), a coalition of toll agencies in the Northeast U.S. operating the E-ZPass ETC system, with which the Fast Lane system is interoperable.

Massport, which formerly operated the Tobin Bridge toll plaza, also remains a member of the IAG. Massport currently uses Fast Lane payment to collect revenue related to its Taxi Pool at Logan Airport. They also have plans to use Fast Lane payment in the future for revenue collection at the Logan Airport Limousine Pool and as part of its new parking management and revenue control system for its garages at Logan Airport.

Fast Lane transponders are also accepted for payment at the Route 128 MBTA/Amtrak parking garage in Westwood. There are also tentative plans for other parking facilities in the region to implement Fast Lane transponder payment options.

5.3.1.6 Emergency Management

The Boston Emergency Management Agency (BEMA), in association with other emergency management agencies in the region, has developed of a number of emergency management plans that establish procedures for coordination during emergencies. These include the following:

- Boston Emergency Response Plan
- Boston Comprehensive Emergency Management Plan
- Boston's Emergency Liaisons Response Plan
- Boston's Interoperability Communications Plan
- Boston's Critical Incident Exodus Evacuation Plan
- Boston's Emergency Shelters
- Boston's Local Emergency Planning Committee Title III Facilities
- Boston's Corporate Community Access Plan for Business Continuity
- Boston's Threat Conditions Matrix Response Plan
- Boston's Threat and Vulnerability Analysis
- Critical Public Safety Infrastructure Earthquake Analysis and HAZUS (Loss Estimation Software)
- Boston's Consequences Assessment Tool Set (CATS) and Hazard Prediction and Assessment Capability (HPAC) (Plume Modeling Capability)

5.3.1.7 Amber Alerts

The Massachusetts Amber Alert Plan documents the criteria and procedures for issuing public alerts about abducted children and their kidnappers. The initial implementation of the plan in

October 2002 was an agreement by and among the Massachusetts Chiefs of Police Association, the Massachusetts State Police, the Massachusetts Emergency Management Agency (MEMA), and local broadcasters for the broadcast of child abduction alert messages via radio, cable and television stations statewide.

An informal agreement also exists to post Amber Alert messages on MassDOT – Highway Division variable message signs.

5.3.2 RECOMMENDED AGREEMENTS

In general, all interagency interfaces identified in this architecture should be covered by formal agreements. This includes interfaces under development or proposed in the architecture that have not yet been implemented, as well as interfaces that are currently operational but without a formal agreement.

Formal agreements assist organizations by clearly defining the goals and objectives of the agreement, the terms of the agreement, and addressing potential liability issues. Furthermore, formal agreements can help ensure that operational arrangements continue despite changes in institutional personnel or priorities. Appendix F provides additional information on how to develop formal interagency agreements and offers examples of interagency agreements. Formal agreements are especially important for those working arrangements that involve technical coordination and cost considerations, as well as arrangements involving public safety. Therefore, the following existing arrangements are recommended for formalization:

- BTD and DCR: DCR traffic signal operation
- BTD and MBTA: Transit signal priority
- MSP and MassDOT – Highway Division: Amber Alert notifications

Agreements should also be developed for the new interfaces proposed in the Regional ITS Architecture. All of the interagency interfaces in the architecture are identified and categorized in Section 5.2. As with the existing informal agreements, all interfaces should have formal agreements. However, the key interfaces to consider initially are those involving technical coordination and those involving emergency management, as shown in Exhibit 5-31.

Exhibit 5-31: Recommended Agreements for New Interfaces

Functional Area	*Interface Type*
Roadway Management	Center-to-Center
Transit Management	Center-to-Center
	Traffic Coordination
Emergency Management	Center-to-Center
	Traffic Coordination
Data Archives	Planning Archives
Electronic Fare Payment	Regional Fare Card
Electronic Toll Collection	Parking Facility Payment

6. IMPLEMENTATION PLAN

This chapter updates the statuses of several ongoing ITS initiatives identified as part of a strategy for implementing the systems defined in the Regional ITS Architecture for Metropolitan Boston. This strategy was initially developed in 2005 and was based in part on the architecture development process, as illustrated in Exhibit 6-1. The initiatives described in this chapter are intended to serve as an important input into future local, regional, and statewide ITS strategic planning efforts.

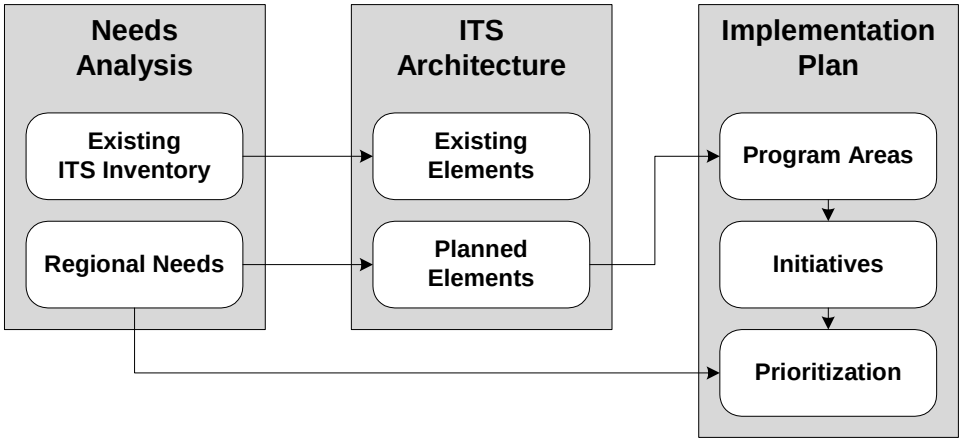

Exhibit 6-1: Implementation Plan Development Process

The architecture identifies a large number of ITS elements for the region, classified as either "existing" or "planned." In developing the Implementation Plan, stakeholders considered the "planned" ITS elements both by function and by stakeholder. Considered functionally, the planned elements were grouped into ***program areas*** that encompassed elements that addressed a specific functional need. Each program area represents a general area for investment.

Within each of the program areas, a series of ***initiatives*** was defined, representing a means of implementing the elements with that program area. Each initiative encompassed a number of planned elements that were recommended for simultaneous implementation. Although a single stakeholder was identified to lead some initiatives, many initiatives require the participation of two or more stakeholders.

As an example, consider the interface between a MassDOT – Highway Division District Office and MassDOT – Highway Division maintenance vehicles. The information flows between these entities include maintenance and construction dispatch data, location data, and status data. These interfaces can be grouped under a single initiative, namely "MassDOT – Highway Division CAD/AVL," as each of these information flows would likely be implemented as part of a single CAD/AVL deployment. These interfaces would also fall under a broader program area, namely "CAD/AVL for Maintenance Vehicles," that would also include CAD/AVL projects for maintenance vehicles at other organizations, such as local cities and towns. As the example illustrates, the program area defines the functional area recommended for implementation, namely CAD/AVL for Maintenance and Construction, while the initiative defines a specific deployment.

Finally, the Implementation Plan also prioritized the identified initiatives, identifying candidates for near-term and longer-term implementation. This prioritization was based on the needs analysis, stakeholder input, and interdependencies among the initiatives.

Through this process, a comprehensive list of program areas and initiatives has been developed that encompasses all of the planned elements from the architecture. The remainder of this chapter is organized as follows:

- Section 6.1 presents the program areas and initiatives of the Implementation Plan, grouped by function.
- Section 6.2 discusses projects that have progressed and/or been implemented since 2005 that were originally identified in the Implementation Plan.

6.1 Program Areas and Initiatives

This section presents a set of program areas, along with a recommended set of initiatives to be implemented within each program area. Each program area represents a general area of investment that is needed for implementation of the architecture.

Presented within each program area is a series of initiatives that provide a method of implementing that portion of the architecture. Some of the initiatives have already been implemented or are already planned. The other initiatives are recommendations to address the needs identified in the development process. The initiatives defined in this section are not the only means by which the architecture can be implemented, however. Instead, this plan provides one method of grouping the planned elements of the architecture into initiatives that together address the needs and planned components from the architecture.

Each of the initiatives presented indicates the stakeholders that are involved. While many initiatives involve only a single stakeholder, in some cases an initiative requires participation from multiple stakeholders. Furthermore, some initiatives are listed for a collective group of stakeholders, such as Regional Transit Authorities. These initiatives are not necessarily meant to cover multiple stakeholders or to consist of a one-time deployment. Instead, each represents an initiative that can be implemented multiple times within the region and on any scale, from single-agency to multi-agency to region-wide implementation.

The subsections below present the program areas and initiatives arranged by function, based on the service areas or high-level grouping of market packages defined in the National ITS Architecture. The program areas are presented under the following functional groupings:

- Traffic Management
  - Roadway Management
  - Parking Management
- Maintenance and Construction Management
- Public Transportation
  - Transit Management
  - Electronic Fare Payment
- Traveler Information
- Commercial Vehicle Operations
- Emergency Management
- Archived Data Management

In addition, there are a number of program areas that cut across multiple functions and thus do not fall under a single classification. These multi-function programs are presented in Section 6.1.1.

6.1.1 MULTI-FUNCTION PROGRAM AREAS

Presented in this section are the program areas that cut across multiple functional areas, and therefore cannot be classified under a single function. These program areas consist of those that

provide or support more than one function, such as both traffic management and transit management.

6.1.1.1 Information Sharing (Events)

This program area covers the sharing of event information among the various operations centers in the region. This addresses the center-to-center interfaces for event data that are shown in the architecture between these elements, including both roadway and transit control centers. The functional areas covered by this program area are Traffic Management, Maintenance and Construction Management, Public Transportation, and Traveler Information.

The interfaces covered by this program area can be implemented through an event reporting system, as recommended through the architecture development process. The following initiative addresses this program area.

Event Reporting System

This initiative, implemented by MassDOT – Highway Division and currently undergoing expansion, provides an Event Reporting System (ERS) for the exchange of event information within MassDOT and with partner transportation and safety management agencies statewide. This system is an Internet-based tool that serves as a centralized repository for information on events affecting the transportation network. Examples of event information to be exchanged include real-time information on incidents and delays, as well as planned events such as construction, road closures, or traffic-generating special events.

The ERS serves as a central system for information exchange by providing authorized users with a consolidated view of entered information regardless of their physical location. MassDOT – Highway Division employees within MassDOT's centralized Highway Operations Center (HOC) and District offices are currently using the system to enter information about planned and un-planned events within their jurisdiction and disseminate notification messages about major incidents to responsible personnel within MassDOT and to partner organizations. While currently in direct use for information viewing and entry by MassDOT – Highway Division, it is envisioned that other organizations may also participate in using ERS in the future, including the following:

- *Roadway Agencies:*
  - Boston Transportation Department (BTD)
  - Local Cities/Towns
  - Massachusetts Port Authority (Massport)
  - Department of Conservation & Recreation (DCR)
- *Transit Authorities:*
  - Brockton Area Transit (BAT)
  - Cape Ann Transportation Authority (CATA)
  - Greater Attleboro-Taunton Regional Transit Authority (GATRA)
  - Lowell Regional Transit Authority (LRTA)
  - Massachusetts Bay Transportation Authority (MBTA)
  - Merrimack Valley Regional Transit Authority (MVRTA)
  - MetroWest Regional Transit Authority (MWRTA)
  - Other Transit Providers
- *Emergency Management Agencies:*
  - Boston Emergency Management Agency (BEMA)
  - Local City/Town Public Safety
  - MBTA Police
  - Massachusetts Emergency Management Agency (MEMA)
  - State Police

While emergency management agencies are included in the list of participants, the system to be developed in this program area is only meant for the exchange of information for traffic and transit management purposes. Emergency management coordination is addressed by an extension of this system, as described in Section 6.1.9.1.

With its Service-Oriented Architecture (SOA), ERS provides multiple ways for different organizations to interface with the system. Organizations can develop their own software modules which take advantage of the information and functions accessible from existing services already provided by ERS, such as its existing mapping, and event management modules.

In addition to being used for information sharing among the participating organizations, the system will also serve as a tool for information dissemination by allowing other users to view information entered into the system. These other users can include emergency management agencies, private information service providers, or even the public. The system also serves as a source of data for the MassDOT XML Feed which provides information to the public developer community and the existing 511 Travel Information System, as described in Section 6.1.7.1.

6.1.1.2 Information Sharing (Video)

This program area covers the sharing of video data between the various operations centers in the region. This addresses the center-to-center interfaces for video data that are shown in the architecture between roadway control centers. The functional areas covered by this program area are Traffic Management, Maintenance and Construction Management, Public Transportation, and Traveler Information.

The interfaces covered by this program area can be implemented through an expansion to the Massachusetts Interagency Video Information System (MIVIS). The following initiative addresses this program area.

Expansion of MIVIS

MassDOT – Highway Division, BTD, MBTA, and the State Police established video sharing in the Boston area through the Massachusetts Interagency Video Information System (MIVIS) in 2005. Since then, MIVIS has expanded to incorporate additional cameras in the City of Boston, and is planned to expand to include even more camera feeds. This initiative expands this system to allow sharing of real-time video feeds among a larger group of organizations. The primary participating organizations are those with video capabilities, including:

- BTD
- Local Cities/Towns (as applicable)
- MassDOT – Highway Division
- Massport
- MBTA
- Private Information Service Providers
- State Police

Other organizations, such as transit and emergency management agencies, can also be included as recipients of the video data. This will support coordination among operations centers within the region, allowing one center to view the CCTV images from other participating organizations. The system also provides traveler information functions, allowing video to be distributed to private information service providers or publicly available websites, such as the 511 Traveler Information System website, as described in Section 6.1.7.1. The system developed and being expanded through this initiative is only meant for the exchange of video for traffic and transit management purposes. Emergency management coordination is addressed by an extension of this system, as described in Section 6.1.9.1.

6.1.1.3 Interagency Communications Network

This program area addresses the communications requirements of the center-to-center and center-to-field interfaces that are shown in the architecture. The functional areas covered by this program area are Traffic Management, Maintenance and Construction Management, Public Transportation, Traveler Information, and Archived Data Management. The following initiative addresses this program area.

Interagency Communications Network

This initiative establishes a communications network linking the region's roadway and transit organizations. The primary participating agencies are the following:

- BTD
- Local Cities/Towns
- MassDOT – Highway Division
- Massport
- DCR
- MBTA
- State Police

These agencies have developed or are developing communications networks to support their operational needs, but many of these networks do not provide the full coverage necessary for their operations. For example, many agencies fill the gaps in their communications networks with leased lines from private telecom providers, leading to high operational costs.

This initiative takes advantage of the geographic overlap of many of these networks and addresses the communications requirements in two ways. First, opportunities for sharing existing communications infrastructure will be identified, leading to agreements for unused bandwidth on an agency's network to be used by other agencies with need. This will allow better use of the existing network and eliminate unnecessary duplication of infrastructure. Second, existing gaps in the overall communications network will be identified, and these gaps will be filled though joint implementation projects. This will allow agencies to pool resources to build infrastructure that benefits each of the partners. Multiple agencies are currently involved in the implementation of METFON, the Metropolitan Emergency & Transportation Fiber Optic Network. It is envisioned that METFON will provide communications infrastructure to support information sharing for transportation events and emergency management functions.

The network to be developed in this program area is primarily intended for traffic and transit management purposes. Communications specifically for emergency management is addressed in a separate initiative, as described in Section 6.1.9.1.

6.1.2 TRAFFIC MANAGEMENT: ROADWAY MANAGEMENT

6.1.2.1 Roadway Monitoring

This program area covers improvements to the traffic monitoring capabilities of the region's organizations with traffic management functions. This addresses planned elements in the architecture relating to field surveillance, additional deployments of field equipment and control centers, and the interfaces of field equipment with the appropriate control center.

This program area addresses the need for traffic data through two means: deployment of devices for monitoring traffic conditions on roadways, and obtaining traffic data through probe surveillance. The following initiatives fall under this program area:

Traffic Monitoring Deployment (Local Cities/Towns, including Brockton, Cambridge, Framingham, and Newton)

This initiative covers the further deployment of devices for monitoring traffic conditions on city and town roads. This will include placement of vehicle detectors and roadside CCTV cameras, as well as devices for monitoring roadway conditions such as weather sensors. This field equipment will be connected to local control centers, where it will provide data to control center operators. The initiative will cover the installation of these devices, establishment of control centers in municipalities where they are not currently present, and implementation of a communications link with the appropriate control center.

Traffic Monitoring Deployment (BTD)

This initiative covers the further deployment of devices for monitoring traffic conditions on roadways operated by the Boston Transportation Department (BTD). This will include installation of vehicle detectors and CCTV cameras. This field equipment will be monitored at the BTD Traffic Management Center (TMC). The initiative will cover the installation of these devices along with the communications link to the TMC. Since 2005, BTD has installed several additional cameras and linked them into MIVIS. Additional expansion is planned, as needed.

Traffic Monitoring Deployment (MassDOT – Highway Division)

This initiative covers the further deployment of devices for monitoring traffic conditions on roadways operated by MassDOT – Highway Division. This will include placement of vehicle detectors and roadside CCTV cameras. This field equipment will be connected to the MassDOT – Highway Division Highway Operations Center (HOC), where it will be integrated into the HOC central software. The initiative will cover the installation of these devices along with the communications link to the HOC.

Traffic Monitoring Deployment (Private Information Service Providers)

This initiative covers private-sector deployment of field equipment for traffic monitoring. This equipment, including vehicle detectors and roadside CCTV cameras, will be linked to centers operated by private traveler information service providers. The initiative will cover the installation of this equipment, communications links with the private operations center, and communications links from the private operations center to relevant public-sector operations centers such as the MassDOT – Highway Division HOC.

Highway Probe Surveillance (MassDOT – Highway Division)

This initiative makes use of existing and planned vehicle identification systems to produce travel time data for operations and planning purposes. The prime implementing organizations will be those with highway jurisdiction, namely MassDOT – Highway Division. This initiative will make use of probe information from systems that provide vehicle identification, including Electronic Toll Collection (ETC) systems and Automatic Vehicle Location (AVL) systems. The organizations will obtain travel time information for roadways under their jurisdiction either through ETC roadside readers or through AVL data provided by fleet operators.

6.1.2.2 Roadway Control

This program area covers improvements to traffic control capabilities for organizations with traffic management functions. This addresses planned elements in the architecture relating to information dissemination, as well as the interfaces of this equipment with the appropriate control center. The program area includes installation and expansion of centralized signal control systems as well as further deployment of field equipment.

Expansion of City of Boston Centralized Signal Control (BTD)

This initiative builds on the existing interface between the BTD Traffic Management Center and BTD Traffic Signals by expanding the scope of the centralized signal system. This initiative addresses a need for system expansion identified by BTD in the Needs Analysis.

BTD operates approximately 400 signalized intersections under central control from its Traffic Management Center (TMC). In addition to city signals, certain signals owned by DCR, and Massport are also operated from the TMC. This initiative increases the number of intersections tied into the central system, thereby expanding the coverage of the control center and allowing greater traffic control within the city. In addition to upgrades and further deployment of field equipment, this initiative also covers additional communications infrastructure to support the expanded system.

Centralized Signal Control (Local Cities/Towns, including Brockton, Cambridge, Framingham, and Newton)

This initiative covers the integration of existing and new traffic signals into a centralized signal control system for a city or town. This would allow coordination of signals and adjustments to signal timings to be made in real-time from a centralized location. In addition to upgrades and further deployment of field equipment, this initiative also covers additional communications infrastructure to support the signal system.

Expansion of Centralized Signal Control (MassDOT – Highway Division)

This initiative builds on the existing interface between MassDOT – Highway Division Districts and MassDOT – Highway Division traffic signals by expanding the scope of existing closed-loop signal systems. In addition to MassDOT – Highway Division traffic signals, certain signals owned by cities and towns in the region are also operated as part of a MassDOT – Highway Division closed-loop system. This initiative increases the number of intersections tied into the systems at district offices, thereby expanding coverage and facilitating signal coordination within the region. In addition to upgrades and further deployment of field equipment, this initiative also covers additional communications infrastructure to support the expanded system.

Variable Message Sign Deployment (BTD)

This initiative comprises the deployment of Variable Message Signs (VMSs) on roadways operated by BTD. These VMSs will be controlled from the TMC, allowing real-time information to be disseminated to drivers on city streets. This information can include traffic conditions, routing information, and parking space availability. These signs will require a communications interface with the TMC.

Variable Message Sign Deployment (Local Cities/Towns, including Brockton and Framingham)

This initiative comprises the deployment of Variable Message Signs on roadways operated by local cities and towns. These VMSs will be controlled from local control centers, allowing real-time information to be disseminated to drivers on city and town roads. This information can include traffic conditions, routing information, and parking space availability. These signs will require a communications interface with local control centers.

Expansion of Variable Message Sign Deployment (MassDOT – Highway Division)

This initiative comprises the deployment of additional Variable Message Signs on roadways operated by MassDOT – Highway Division. Like those already deployed in the region, these VMSs will be controlled from the MassDOT – Highway Division Highway Operations Center in South Boston. In addition to upgrades and further deployment of field equipment, this initiative also covers additional communication infrastructure to support the system expansion.

6.1.2.3 Roadway Management Coordination

This program area covers improvements to coordination among agencies with traffic management functions. This addresses the center-to-center interfaces shown in the architecture among the various centers operated by traffic management agencies and private information service providers.

In addition to the initiatives described in this section, there are a number of multi-function program areas that address Roadway Management Coordination, including the video integration and event reporting systems. These are described in Section 6.1.1.

Remote MassDOT – Highway Division HOC Workstation

This initiative consists of the installation of a back-up workstation for the Highway Operations Center (HOC) at the Massachusetts Emergency Management Agency (MEMA) in Framingham. This workstation will allow viewing of event and response information at MEMA under normal operating conditions, and will allow remote operation of some MassDOT – Highway Division field equipment under emergency operating conditions. This initiative will include the workstation hardware and software, as well as the necessary communications between the remote workstation and the HOC.

6.1.3 TRAFFIC MANAGEMENT: PARKING MANAGEMENT

6.1.3.1 ETC Integration for Parking

This program area covers acceptance of Electronic Toll Collection transponders at parking facilities within the region. This addresses the interfaces in the architecture between the MassDOT – Highway Division FAST LANE transponders and various parking facilities and parking management systems.

Organizations with parking facilities include BTD, Local Cities and Towns, Massport, and the MBTA. Due to the means by which the transponders are read, the use of the regional electronic collection transponders is limited to parking lots and garages with controlled entry and exit points. This implementation allows parking fees to be deducted from the user's account balance. In addition to acceptance of the transponders at parking facilities, the system will also support reconciliation of accounts between each parking facility operator and the MassDOT – Highway Division, who operates the current electronic toll collection program.

ETC Integration at Parking Facilities (BTD)

This initiative introduces acceptance of the regional ETC transponders at parking facilities operated by BTD. In addition to acceptance of the transponders at parking facilities, the system will also support reconciliation of accounts between BTD and the MassDOT – Highway Division.

ETC Integration at Parking Facilities (MCCA)

This initiative introduces acceptance of the regional ETC transponders at parking facilities operated by the Massachusetts Convention Center Authority (MCCA), such as the Boston Common Garage. In addition to acceptance of the transponders at parking facilities, the system will also support reconciliation of accounts between MCCA and the MassDOT – Highway Division.

ETC Integration at Parking Facilities (Local Cities/Towns)

This initiative introduces acceptance of the regional ETC transponders at parking facilities operated by local cities and towns. In addition to acceptance of the transponders at parking facilities, the system will support reconciliation of accounts between local parking facility operators and the MassDOT – Highway Division.

ETC Integration at Parking Facilities (MBTA)

This initiative provides for acceptance of the regional ETC transponders at MBTA-operated parking facilities, extending the current pilot project at the Route 128 Station parking garage. In addition to acceptance of the transponders at parking facilities, the system will support reconciliation of accounts between the MBTA and the MassDOT – Highway Division.

Expansion of the Logan Parking Management System (Massport)

This initiative expands the Parking Management System for the parking facilities at Logan Airport. The system currently includes revenue and inventory control functions, as well as ITS elements such as a pay-on-foot system for parking. This system will be expanded to allow regional ETC transponders to be accepted for payment at parking facilities. This system will make use of the existing agreement between Massport and the MassDOT – Highway Division for reconciliation of ETC accounts.

ETC Integration at Parking Facilities (Other Parking Operators)

In addition to the parking facilities operated by the agencies discussed above, there are a large number of parking facilities operated by other organizations. These organizations include other public agencies (e.g. the Massachusetts Convention Center Authority) as well as private companies. This initiative introduces acceptance of the regional ETC transponders at parking facilities operated by these other organizations. In addition to acceptance of the transponders at parking facilities, the system will support reconciliation of accounts between parking facility operators and the MassDOT – Highway Division.

6.1.3.2 Regional Fare Card Integration for Parking

This program area covers acceptance of the planned Regional Fare Card, discussed in Section 6.1.6.2, at parking facilities operated by stakeholders within the region. This addresses the interfaces in the architecture between the Regional Fare Card and the various parking facilities and parking management systems.

Organizations with parking facilities include BTD, Local Cities and Towns, Massport, the MBTA, and the other Regional Transit Authorities. This program area covers metered parking as well as ticketed parking lots and garages, allowing parking fees to be deducted from the balance on a patron's Fare Card. In addition to acceptance of the new media at meters and parking facilities, the systems will also support reconciliation of accounts between the parking operators and the Regional Fare Card Agency.

Automated Fare Collection for Parking Facilities (MBTA)

This initiative extends the MBTA's planned Automatic Fare Collection (AFC) system, described in Section 6.1.6.1, to MBTA parking facilities, allowing payment by fare card for parking fees. This will include fare card readers at parking facility exits, potentially additional fare vending machines at parking facilities, and upgrading the communications infrastructure to support the new data requirements.

Regional Fare Card Integration at Parking Facilities (BTD)

This initiative introduces acceptance of the planned Regional Fare Card at parking facilities operated by BTD. This includes both on-street metered parking as well as off-street municipal lots. In addition to acceptance of the new media at BTD parking meters, the system will also support reconciliation of accounts between BTD and the Regional Fare Card Agency.

Regional Fare Card Integration at Parking Facilities (Local Cities/Towns)

This initiative introduces acceptance of the planned Regional Fare Card at parking facilities operated by local cities and towns. This will include metered parking as well as ticketed parking

lots and garages. In addition to acceptance of the new media at meters and parking facilities, the system will support reconciliation of accounts between the local parking operators and the Regional Fare Card Agency.

Regional Fare Card Integration at Parking Facilities (Massport)

This initiative will introduce acceptance of the planned Regional Fare Card at Massport-operated parking facilities. This will include Logan parking facilities (through an extension to the Logan Parking Management System) as well as other facilities, such as Logan Express lots. In addition to acceptance of the new media, the system will support reconciliation of accounts between Massport and the Regional Fare Card Agency.

Regional Fare Card Integration at Parking Facilities (BAT, CATA, GATRA, LRTA, MVRTA, MWRTA)

This initiative introduces acceptance of the planned Regional Fare Card at parking facilities operated by Regional Transit Authorities within the study area. In addition to acceptance of the new media parking facilities, the system will support reconciliation of accounts between each RTA and the Regional Fare Card Agency.

Regional Fare Card Integration at Parking Facilities (Other Parking Operators)

This initiative introduces acceptance of the planned Regional Fare Card at parking facilities operated by other parking facility operators, such as the Massachusetts Convention Center Authority. In addition to acceptance of the new media at parking facilities, the system will support reconciliation of accounts between the parking operators and the Regional Fare Card Agency.

6.1.4 MAINTENANCE AND CONSTRUCTION MANAGEMENT

6.1.4.1 Environmental Sensors

This program area covers the deployment of environmental sensors on roadways in the region. It addresses the planned environmental sensor elements in the architecture, including those for BTD, Massport, and local cities and towns, as well as expansion of existing deployments.

These devices include weather stations reporting measures such as air temperature and precipitation, as well as sensors reporting on the condition of the roadway surface. Through a communications link with a central control center, the sensors will provide their information on a computer interface for control center operators.

Environmental Sensors (BTD)

This initiative comprises the deployment of environmental sensors on roadways operated by BTD, as well as an interface with the BTD Traffic Management Center (TMC).

Environmental Sensors (Local Cities/Towns)

This initiative comprises the deployment of environmental sensors on roadways operated by local cities and towns, as well as an interface with local control centers.

Environmental Sensors (Massport)

This initiative comprises the deployment of environmental sensors on roadways operated by Massport, as well as interfaces with the relevant control centers (i.e. the Landside Operations Control Center, the Facilities Maintenance Unit, and/or the Aviation Operations Unit).

Environmental Sensors (MassDOT – Highway Division)

This initiative comprises the deployment of environmental sensors on roadways operated by MassDOT – Highway Division, as well as an interface with MassDOT – Highway Division District Offices, operational depots, and the statewide HOC.

6.1.4.2 CAD/AVL for Maintenance Management

This program area covers the provision of Computer-Aided Dispatching/Automatic Vehicle Location (CAD/AVL) systems for managing maintenance vehicles. This addresses the planned interfaces in the architecture between control centers and maintenance vehicles, such as those of BTD, MassDOT – Highway Division, and Massport.

The systems to be implemented under this program area allow a control center to track its vehicles in real-time and to dispatch those vehicles in the most efficient manner. This program requires equipment in each vehicle to be tracked, as well as a central system at the dispatch center to receive and manage the tracking information.

CAD/AVL for Maintenance Vehicles (Local Cities/Towns)

This initiative provides CAD/AVL systems for managing city and town maintenance vehicles. This initiative will require equipment in each vehicle to be tracked, as well as a central system at the local dispatch center to receive and manage the tracking information.

CAD/AVL for Maintenance Vehicles (MassDOT – Highway Division)

This initiative provides a CAD/AVL system for managing MassDOT – Highway Division maintenance vehicles. Similar to the system in place for tracking the CaresVan roadway service patrol vehicles and snowplow contractors, this system will require equipment in each vehicle to be tracked, as well as central systems at the MassDOT – Highway Division District Offices, operations depots, and the statewide HOC to receive and manage the tracking information.

6.1.4.3 Infrastructure Monitors

This program area covers the deployment of infrastructure monitors on roadways, bridges, tunnels, and other sensitive transportation infrastructure in the region. It addresses the planned infrastructure sensor elements in the architecture, including those for MassDOT – Highway Division and local cities and towns.

These devices include sensors to monitor vibration, stress, temperature, continuity, and other measures. This may also include data logging devices to collect information on infrastructure condition and communications links to convey this information back to central systems.

Infrastructure Sensors (Local Cities/Towns)

This initiative comprises the deployment of infrastructure sensors on roadways operated by local cities and towns, as well as an interface with local control centers.

Environmental Sensors (MassDOT – Highway Division)

This initiative comprises the deployment of infrastructure sensors on roadways operated by MassDOT – Highway Division, as well as interfaces with the relevant control centers (i.e. MassDOT – Highway Division District Offices, maintenance and operational depots, and/or the HOC).

6.1.5 PUBLIC TRANSPORTATION: TRANSIT MANAGEMENT

6.1.5.1 CAD/AVL for Transit

This program area covers the provision of Computer-Aided Dispatching/Automatic Vehicle Location (CAD/AVL) systems for managing transit vehicles. This addresses the planned interfaces in the architecture between transit control centers and transit vehicles for organizations such as the MBTA and the other Regional Transit Authorities, Local City/Town services, and other transit providers such as TMAs and local human service agencies.

The systems under this program area allow a dispatch center to track its vehicles in real-time and to manage its fleet more efficiently. This will be applicable to both fixed-route and paratransit operations centers. For fixed-route services, real-time tracking allows more efficient fleet management and allows the provision of real-time service status to passengers both pre-trip and en-route. For paratransit services, it allows more efficient dispatching and faster response time. This information is also used to provide real-time service status to passengers both pre-trip and en-route. The systems will require equipment in each vehicle to be tracked, as well as a central system at the dispatch center to receive and manage the tracking information. For the traveler information component, this system will also include a means for disseminating this information, such as electronic signs at shuttle stops or websites with real-time information.

CAD/AVL for Transit Vehicles (Local Cities/Towns)

This initiative provides a CAD/AVL system for managing local city and town transit vehicles. This initiative will require equipment in each vehicle to be tracked, a central system at the local dispatch center to receive and manage the tracking information, and a means for disseminating this information to the public.

CAD/AVL for Transit Vehicles (MBTA)

Since 2005, the MBTA has implemented a CAD/AVL system for its entire bus fleet that allows the Bus Operations Center to track vehicles in real-time and to manage the fleet more efficiently. This information is also being used to provide real-time service status to passengers via the MBTA's "Open Data" initiative. MBTA has plans to continue to expand its program of providing real-time transit vehicle location data to the public.

CAD/AVL for Transit Vehicles (Regional Transit Authorities, including BAT, CATA, GATRA, LRTA, MVRTA, MWRTA)

This initiative provides a CAD/AVL system for managing RTA transit vehicles, allowing an RTA dispatch center to track its vehicles in real-time. This initiative will require equipment in each vehicle to be tracked, a central system at each RTA dispatch center to receive and manage the tracking information, and a means for disseminating this information to the public.

Since 2005, BAT has implemented AVL for its paratransit fleet and GATRA, MVRTA, and MWRTA have implemented AVL for their fixed route and demand response vehicles. The RTAs plan to continue to expand the extent and functionality of these CAD/AVL systems.

CAD/AVL for Transit Vehicles (Other Transit Providers)

In addition to the MBTA and the other RTAs, there are a number of other providers of transit service in the region. These include Transportation Management Associations (TMAs), local human service transit providers, as well as private paratransit operators under contract with the MBTA. This initiative establishes a CAD/AVL system for managing transit vehicles operated by these other transit providers, allowing a transit dispatch center to track its vehicles in real-time. This initiative will require equipment in each vehicle to be tracked, a central system at each dispatch center to receive and manage the tracking information, and a means for disseminating this information to the public.

6.1.5.2 Traffic Signal Priority

This program area covers signal priority for buses operated by transit authorities within the study area. This addresses the planned interfaces between transit vehicles and traffic signal systems shown in the architecture.

The systems to be implemented under this program area require coordination between the relevant organization and the cities or towns in which signal priority will be requested for buses. Requests for traffic signal priority will be made to the traffic signal system controlled by the local city/town. This will occur either locally at the signal controller or through a request to the central system, if the signal is part of such a system. Depending on the type of system used, the system may include elements on the buses to identify them to the signal system, elements on the controller hardware in the field, elements in the central signal system, and the network infrastructure to support communications between these system elements.

Traffic Signal Priority (MBTA)

This initiative extends the signal priority system currently in place on the Silver Line to other bus routes in the MBTA system. This will require coordination with BTD and any other cities or towns in which signal priority will be requested for MBTA buses. Requests for traffic signal priority will be made to the traffic signal system controlled by BTD or the local city/town. Work is currently underway on developing a center-to-center interface that will expand transit signal priority for MBTA buses throughout the City of Boston.

Traffic Signal Priority (BAT, CATA, GATRA, LRTA, MVRTA, MWRTA)

This initiative introduces signal priority on buses operated by Regional Transit Authorities within the study area. This will require coordination between the relevant RTA and the cities or towns in which signal priority will be requested for buses. Requests for traffic signal priority will be made to the traffic signal system controlled by the MassDOT – Highway Division, or the local city/town. Since 2005, BAT and the City of Brockton have implemented transit signal priority in downtown Brockton.

6.1.6 PUBLIC TRANSPORTATION: ELECTRONIC FARE PAYMENT

6.1.6.1 Automated Fare Collection for the MBTA

This program area covers the replacement of the MBTA's former token-based fare collection system with a fare card system. This addresses the planned element of the Regional Fare Card in the architecture, as well as its interfaces with MBTA transit services. The system will cover fare collection on all subway, trolley, and bus services, with planned expansion to MBTA commuter rail services.

Automated Fare Collection for Subway/Bus (MBTA)

Since 2005, the MBTA has implemented its fare collection system with a cashless system based on fare cards and fare tickets. The Automated Fare Collection (AFC) system consisted of upgrades to turnstiles and fareboxes to accept the new fare media, vending machines for the new fare cards, a centralized fare collection and revenue management system, and supporting communications infrastructure upgrades. This AFC system currently covers fare collection on all subway, trolley, and bus services.

Automated Fare Collection for Commuter Rail (MBTA)

This initiative extends the MBTA's AFC system to include commuter rail services, allowing payment by fare card for commuter rail trips. This will include fare vending machines at commuter rail stations, fare card readers at stations or aboard trains, and upgrading the communications infrastructure to support the new data requirements.

6.1.6.2 Regional Fare Card

This program area covers acceptance of the planned Regional Fare Card (envisioned in the architecture to be interoperable with the MBTA's automated fare collection system) on non-MBTA transit services. This may be established as an expansion of the MBTA's CharlieCard or through a separate interoperable fare card. This program area addresses the planned interfaces between the Regional Fare Card and services operated by the Regional Transit Authorities and other transit providers.

The systems to be implemented under this program area will allow fares on these services to be deducted from the balance carried on the Fare Card. In addition to acceptance of the new media aboard the vehicles, the system will also support reconciliation of accounts between the transit operator and the Regional Fare Card Agency.

Regional Fare Card Integration for Transit Vehicles (Local Cities/Towns)

This initiative introduces acceptance of the planned Regional Fare Card on local shuttle services operated by local cities and towns. In addition to acceptance of the new media aboard the shuttles, the system will support reconciliation of accounts between the shuttle service operator and the Regional Fare Card Agency.

Regional Fare Card Integration for Transit Vehicles (BAT, CATA, GATRA, LRTA, MVRTA, MWRTA)

This initiative introduces acceptance of the planned Regional Fare Card on transit services operated by Regional Transit Authorities within the study area. In addition to acceptance of the new media aboard transit vehicles, the system will support reconciliation of accounts between the RTA and the Regional Fare Card agency. Currently there is a consortium of RTAs, working to procure new fareboxes and equipment that will accept smart card media interoperable with the MBTA's CharlieCard.

Regional Fare Card Integration for Transit Vehicles (Other Transit Providers)

This initiative introduces acceptance of the planned Regional Fare Card on transit services operated by other transit providers in the region. In addition to acceptance of the new media aboard the buses, the system will support reconciliation of accounts between the appropriate transit provider and the Regional Fare Card Agency.

6.1.6.3 Regional Fare Card Integration for ETC

This program area covers the integration of the Regional Fare Card with the regional electronic toll collection (ETC) transponders. This addresses the planned interface shown in the architecture between the Regional Fare Card and the MassDOT – Highway Division FAST LANE transponders. The following initiative addresses this program area.

Regional Fare Card Integration with ETC Transponders (Regional Fare Card Agency and MassDOT – Highway Division)

This initiative covers the integration of the Regional Fare Card with the regional ETC transponders. This initiative will extend the planned Regional Fare Card for use in highway toll transactions, allowing transfer of funds from the fare card to the toll transponder. In addition to acceptance of the fare card media by the toll transponder, the system will also support reconciliation of accounts between the MassDOT – Highway Division (the operator of the FAST LANE system) and the Regional Fare Card agency.

6.1.7 TRAVELER INFORMATION

6.1.7.1 Regional Traveler Information

This program area covers the deployment of a regional traveler information system, including a telephone-based system as well as other systems (e.g., websites, kiosks) covering the region's

roadways and transit services. This program area includes the statewide 511 Traveler Information System.

511 Travel Information System

This initiative consists of the deployment of a publicly available traveler information system covering the roadways and transit services in the region. The participating organizations are the following:

- *Roadway Agencies:*
  - BTD
  - Local Cities/Towns
  - MassDOT – Highway Division
  - Massport
  - DCR
- *Transit Authorities:*
  - BAT
  - CATA
  - GATRA
  - LRTA
  - MBTA
  - MVRTA
  - MWRTA
  - Local Cities/Towns Shuttles
  - Other Transit Providers

Although the lead agency for implementation is MassDOT – Highway Division, all roadway and transit organizations in the region can provide information for dissemination through the system to be implemented under this program area. Examples of information to be provided include real-time information on incidents and delays, as well as planned events such as construction, road closures, or traffic-generating special events.

In 2010, MassDOT – Highway Division procured the services of a private sector company to provide 511 interactive telephone services. This 511 service provides statewide coverage. The private sector company has also developed a traveler information website that includes links to MassDOT – Highway Division camera views and traveler information. Enhancement of the 511 telephone service and traveler information website is planned.

The Event Reporting System, described in Section 6.1.1.1, also serves as a source of data for the 511 system, allowing event information to be collected from the various participating organizations for dissemination to the public via the 511 telephone system and its associated website.

6.1.7.2 Stakeholder-Specific Traveler Information

This program area covers the development or expansion of travel information systems specific to particular roadway and transit organizations. This addresses planned components in the architecture relating to traveler information dissemination, such as information kiosks and websites, as well as their interfaces with the appropriate traveler information system.

The systems identified under this program area consist of central information systems that serve as an organization's traveler information repository, as well as the elements allowing dissemination of information to the public.

Traveler Information Website (BTD)

This initiative establishes a traveler information website for the City of Boston, covering the roadways operated by BTD. The website will provide information from the TMC such as traffic advisories and CCTV images. The server for this website will obtain information from the central systems at the TMC for dissemination to the public via the internet.

Traveler Information Kiosks (MassDOT – Highway Division)

This initiative comprises the deployment of Traveler Information Kiosks at service areas along the Turnpike. The kiosks provide travel information such as traffic conditions and weather advisories, as well as tourism information. With the rapid adoption of personal devices with web access, MassDOT – Highway Division may decide to reexamine the need for information kiosks at service plazas.

6.1.8 COMMERCIAL VEHICLE OPERATIONS (CVO)

6.1.8.1 Automated Oversize/Overweight Credentialing

This program area covers the provision of electronic systems for managing oversize/overweight vehicle permits. This addresses the elements planned in the architecture for this purpose, namely a central system for managing these permits electronically at Oversize/Overweight Permit Offices, as well as an interface with Private Motor Carriers. The following initiative addresses this program area.

Automated Oversize/Overweight Credentialing System

This initiative establishes a computer-based system for managing oversize/overweight (OS/OW) vehicle permits. This includes a central system for managing these permits electronically at the Oversize/Overweight Permit Office at BTD, as well as an interface with Private Motor Carriers. This interface will allow electronic submission of credentials and permit applications, as well as electronic distribution of permits and credential status confirmations.

6.1.8.2 CVO Administrative Processes

This program area covers the provision of electronic systems for new planned electronic credentialing and commercial vehicle information exchange systems. This addresses the elements planned in the architecture for this purpose, including plans for a new CVO portal to consolidate links to the Commonwealth's various stand-alone electronic credentialing systems, and plans to design and deploy a Massachusetts CVIEW (Commercial Vehicle Information Exchange Window) system.

CVO Portal

This initiative will provide a single website or "portal" that provides information on all the Commonwealth's CVO regulatory and enforcement programs. It will include links to all the Commonwealth's stand-alone credentialing systems (e.g., International Registration Plan (IRP), International Fuel Tax Agreement (IFTA), Oversize and Overweight (OS/OW)), links to instructions and supporting documentation, and PDF application forms that can be downloaded and printed.

Massachusetts CVIEW

This initiative established the design and deployment of a Commercial Vehicle Information Exchange Window (CVIEW) system to serve as the core CVO data exchange system in Massachusetts. The CVIEW will act as a central repository for CVO data, allow for web-based querying of real-time vehicle safety and credentialing data, and exchange data with national commercial vehicle safety and administration systems.

6.1.8.3 Weigh-In-Motion

This program area covers the provision of Weigh-In-Motion (WIM) sensors for collecting commercial vehicle data at mainline highway speeds. This addresses the WIM sensor elements included in the architecture.

WIM Stations (MassDOT – Highway Division)

This initiative encompasses MassDOT – Highway Division's existing forty-eight (48) WIM stations currently installed around the state and planned future WIM stations to support commercial vehicle reporting and enforcement efforts.

6.1.8.4 Roadside CVO Safety

This program area covers the provision of planned ITS elements for roadside safety monitoring and roadside electronic screening.

Mobile Inspection Station (Massachusetts State Police)

This initiative will deploy a mobile screening unit employing advanced technologies to electronically screen commercial vehicles at mainline speeds. It is anticipated that this unit will include a license plate reader, a USDOT number reader, communications equipment, automatic querying of the CVIEW database, and supporting hardware and software systems.

6.1.9 EMERGENCY MANAGEMENT

6.1.9.1 Emergency Management Coordination

This program area covers the extension of the Interagency Communications Network and the Event Reporting and Video Integration Systems to support emergency management functions for the transportation systems in the region. This covers the planned center-to-center interfaces among emergency operations centers, as well as interfaces between emergency management and traffic/transit management centers. The following initiative addresses this program area.

Emergency Management Network

This initiative extends the functionality of the interagency systems proposed in the architecture, namely the Interagency Communications Network and the Event Reporting and Video Integration Systems, to support emergency management functions. The participating organizations are those with roadway, transit, or emergency management functions, including the following:

- *Roadway Agencies:*
  - BTD
  - Local Cities/Towns
  - MassDOT – Highway Division
  - Massport
  - DCR
- *Transit Authorities:*
  - BAT
  - CATA
  - GATRA
  - LRTA
  - MBTA
  - MVRTA
  - MWRTA
  - Local City/Town Shuttles
  - Private Surface Transportation Providers

- Local/Regional School Districts
- Amtrak

- *Emergency Management Agencies:*
  - BEMA
  - Local City/Town Public Safety
  - MBTA Police
  - MEMA
  - State Police

In emergency management, coordination among organizations may often require the transmission of sensitive or privileged information. This includes information that must remain restricted due to security concerns and that must be managed more securely. This initiative addresses this need by adding a secure layer to these systems, allowing sensitive information to be accessible only to users with appropriate privileges. Once a user's identification is established (e.g. through password or other means of verification), each user will be able to view information appropriate for his/her access level. Multiple agencies are currently involved in the implementation of METFON, the Metropolitan Emergency & Transportation Fiber Optic Network. It is envisioned that METFON will provide communications infrastructure to support information sharing for transportation events and emergency management functions. Likewise, since 2005, the region has participated in radio interoperability planning and is exploring opportunities to improve the interagency interoperability of emergency communications.

The initiative also extends the Event Reporting System, described in Section 6.1.1.1, to support new categories and protocols for information exchange. This includes incident information essential for emergency response (e.g. nature of event or threat, severity, etc.) as well as response information (e.g. units dispatched, response plans, route diversions, etc.). The initiative also includes the development of tools for evacuation planning and management, allowing a coordinated response in case of local or regional evacuations.

6.1.9.2 CAD/AVL for Emergency Management

This program area provides Computer-Aided Dispatching/Automatic Vehicle Location systems for managing emergency vehicles. This addresses the planned interfaces in the architecture between emergency dispatch centers and emergency vehicles. The following initiative addresses this program area.

CAD/AVL for Emergency Vehicles (Local Cities/Towns)

This initiative provides a CAD/AVL system for managing emergency vehicles. This system will allow a local or regional emergency dispatch center to track its vehicles in real-time and to dispatch those vehicles in the most efficient manner. This initiative will require equipment in each vehicle to be tracked, as well as a central system at the dispatch center to receive and manage the tracking information.

6.1.9.3 Transit Safety

This program area covers the deployment of emergency call boxes at transit facilities. This addresses the planned emergency call box elements in the architecture, as well as the interfaces with the emergency call centers. The following initiative addresses this program area.

Emergency Call Boxes (CATA, GATRA, LRTA, MVRTA, MWRTA)

This initiative comprises the deployment of emergency call boxes at Regional Transit Authority (RTA) facilities. Locations for deployment will include bus stops, terminals, and parking facilities. These call boxes will allow a voice connection to security personnel either at RTA control centers or at relevant police dispatch centers. They will also support silent alarms, alerting

security personnel to a problem without the need for voice communications. This initiative will require a communications interface between the call boxes and the dispatch center.

6.1.10 ARCHIVED DATA MANAGEMENT

6.1.10.1 Planning Data Archive Coordination

This program area covers the development of interfaces among the planning data archives held by transportation organizations in the region. This addresses the planned interfaces between the MassDOT - Office of Transportation Planning (OTP) archive and the other databases in the region. The following initiative addresses this program area.

Planning Data Archive

This initiative consists of the development of a system for coordinating the planning data archives for the transportation organizations in the region. The system will provide access to the planning data collected by roadway and transit organizations, planning agencies such as the five RPAs and CTPS, and the Registry of Motor Vehicles. As envisioned by the architecture, OTP will serve as the regional archived data management system hub, holding information managed by OTP as well as providing a portal to the information held by other organizations. This initiative will require interfaces between OTP and each of the other participating organizations' databases. This will provide OTP with access to data held by the other organizations, and will provide the other organizations with access to data held by OTP. Moreover, this will also provide participating organizations with access to each others' data, allowing one RPA, for example, to access data held by an adjacent RPA through the system maintained by OTP.

6.2 Implementation Strategy

When implemented, the initiatives identified in the previous section will provide the integrated transportation system envisioned by the Regional ITS Architecture. However, due to limitations in resources and time, it is not possible to implement all of these initiatives immediately. Therefore, transportation stakeholders are encouraged to refer to the architecture as an important input in prioritizing their implementation strategy, taking into account existing stakeholder initiatives and program areas, regional needs, and potential for successful implementation. As a general rule, stakeholders should also seek to prioritize ITS initiatives that yield benefits for multiple transportation organizations.

Many initiatives in this plan, however, are identified for implementation by a single agency. For example, there are a number of initiatives that can be implemented independently by a local city or town, such as CAD/AVL for emergency vehicles, CAD/AVL for maintenance vehicles, or variable message signs. As these initiatives are independent of any other agency or organization, this implementation strategy does not address them. Prioritization of these initiatives will be the responsibility of the implementing agency, as only that agency will be able to determine how these initiatives fit into its overall capital and operational planning strategies.

It is important to note that regional stakeholders have expressed a desire to adopt an increasingly coordinated approach to ITS planning and deployment. In particular, regional stakeholders are interested in participating to a greater extent in the planning and coordination of state-wide ITS efforts, such as 511, ERS, and CVO initiatives. This approach has already yielded benefits for the Metropolitan Boston region as several of the multi-agency initiatives identified for prioritization in 2005 have progressed and/or already been implemented. For example, Exhibit 6-2 describes the near-term multi-agency initiatives recommended for prioritization in 2005.

Exhibit 6-2: Recommended Near-Term Multi-Agency Initiatives (from 2005)

Functional Area	*Initiative*
Multimodal	▪ Event Reporting System ▪ Expansion of MIVIS ▪ Interagency Communications Network ▪ 511 Travel Information System ▪ Planning Data Archive
Roadway	▪ Remote MassDOT – Highway Division HOC Workstation (MassHighway and MEMA)
Transit	▪ Traffic Signal Priority for MBTA Vehicles
Parking	▪ Expansion of the Logan Parking Management System (Massport) ▪ ETC Integration at MBTA Parking Facilities

Since then, several of these near-term initiatives, including the Event Reporting System, the expansion of MIVIS, and the 511 Traveler Information System, have been implemented. Other initiatives, such as the interagency communications network and transit signal priority for the MBTA vehicles have demonstrated significant progress and continue to move forward. Also, the interface between the MassHighway TOC and the MassPike CA/T OCC are no longer necessary since these two control centers have since been combined into the consolidated MassDOT – Highway Division's Highway Operation Center (HOC). Stakeholders also recommended several "future" multi-agency initiatives for prioritization in 2005. Exhibit 6-3 describes these recommended initiatives.

Exhibit 6-3: Future Multi-Agency Initiatives (from 2005)

Functional Area	*Initiative (and Lead Agency)*
Multimodal	▪ Emergency Management Network ▪ Regional Fare Card Integration with ETC Transponders
Transit	▪ Traffic Signal Priority (BAT, CATA, GATRA, LRTA, MVRTA, MWRTA) ▪ Regional Fare Card Integration for Transit Vehicles (BAT, CATA, GATRA, LRTA, MVRTA, Cities/Towns, Other Transit Providers)
Parking	▪ ETC Integration at Parking Facilities (BTD, Cities/Towns, Massport, Other Parking Operators) ▪ Regional Fare Card Integration at Parking Facilities (BTD, Cities/Towns, Massport, MBTA, Other Parking Operators, BAT, CATA, GATRA, LRTA, MVRTA)

The region has seen success in implementing the ITS initiatives in Exhibit 6-3. Regional stakeholders have progressed the Emergency Management Network initiative, including ongoing work developing the METFON (Metropolitan Emergency & Transportation Fiber Optic Network) and ongoing regional radio interoperability efforts. BAT, working with the City of Brockton, has implemented limited transit signal priority in downtown Brockton. A consortium of RTAs is also currently in the process of procuring and deploying fareboxes and equipment to have smart card fare media that is interoperable with the MBTA's CharlieCard.

Given the region's success in implementing these priority initiatives, it is highly recommended that local, regional, and state agencies continue to reference the architecture and its associated ITS initiatives in their future ITS strategic planning efforts. In particular, stakeholders should take advantage of the recently formed Regional ITS Planning and Coordination Committees to prioritize and explore implementation of initiatives that will benefit multiple stakeholder organizations.

7. ARCHITECTURE CONSISTENCY AND MAINTENANCE

The Implementation Plan discussed in the preceding chapter outlines a strategy for implementation of the ITS components contained in the architecture. However, it is recognized that in order for ITS implementation to be successful, ITS must be integrated into the mainstream transportation planning process. This chapter addresses two separate but related issues. The first is ensuring that when projects are developed, any ITS elements are consistent with the architecture. The second is maintaining the architecture so that it remains relevant and useful to stakeholders in the region. Both of these are valuable exercises, and both are also the subject of the federal rules and policies governing metropolitan planning.

As it did for the development of the architecture, MassDOT – Office of Transportation Planning will take responsibility for the oversight of the architecture for Metropolitan Boston. This approach recognizes the complexity of coordinating planning across five MPO regions. To be successful, this approach will require ongoing information exchange and collaboration among the stakeholders in this region.

This chapter outlines the approach by which OTP plans – in collaboration with stakeholders in the region – to address the federal consistency and maintenance requirements. Ensuring consistency between projects with ITS elements and the architecture is based on the MPO-oriented capital programming process, and maintaining the Regional ITS Architecture is designed to be responsive to updates of the long-term regional transportation plans and other planning activities. The following sections present the proposed approach.

7.1 Architecture Consistency

The United States Department of Transportation is responsible for ensuring that federal transportation dollars are used in a manner that is consistent with federal laws and regulations, including the Clean Air Act, the Americans with Disabilities Act, and others. As stated in the 2001 FHWA Rule and FTA Policy:

> "The final design of all ITS projects funded with highways trust funds shall accommodate the interface requirements and information exchanges as specified in the regional ITS architecture. If the final design of the ITS project is inconsistent with the regional ITS architecture, then the regional ITS architecture shall be updated."[2]

As with the other federal requirements, this ITS consistency policy means that if organizations seeking federal funds want to avoid costly delays during the approval and funding process, they need to be sure that the consistency requirement has been met. The objective of the policy is to help an organization at the earliest stage possible to realize the opportunities for collaboration with other stakeholders, to take advantage of synergies with projects under development at other organizations, and to avoid conflicts or duplication of effort.

The federal regulations also require that all ITS projects be based on a systems engineering analysis at a scale commensurate with the project scope, meaning that the more complex the project, the more complex the analysis. Such an analysis is typical of any transportation engineering project involving the application of advanced technology. While the architecture has relevance throughout the project development process, the discussion in this section focuses on the initial review for architecture consistency in the early stages of the process.

[2] Federal Highway Administration "Intelligent Transportation System Architecture and Standards; Final Rule" and Federal Transit Administration "National ITS Architecture Policy on Transit Projects; Notice" in Federal Register volume 66 number 5, Monday, January 8, 2001.

Since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 and reaffirmed in subsequent transportation legislation, transportation planning has been driven by a set of rules governing metropolitan and statewide transportation planning. The path that leads from a project concept to federal approval and funding goes through two major phases: project initiation and federal approval. The former involves all of the work that leads up to submission of a project to a Metropolitan Planning Organization; the latter begins with the adoption by that MPO of a fiscally-constrained, prioritized set of projects known as a Transportation Improvement Program (TIP), and concludes with federal approval of the state TIP (STIP), which is an aggregation of TIPs from around the state, as shown in Exhibit 7-1. The process for addressing consistency with the Regional ITS Architecture is designed to fit into this existing transportation planning process. As such, this approach relies on existing collaborative relationships between each MPO and its local planning partners.

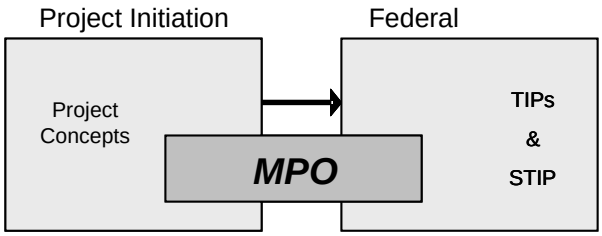

Exhibit 7-1: Project Planning Process

7.1.1 FEDERAL APPROVAL PHASE

Because the FHWA Rule and FTA Policy driving this process is focused on the final approval granted by FHWA and FTA, the description of the process begins with the federal approval phase. During the federal approval phase, each MPO submits its TIP to the state. In Massachusetts, the State Transportation Improvement Program (STIP) is an aggregation of the TIPs from around the Commonwealth. The Massachusetts Department of Transportation is responsible for submitting the STIP to the United States Environmental Protection Agency (EPA), the Massachusetts Department of Environmental Protection (MassDEP), FHWA and FTA for final approval. As the discussion of the project initiation process explains, a project with ITS elements should not reach the TIP unless consistency has been addressed. As a result of addressing the issue before projects reach the TIP, each TIP that is submitted to MassDOT – and by extension the STIP – should be ready for federal approval with respect to the consistency issue.

7.1.2 PROJECT INITIATION PHASE

The project initiation phase begins with project concepts. By the end of this stage when the TIP is being developed, each MPO needs to be certain that the consistency requirement has been addressed for all projects that have ITS elements. Each MPO, therefore, will work with its planning partners during the project initiation phase, when concepts are being developed for eventual inclusion in the TIP, to ensure that the consistency issue is addressed.

As planning practices vary by region, differences are expected among the MPOs in Massachusetts but in general it is expected that the focus will be on whichever organization or entity assumes responsibility for a project concept's development. The role of "project proponent" is often assumed by a Regional Transit Authority or MassDOT – Highway Division District office, which often facilitate the development of a concept. Consultants and contractors, who often provide extensive technical assistance, could also occupy this niche on behalf of their client, as could the individual municipalities that often champion specific projects. Regardless of who acts as the project proponent, however, the MPO will want to know if a project that has ITS elements is consistent with the architecture. Based on input from MPO participants in each region, it is anticipated that this will

be handled through the project submission forms employed by each MPO. These forms, which document many project attributes, vary among the MPOs. By adding architecture consistency as an additional attribute, the MPOs can ensure that the consistency requirement is addressed within existing planning practices.

In this context, it is necessary to differentiate roadway and transit projects, because the paths through which they reach the MPO are different in some respects. Transit projects are developed and eventually submitted by transit authorities. Each transit authority develops a list of capital projects, which depend on funds over which the MPO has authority. For all kinds of projects but especially for major projects, the authorities tend to work closely with the Federal Transit Administration, and proposals are often scrutinized closely for various policy issues before they reach the TIP. In most cases, therefore, the transit authority acts as a project proponent. When projects are submitted for inclusion in the TIP, regardless of scope or funding type, the transit authority, as project proponent, will document whether or not the project has ITS elements and, if it does, that the transit authority affirms that they are consistent with the architecture.

In contrast, aside from major highway improvements, roadway projects tend to begin with an advocate such as a city or town within the region proposing an idea to the appropriate MassDOT – Highway Division District office. In general, therefore, the Districts will serve as the project proponent for most roadway projects from the region that will eventually reach the TIP. When roadway projects are submitted for inclusion in the TIP, the District, as the project proponent, will document whether or not each project has ITS elements and, if it does, will affirm that they are consistent with the architecture.

For roadway projects, there is another piece of the project initiation phase that happens to benefit the consistency requirement. A Project Initiation Form (PIF), required of all project concepts, is often drafted by the project advocate and completed by the District, which then submits each PIF to a statewide Project Review Committee. This creates an additional opportunity to ensure that the project proponent has examined the project for consistency with the architecture.

This process is illustrated in Exhibit 7-2:

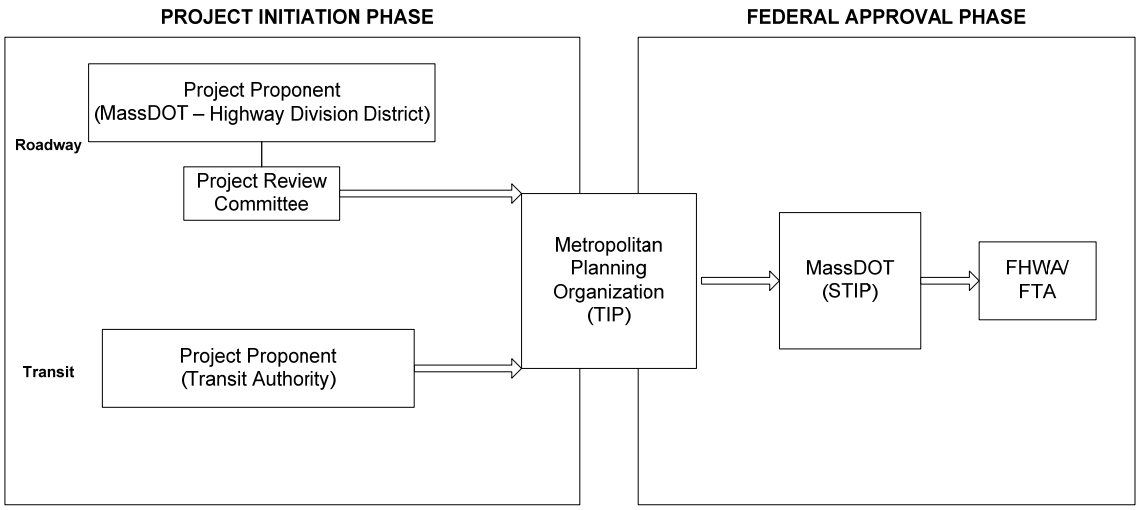

Exhibit 7-2: Project Initiation and Approval Process

In addition to this initial review in the early stages of the project development process, consistency with the architecture must be revisited as a project develops further in order to ensure that it has not been affected by changes to the scope of the project. Moreover, as a project progresses into the design stage, it must undergo a systems engineering analysis, as is typical of ITS projects and as is required by the FHWA Rule and FTA Policy.

A note about the term "consistency":

Because of the superficial similarity to air quality conformity, it is important to clarify the differences between the terms consistency and conformity. Whereas air quality goals are definitive and fixed, the Regional ITS Architecture is a dynamic product of the transportation planning process. The goal of air quality conformity is, in large part, to filter out detrimental projects; the intent of the ITS consistency policy is to ensure that when actual projects are developed and become candidates for federal funding, the technical and institutional aspects are consistent with the architecture. A project may prompt a modification to the architecture, as discussed in Section 7.2.2, or may be revised to be consistent with the architecture. As such, demonstrating consistency places a great emphasis on considering the relationship between a project and the architecture as early and as often as possible.

7.2 Architecture Maintenance

Comparable to a Regional Transportation Plan (RTP), the Regional ITS Architecture is a vision of the future transportation system, documented at one point in time. The architecture, like an RTP, reflects the current situation and documents planned changes or investments. However, in order to remain relevant, the architecture has to be maintained. As regional needs evolve, as planned elements are deployed, and as other changes occur, the architecture must be updated to reflect those developments. Maintenance of the architecture is also motivated by federal requirements that require consistency between all federally funded projects with ITS elements and the Regional ITS Architecture.

This section describes how the architecture will be maintained so that it remains relevant to the transportation system and useful to planners and operators. The maintenance strategy relies on two elements. The first is a formal periodic update at the same frequency as the RTPs, which are currently on a four-year update cycle. However, since the RTPs will provide valuable input to the architecture, the architecture update process will be staggered to occur after the RTP update. The second is interim architecture modifications that may occur at any point in the update cycle, outside of the formal update process. This two-pronged approach will have the added benefit of sustaining an ongoing region-wide dialogue about ITS.

The MassDOT - Office of Transportation Planning (OTP), will be responsible for the maintenance of the architecture. However, other stakeholders will be involved, as they have been throughout the development process. The maintenance strategy describes who will be involved and what responsibilities transportation stakeholders in the region should assume.

7.2.1 PERIODIC ARCHITECTURE UPDATES

Under this strategy, the Regional ITS Architecture will be formally revisited on the same cycle as the Regional Transportation Plan updates (currently every four years). Since the RTPs will provide valuable input to the architecture, assessment of the architecture will be staggered to occur after the RTP update. In this way, it is expected that the assessment of architecture can incorporate new ideas and/or projects that are included in an updated RTP.

The OTP will formally assess the Regional ITS Architecture to determine whether significant changes in ITS deployment in the region merit a formal update to the architecture. Based on this assessment, OTP may initiate a formal update to the architecture with a request for information from stakeholders in the region regarding new ITS-related projects, initiatives, or needs. OTP may also gather information from the stakeholders in order to evaluate the status of the architecture's implementation, identifying, for example, ITS elements or interfaces that have evolved from "planned" to "existing" or that are no longer relevant and should be removed.

Based on the information gathered through this process, OTP will generate a draft list of architecture modifications and distribute it to the stakeholders for review. OTP can then call a stakeholder meeting for the region to review the draft list. This meeting can also provide an opportunity to discuss emerging ITS issues. After the stakeholder review of the draft list, OTP will make any modifications necessary and release the updated architecture. It was as part of this periodic update process that the Regional ITS Architecture for Metropolitan Boston was formally updated in 2011.

7.2.2 INTERIM ARCHITECTURE MODIFICATIONS

Just as project developments necessitate TIP amendments, it is anticipated that some modifications to the architecture will be needed during the interval between the periodic updates. Therefore, on the basis of project developments or other circumstances that require modifications, the project proponent will be responsible for drafting an architecture modification proposal and submitting it to OTP. The proposal will then be circulated to affected stakeholders for their review. It is expected that most architecture modifications, whether periodic or interim, will involve adding new ideas, dimensions, or stakeholders to existing market packages, interfaces, or functions.

7.2.3 SUMMARY

This maintenance strategy is meant to accomplish several objectives. First, it ensures that the architecture will remain current and will reflect the most recent Regional Transportation Plans. Second, it allows the architecture to be responsive to changes between updates. And third, it helps facilitate an ongoing dialogue about ITS and the implementation of the architecture. Through the interim modifications and the periodic updates, this strategy should help to integrate ITS into the mainstream transportation planning process.

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8. CONCLUSION

8.1 Reasons for the Regional ITS Architecture

The Regional ITS Architecture for Metropolitan Boston is the result of the significant efforts and contributions of the participants in the process and it provides a strong foundation and opportunity for moving forward with ITS planning, implementation, and coordination in the region. The process of developing and updating the architecture was motivated by federal requirements and by the benefits of having a regional ITS architecture.

The first of these benefits is improved interagency coordination. The architecture development process represents a significant step towards coordinating ITS planning in the region by bringing together a diverse stakeholder group. The subsequent architecture update stakeholder meetings and the recent establishment of the Regional ITS Planning and Coordination Committee have continued to demonstrate the benefits of interagency information exchange regarding ongoing ITS initiatives occurring throughout the Commonwealth.

The second benefit is cost savings. For example, coordination of investments and consideration of standards for interagency interfaces offer opportunities for cost savings, especially in terms of long-term maintenance and operational costs.

The third benefit is better services for the traveling public. The public has the potential to benefit from this process, as the architecture addresses needs and priorities that cut across jurisdictional lines and that are not able to be addressed through single-agency initiatives. The framework outlined by the architecture is for a regional transportation system that can provide the public with a seamless and consistent travel experience across multiple jurisdictions.

To fully maximize the benefits of the regional ITS architecture, the architecture must remain current, relevant, and useful to transportation stakeholders.

8.2 Summary of Changes

The most significant changes that were incorporated into this version of the Regional ITS Architecture reflect the following:

- **Changes to the National ITS Architecture and Turbo Architecture**
  Since 2005, the National ITS Architecture has been updated to Version 6.1. This includes changes to existing market packages and information flows, new market packages and information flows, as well as a new version of the Turbo Architecture software (Version 5.0). For example, new market packages that are included in the updated Regional ITS Architectures include the following:
    - *APTS09 - Transit Signal Priority*
    - *APTS10 - Transit Passenger Counting*
    - *MC12 - Infrastructure Monitoring*

  Further information on the National ITS Architecture and its requirements is available online from the FHWA's ITS Architecture Implementation Program, which is located at http://www.ops.fhwa.dot.gov/its_arch_imp/index.htm.

- **The Creation of MassDOT**
  In 2009, Governor Deval Patrick signed a bill to create the new Massachusetts Department

of Transportation (MassDOT) to consolidate and oversee the former highway, mass transit, aeronautics, and Registry of Motor Vehicles agencies. Because of the institutional reorganization, many of the elements of the regional architectures have been combined and renamed. For example, the MassHighway Transportation Operations Center (TOC) and the MassPike Operations Control Center (OCC) have been combined and renamed the MassDOT – Highway Division Highway Operations Center (HOC).

- **Addition of Stakeholders**
  Expanding on the inclusiveness of the original architecture development process, the update process involved inviting additional stakeholders to participate in this effort. For example, MetroWest Regional Transit Authority (MWRTA), which was established in 2006, has been added as a new stakeholder. The support and input of the recently established Regional ITS Planning and Coordination Committees for Metropolitan Boston was also solicited. These regional transportation stakeholders provided input, reviewed documents, and provided guidance on the necessary updates to the architecture.

- **Refined Needs**
  The Needs Analysis, which identified the regional ITS-related projects and needs, was revisited to ensure that the updated architecture would remain consistent with the evolving needs and priorities of the region. Planning documents from the region, including RTPs and TIPs, were reviewed as part of the needs analysis. Further information was obtained through a series of meetings with regional transportation stakeholders.

- **Additional ITS Information**
  Updates to the architecture reflect information gathered from research on documents such as RTPs and TIPs, and stakeholder input on new transportation projects, plans, policies, procedures, and infrastructure implemented since 2005. Several additional market packages have also been identified for inclusion to the Regional ITS Architectures, including:

  - *CVO06 - Weigh-In-Motion*
  - *CVO07 - Roadside CVO Safety*
  - *EM05 - Transportation Infrastructure Protection*

  Stakeholder participation was critical in identifying updates. An initial draft of recommended updates to the architecture was developed based on a revised inventory of ITS elements and from stakeholder input at project meetings. These recommendations were reviewed at a meeting with regional transportation stakeholders, prompting extensive feedback that was incorporated into a finalized set of recommended updates to the Regional ITS Architecture.

The Operational Concept for the region was also updated to reflect changes in interagency interfaces. The Implementation Plan chapter in this report has also been updated to reflect the current status of planned ITS initiatives. The architecture and the Final Report will continue to serve as an important input into future regional and statewide ITS strategic planning efforts.

Throughout this update process, transportation stakeholders have focused on producing an ITS architecture that accurately reflects regional needs and priorities. For ease of use and reference, the Regional ITS Architecture for Metropolitan Boston has been made available in an interactive format on the internet. The interface allows a user to view the architecture in multiple ways and varying levels of detail. The architecture is available on the Commonwealth's website at http://www.mass.gov/RegionalITSArchitecture.

8.3 Recommendations

Through the process of updating the Regional ITS Architecture, a number of recommendations should be considered as the region continues to move forward with deployment of ITS:

- The stakeholder organizations that are represented in the Regional ITS Planning and Coordination Committee, as well as other relevant ITS stakeholders, should continue to meet and remain involved, not only in the maintenance of the architecture, but also in planning and coordinating ITS in the region. The benefits that this group has realized in working together on the architecture should be built upon and expanded to other regional and statewide ITS planning and coordination efforts.

- The Regional ITS Architecture should continue to be regularly updated to reflect the changing needs and priorities of the region. Because the initial architecture was forward-looking, few interim changes were necessary between 2005 and 2011. However, cumulative changes at the local, state, and national level have required a significant level of effort to be expended in formally updating the architecture. To make this work with the existing transportation planning process, it is recommended that the architecture be regularly assessed to determine if a formal update is necessary to reflect the needs identified in RTPs in the region. In addition, informal updates to ensure consistency with newly proposed projects should be done on an as-needed basis.

- Many of the multi-agency ITS initiatives identified by regional stakeholders in 2005 have progressed, while others are no longer relevant. The Regional ITS Architecture should serve as an important input to future local, regional, and statewide ITS strategic planning efforts. In particular, the architecture should be used to help identify multi-agency ITS initiatives that reflect the current needs and priorities of the region.

- Transportation stakeholders should continue to be trained and educated regarding ITS and architecture consistency. While the understanding of and familiarity with the architecture has grown considerably in recent years, new transportation stakeholders and changes in organizational personnel necessitate ongoing education and outreach efforts. The Regional ITS Planning and Coordination Committee may be able to assist in identifying areas of education and outreach that should be pursued. This education and outreach effort will help further mainstream ITS architecture consistency into the existing MPO transportation planning process.

- Formal agreements should be established for the existing and planned interagency interfaces identified in the architecture. Existing informal agreements should be formalized in order to ensure that their benefits are maintained. Operational agreements for new interfaces should be drawn up as these new interfaces are established. Additionally, existing operational agreements should be reexamined in light of the reorganization of state transportation agencies to ensure that these agreements remain relevant. Proper documentation of interagency agreements helps facilitate interagency coordination and the successful long term operation of the transportation network.

8.4 Using the Architecture

This process has yielded a valuable tool for planners and operators of the region's transportation system, and there are a number of ways in which the architecture should be used: First, the architecture should be used by stakeholder organizations as a framework for planning ITS projects, as it documents what they have planned, as expressed in the architecture development and update process. If the architecture does not reflect the current project plans, then the architecture and/or the project plans should be revised so that both are consistent and up to date.

Second, stakeholder organizations should use the architecture as a guide to how they should interface with other stakeholder organizations. The ITS architecture documents the interfaces that are planned for development, as well as standards that are relevant to these interfaces. In addition, the Operational Concept details the operational arrangements that are required for managing these interfaces and provides a model for the interagency agreements that should be established.

Finally, the Regional ITS Architecture provides the basis for satisfying the federal architecture consistency requirement for projects with ITS elements. Therefore, it is vital that project proponents use the architecture as a guideline during project development, just as the FHWA and FTA will be using the architecture when considering whether to approve the project. It is also important that consistency with the architecture is revisited throughout the project development process and as part of the systems engineering analysis that is required of all ITS projects. Incorporating the architecture into the planning, design, and operations process will ensure that all stakeholders in the region are moving together towards the vision that they have created through this process.

APPENDIX A

REGIONAL ITS ARCHITECTURE INTERACTIVE CD

The interactive CD-ROM containing the 2011 version of the Regional ITS Architectures for Massachusetts can be found on the inside back cover of this report. To use, insert the disc and open the file, “Click_Me.htm”. To view the current online version of the Architectures, please visit http://www.mass.gov/RegionalITSArchitecture

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APPENDIX B

FHWA RULE ON ITS ARCHITECTURE AND STANDARDS

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Federal Register

Monday,
January 8, 2001

Part IV

Department of Transportation

Federal Highway Administration

23 CFR Parts 655 and 940
Intelligent Transportation System Architecture and Standards; Final Rule

Federal Transit Administration

Federal Transit Administration National ITS Architecture Policy on Transit Projects; Notice

DEPARTMENT OF TRANSPORTATION

Federal Highway Administration

23 CFR Parts 655 and 940

[FHWA Docket No. FHWA–99–5899]

RIN 2125–AE65

Intelligent Transportation System Architecture and Standards

AGENCY: Federal Highway Administration (FHWA), DOT.

ACTION: Final rule.

SUMMARY: The purpose of this document is to issue a final rule to implement section 5206(e) of the Transportation Equity Act for the 21st Century (TEA–21), enacted on June 9, 1998, which required Intelligent Transportation System (ITS) projects funded through the highway trust fund to conform to the National ITS Architecture and applicable standards. Because it is highly unlikely that the entire National ITS Architecture would be fully implemented by any single metropolitan area or State, this rule requires that the National ITS Architecture be used to develop a local implementation of the National ITS Architecture, which is referred to as a ''regional ITS architecture.'' Therefore, conformance with the National ITS Architecture is defined under this rule as development of a regional ITS architecture within four years after the first ITS project advancing to final design, and the subsequent adherence of ITS projects to the regional ITS architecture. The regional ITS architecture is based on the National ITS Architecture and consist of several parts including the system functional requirements and information exchanges with planned and existing systems and subsystems and identification of applicable standards, and would be tailored to address the local situation and ITS investment needs.

EFFECTIVE DATE: February 7, 2001.

FOR FURTHER INFORMATION CONTACT: *For technical information:* Mr. Bob Rupert, (202) 366–2194, Office of Travel Management (HOTM–1) and Mr. Michael Freitas, (202) 366–9292, ITS Joint Program Office (HOIT–1). *For legal information:* Mr. Wilbert Baccus, Office of the Chief Counsel (HCC–32), (202) 366–1346, Federal Highway Administration, 400 Seventh Street, SW., Washington, DC 20590. Office hours are from 8 a.m. to 4:30 p.m., e.t., Monday through Friday, except Federal holidays.

SUPPLEMENTARY INFORMATION:

Electronic Access and Filing

You may submit or retrieve comments online through the Docket Management System (DMS) at: *http//dmses.dot.gov/submit.* Acceptable formats include: MS Word (versions 95 to 97), MS Word for Mac (versions 6 to 8), Rich Text Format (RTF), American Standard Code Information Interchange (ASCII) (TXT), Portable Document Format (PDF), and WordPerfect (version 7 to 8). The DMS is available 24 hours each day, 365 days each year. Electronic submission and retrieval help and guidelines are available under the help section of the web site.

An electronic copy of this document may be downloaded by using a computer, modem, and suitable communications software from the Government Printing Office's Electronic Bulletin Board Service at (202) 512–1661. Internet users may also reach the Office of the **Federal Register**'s home page at *http://www.nara.gov/fedreg* and the Government Printing Office's web page at: *http://www.access.gpo.gov/nara.* The document may also be viewed at the DOT's ITS web page at *http://www.its.dot.gov.*

Background

A notice of proposed rulemaking (NPRM) concerning this rule was published at 65 FR 33994 on May 25, 2000, and an extension of the comment period to September 23, 2000, was published at 65 FR 45942 on July 26, 2000.

In the NPRM on this rule, the FHWA had proposed that the regional ITS architecture follow from the ITS integration strategy proposed in another NPRM entitled ''Statewide Transportation Planning; Metropolitan Transportation Planning'' published at 65 FR 33922 on May 25, 2000. That rule is being developed according to a different schedule and will be issued separately. For this reason, all references to the proposed integration strategy have been removed from this rule. However, it is still the intent of this rule that regional ITS architectures be based on established, collaborative transportation planning processes. The other major changes to the final rule relate to options for developing a regional ITS architecture and the time allowed to develop such an architecture. Additional changes to the final rule largely deal with clarification of terms, improved language dealing with staging and grandfathering issues, and clarification of use of ITS standards.

Intelligent Transportation Systems represent the application of information processing, communications technologies, advanced control strategies, and electronics to the field of transportation. Information technology in general is most effective and cost beneficial when systems are integrated and interoperable. The greatest benefits in terms of safety, efficiency, and costs are realized when electronic systems are systematically integrated to form a whole in which information is shared with all and systems are interoperable.

In the transportation sector, successful ITS integration and interoperability require addressing two different and yet fundamental issues; that of technical and institutional integration. *Technical integration* of electronic systems is a complex issue that requires considerable up-front planning and meticulous execution for electronic information to be stored and accessed by various parts of a system. *Institutional integration* involves coordination between various agencies and jurisdictions to achieve seamless operations and/or interoperability.

In order to achieve effective institutional integration of systems, agencies and jurisdictions must agree on the benefits of ITS and the value of being part of an integrated system. They must agree on roles, responsibilities, and shared operational strategies. Finally, they must agree on standards and, in some cases, technologies and operating procedures to ensure interoperability. In some instances, there may be multiple standards that could be implemented for a single interface. In this case, agencies will need to agree on a common standard or agree to implement a technical translator that will allow dissimilar standards to interoperate. This coordination effort is a considerable task that will happen over time, not all at once. Transportation organizations, such as, transit properties, State and local transportation agencies, and metropolitan planning organizations must be fully committed to achieving institutional integration in order for integration to be successful. The transportation agencies must also coordinate with agencies for which transportation is a key, but not a primary part of their business, such as, emergency management and law enforcement agencies.

Successfully dealing with both the technical and institutional issues requires a high-level conceptual view of the future system and careful, comprehensive planning. The framework for the system is referred to as the *architecture.* The architecture defines the system components, key functions, the organizations involved, and the type of information shared

between organizations and parts of the system. The architecture is, therefore, fundamental to successful system implementation, integration, and interoperability.

Additional background information may be found in docket number FHWA–99–5899.

The National ITS Architecture

The Intermodal Surface Transportation Efficiency Act of 1991, Public Law 102–240, 105 Stat. 1914, initiated Federal funding for the ITS program. The program at that time was largely focused on research and development and operational tests of technologies. A key part of the program was the development of the National ITS Architecture. The National ITS Architecture provides a common structure for the design of ITS systems. The architecture defines the functions that could be performed to satisfy user requirements and how the various elements of the system might connect to share information. It is not a system design, nor is it a design concept. However, it does define the framework around which multiple design approaches can be developed, each one specifically tailored to meet the needs of the user, while maintaining the benefits of a common approach.

The National ITS Architecture, Version 3.0 can be obtained from the ITS Joint Program Office of the DOT in CD–ROM format and on the ITS web site *http://www.its.dot.gov*. The effort to develop a common national system architecture to guide the evolution of ITS in the United States over the next 20 years and beyond has been managed since September 1993 by the DOT. The National ITS Architecture describes in detail what types of interfaces should exist between ITS components and how they will exchange information and work together to deliver the given ITS user service requirements.

The National ITS Architecture and standards can be used to guide multi-level government and private-sector business planners in developing and deploying nationally compatible systems. By ensuring system compatibility, the DOT hopes to accelerate ITS integration nationwide and develop a strong, diverse marketplace for related products and services.

It is highly unlikely that the entire National ITS Architecture will be fully implemented by any single metropolitan area or State. For example, the National ITS Architecture contains information flows for an Automated Highway System that is unlikely to be part of most regional implementations. However, the National ITS Architecture has considerable value as a framework for local governments in the development of regional ITS architectures by identifying the many functions and information sharing opportunities that may be desired. It can assist local governments with both of the key elements: technical interoperability and institutional coordination.

The National ITS Architecture, because it aids in the development of a high-level conceptual view of a future system, can assist local governments in identifying applications that will support their future transportation needs. From an institutional coordination perspective, the National ITS Architecture helps local transportation planners to identify other stakeholders who may need to be involved and to identify potential integration opportunities. From a technical interoperability perspective, the National ITS Architecture provides a logical and physical architecture and process specifications to guide the design of a system. The National ITS Architecture also identifies interfaces where standards may apply, further supporting interoperability.

Transportation Equity Act for the 21st Century

As noted above, section 5206(e) of the TEA–21, Public Law 105–178, 112 Stat. 457, requires ITS projects funded from the highway trust fund to conform to the National ITS Architecture, applicable or provisional standards, and protocols. One of the findings of Congress in section 5202 of the TEA–21, is that continued investment in systems integration is needed to accelerate the rate at which ITS is incorporated into the national surface transportation network. Two of the purposes of the ITS program, noted in section 5203(b) of the TEA–21, are to expedite the deployment and integration of ITS, and to improve regional cooperation and operations planning for effective ITS deployment. Use of the National ITS Architecture provides significant benefits to local transportation planners and deployers as follows:

1. The National ITS Architecture provides assistance with technical design. It saves considerable design time because physical and logical architectures are already defined.

2. Information flows and process specifications are defined in the National ITS Architecture, allowing local governments to accelerate the process of defining system functionality.

3. The architecture identifies standards that will support interoperability now and into the future, but it leaves selection of technologies to local decisionmakers.

4. The architecture provides a sound engineering framework for integrating multiple applications and services in a region.

ITS Architecture and Standards NPRM

Discussion of Comments

The FHWA received 105 comments on this docket from a wide range of stakeholders, including major industry associations, State departments of transportation, Metropolitan Planning Organizations (MPOs), and local agencies. The comments were generally favorable about the scope and content, but requested additional clarification and guidance on implementation of specific items. On many issues, some commenters wanted more specific requirements, while others wanted more flexibility. Most commenters, including major industry associations and public sector agencies, agreed with the overall scope, but some felt that the specifics might be difficult to implement and asked for clarification of key terms. A few commenters wanted the FHWA to reduce the number of requirements or convert the rulemaking into a guidance activity until more ITS deployment experience is gained.

In summary, the FHWA received a large number of generally favorable comments about the NPRM that suggested minor specific changes and expressed a need for further guidance on implementation. Since the general tenor of the comments was positive, the FHWA has kept the scope of the NPRM and made appropriate clarifications to the text of the final rule to address concerns raised in comments. In response to the many comments requesting it, starting in early 2001, the FHWA will also provide a program of guidance, training, and technical support to assist with the implementation of this rule. The following is a detailed discussion of the comments and their disposition, organized by subject matter.

Section 940.3 Definitions

ITS Project. There were 34 comments submitted to the docket concerning the definition of an ITS project. Many of the commenters felt the definition was not clear enough, was too broad, or was too subject to interpretation. Some comments questioned how much of a project's budget would have to be spent on ITS before a project would be considered an ITS project. Some suggested specific language to more narrowly define an ITS project by

focusing on the portion of the overall project that is actually ITS or by suggesting language that would narrow the definition of an ITS project to only include projects which introduce new or changed integration opportunities.

Since the intent of this rule and the supporting legislation is to facilitate the deployment of integrated ITS systems, it is the position of the FHWA that the definition of an ITS project must be fairly broad to include any ITS system being funded with highway trust fund dollars. It is only by properly considering all planned ITS investments in the development of a regional ITS architecture that the integration opportunities and needs can even be identified. This consideration should be carried out in the development of an architecture prior to the specific project being advanced. If, in the development of a regional ITS architecture, it is determined that a specific planned project offers no real integration opportunities for the region, then the impact of this rule on that specific project is minimal.

As a response to the comments concerning the clarity of the definition, the definition of an ITS project has been slightly modified to remove the examples since they were considered misleading. The FHWA recognizes that any definition will be subject to interpretation by the stakeholders and acknowledges the need for guidance in this area to ensure clear and consistent interpretation of this rule. Guidance on what constitutes an ITS project (including examples) will be developed to assist the various stakeholders, including the FHWA Division Offices, to better understand what projects should be considered ITS projects.

Region. There were 26 comments submitted related to the definition of a region. Seven comments supported the open definition provided in the NPRM, arguing that the possible integration opportunities in an area should define the region and that there were too many possible variations to allow a restrictive definition. Six commenters who expressed concern over varying conditions interpreted the definition to mean Metropolitan Planning Area (MPA). Five comments suggested an MPA was too restrictive. Eight other comments indicated that the proposed definition of a region did not clearly identify what entity would have the lead in developing a regional ITS architecture or thought the definition implied the MPO should have the lead. Nine comments suggested various limits or boundaries to fit specific situations. Ten comments expressed a need for greater clarification of the definition for a region.

The intent of the proposed definition was to allow considerable flexibility on the part of the stakeholders in defining the boundaries of a region to best meet their identified integration opportunities. While there was no intent to generally restrict the definition to MPAs or States, the FHWA determined that regional ITS architectures should be based on an integration strategy that was developed by an MPO or State as part of its transportation planning process.

Given that the final rule does not require or reference an integration strategy, the FHWA feels a need to provide more specific guidance on the definition of a region. As such, the definition of a region has been revised to indicate that the MPA should be the minimum area considered when establishing the boundaries of a region for purposes of developing a regional ITS architecture within a metropolitan area. This should not be interpreted to mean that a region must be an MPA, or no less than an MPA, but the MPA and all the agencies and jurisdictions within the MPA should be at least considered for inclusion in the process of developing a regional ITS architecture within a metropolitan area. This rule is silent on other possible limits or minimum areas for defining a region, relying on the flexible nature of this rule to accommodate those special circumstances. The FHWA also acknowledges it is possible that overlapping regions could be defined and overlapping regional ITS architectures be developed to meet the needs of the regions.

Other Definitions. There were 20 comments suggesting that other terms used in the NPRM be defined. These included ''interoperability,'' ''standards,'' ''concept of operations,'' ''conceptual design,'' and ''integration strategy.'' Several of these are no longer used in the final rule and, therefore, were not defined. Other terms, such as ''interoperability'' and ''standards,'' were determined to be common terms whose definition did not effect the implementation of the final rule. Furthermore, language regarding standards conformity has been clarified in the body of the final rule.

Section 940.5 Policy

Twenty-eight commenters addressed the issue of consistency between the two related FHWA notices of proposed rulemaking (23 CFR parts 940 and 1410) and the Federal Transit Administration's (FTA) notice (FTA Docket No. FTA–99–6417) on National ITS Architecture published at 65 FR 34002 on May 25, 2000. The comments revealed a lack of understanding about the relationship between the regional ITS architecture and the integration strategy proposed as part of the revisions to FHWA's transportation planning rules. There were five comments suggesting a single DOT rule addressing how all ITS projects would meet the National ITS Architecture conformance requirements of the TEA–21 instead of an FHWA rule for highway projects and an FTA policy for transit projects. Four other comments acknowledged the need for two policies, but recommended they articulate the same process.

A final transportation planning rule is being developed on a different schedule than this rule, and comments regarding the portions of the National ITS Architecture conformity process included in the transportation planning rule will be addressed as it proceeds toward issuance. The FHWA and FTA have chosen to go forward with policies that have been developed cooperatively to implement the National ITS Architecture conformance process. This FHWA rule and the parallel FTA policy have been developed without reference to the proposed changes to the transportation planning process, including no mention of the development of an integration strategy. However, the policy statement of this rule notes a link to established transportation planning processes, as provided under 23 CFR part 450. This rule fully supports these collaborative methods for establishing transportation goals and objectives, and does not provide a mechanism for introducing projects outside of the transportation planning processes.

This final rule on National ITS Architecture conformance and the FTA policy on the same subject have been developed cooperatively and coordinated among the agencies to ensure compatible processes. Any differences between this rule and the parallel FTA policy are intended to address differences in highway and transit project development and the way the FHWA and the FTA administer projects and funds.

Fifteen commenters questioned the need for an integration strategy, and the relationship between the strategy and the regional ITS architecture.

Given the fact that proposed revisions to the FHWA's transportation planning rules are being developed according to a different schedule, this rule has been revised to remove any references to an integration strategy. Comments regarding the integration strategy will be addressed in the final transportation

planning rule, and the discussion of the regional ITS architecture in § 940.9 has been revised to clarify its content.

Section 940.7 Applicability

A few commenters noted that the proposed rule had not addressed the TEA–21 language that allows for the Secretary to authorize certain exceptions to the conformity provision. These exceptions relate to those projects designed to achieve specific research objectives or, if three stated criteria are met, to those intended to upgrade or expand an ITS system in existence on the date of enactment of the TEA–21. The legislation also included a general exemption for funds used strictly for operations and maintenance of an ITS system in existence on the date of enactment of the TEA–21.

The FHWA acknowledges this omission and has included the appropriate language in this section of the rule.

Section 940.9 Regional ITS Architecture

Several comments were received related to the way the proposed rule referred to developing regional ITS architectures. Eight comments, from State agencies and metropolitan planning organizations, supported an incremental approach to developing regional ITS architectures, starting with project ITS architectures and building them together. Four other comments, from metropolitan planning organizations and industry associations, noted that an ad hoc regional ITS architecture developed incrementally through projects would result in an architecture less robust than if there were a single, initial effort to develop it.

Also, thirteen comments from the Association of American State Highway and Transportation Officials (AASHTO) and a number of States recommended extending the time for developing regional ITS architectures, as the proposed two year implementation would be too short. Ten of the commenters preferred four years in order to acquire the necessary resources for developing regional ITS architectures.

Most commenters were in agreement with the content of the regional ITS architecture as defined in the proposed rule. However, there were 19 comments that dealt with confusion over the definition of both ''conceptual design'' and ''concept of operations.'' In addition, there were 17 other comments on the makeup of the stakeholders, involvement of the private sector, and the need and desirability of ''agreements'' between stakeholders.

The comments indicated confusion regarding the development of regional ITS architectures, and especially so in discussing the period of time for their development. Therefore, the final rule has clarified the time period for developing regional ITS architectures by adopting the proposed extension to four years subsequent to beginning to deploy ITS projects (§ 940.9(c)), or four years from the effective date of this rule for those areas that are currently deploying ITS projects (§ 940.9(b)). In clarifying the time for development, this rule has eliminated any references to specific methods for developing regional ITS architectures. By not prescribing any methods, the rule provides flexibility to a region in deciding how it should develop its regional ITS architecture. Guidance and information related to developing regional ITS architectures is available from FHWA Division Offices and from the ITS web site, *http://www.its.dot.gov*, and will be expanded to provide assistance in meeting the intent of the rule.

Both the terms ''conceptual design'' and ''concept of operations'' have been deleted from the final rule. In their stead are descriptions of the content that is expected to form the basis for a regional ITS architecture. This content has not significantly changed from that defined in the NPRM but is now contained in § 940.9(d). The level of detail required is to the architecture flow level as defined in the National ITS Architecture. The regional ITS architecture must identify how agencies, modes, and systems will interact and operate if the architecture is to fulfill the objective of promoting ITS integration within a region.

The relevant stakeholders for a region will vary from region to region. The list articulated in § 940.9(a) is representative only and not meant to be inclusive or exclusive. On the specific issue of private sector participation, if the private sector is deploying ITS systems in a region or otherwise providing an ITS-based service, it would be appropriate to engage them in the development of a regional ITS architecture. Because of these variations from region to region, the FHWA felt it inappropriate to attempt to define an all inclusive list of stakeholders. The group of relevant stakeholders will be a function of how the region is defined and how transportation services are provided to the public. Section 940.9(d)(4) specifies that in the development of the regional ITS architecture, it shall include ''any agreements (existing or new) required for operations.'' The formalization of these types of agreements is at the discretion of the region and participating stakeholders.

There were 14 comments from a broad range of organizations questioning how existing regional ITS architectures, strategic plans or ITS Early Deployment Plans would be treated under this rule. It is the intent of the FHWA that any existing ITS planning documents should be used to the extent practical to meet the requirements of this rule. If a regional ITS architecture is in place, is up to date, and addresses all the requirements of a regional ITS architecture as described in this rule, there is no requirement to develop a ''new'' one. If the existing regional ITS architecture does not address all the requirements of the rule, it may be possible to update it so that it meets the regional ITS architecture requirements of this rule. What is necessary is that the end result is an architecture that meets the requirements of this rule and properly addresses the ITS deployments and integration opportunities of that region. This issue is specifically addressed in § 940.9(e) of this rule.

There were five comments related to the impact of this rule on legacy systems (*i.e.*, ITS systems already in place) and requesting some sort of ''grandfathering'' for them. The language in § 940.11(g) of the final rule clarifies the grandfathering or staging aspects of the process. The final rule does not require any changes or modifications to existing systems to conform to the National ITS Architecture. It is very likely that a regional ITS architecture developed by the local agencies and other stakeholders would call for changes to legacy systems over time to support desired integration. However, such changes would not be required by the FHWA; they would be agreed upon by the appropriate stakeholders as part of the development of the regional ITS architecture.

There were 15 comments dealing with the maintenance process and status of the National ITS Architecture. Two comments suggested the need for the FHWA to formally adopt the National ITS Architecture. Four other comments also supported the formalization of a process for maintaining or updating it with the full opportunity for public input.

Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a regional ITS architecture, and the subsequent adherence of all ITS projects to that regional ITS architecture. This rule requires that the National ITS Architecture be used as a resource in developing a regional ITS architecture.

As a technical resource, it is important that the National ITS Architecture be maintained and updated as necessary in response to user input or to add new user services, but formal adoption of the National ITS Architecture is not necessary. However, the FHWA recognizes the need to maintain the National ITS Architecture and to establish an open process for configuration control that includes public participation. The process currently used by the DOT to maintain the National ITS Architecture is very rigorous and involves significant public participation. That process is currently being reviewed by the DOT with the intent of establishing a configuration management process that engages the public at key stages and ensures a consensus for updating the National ITS Architecture.

Four comments suggested that this rule should not be implemented until the National ITS Architecture was complete. The National ITS Architecture will never stop evolving since there always is a potential need to regularly update it as more is learned about ITS deployment. The FHWA believes the National ITS Architecture is developed to a stage where it can be used as a resource in developing regional ITS architectures, as required by this rule.

Seventeen comments asked the FHWA to define the agency that is responsible for the development and maintenance of the regional ITS architecture; specifically MPOs and/or the State as those entities that are already responsible for the planning process.

The FHWA did not define the responsibility for either creating or maintaining the regional ITS architecture to a specific entity because of the diversity of transportation agencies and their roles across the country. It is recognized that in some regions traditional State and MPO boundaries may not meet the needs of the traveling public or the transportation community. This is also why the FHWA did not rigidly define a region. The FHWA encourages MPOs and States to include the development of their regional ITS architectures as part of their transportation planning processes. However, the decision is best left to the region to determine the approach that best reflects their needs, as indicated in § 940.9. It is clear that the value of a regional ITS architecture will only be realized if that architecture is maintained through time. However, in accepting Federal funds under title 23, U.S.C., the State is ultimately responsible for complying with Federal requirements, as provided in 23 U.S.C. 106 and 133.

Four commenters noted that the proposed rule did not adequately address planning for, or committing to, a defined level of operations and maintenance.

The final rule addresses this concern on two primary levels, in the development of the regional ITS architecture and the development of individual projects. Section 940.9(d)(4) specifies that in the development of the regional ITS architecture, it shall include ''any agreements (existing or new) required for operations.'' The formalization of these types of agreements is at the discretion of the region and participating stakeholders.

Also, relative to operations and management at a project level, § 940.11(c)(7) specifies that the systems engineering analysis (required of all ITS projects) includes ''procedures and resources necessary for the operations and management of the system.''

Section 940.11 Project Implementation

In addition to the comments on regional ITS architecture development noted above, the docket received 86 comments on systems engineering and project implementation. These comments revealed that the structure of the NPRM in discussing regional ITS architecture development, project systems engineering analysis, and project implementation was confusing and difficult to read.

To clarify these portions of the rule, the systems engineering and project implementation sections of the NPRM have been combined into § 940.11, Project Implementation. Also, paragraphs that were in the regional ITS architecture section of the NPRM that discussed major ITS projects and the requirements for developing project level ITS architectures have been rewritten to clarify their applicability. Since these paragraphs deal with project development issues, they have been moved to § 940.11(e). A definition for ''project level ITS architecture'' was added in § 940.3 and a description of its contents provided in § 940.11(e).

The docket received 33 comments regarding systems engineering and the systems engineering analysis section of the proposed rule. Most of the comments related to the definition, the process not being necessary except for very large projects, and confusion as to how these requirements relate to existing FHWA policy.

In response to the docket comments, the definition of systems engineering in § 940.3 has been clarified and is more consistent with accepted practice. In order to provide consistency in the regional ITS architecture process, the systems engineering analysis detailed in §§ 940.11(a) through 940.11(c) must apply to all ITS projects regardless of size or budget. However, the analysis should be on a scale commensurate with project scope. To allow for the greatest flexibility at the State and local level, in § 940.11(c), a minimum number of elements have been clearly identified for inclusion in the systems engineering analysis. Many of those elements are currently required as provided in 23 CFR 655.409, which this rule replaces. Recognizing the change in some current practices this type of analysis will require, the FHWA intends to issue guidance, training, and technical support in early 2001 to help stakeholders meet the requirements of the final rule.

Fifty-three comments were submitted regarding ITS standards and interoperability tests. The commenters expressed concern about requiring the use of ITS standards and interoperability tests prematurely, the impact on legacy systems of requiring ITS standards, and confusion regarding the term ''adopted by the DOT.''

In response to the comments, the FHWA has significantly modified the final rule to eliminate reference to the use of standards and interoperability tests prior to adoption in § 940.11(f). Section 940.11(g) addresses the applicability of standards to legacy systems. It is not the intent of the DOT to formally adopt any standard before the standard is mature; and also, not all ITS standards should, or will, be formally adopted by the DOT. Formal adoption of a standard means that the DOT will go through the rulemaking process, including a period of public comment, for all standards that are considered candidates for adoption.

The DOT has developed a set of criteria to determine when a standard could be considered for formal adoption. These criteria include, at a minimum, the following elements:

1. The standard has been approved by a Standard Development Organization (SDO).

2. The standard has been successfully tested in real world applications as appropriate.

3. The standard has received some degree of acceptance by the community served by the standard.

4. Products exist to implement the standard.

5. There is adequate documentation to support the use of the standard.

6. There is training available in the use of the standard where applicable.

Therefore, the intent of the rule is to require the use of a standard only when these criteria have been met, and there has been a separate rulemaking on adoption of the standard.

The only interoperability tests that are currently contemplated by the DOT are those associated with the Commercial Vehicle Operations (CVO) program. These tests are currently being used by States deploying CVO systems and will follow a similar set of criteria for adoption as those defined for standards.

Section 940.13 Project Administration

There were nine comments related to how conformity with the final rule would be determined, and by whom. There were 11 comments about how conformity with the regional ITS architecture would be determined, and by whom. Six comments specifically suggested methods for determining conformance, including a process similar to current Federal planning oversight procedures. Six other commenters suggested that determination be made by the MPO or State. For either case, the comments reflected a lack of clarity as to what documentation would be necessary. There were six related comments suggesting the level of documentation be commensurate with the scale of the planned ITS investments in the region.

In § 940.13 of the final rule, the FHWA has attempted to clarify the process for determining conformance. Conformance of an ITS project with a regional ITS architecture shall be made prior to authorization of funding for project construction or implementation as provided in 23 U.S.C. 106 and 133. We do not intend to create new oversight procedures beyond those provided in 23 U.S.C. 106 and 133, but in those cases where oversight and approval for ITS projects is assumed by the State, the State will be responsible for ensuring compliance with this regulation and the FHWA's oversight will be through existing processes.

There were 14 comments concerning the documentation requirements of the proposed rule and generally suggesting they be reduced. Certainly the development of a regional ITS architecture and evidence of conformance of a specific project to that regional ITS architecture implies some level of documentation be developed. However, to allow flexibility on the part of the State or local agency in demonstrating compliance with the final rule, no specific documentation is required to be developed or submitted to the FHWA for review or approval. The FHWA recognizes the need to be able to scale the regional ITS architecture and the associated documentation to the needs of the region. Section 940.9(a) of the final rule contains specific language allowing such scaling.

Summary of Requirements

I. The Regional ITS Architecture

This final rule on the ITS Architecture and Standards requires the development of a local implementation of the National ITS Architecture referred to as a regional ITS architecture. The regional ITS architecture is tailored to meet local needs, meaning that it does not address the entire National ITS Architecture and can also address services not included in the National ITS Architecture. The regional ITS architecture shall contain a description of the region and the identification of the participating agencies and other stakeholders; the roles and responsibilities of the participating agencies and other stakeholders; any agreements needed for operation; system functional requirements; interface requirements and information exchanges with planned and existing systems; identification of applicable standards; and the sequence of projects necessary for implementation. Any changes made in a project design that impact the regional ITS architecture shall be identified and the appropriate revisions made and agreed to in the regional ITS architecture.

Any region that is currently implementing ITS projects shall have a regional ITS architecture within four years of the effective date of this rule. All other regions not currently implementing ITS projects shall have a regional ITS architecture within four years of the first ITS project for that region advancing to final design. In this context, a region is a geographical area that is based on local needs for sharing information and coordinating operational strategies among multiple projects. A region can be specified at a metropolitan, Statewide, multi-State, or corridor level. Within a metropolitan area, the metropolitan planning area should be the minimum area that is considered when establishing the boundaries of a region for purposes of developing a regional ITS architecture. A regional approach promotes integration of transportation systems. The size of the region should reflect the breadth of the integration of transportation systems.

II. Project Development

Additionally, this rule requires that all ITS projects be developed using a systems engineering analysis. All ITS projects that have not yet advanced to final design are required to conform to the system engineering requirements in § 940.11 upon the effective date of this rule. Any ITS project that has advanced to final design by the effective date of this rule is exempt from the requirements of § 940.11. When the regional ITS architecture is completed, project development will be based on the relevant portions of it which the project implements. Prior to completion of the regional ITS architecture, major ITS projects will develop project level ITS architectures that are coordinated with the development of the regional ITS architecture. ITS projects will be required to use applicable ITS standards and interoperability tests that have been officially adopted by the DOT. Where multiple standards exist, it will be the responsibility of the stakeholders to determine how best to achieve the interoperability they desire.

Rulemaking Analyses and Notices

Executive Order 12866 (Regulatory Planning and Review) and DOT Regulatory Policies and Procedures

The FHWA has determined that this action is not a significant regulatory action within the meaning of Executive Order 12866 or significant within the meaning of the Department of Transportation's regulatory policies and procedures. It is anticipated that the economic impact of this rulemaking will be minimal. This determination is based upon preliminary and final regulatory assessments prepared for this action that indicate that the annual impact of the rule will not exceed $100 million nor will it adversely affect the economy, a sector of the economy, productivity, jobs, the environment, public health, safety, or State, local, or tribal governments. In addition, the agency has determined that these changes will not interfere with any action taken or planned by another agency and will not materially alter the budgetary impact of any entitlements, grants, user fees, or loan programs. Copies of the preliminary and final regulatory assessments are included in the docket.

Costs

The FHWA prepared a preliminary regulatory evaluation (PRE) for the NPRM and comments were solicited. That analysis estimated the total costs of this rule over 10 years to be between $38.1 million and $44.4 million (the net present value over 10 years was between $22.3 million and $31.2 million). The annual constant dollar impact was estimated to range between $3.2 million and $4.4 million. We believe that the

cost estimates as stated in the PRE are negligible. The FHWA received only one comment in response to the PRE. That commenter, the Capital District Transportation Committee of Albany, New York suggested that our cost estimates were too low, but provided no further detail or rationale which would cause us to reconsider or increase our cost estimates in the initial regulatory evaluation.

These 10-year cost estimates set forth in the PRE included transportation planning cost increases, to MPOs ranging from $10.8 million to $13.5 million, and to States from $5.2 million to $7.8 million associated with our initial requirement to develop an ITS integration strategy that was proposed as part of the metropolitan and statewide planning rulemaking effort. The agency now plans to advance that proposed ITS integration strategy in the planning rule on a different time schedule than this final rule. Thus, the costs originally set forth in the PRE for the ITS integration strategy have been eliminated from the final cost estimate in the final regulatory evaluation (FRE) for this rule.

In the FRE, the agency estimates the cost of this rule to be between $1 million an $16 million over ten years, which are the estimated costs of this rule to implementing agencies for the development of the regional ITS architectures. These costs do not include any potential additional implementation costs for individual projects which are expected to be minimal and were extremely difficult to estimate. Thus, the costs to the industry are less than that originally estimated in the agency's NPRM.

Benefits

In the PRE, the FHWA indicated that the non-monetary benefits derived from the proposed action included savings from the avoidance of duplicative development, reduced overall development time, and earlier detection of potential incompatibilities. We stated that, as with project implementation impacts, the benefits of the rule are very difficult to quantify in monetary terms. Thus, we estimated that the coordination guidance provided through implementation of the rule could provide savings of approximately $150,000 to any potential entity seeking to comply with the requirements of section 5206(e) of the TEA–21 as compared with an entity having to undertake compliance individually. The costs may be offset by benefits derived from the reduction of duplicative deployments, reduced overall development time, and earlier detection of potential incompatibilities.

In developing a final regulatory evaluation for this action, we did not denote a significant change in any of the benefits anticipated by this rule. This is so notwithstanding the fact that our planning costs for the ITS integration strategy have been eliminated from the final cost estimate. The primary benefits of this action that result from avoidance of duplicative development, reduced overall development time, and earlier detection of potential incompatibilities will remain the same.

In sum the agency believes that the option chosen in this action will be most effective at helping us to implement the requirements of section 5206(e) of the TEA–21. In developing the rule, the FHWA has sought to allow broad discretion to those entities impacted, in levels of response and approach that are appropriate to particular plans and projects, while conforming to the requirements of the TEA–21. The FHWA has considered the costs and benefits of effective implementation of ITS through careful and comprehensive planning. Based upon the information above, the agency anticipates that the economic impact associated with this rulemaking action is minimal and a full regulatory evaluation is not necessary.

Regulatory Flexibility Act

In compliance with the Regulatory Flexibility Act (5 U.S.C. 601–612), the FHWA has evaluated, through the regulatory assessment, the effects of this action on small entities and has determined that this action will not have a significant economic impact on a substantial number of small entities. Small businesses and small organizations are not subject to this rule, which applies to government entities only. Since § 940.9(a) of this rule provides for regional ITS architectures to be developed on a scale commensurate with the scope of ITS investment in the region, and § 940.11(b) provides for the ITS project systems engineering analysis to be on a scale commensurate with the project scope, compliance requirements will vary with the magnitude of the ITS requirements of the entity. Small, less complex ITS projects have correspondingly small compliance documentation requirements, thereby accommodating the interest of small government entities. Small entities, primarily transit agencies, are accommodated through these scaling provisions that impose only limited requirements on small ITS activities. For these reasons, the FHWA certifies that this action will not have a significant impact on a substantial number of small entities.

Unfunded Mandates Reform Act of 1995

This action does not impose unfunded mandates as defined by the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4, March 22, 1995, 109 Stat. 48). This rule will not result in an expenditure by State, local, and tribal governments, in the aggregate, or by the private sector, of $100 million or more in any one year.

Executive Order 13132 (Federalism)

This action has been analyzed in accordance with the principles and criteria contained in Executive Order 13132, dated August 4, 1999, and the FHWA has determined that this action does not have sufficient federalism implications to warrant the preparation of a federalism assessment. The FHWA has also determined that this action does not preempt any State law or State regulation or affect the State's ability to discharge traditional State governmental functions.

Executive Order 12372 (Intergovernmental Review)

Catalog of Federal Domestic Assistance Program Number 20.205, Highway planning and construction. The regulations implementing Executive Order 12372 regarding intergovernmental consultation on Federal programs and activities apply to this program.

Paperwork Reduction Act of 1995

This action does not contain information collection requirements for the purposes of the Paperwork Reduction Act of 1995, 44 U.S.C. 3501–3520.

Executive Order 12988 (Civil Justice Reform)

This action meets applicable standards in sections 3(a) and 3(b)(2) of Executive Order 12988, Civil Justice Reform, to minimize litigation, eliminate ambiguity, and reduce burden.

Executive Order 13045 (Protection of Children)

We have analyzed this action under Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. This rule is not an economically significant rule and does not concern an environmental risk to health or safety that may disproportionately affect children.

Executive Order 12630 (Taking of Private Property)

This rule does not effect a taking of private property or otherwise have taking implications under Executive Order 12630, Government Actions and Interference with Constitutionally Protected Property Rights.

National Environmental Policy Act

The agency has analyzed this action for the purposes of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321–4347), and has determined that this action will not have any effect on the quality of the environment.

Regulation Identification Number

A regulation identification number (RIN) is assigned to each regulatory action listed in the Unified Agenda of Federal Regulations. The Regulatory Information Service Center publishes the Unified Agenda in April and October of each year. The RIN contained in the heading of this document can be used to cross reference this proposed action with the Unified Agenda.

List of Subjects

23 CFR Part 655

Design standards, Grant programs-transportation, Highways and roads, Incorporation by reference, Signs and symbols, Traffic regulations.

23 CFR Part 940

Design standards, Grant programs-transportation, Highways and roads, Intelligent transportation systems.

Issued on: January 2, 2001.

Kenneth R. Wykle,

Federal Highway Administrator.

In consideration of the foregoing, the FHWA amends Chapter I of title 23, Code of Federal Regulations, as set forth below:

PART 655—[AMENDED]

1. The authority citation for part 655 continues to read as follows:

Authority: 23 U.S.C. 101(a), 104, 109(d), 114(a), 217, 315, and 402(a); 23 CFR 1.32, and 49 CFR 1.48(b).

Subpart D—[Removed and reserved]

2. Remove and reserve subpart D of part 655, consisting of §§ 655.401, 655.403, 655.405, 655.407, 655.409, 655.411.

3. Add a new subchapter K, consisting of part 940, to read as follows:

Subchapter K—Intelligent Transportation Systems

PART 940—INTELLIGENT TRANSPORTATION SYSTEM ARCHITECTURE AND STANDARDS

Sec.

Authority: 23 U.S.C. 101, 106, 109, 133, 315, and 508; sec 5206(e), Public Law 105–178, 112 Stat. 457 (23 U.S.C. 502 note); and 49 CFR 1.48.

§ 940.1 Purpose.

This regulation provides policies and procedures for implementing section 5206(e) of the Transportation Equity Act for the 21st Century (TEA–21), Public Law 105–178, 112 Stat. 457, pertaining to conformance with the National Intelligent Transportation Systems Architecture and Standards.

§ 940.3 Definitions.

Intelligent Transportation System (ITS) means electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.

ITS project means any project that in whole or in part funds the acquisition of technologies or systems of technologies that provide or significantly contribute to the provision of one or more ITS user services as defined in the National ITS Architecture.

Major ITS project means any ITS project that implements part of a regional ITS initiative that is multi-jurisdictional, multi-modal, or otherwise affects regional integration of ITS systems.

National ITS Architecture (also ''national architecture'') means a common framework for ITS interoperability. The National ITS Architecture comprises the logical architecture and physical architecture which satisfy a defined set of user services. The National ITS Architecture is maintained by the United States Department of Transportation (DOT) and is available on the DOT web site at *http://www.its.dot.gov.*

Project level ITS architecture is a framework that identifies the institutional agreement and technical integration necessary to interface a major ITS project with other ITS projects and systems.

Region is the geographical area that identifies the boundaries of the regional ITS architecture and is defined by and based on the needs of the participating agencies and other stakeholders. In metropolitan areas, a region should be no less than the boundaries of the metropolitan planning area.

Regional ITS architecture means a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects.

Systems engineering is a structured process for arriving at a final design of a system. The final design is selected from a number of alternatives that would accomplish the same objectives and considers the total life-cycle of the project including not only the technical merits of potential solutions but also the costs and relative value of alternatives.

§ 940.5 Policy.

ITS projects shall conform to the National ITS Architecture and standards in accordance with the requirements contained in this part. Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a regional ITS architecture, and the subsequent adherence of all ITS projects to that regional ITS architecture. Development of the regional ITS architecture should be consistent with the transportation planning process for Statewide and Metropolitan Transportation Planning.

§ 940.7 Applicability.

(a) All ITS projects that are funded in whole or in part with the highway trust fund, including those on the National Highway System (NHS) and on non-NHS facilities, are subject to these provisions.

(b) The Secretary may authorize exceptions for:

(1) Projects designed to achieve specific research objectives outlined in the National ITS Program Plan under section 5205 of the TEA–21, or the Surface Transportation Research and Development Strategic Plan developed under 23 U.S.C. 508; or

(2) The upgrade or expansion of an ITS system in existence on the date of enactment of the TEA–21, if the Secretary determines that the upgrade or expansion:

(i) Would not adversely affect the goals or purposes of Subtitle C (Intelligent Transportation Systems Act of 1998) of the TEA–21;

(ii) Is carried out before the end of the useful life of such system; and

(iii) Is cost-effective as compared to alternatives that would meet the conformity requirement of this rule.

(c) These provisions do not apply to funds used for operations and maintenance of an ITS system in existence on June 9, 1998.

§ 940.9 Regional ITS architecture.

(a) A regional ITS architecture shall be developed to guide the development of ITS projects and programs and be consistent with ITS strategies and projects contained in applicable transportation plans. The National ITS Architecture shall be used as a resource in the development of the regional ITS architecture. The regional ITS architecture shall be on a scale commensurate with the scope of ITS investment in the region. Provision should be made to include participation from the following agencies, as appropriate, in the development of the regional ITS architecture: Highway agencies; public safety agencies (*e.g.,* police, fire, emergency/medical); transit operators; Federal lands agencies; State motor carrier agencies; and other operating agencies necessary to fully address regional ITS integration.

(b) Any region that is currently implementing ITS projects shall have a regional ITS architecture by February 7, 2005.

(c) All other regions not currently implementing ITS projects shall have a regional ITS architecture within four years of the first ITS project for that region advancing to final design.

(d) The regional ITS architecture shall include, at a minimum, the following:

(1) A description of the region;

(2) Identification of participating agencies and other stakeholders;

(3) An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture;

(4) Any agreements (existing or new) required for operations, including at a minimum those affecting ITS project interoperability, utilization of ITS related standards, and the operation of the projects identified in the regional ITS architecture;

(5) System functional requirements;

(6) Interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture);

(7) Identification of ITS standards supporting regional and national interoperability; and

(8) The sequence of projects required for implementation.

(e) Existing regional ITS architectures that meet all of the requirements of paragraph (d) of this section shall be considered to satisfy the requirements of paragraph (a) of this section.

(f) The agencies and other stakeholders participating in the development of the regional ITS architecture shall develop and implement procedures and responsibilities for maintaining it, as needs evolve within the region.

§ 940.11 Project implementation.

(a) All ITS projects funded with highway trust funds shall be based on a systems engineering analysis.

(b) The analysis should be on a scale commensurate with the project scope.

(c) The systems engineering analysis shall include, at a minimum:

(1) Identification of portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS Architecture);

(2) Identification of participating agencies roles and responsibilities;

(3) Requirements definitions;

(4) Analysis of alternative system configurations and technology options to meet requirements;

(5) Procurement options;

(6) Identification of applicable ITS standards and testing procedures; and

(7) Procedures and resources necessary for operations and management of the system.

(d) Upon completion of the regional ITS architecture required in §§ 940.9(b) or 940.9(c), the final design of all ITS projects funded with highway trust funds shall accommodate the interface requirements and information exchanges as specified in the regional ITS architecture. If the final design of the ITS project is inconsistent with the regional ITS architecture, then the regional ITS architecture shall be updated as provided in the process defined in § 940.9(f) to reflect the changes.

(e) Prior to the completion of the regional ITS architecture, any major ITS project funded with highway trust funds that advances to final design shall have a project level ITS architecture that is coordinated with the development of the regional ITS architecture. The final design of the major ITS project shall accommodate the interface requirements and information exchanges as specified in this project level ITS architecture. If the project final design is inconsistent with the project level ITS architecture, then the project level ITS architecture shall be updated to reflect the changes. The project level ITS architecture is based on the results of the systems engineering analysis, and includes the following:

(1) A description of the scope of the ITS project;

(2) An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the ITS project;

(3) Functional requirements of the ITS project;

(4) Interface requirements and information exchanges between the ITS project and other planned and existing systems and subsystems; and

(5) Identification of applicable ITS standards.

(f) All ITS projects funded with highway trust funds shall use applicable ITS standards and interoperability tests that have been officially adopted through rulemaking by the DOT.

(g) Any ITS project that has advanced to final design by February 7, 2001 is exempt from the requirements of paragraphs (d) through (f) of this section.

§ 940.13 Project administration.

(a) Prior to authorization of highway trust funds for construction or implementation of ITS projects, compliance with § 940.11 shall be demonstrated.

(b) Compliance with this part will be monitored under Federal-aid oversight procedures as provided under 23 U.S.C. 106 and 133.

[FR Doc. 01–391 Filed 1–5–01; 8:45 am]

BILLING CODE 4910–22–P

APPENDIX C

FTA NATIONAL ITS ARCHITECTURE POLICY ON TRANSIT PROJECTS

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DEPARTMENT OF TRANSPORTATION

Federal Transit Administration

Federal Transit Administration National ITS Architecture Policy on Transit Projects

AGENCY: Federal Transit Administration (FTA), DOT.

ACTION: Notice.

SUMMARY: The Federal Transit Administration (FTA) announces the FTA National ITS Architecture Policy on Transit Projects, which is defined in this document. The National ITS Architecture Policy is a product of statutory changes made by the Transportation Equity Act for the 21st Century (TEA–21) (Pub. L. 105–178) enacted on June 9, 1998. The National ITS Architecture Policy is also a product of the Request for Comment on the National ITS Architecture Consistency Policy for Project Development that was published in the **Federal Register** on May 25, 2000. Because it is highly unlikely that the entire National ITS Architecture would be fully implemented by any single metropolitan area or State, this policy requires that the National ITS Architecture be used to develop a local implementation of the National ITS Architecture, which is referred to as a ''regional ITS architecture.'' Therefore, conformance with the National ITS Architecture is defined under this policy as development of a regional ITS architecture within four years after the first ITS project advancing to final design, and the subsequent adherence of ITS projects to the regional ITS architecture. The regional ITS architecture is based on the National ITS Architecture and consists of several parts including the system functional requirements and information exchanges with planned and existing systems and subsystems and identification of applicable standards, and would be tailored to address the local situation and ITS investment needs.

DATE: *Effective Date:* This policy is effective from February 7, 2001.

ADDRESSES: For FTA staff, Federal Transit Administration, Department of Transportation (DOT), 400 Seventh Street, SW., Washington, DC 20590.

FOR FURTHER INFORMATION CONTACT: *For Technical Information:* Ron Boenau, Chief, Advanced Public Transportation Systems Division (TRI–11), at (202) 366–0195 or Brian Cronin, Advanced Public Transportation Systems Division (TRI–11), at (202) 366–8841. *For Legal Information:* Richard Wong, Office of the Chief Council (202) 366–1936. The policy is posted on the FTA website on the Internet under http://www.fta.dot.gov.

Electronic Access: An electronic copy of this document may be downloaded using a computer, modem and suitable communications software from the Government Printing Office's Electronic Bulletin Board Service at (202) 512–1661. Internet users may reach the Office of the Federal Register's home page at: *http://www.nara.gov/fedreg* and the Government Printing Office's web page at: *http://www.access.gpo.gov/nara.*

Internet users may access all comments received by the U.S. DOT Dockets, Room PL–401, for the Request for Comment that was issued on May 25, 2000 which were used to clarify this Policy, by using the universal resource locator (URL): *http://dms.dot.gov.* It is available 24 hours each day, 365 days each year. Please follow the instructions online for more information and help. The docket number for the Request for Comment was FTA–99–6417.

SUPPLEMENTARY INFORMATION:

I. Background

The Federal Transit Administration (FTA) published a Request for Comment on May 25, 2000, to implement section 5206(e) of the Transportation Equity Act for the 21st Century (TEA–21) (Pub.L. 105–178), which was enacted on June 9, 1998.

Section 5206(e) of TEA–21 requires that the Secretary of the DOT must

> Ensure that intelligent transportation system projects carried out using funds made available from the Highway Trust Fund, * * * conform to the national architecture, applicable standards or provisional standards, and protocols developed under subsection(a).

The objectives for the FTA's National ITS Architecture Policy for Transit Projects are to:

- Provide requirements for ITS project development for projects implemented wholly or partially with highway trust funds.
- Achieve system integration of ITS projects funded through the highway trust fund with other transportation projects planned for the region, which will thereby enable electronic information and data sharing for advanced management and operations of the ITS infrastructure.
- Engage stakeholders (state DOT's, transit agencies, public safety agencies, other transportation operating agencies) in the project development and implementation process.
- Facilitate future expansion capability of the ITS infrastructure.
- Save design time through use of the National ITS Architecture requirements definitions and market packages.

FTA has developed this policy to meet the TEA–21 requirement contained in Section 5206(e) and the DOT/FTA goal to encourage effective deployment of ITS projects. Additionally, DOT and FTA encourage the coordination of local ITS strategies and projects to help meet national and local goals for mobility, accessibility, safety, security, economic growth and trade, and the environment.

The National ITS Architecture documents were developed by the US DOT, and are updated on an as-needed basis. Current work to update the National ITS Architecture is the Archive Data User Service, which provides the ability to store and process data over an extended period of time. FTA is pursuing the addition of a Rail ITS program for travel management, vehicles, and users. New versions of the documents, when they are issued, will be available from the US DOT on the DOT website at *www.its.dot.gov.* Version 3.0 is the latest version of the National ITS Architecture.

The first section of this policy contains a complete analysis of and response to the comments provided to the docket. The remainder of the Notice contains the FTA National ITS Architecture Policy for Transit Projects.

II. Public Comments

Eighteen comments were submitted to the FTA National ITS Architecture Consistency Policy for Project Development docket by the September 23, 2000, close of the comment period. Comments were submitted by transit operators (3), state and local governments (5), metropolitan planning organizations (4), industry associations (3), and consultants (3). As indicated earlier, a complete analysis and response to the docket comments is provided. In order to facilitate focused comments, FTA asked a series of questions about the policy. The public comment section is organized first by analysis and response to the specific questions asked; second by responses to comments not specifically related to one of the nine questions; and finally by an explanation of other changes. In general, the comments received were positive. Therefore, the FTA has kept the scope of the policy and made appropriate clarifications to the text of the policy to address concerns raised in comments. In response to the many comments requesting it, the FTA, in association with the ITS Joint Program Office, in the Federal Highway Administration (FHWA) will also provide a program of guidance, training, and technical

support to assist with the implementation of this policy.

Questions

1. Do reviewers understand the definition of a major ITS investment as defined in Section IV, ''Regional ITS Architecture,'' or is more clarification needed, and if so please explain?

Comments: Nine commenters submitted responses to this question. In general, commenters found the definition confusing, and did not understand why major ITS projects need to be called out over other ITS projects. One commenter noted that small dollar projects can have a major impact on future development, while an expensive system may have no impact. Another commenter was unclear about the term ''supporting national interoperability.''

Response: Of specific concern to the agency is the timing in which requirements for this policy are enacted. As such, the terms ''major ITS investment'' and ''major ITS project'' were provided so as to distinguish between projects that will require immediate correlation to the regional ITS architecture and those that do not. The term ''major ITS investment'' was also found to be redundant to ''major ITS project'' and was removed from the policy. Guidance on the classification of ''ITS projects'' and ''major ITS projects'' will be provided upon enactment of the policy.

2. Do reviewers understand the definition of an ITS project, or is more clarification needed, and if so please explain?

Comments: Nine commenters submitted responses to this question. Commenters found this term less confusing than ''major ITS investments,'' but requested more clarification. Some commenters proposed alternative language or asked for clarification on particular examples.

Response: The agency has clarified the definition by deleting the potentially ambiguous examples provided and will develop guidance material that provides examples of projects that will be considered ITS projects and those that will not be considered ITS projects. In general, unless a technology project is implementing one of the ITS user services defined in the National ITS Architecture, it would not be considered an ITS project.

3. Do reviewers understand the difference between a ''major ITS investment,'' and an ''ITS project'', or is more clarification needed, and if so please explain?

Comments: Eight commenters submitted responses to this question. Commenters had mixed responses, as some commenters found the differences to be clear, while others requested that guidance material be provided to further explain the differences. Commenters did suggest that a ''project'' is a ''project'' and should not be quantified in terms of dollar amounts.

Response: As described in the response to question 1, the agency has removed the term ''major ITS investment'' and will provide guidance on the term ''ITS project.''

4. Are the requirements for development of a Regional ITS Architecture clear? If not, what is not clear about the requirement?

Comment: Nine commenters provided responses to the question. Most commenters found the requirements to be unclear and/or did not agree with the requirements. One commenter suggested that a region will have different definitions. One commenter noted that a concept of operations and conceptual design are normally conducted at the project level. One commenter requested clarification as to the appropriate place to program projects, in the regional ITS architecture, or in the planning process.

Response: Of specific concern to the agency is providing a flexible policy that allows the transportation stakeholders to define their region and the roles and responsibilities of each stakeholder during the development of a regional ITS architecture. As such, the agency has clarified the requirements of a regional ITS architecture and also removed the specific requirements for a Concept of Operations and a Conceptual Design. Instead, the agency has listed the specific requirements for a regional ITS architecture and has left the development, documentation, and maintenance of the regional ITS architecture to the stakeholders involved. Also, the region is defined as ''a geographical area that is based on local needs for sharing information and coordinating operational strategies among multiple projects.'' A region can be specified at a metropolitan, Statewide, multi-State, or corridor level. Additional guidance on this topic will be provided after enactment of the policy.

5. What additional guidance, if any, is required to explain how to implement this proposed policy?

Comments: Ten commenters provided responses to this question. All the comments called for additional guidance on the specifics of implementing this policy. Commenters requested guidance on the definition of a ''region,'' the ownership of the regional ITS architecture, determination of stakeholders, regional ITS architecture maintenance, certification and simplification of definitions. One commenter requested that the policy be limited to only the ITS Integration Requirements defined in the Metropolitan and Statewide Planning NPRM.

Response: The agency will provide guidance materials to address the comments suggested. The ITS Integration Strategy, as defined in the NPRM, is part of the planning process and as such does not satisfactorily address project level requirements.

6. The proposed rule allows regions to develop a Regional Architecture as a separate activity, or incrementally, as major ITS investments are developed within a region. Do reviewers anticipate particular difficulties with implementing and documenting either approach?

Comments: Nine commenters provided responses to this question. Commenters largely did not favor one approach over the other. One commenter suggested that a regional ITS architecture with a twenty year time horizon is impractical and infeasible. One commenter suggested that either approach would require additional staff resources.

Response: The agency was concerned about the time horizon and development process needed to create a regional ITS architecture within the time period required and as a result suggested both an incremental and initial comprehensive approach. Based on the responses, the agency has modified the policy to be silent on the approach used to develop the regional ITS architecture. Instead, the agency focused on the products included in the regional ITS architecture, the effective date of the requirements, and the catalyst for requiring the development of a regional ITS architecture.

7. Do reviewers understand the relationships between the Integration Strategy, the Regional ITS Architecture, and the ITS Project Architecture?

Comment: Seven commenters provided a response to this question. In general, commenters did not understand the relationship between the Integration Strategy, regional ITS architecture, and the ITS Project Architecture. One commenter suggested that flexibility in application of project architecture must be maintained to accommodate legacy systems and to take advantage of technological innovation, while maintaining the outcome of interoperability, where applicable.

Response: The Agency is concerned with linkage between the planning process and the project development process. However, this policy only deals with the project level requirements.

Planning level requirements, including the Integration Strategy, will be explained as the Metropolitan and Statewide Planning Process rulemaking process is advanced. This policy only requires that the regional ITS architecture should be consistent with the transportation planning process. A definition for a project level ITS architecture has been added to the policy.

8. What additional guidance, if any, is required regarding phasing of this rule?

Comments: Six commenters submitted responses to this question. In general, the commenters stated that the phasing was clear. However, one commenter requested a three-year phase-in period. Several commenters requested that existing projects be exempt from the policy.

Response: The agency has clarified the policy statements that refer to the project status and the applicability of this policy. Projects that have reached final design by the date of this policy are exempt from the policy requirements. The agency has extended the time period for regional ITS architecture development to four years. Any region that is currently implementing ITS projects shall have a regional architecture within four years of the effective date of the final policy. All other regions not currently implementing ITS projects shall have a regional ITS architecture in place within four years of the first ITS project for that region advancing to final design.

9. Are the oversight and documentation requirements clear? If not, what is not clear about the requirements?

Comments: Eight commenters submitted responses to this question. Commenters in general requested more guidance from FTA on oversight and documentation requirements, but few provided suggestions to clarify the requirements. One commenter suggested that checklists to verify consistency requirements will be needed. Other commenters suggested that self-certification should be allowed, but also needs to be clearly defined.

Response: The agency will continue to use normal existing oversight procedures to review grantee compliance with FTA policies and regulations. Normal oversight procedures include the annual risk assessment of grantees performed by regional office staff, triennial reviews, planning process reviews, and project management oversight reviews, as applicable. In TEA–21, FTA was granted authority to use oversight funds to provide technical assistance to grantees in which oversight activities suggested non-compliance with agency policies and regulations. FTA is using oversight funds to specifically hire contractors with ITS experience who will monitor and assist grantees who are at risk of NOT meeting the National ITS Architecture Policy requirements. Additional guidance on oversight and documentation requirements will be provided.

Additional Comments

One commenter suggested that the proposed guidance circular requires that all of the agencies in a region agree before a project can be implemented, thus conferring ''veto'' power over the project. The agency does not intend for the policy to halt ITS deployment in areas where agencies cannot agree on project designs. As part of the regional ITS Architecture development, the agencies can agree to disagree, however, the regional ITS architecture should include a representation of the stand-alone ITS deployments.

One commenter suggests that the proposal infers that existing agreements between agencies will now need to be amended or redone, which would result in a halt in operations of successful ITS projects and prevent the completion of other ITS projects. In response to the comment, the agency has clarified the regional ITS architecture requirements to specify that existing agreements that address the regional ITS architecture requirements are sufficient and that new agreements are not necessarily required.

One commenter noted that a definition of ITS was not included in the policy. The commenter suggested that the definition provided in TEA–21 section 5206(e) should be included in the policy. The agency agrees and has added the definition of ITS to the list of definitions. However, the legislative definition of ITS is broad and other commenters have suggested that if the policy is written to include every new piece of electronics or hardware, then the policy would be too limiting. As a result, the policy is intended to apply only to projects meeting the definition of an ''ITS project'' listed in the ''Definitions'' section of the policy.

One commenter suggested that DOT should ensure that the Federal Highway Administration's (FHWA's) regulation and the FTA policy have the same statutory standing and that their requirements in ITS planning and deployment be consistent if not identical. The FTA and FHWA have different processes and procedures for project development. Therefore, the FHWA has issued a regulation, and FTA has issued the policy. The policy language in each document is consistent and will be carried out in a coordinated fashion, as applicable under FTA and FHWA project management and oversight procedures. FTA and FHWA planning procedures are a joint regulation and as such will be identical.

FTA received some comments regarding the use of standards. Several comments concern the premature use of required standards and interoperability tests, their impact on legacy systems, and confusion regarding the term ''adopted by the USDOT.''

In response to the comments, FTA has significantly modified the final policy to eliminate reference to the use of standards and interoperability tests prior to adoption through formal rulemaking. It is not the intent of the USDOT to formally adopt any standard before the standard is mature; also, not all ITS standards should, or will, be formally adopted by the USDOT. The only interoperability tests that are currently contemplated by the USDOT are those associated with the Commercial Vehicle Operations (CVO) program. These tests are currently being used by States deploying CVO systems and will follow a similar set of criteria for adoption as those defined for standards.

Other Changes

Several commenters expressed concern about linkages to the planning rule and the integration strategy. Comments regarding the portions of the National ITS Architecture conformity process included in the proposed transportation planning rule will be addressed as that rule proceeds to its issuance. The FHWA rule and the parallel FTA policy have been developed without direct reference to the proposed changes to the transportation planning process, including no mention of the development of an integration strategy. However, the policy statement of this guidance notes a link to transportation planning processes, and fully supports those collaborative methods for establishing transportation goals and objectives.

Policy Contents

I. Purpose

This policy provides procedures for implementing section 5206(e) of the Transportation Equity Act for the 21st

Century, Public Law 105–178, 112 Stat. 547, pertaining to conformance with the National Intelligent Transportation Systems Architecture and Standards.

II. Definitions

Intelligent Transportation Systems (ITS) means electronics, communications or information processing used singly or in combination to improve the efficiency or safety of a surface transportation system.

ITS project means any project that in whole or in part funds the acquisition of technologies or systems of technologies that provide or significantly contribute to the provision of one or more ITS user services as defined in the National ITS Architecture.

Major ITS project means any ITS project that implements part of a regional ITS initiative that is multi-jurisdictional, multi-modal, or otherwise affects regional integration of ITS systems.

National ITS Architecture (also ''national architecture'') means a common framework for ITS interoperability. The National ITS Architecture comprises the logical architecture and physical architecture which satisfy a defined set of user services. The National ITS Architecture is maintained by U.S. DOT (Department of Transportation) and is available on the DOT web site at *http://www.its.dot.gov.*

Project level ITS architecture is a framework that identifies the institutional agreement and technical integration necessary to interface a major ITS project with other ITS projects and systems.

Region is the geographical area that identifies the boundaries of the regional ITS architecture and is defined by and based on the needs of the participating agencies and other stakeholders. A region can be specified at a metropolitan, Statewide, multi-State, or corridor level. In metropolitan areas, a region should be no less than the boundaries of the metropolitan planning area.

Regional ITS architecture means a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects.

Systems engineering is a structured process for arriving at a final design of a system. The final design is selected from a number of alternatives that would accomplish the same objectives and considers the total life-cycle of the project including not only the technical merits of potential solutions but also the costs and relative value of alternatives.

III. Policy

ITS projects shall conform to the National ITS Architecture and standards in accordance with the requirements contained in this part. Conformance with the National ITS Architecture is interpreted to mean the use of the National ITS Architecture to develop a regional ITS architecture in support of integration and the subsequent adherence of all ITS projects to that regional ITS architecture. Development of the regional ITS architecture should be consistent with the transportation planning process for Statewide and Metropolitan Transportation Planning (49 CFR part 613 and 621).

IV. Applicability

(a) All ITS projects that are funded in whole or in part with the Highway Trust Fund (including the mass transit account) are subject to these provisions.

(b) The Secretary may authorize exceptions for:

1. Projects designed to achieve specific research objectives outlined in the National ITS Program Plan under section 5205 of the Transportation Equity Act for the 21st Century or the Surface Transportation Research and Development Strategic Plan developed under section 5208 of Title 23, United States Code; or

2. The upgrade or expansion of an ITS system in existence on the date of enactment of the Transportation Equity Act for the 21st Century if the Secretary determines that the upgrade or expansion—

a. Would not adversely affect the goals or purposes of Subtitle C (Intelligent Transportation Systems) of the Transportation Equity Act for the 21st Century and

b. Is carried out before the end of the useful life of such system; and

c. Is cost-effective as compared to alternatives that would meet the conformity requirement of this rule

(c) These provisions do not apply to funds used for Operations and Maintenance of an ITS system in existence on June 9, 1998.

V. Regional ITS Architecture

(a) A regional ITS architecture shall be developed to guide the development of ITS projects and programs and be consistent with ITS strategies and projects contained in applicable transportation plans. The National ITS Architecture shall be used as a resource in the development of the regional ITS architecture. The regional ITS architecture shall be on a scale commensurate with the scope of ITS investment in the region. Provision should be made to include participation from the following agencies, as appropriate, in the development of the regional ITS architecture: Highway agencies; public safety agencies (*e.g.,* police, fire, emergency/medical); transit agencies; federal lands agencies; state motor carrier agencies; and other operating agencies necessary to fully address regional ITS integration.

(b) Any region that is currently implementing ITS projects shall have a regional ITS architecture February 7, 2005.

(c) All other regions not currently implementing ITS projects shall have a regional ITS architecture within four years of the first ITS project for that region advancing to final design.

(d) The regional ITS architecture shall include, at a minimum, the following:

(1) A description of the region;

(2) Identification of participating agencies and other stakeholders;

(3) An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture;

(4) Any agreements (existing or new) required for operations, including at a minimum those affecting integration of ITS projects; interoperability of different ITS technologies, utilization of ITS-related standards, and the operation of the projects identified in the regional ITS architecture;

(5) System functional requirements;

(6) Interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture);

(7) Identification of ITS standards supporting regional and national interoperability;

(8) The sequence of projects required for implementation of the regional ITS architecture.

(e) Existing regional ITS architectures that meet all of the requirements of section V(d) shall be considered to satisfy the requirements of V(a).

(f) The agencies and other stakeholders participating in the development of the regional ITS architecture shall develop and implement procedures and responsibilities for maintaining the regional ITS architecture, as needs evolve within the region.

VI. Project Implementation

(a) All ITS projects funded with mass transit funds from the highway trust

fund shall be based on a systems engineering analysis.

(b) The analysis should be on a scale commensurate with the project scope.

(c) The systems engineering analysis shall include, at a minimum:

(1) Identification of portions of the regional ITS architecture being implemented (or if a regional ITS architecture does not exist, the applicable portions of the National ITS Architecture).

(2) Identification of participating agencies' roles and responsibilities;

(3) Requirements definitions:

(4) Analysis of alternative system configurations and technology options to meet requirements;

(5) Analysis of financing and procurement options;

(6) Identification of applicable ITS standards and testing procedures; and

(7) Procedures and resources necessary for operations and management of the system;

(d) Upon completion of the regional ITS architecture required in section V, the final design of all ITS projects funded with highway trust funds shall accommodate the interface requirements and information exchanges as specified in the regional ITS architecture. If the final design of the ITS project is inconsistent with the regional ITS architecture, then the regional ITS architecture shall be updated as per the process defined in V(f) to reflect the changes.

(e) Prior to completion of the regional ITS architecture, any major ITS project funded with highway trust funds that advances to final design shall have a project level ITS architecture that is coordinated with the development of the regional ITS architecture. The final design of the major ITS project shall accommodate the interface requirements and information exchanges as specified in this project level ITS architecture. If the project final design is inconsistent with the project level architecture, then the project level ITS architecture shall be updated to reflect the changes. The project level ITS architecture is based on results of the systems engineering analysis, and includes the following:

(1) A description of the scope of the ITS project

(2) An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the ITS project;

(3) Functional requirements of the ITS project;

(4) Interface requirements and information exchanges between the ITS project and other planned and existing systems and subsystems; and

(5) Identification of applicable ITS standards

(b) All ITS projects funded with Mass Transit Funds from the Highway Trust Funds shall use applicable ITS standards and interoperability tests that have been officially adopted through rulemaking by the United States Department of Transportation (US DOT).

(c) Any ITS project that has advanced to final design by (effective date of policy) is exempt from the requirements of VI.

VII. Project Oversight

(a) Prior to authorization of Mass Transit Funds from the Highway Trust Fund for acquisition or implementation of ITS projects, grantees shall self-certify compliance with sections V and VI. Compliance with this policy shall be monitored under normal FTA oversight procedures, to include annual risk assessments, triennial reviews, and program management oversight reviews as applicable.

(b) Compliance with the following FTA Circulars shall also be certified:

- C5010.1C, Grant Management Guidelines
- C6100.1B, Application Instructions and Program Management Guidelines

VIII. FTA Guidance

FTA will develop appropriate guidance materials regarding the National ITS Architecture Consistency Policy.

Issued on: January 2, 2001.

Nuria I. Fernandez,

Acting Administrator.

[FR Doc. 01–392 Filed 1–5–01; 8:45 am]

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APPENDIX D

GLOSSARY OF ITS ARCHITECTURE TERMS

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Glossary of Architecture Terms from the National ITS Architecture

Full glossary available online at:
http://itsarch.iteris.com/itsarch/html/glossary/glossary.htm

Architecture	A framework within which a system can be built. Requirements dictate what functionality the architecture must satisfy. An architecture functionally defines what the pieces of the system are and the information that is exchanged between them. An architecture is functionally oriented and not technology-specific which allows the architecture to remain effective over time. It defines "what must be done," not "how it will be done."
Architecture Flow	Information that is exchanged between subsystems and terminators in the physical architecture view of the National ITS Architecture. Architecture flows are the primary tool that is used to define the Regional ITS Architecture interfaces. These architecture flows and their communication requirements define the interfaces which form the basis for much of the ongoing standards work in the national ITS program. The terms "information flow" and "architecture flow" are used interchangeably.
Element	This is the basic building block of Regional ITS Architectures and Project ITS Architectures. It is the name used by stakeholders to describe a system or piece of a system.
Equipment Package	Equipment packages are the building blocks of the physical architecture subsystems. Equipment Packages group similar processes of a particular subsystem together into an "implementable" package. The grouping also takes into account the user services and the need to accommodate various levels of functionality.
Information Flow	Information that is exchanged between subsystems and terminators in the physical architecture view of the National ITS Architecture. These information flows are normally identical to the architecture flows in the National ITS Architecture. The terms "information flow" and "architecture flow" are used interchangeably.
Intelligent Transportation System	The system defined as the electronics, communications or information processing used singly or integrated to improve the efficiency or safety of surface transportation.
Inventory	See *System Inventory*.
ITS Architecture	Defines an architecture of interrelated systems that work together to deliver transportation services. An ITS architecture defines how systems functionally operate and the interconnection of information exchanges that must take place between these systems to accomplish transportation services.
ITS Project	Any project that in whole or in part funds the acquisition of technologies or systems of technologies that provide or significantly contribute to the provision of one or more ITS user services.
Logical Architecture	The logical architecture view of the National ITS Architecture defines what has to be done to support the ITS user services. It defines the processes that perform ITS functions and the information or data flows that are shared between these processes.
Market Package	The market packages provide an accessible, service-oriented perspective to the National ITS Architecture. They are tailored to fit, separately or in combination, real world transportation problems and needs. Market packages collect together one or more equipment packages that must work together to deliver a given transportation service and the architecture flows that connect them and other important external systems. In other words, they identify the pieces of the physical architecture that are required to implement a particular transportation service.

National ITS Architecture	A common, established framework for developing integrated transportation systems. The National ITS Architecture is comprised of the logical architecture and the physical architecture, which satisfy a defined set of user service requirements. The National ITS Architecture is maintained by the United States Department of Transportation (USDOT).
Physical Architecture	The physical architecture is the part of the National ITS Architecture that provides agencies with a physical representation (though not a detailed design) of the important ITS interfaces and major system components. It provides a high-level structure around the processes and data flows defined in the logical architecture. The principal elements in the physical architecture are the subsystems and architecture flows that connect these subsystems and terminators into an overall structure. The physical architecture takes the processes identified in the logical architecture and assigns them to subsystems. In addition, the data flows (also from the logical architecture) are grouped together into architecture flows. These architecture flows and their communication requirements define the interfaces required between subsystems, which form the basis for much of the ongoing standards work in the ITS program.
Project ITS Architecture	A framework that identifies the institutional agreement and technical integration necessary to interface a major ITS project with other ITS projects and systems.
Region	The geographical area that identifies the boundaries of the Regional ITS Architecture and is defined by and based on the needs of the participating agencies and other stakeholders. In metropolitan areas, a region should be no less than the boundaries of the metropolitan planning area.
Regional ITS Architecture	A specific, tailored framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects in a particular region. It functionally defines what pieces of the system are linked to others and what information is exchanged between them.
Stakeholders	A widely used term that notates a public agency, private organization or the traveling public with a vested interest, or a “stake” in one or more transportation elements within a Regional ITS Architecture.
Standards	Documented technical specifications sponsored by a Standards Development Organization (SDO) to be used consistently as rules, guidelines, or definitions of characteristics for the interchange of data. A broad array of ITS standards is currently under development that will specifically define the interfaces identified in the National ITS Architecture.
Subsystem	The principle structural element of the physical architecture view of the National ITS Architecture. Subsystems are individual pieces of the Intelligent Transportation System defined by the National ITS Architecture. Subsystems are grouped into four classes: Centers, Field, Vehicles, and Travelers. Example subsystems are the Traffic Management Subsystem, the Vehicle Subsystem, and the Roadway Subsystem. These correspond to the physical world: respectively traffic operations centers, automobiles, and roadside signal controllers. Due to this close correspondence between the physical world and the subsystems, the subsystem interfaces are prime candidates for standardization.
System	A collection of hardware, software, data, processes, and people that work together to achieve a common goal. Note the scope of a “system” depends on one’s viewpoint. To a sign manufacturer, a dynamic message sign is a “system.” To a state DOT, the same sign is only a component of a larger Freeway Management “System.” In a Regional ITS Architecture, a Freeway Management System is a part of the overall surface transportation “system” for the region.
System Inventory	The collection of all ITS-related elements in a Regional ITS Architecture.

Terminator	Terminators define the boundary of an architecture. The National ITS Architecture terminators represent the people, systems, and general environment that interface to ITS. The interfaces between terminators and the subsystems and processes within the National ITS Architecture are defined, but no functional requirements are allocated to terminators. The logical architecture and physical architecture views of the National ITS Architecture both have exactly the same set of terminators. The only difference is that logical architecture processes communicate with terminators using data flows, while physical architecture subsystems use architecture flows.
Turbo Architecture	An automated software tool used to input and manage system inventory, market packages, architecture flows and interconnects with regard to a Regional ITS Architecture and/or multiple Project ITS Architectures.
User Services	User services document what ITS should do from the user's perspective. A broad range of users are considered, including the traveling public as well as many different types of system operators. User services, including the corresponding user service requirements, form the basis for the National ITS Architecture development effort. The initial user services were jointly defined by USDOT and ITS America with significant stakeholder input and documented in the National Program Plan. The concept of user services allows system or project definition to begin by establishing the high level services that will be provided to address identified problems and needs. New or updated user services have been and will continue to be satisfied by the National ITS Architecture over time.

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APPENDIX E

COMPILED LIST OF MEETING PARTICIPANTS

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Compiled List of Meeting Participants

Organization	Name
Boston Region MPO	Eric Howard Anne McGraham Efi Pagitsas Pam Wolfe
Brockton Area Transit	Kathy Riddell
City of Boston	Bill Oates
City of Boston – Transportation Department	Don Burgess Jim Gillooly
City of Cambridge	Jeff Parenti
Federal Highway Administration	Tim White
Federal Transit Administration	Bill Gordon
IBI Group	Rebecca Morgan Carl-Henry Piel James Sorensen Tegin Teich
Lowell Regional Transit Authority	Tom Henderson
Massachusetts Bay Transportation Authority	Dave Barker Gary Foster Adam Veneziano
Massachusetts Emergency Management Agency	Jeffrey Trask
Massachusetts Department of Transportation	Chris Dempsey Joshua Robins
Massachusetts Department of Transportation – Office of Transportation Planning	Ned Codd Patrick McMahon Steve Pepin Peter Sutton
Massachusetts Department of Transportation – Highway Division	Phyllis Hassiotou Thomas Loughlin Michelle Maffeo Frank Spada Leonard Walsh
Massachusetts Department of Transportation – Registry of Motor Vehicles	Matt Poirer
Massachusetts Port Authority	Lorenco Danzas
Massachusetts State Police	Jim Hanlon Mark Horgan

Organization	Name
Merrimack Valley Planning Commission	Jim Terlizzi
Merrimack Valley Regional Transit Authority	Joe Costanzo John Whittaker
Metropolitan Area Planning Council	Jim Gallagher
MetroWest Regional Transit Authority	Daniel Fitch
New Hampshire Department of Transportation	James Knowlton Steve Lemuire
Northern Middlesex Council of Governments	Justin Howard
Old Colony Planning Council	Bill McNulty
Southeastern Regional Planning & Economic Development District	Christopher Cardaci
Transystems	Carol Schweiger

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APPENDIX F

INTERAGENCY AGREEMENTS

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The following text summarizes the elements of an agreement, highlights the reasons for formalizing agreements, and includes sample formal agreements between agencies.

Elements of an Agreement

Agreements are established to clearly define responsibilities among the involved parties. The level of formality generally increases as risks escalate and when financial transactions take place. Formality will also increase when the performance or lack of performance on the part of one agency impacts the operations of another. For example, if an agency maintains and operates the traffic signals of another agency, clear definition of responsibilities for both parties will help ensure smooth operations.

The table below presents a list of elements to consider in the development of an agreement for ITS operations and maintenance. Not all elements are relevant to each exchange of information. The level of specificity will depend on the nature of the interface.

Elements of an Agreement

- Operational Concept (a layperson's introduction to the nature and purpose of the agreement)
- Benefits of the agreement (e.g. operational, economic)
- Duties of Responsible Agencies (a summary of duties and responsibilities)
- Data Sharing (aspects of sharing data to be considered)
  - Provision of Data
  - Data Rights
  - Data Reuse
  - Data Identification
  - Data Availability
  - Data Accuracy
- Control Sharing (aspects of sharing control to be considered with rights and priorities being clearly understood)
  - Provision of Control
  - Control Rights
  - Control Restrictions
  - Control Priority
  - Control Availability
- Connections (defines how the connection is made)
  - Provision of Equipment
  - Physical Access Point
  - Demarcation Point / Boundary
  - Security
  - Configuration Management
  - Standards and Protocols
- System Documentation
- Operations
  - Contacts
  - Hours of Operations
  - Responsibilities
- Maintenance
  - Contacts
  - Hours of Operations
  - Responsibilities
  - Response Time
- Liability
  - Indemnity
  - Damage to Equipment
- Ownership
  - Equipment
  - Software
  - Intellectual Property
- Coordination
  - Notification
  - Periodic Reporting
  - Pre-Change Coordination
- Dispute Resolution
- Termination of Agreement
- Compensation

Formalization of Existing Working Arrangements

Although some existing informal agreements may be operating without apparent problems, there are a number of considerations that point to the need for adoption of a formal agreement:

- *Rationale for agreement:* A formal agreement that explains the reasoning behind the agreement and that lays out the benefits of the cooperation will help justify the arrangement to the participating parties, other agencies that would benefit from coordination, and to the public. This will help build and maintain support for continuing a beneficial relationship, especially when the agreement may be reconsidered in the future.

- *Documentation of procedures:* By documenting existing procedures that are operating successfully, a formal agreement can help maintain an interface in the face of personnel or administrative change. An informal agreement that relies solely on interpersonal relationships at the operating level may quickly dissolve if operating staff changes occur.

- *Institutional commitment:* Adopting a formal agreement shows commitment by the participating agencies to continue the relationship. While an informal agreement shows commitment at the operating level, a formal agreement shows commitment at the institutional level. Support for a relationship at the administrative levels of the participating agencies will be essential for continued operation of the interface.

- *Address liability issues:* In a cooperative arrangement, situations may arise where one or both parties may be held liable for damage or injuries sustained as a result of human or technical error. A formal agreement that documents agency roles and responsibilities with consideration for liability concerns will speed the process of conflict resolution and reduce resulting legal costs.

The following two samples illustrate the components of an interagency agreement:

- The first is an example of an agreement between an RTA and a municipality. This agreement corresponds to the "Transit Management – Traffic Coordination and Signal Priority" operational concept that was shown in Exhibit 5-13.

- The second is an example of an agreement between a traffic management agency and an emergency management or public safety agency. This agreement corresponds to the "Emergency Management – Traffic Coordination" operational concept that was shown in Exhibit 5-18.

These agreements document the rationale for the agreement as well as the operational procedures that govern the relevant interfaces.

AGREEMENT

This AGREEMENT, dated the __ day of, _____, is entered into by and between the _____ Regional Transit Authority ("_RTA") a body politic and corporate and public instrumentality of the Commonwealth, organized and existing under Chapter 161B of the Massachusetts General Laws, as amended and the _____ ("___") an agency of the City of _____, a municipal corporation of the Commonwealth of Massachusetts, as amended.

RECITALS

WHEREAS, Chapter 161B, Section 2, of the Massachusetts General Laws ("Chapter 161B") authorizes the _RTA to enter into all contracts and agreements and to do all acts and things necessary, convenient or desirable in the performance of its duties and the execution of its powers under Chapter ____; and

WHEREAS, _RTA operates the _RTA Operations Control Center and the ___ operates the ___ Traffic Management Center in order to, among other things, facilitate intermodal traffic flow, enhance passenger and motorist safety, improve the efficiency of incident management resources and enhance incident response for the _RTA and the city of _____; and

WHEREAS, the parties desire to improve their efforts to facilitate intermodal traffic flow, enhance passenger and motorist safety, improve the efficiency of incident management resources and enhance incident response for the _RTA and the city of _____; and

WHEREAS, the parties desire to set forth in this Agreement the terms and conditions of the interface between the transit operations center and the city traffic management centers described herein.

NOW, THEREFORE, THE _RTA AND ___ agree as follows:

1. The term of this Agreement will be for (xx) years, subject to renewal by mutual agreement.

2. _RTA will have access to video feed from select traffic cameras, identified in "Exhibit A" and attached hereto and made part of this agreement, to support dispatching operations.

3. Pan/tilt/zoom control of the camera will remain in the control of the ___ traffic operations center, but requests for camera repositioning by the _RTA may be made via voice communications (e.g. phone or radio).

4. Video will be transmitted by means of a Video Integration System, which will transmit video over a secure Internet connection.

5. Event information from the ___ traffic operations center, such as accident, delay, and construction information, will be provided to the _RTA via the Internet-based Event Reporting System (ERS).

6. The ___ traffic operations center will enter event information for roadways within its jurisdiction into the ERS. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the traffic management software at each control center. The _RTA will receive event information through operator monitoring of the ERS interface.

7. Exchange of device status information, including incident response measures such as street closures or service modifications, will occur via voice communications.

8. Coordination via voice or radio will be essential when incident response by the ___ traffic operations center affects operations by the _RTA, and vice versa.

9. Relevant status information for field devices will include traffic signal status and information about transit priority calls.

10. Field device status will be reported to the _RTA from the ___ traffic management center by means of a direct connection between the central systems.

11. Requests for traffic signal priority for buses or light rail vehicles will be made to the traffic signal system controlled by the ___ traffic operations center.

12. Direct control of roadway field equipment will not be permitted, as all control will remain with the ___ traffic operations center.

13. Indirect control by the _RTA is possible via a voice communications (e.g. phone or radio) request to the ___ traffic operations center.

14. _RTA and ___ agree that there will be no transfer of rights under this Agreement to any party without the written consent of both the _RTA and ___.

Whenever notice to one party by the other party is necessary or appropriate under this Agreement, such notice will be in writing and will be sent by first class mail, overnight delivery, hand delivery or facsimile to the following persons, unless otherwise directed by a formal notice:

_RTA: Executive Director
_____ Regional Transit Authority

Copy to: General Counsel
_____ Regional Transit Authority

"City":

Copy to: City Solicitor

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be duly exercised as a sealed instrument as of the date first written above.

_____ REGIONAL TRANSIT AUTHORITY

CITY OF _____

_____

_____

Approved as to Form:

Approved as to Form:

_____
General Counsel

_____
City Solicitor

AGREEMENT

This AGREEMENT, dated the __ day of, _____, is entered into by and between the _____and the _____.

RECITALS

WHEREAS,; and

WHEREAS,; and

WHEREAS, the parties desire to improve their efforts to facilitate traffic flow, enhance motorist safety, improve the efficiency of incident management resources and enhance incident response for _____through the interface of _____ emergency management control centers and _____traffic management centers; and

WHEREAS, the parties desire to set forth in this Agreement the terms and conditions of their duties for the traffic coordination between the _____ emergency management control centers and the _____traffic management centers described herein.

NOW, THEREFORE, THE ___ AND ____ agree as follows:

1. The term of this Agreement will be for (xx) years, subject to renewal by mutual agreement.

2. Video images will be exchanged between the two control centers to allow operator viewing of select CCTV cameras from the other agency.

3. ___ and ___ will agree on the exchange of video by means of a Video Integration System, which will transmit video over a secure Internet connection.

4. Pan/tilt/zoom control of the camera will remain in the control of the agency owning the camera, but requests for camera repositioning may be made via voice communications (e.g. phone or radio).

5. All costs related to the establishment and maintenance of the Video Integration System will be divided equally by the parties.

6. ___ and ___ will develop Standard Operating Procedures (SOPs) for operation of the Video Integration System.

7. Event information from the ___ traffic operations center, such as accident, delay, and construction information, will be provided to the ____ via the Internet-based Event Reporting System (ERS).

8. The ___ traffic operations center will enter event information for roadways within its jurisdiction into the ERS. Entering of information may be manual, by means of a web-based interface, or automatic, by means of an automated process developed for the traffic management software at each control center. The ____ will receive event information through operator monitoring of the ERS interface.

9. Exchange of device status information, including incident response measures such as street closures or service modifications, will occur via voice communications.

10. Coordination via voice or radio will be essential when incident response by the ___ traffic operations center affects operations by the ____, and vice versa.

11. Direct control of roadway field equipment will not be permitted, as all control will remain with the ___ traffic operations center.

12. Indirect control by the ____ is possible via a voice communications (e.g. phone or radio) request to the ____ traffic operations center.

13. ___ and ___ agree that there will be no transfer of rights under this Agreement to any party without the written consent of both the ___ and ___.

Whenever notice to one party by the other party is necessary or appropriate under this Agreement, such notice will be in writing and will be sent by first class mail, overnight delivery, hand delivery or facsimile to the following persons, unless otherwise directed by a formal notice:

IN WITNESS WHEREOF, the parties hereto have caused this agreement to be duly exercised as a sealed instrument as of the date first written above.

_____ _____

Approved as to Form: Approved as to Form:

_____ _____

APPENDIX G

ARCHITECTURE RELATED ACRONYMS

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ACRONYM DEFINITIONS (NON-ORGANIZATIONAL)

Acronyms	Definition
AD	Archived Data Management
AFC	Automatic Fare Collection
APC	Automatic Passenger Counter
APTS	Advanced Public Transportation System
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVA	Automatic Voice Annunciation
AVAS	Automated Voice Announcement System
AVI	Automatic Vehicle Identification
AVL	Automatic Vehicle Location
AVS	Advanced Vehicle Safety Systems
CA/T	Central Artery/Tunnel
CATS	Consequences Assessment Tool Set
C2C	Center to Center
CAD	Computer Aided Dispatch
CCTV	Closed Circuit Television
CV	Commercial Vehicle
CVAS	Other Commercial Vehicle Administration Services
CVIEW	Commercial Vehicle Information Exchange Window
CVISN	Commercial Vehicle Information Systems and Networks
CVO	Commercial Vehicle Operations
e-DEP	Electronic Department of Environmental Protection
DTOC	District Traffic Operations Center
EFP	Electronic Fare Payment
EM	Emergency Management
EMC	Emergency Management Center
EOC	Emergency Operations Center
ERS	Event Reporting System
ETC	Electronic Toll Collection
GPS	Global Positioning System
HAR	Highway Advisory Radio
HOC	Highway Operations Center
HPAC	Hazard Prediction and Assessment Capability
ICS	Incident Command System
IFTA	International Fuel Tax Agreement

IPCS	Integrated Project Control System
IRIS	Incident Reporting Information System
IRP	International Registration Plan
ISP	Internet Service Provider
ISTEA	Intermodal Surface Transportation Efficiency Act
ITIP	Intelligent Transportation Infrastructure Program
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
MassTERS	Massachusetts Traffic and Emergency Response System
MC	Maintenance and Construction
MCRS	Maintenance Control and Reporting System
MDT	Mobile Data Terminals
METFON	Metropolitan Emergency & Transportation Fiber Optic Network
M-ITS	MART Integrated Traveler Services
MIVIS	Massachusetts Interagency Video Information System
MOU	Memorandum of Understanding
NHS	National Highway System
NTCIP	National Transportation Communication for ITS Protocol
OCC	Operations Control Center
OS/OW	Oversize and Overweight
PA	Public Address
PDF	Portable Document Format
PIF	Project Initiation Form
RTIC	Regional Traveler Information Center
RTP	Regional Transportation Plans
RWIS	Road Weather Information System
RSS	Really Simple Syndication
SAFETEA-LU	Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users
SCADA	Supervisory Control and Data Acquisition
SOA	Service Oriented Architecture
STIP	State Transportation Improvement Program
TEA-21	Transportation Equity Act for the 21st Century
TIP	Transportation Improvement Program
TMC	Traffic Management Center
TOC	Traffic Operations Center
TSP	Transit Signal Priority
URM	Unified Response Manual
UWR	United We Ride

VIS	Video Integration System
VMS	Variable Message Sign
WAN	Wide Area Network
WiFi	Wireless Fidelity
WIM	Weigh-In-Motion
XML	eXtensible Markup Language

ACRONYM DEFINITIONS (AGENCIES & ORGANIZATIONS)

Acronyms	Definition
AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BAT	Brockton Area Transit
BEMA	Boston Emergency Management Agency
BFD	Boston Fire Department
BPWD	Boston Public Works Department
BRPC	Berkshire Regional Planning Commission
BRTA	Berkshire Regional Transit Authority
BTD	Boston Transportation Department
CATA	Cape Ann Transportation Authority
CCC	Cape Cod Commission
CCRTA	Cape Cod Regional Transit Authority
CMRPC	Central Massachusetts Regional Planning Commission
CTPS	Central Transportation Planning Staff
DCR	Department of Conservation & Recreation
DPW	Department of Public Works
EOT	Executive Office of Transportation
EPA	United States Environmental Protection Agency
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRCOG	Franklin Regional Council of Governments
FRTA	Franklin Regional Transit Authority
FTA	Federal Transit Administration
GATRA	Greater Attleboro-Taunton Regional Transit Authority
GMTA	Greenfield-Montague Transportation Area
IAG	E-Z Pass Inter-Agency Group
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
LRTA	Lowell Regional Transit Authority
MAPC	Metropolitan Area Planning Council
MART	Montachusett Regional Transit Authority
MARTA	Massachusetts Association of Regional Transit Authorities
MassDEP	Massachusetts Department of Environmental Protection
MassDOT	Massachusetts Department of Transportation

MBI	Massachusetts Broadband Institute
MBTA	Massachusetts Bay Transportation Authority
MCCA	Massachusetts Convention Center Authority
MDC	Metropolitan District Commission
MEMA	Massachusetts Emergency Management Agency
MPO	Metropolitan Planning Organization
MRPC	Montachusett Regional Planning Commission
MSP	Massachusetts State Police
MVC	Martha's Vineyard Commission
MVPC	Merrimack Valley Planning Commission
MVRTA	Merrimack Valley Regional Transit Authority
MWRTA	MetroWest Regional Transit Authority
NEMA	National Electrical Manufacturers Association
NMCOG	Northern Middlesex Council of Governments
NOAA	National Oceanic and Atmospheric Administration
NP&EDC	Nantucket Planning and Economic Development Commission
NRTA	Nantucket Regional Transit Authority
OCPC	Old Colony Planning Council
OTP	Office of Transportation Planning
PVPC	Pioneer Valley Planning Commission
PVTA	Pioneer Valley Transit Authority
RMV	Registry of Motor Vehicles
RPA	Regional Planning Authority
RTA	Regional Transit Authority
SAE	Society of Automotive Engineers
SRPEDD	Southeastern Regional Planning and Economic Development District
SRTA	Southeastern Regional Transit Authority
SDO	Standards Development Organization
TMA	Transportation Management Associations
USDOT	United States Department of Transportation
VTA	Martha's Vineyard Transportation Authority
WRTA	Worcester Regional Transit Authority