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Tech Notes

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Regional ITS Architectures for Massachusetts

Intelligent Transportation Systems (ITS) are applications of advanced technology in the field of transportation, with the goals of increasing operational efficiency and capacity, improving safety, reducing environmental costs, and enhancing personal mobility. Successful ITS deployment requires an approach to planning, implementation, and operations that emphasizes collaboration between relevant entities and compatibility of individual systems. At the core of this process is an architecture that guides the coordination and integration of individual ITS deployment projects. **This ITS architecture is a framework that defines the component systems and their interconnections, and that provides a tool for facilitating institutional relationships within a region.**

The Commonwealth of Massachusetts, through the Executive Office of Transportation and Construction (EOTC)/Massachusetts Highway Department (MassHighway), is undertaking the development of Regional ITS Architectures across the Commonwealth. The architecture is near completion in the Metropolitan Boston area, and the architecture development efforts are now underway in Southeastern, Central, and Western Massachusetts. The Bureau of Transportation Planning and Development is leading this effort on behalf of EOTC/MassHighway, with input and participation from key transportation agencies and other organizations in each region. The consultant team for this work is led by IBI Group, in association with ConSysTec Corporation and Rizzo Associates. The architecture development effort is funded by FHWA and the Commonwealth.

The most critical component of the architecture development process is the participation of the regional stakeholders. The reason that participation is so critical is that stakeholder input is the foundation of the architecture. The architecture is not meant to impose a plan for ITS on the region. Instead, the architecture builds on the needs of the region, the existing systems, and the planned ITS systems, as voiced by the stakeholders. The architecture process then looks into the possible interfaces between those systems and elements, again as defined by the stakeholders.

In each region of the state, a Guidance Committee consisting of key transportation players and stakeholders was established to support the architecture development process. This committee contributes to the architecture development process through group meetings, workshops, individual working sessions, and review of deliverables. The outcome of this process is an architecture that represents a vision of an integrated transportation system for each region and the interagency relationships needed to support it.

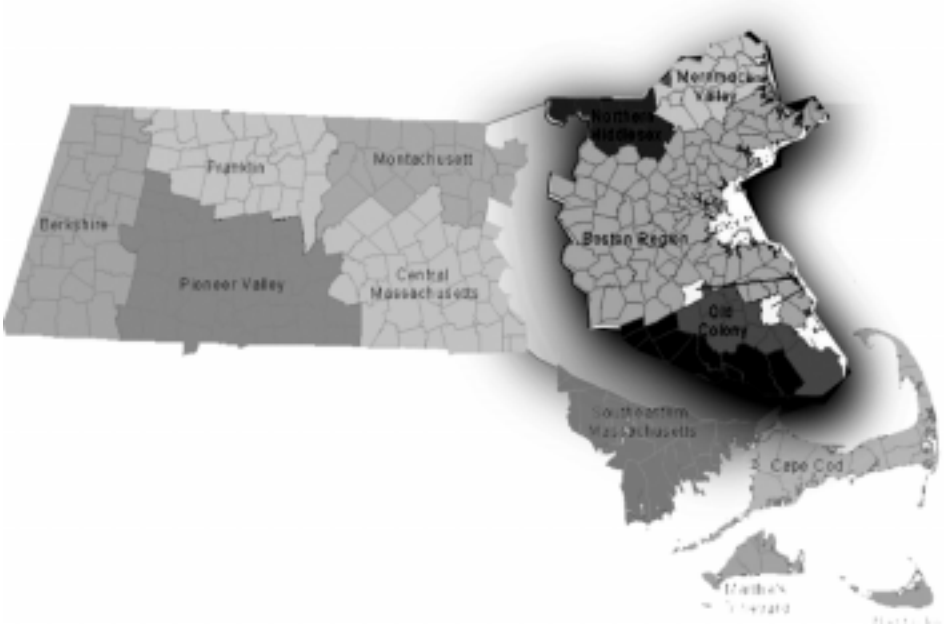


Exhibit 1: Metropolitan Boston Study Region

Reasons for the Regional ITS Architecture

This process of developing Regional ITS Architectures across Massachusetts has been undertaken for a number of reasons. While Federal requirements are certainly a motivating factor, there are other key objectives and benefits that the architecture also addresses.

Interagency coordination is one of the key issues that the architecture process addresses, not only in the recommendations that have come out of the architecture, but also through the process of developing the architecture itself. The establishment of the multi-agency stakeholder group that meets throughout the architecture development process is a significant step towards building an ITS working group in each region. The numerous meetings and workshops of the Guidance Committee throughout the process provide such a forum to exchange information on needs and project plans. Furthermore, as each region's architecture must be maintained in order to ensure that it remains consistent with the needs and priorities of the region, this interaction will continue after the architecture is complete, promoting integration of ITS across agencies with mutual benefits for all of the participants.

In each region, this multi-agency effort will result in an architecture (and an associated operational concept and implementation plan) that provides opportunities for additional benefits. 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. In addition, the public benefits from the development of the architecture, as the architecture outlines a framework for information sharing that crosses jurisdictional boundaries and provides it to the public when and as needed.

Regional Definitions

The Regional ITS Architecture development effort for the Commonwealth has led off with the development of the architecture for Metropolitan Boston. As shown in *Exhibit 1*, the Metropolitan Boston Regional ITS Architecture was developed for the area generally within I-495, Boston's outer circumferential highway. The study region includes the Boston, Northern Middlesex, Old Colony, and Merrimack Valley MPO regions, as well as the northern portion of the Southeastern Massachusetts MPO region.

The effort is now underway for the remainder of the Commonwealth. Three additional regions have been defined that cover the remaining area. The Southeastern Massachusetts region includes Cape Cod, Martha's Vineyard, and Nantucket, as well as the southern portions of the Old Colony and Southeastern Massachusetts MPO regions. The Central Massachusetts region covers the Montachusett and Central Massachusetts planning regions. The Western Massachusetts region covers Berkshire, Franklin, and Pioneer Valley planning regions. The draft architectures in these regions are anticipated to be complete during the first quarter of 2005.

Architecture Development Approach

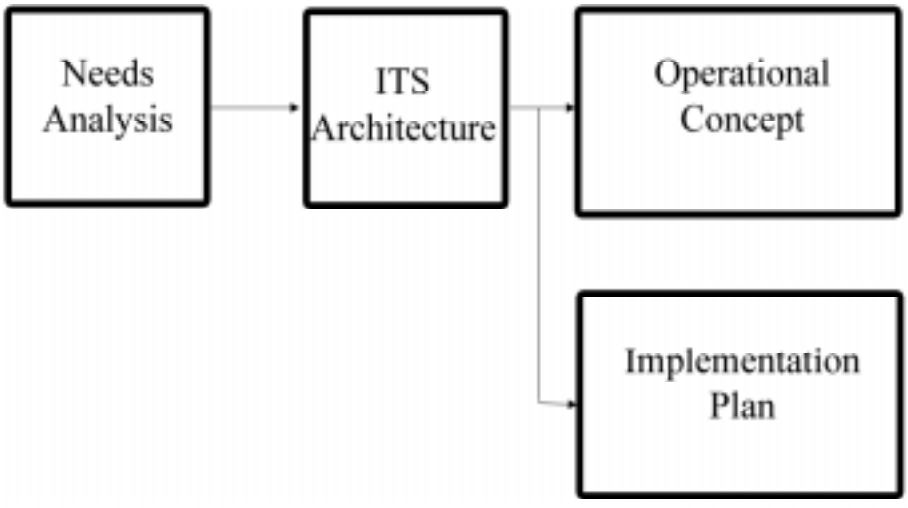
The process undertaken for the development of the Massachusetts Regional ITS Architectures is illustrated in *Exhibit 2*. The first step of this process is the ***Needs Analysis***, which identifies the ITS-related projects and needs of the operating and planning agencies in the region. This analysis serves as the basis for the development of the functional requirements of the ITS Architecture and its com-

ponent systems, developed in the following step. This approach ensures that the interfaces recommended under this architecture are consistent with the needs and goals of the region. For the Massachusetts regional architectures, the needs analysis starts with a review of information collected from participating agencies. That information is then supplemented by discussion directly with regional stakeholders through a number of channels, including meetings of the full Guidance Committee, information collection meetings with groups of stakeholders, and follow-up meetings with individual agencies and organizations as needed.

The next step in the process will be the development of the ***ITS Architecture***, which defines the existing and planned component systems and the interfaces among them. An initial draft of the architecture is developed from an inventory of ITS elements developed in the needs analysis and from stakeholder input at an architecture development workshop. Refinements to the architecture will be made following stakeholder review, including a series of follow-up review meetings with various stakeholder groups.

Exhibit 3 presents a sample diagram (out of hundreds) from the Metropolitan Boston Regional ITS Architecture, detailing the information flows to and from the MassHighway Traffic Operations Center (TOC) relating to regional traffic control. Similar diagrams are produced for each of the functions covered by the architecture, outlining the information that is exchanged between each of the elements of the architecture.

Exhibit 2: Architecture Development Process



While the architecture addresses what systems will exist and what information they will exchange, it does not address how those interfaces will operate and how we move from the current state of deployment to the full system envisioned by the architecture. These issues are addressed in the Operational Concept and the Implementation Plan, respectively.

The ***Operational Concept*** addresses 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 the stakeholders in the implementation and operation of the 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 the interfacing agencies, and the operational agreements that will be required.

The final piece of the architecture development process is the development of the ***Implementation Plan***, which provides a strategy for achieving the integrated transportation system envisioned by the architecture. The Implementation Plan considers what steps are necessary in order to fulfill the architecture's vision, specifically what areas of investment are required and what initiatives will need to be undertaken in order to implement the component systems of the architecture.

Using the Regional ITS Architecture

The architecture development process yields a valuable tool for the region. There are a number of ways in which the architecture should be applied. First, the architecture should be used by agencies as a framework for planning ITS projects, as it documents what they have planned, as expressed in the architecture development process. If it does not reflect the current plans, it must be revised so that it is up to date.

Agencies should also use the architecture as a guide for interfacing their projects with other agencies.

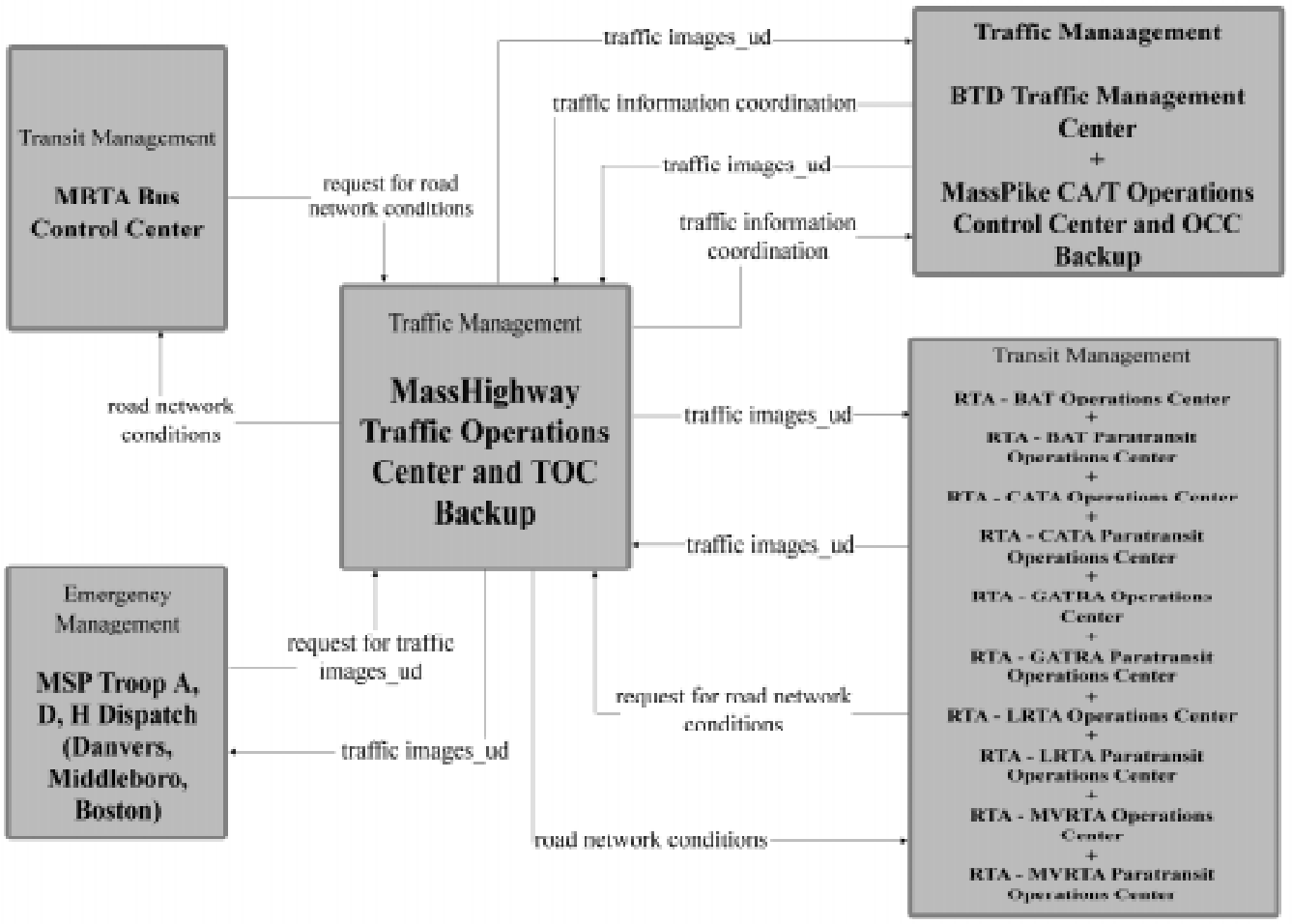


Exhibit 3: Sample Interface from Regional ITS Architecture

The ITS architecture documents the interfaces that are planned for development, as well as the standards that apply 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 sole determination of conformity to federal requirements for any projects with ITS components. 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 or reject the project. 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.

The Regional ITS Architecture for Metropolitan Boston will be posted to a publicly accessible website shortly. Architectures for the other regions of the Commonwealth are currently under development. For more information, contact Steve Pepin, Manager of Research at the Bureau of Transportation Planning and Development, at *Stephen.Pepin@state.ma.us*.