

A Look into Regional ITS Architecture

By: Ben Steinberg

NARC extends special thanks to FHWA, in particular Pam Kordenbrock, who collaborated with NARC staff to bring this article to you.

Throughout the last decade Intelligent Transportation Systems (ITS) has created a new way in which to provide more efficient and safer transportation. To encourage coordination between transportation providers, the U.S. DOT developed the National ITS Architecture and related tools to help identify and exploit opportunities for cost-effective cooperation. The National ITS Architecture helps to plan, define, and integrate ITS technology at the local, regional, statewide, and national level.

The National ITS Architecture is defined as:

- The functions (ex: traffic information or request a route) that are required for ITS;
- The physical entities or subsystems where these functions reside (ex: roadside or the vehicle), and;
- The information flows that connect these functions and physical subsystems together into an integrated system.

Source: National ITS Architecture Document

In 1997, the Transportation Equity Act for the 21st Century (TEA-21) was passed by Congress containing Section 5206(e). This section requires ITS projects funded from the Highway Trust Fund, including the Mass Transit Account, to conform with the National ITS Architecture and appropriate standards. In January 2001, FHWA published an ITS Architecture and Standards Conformity Final Rule, and the FTA published a companion ITS Architecture and Standards Final Policy implementing Section 5206(e). Conformance with the National ITS Architecture is defined in the Final Rule/Policy as using the National ITS Architecture to develop a **regional** ITS architecture, or RA, that would be tailored to address the local situation and ITS investment needs, and the subsequent adherence of ITS projects to the regional ITS architecture. Prior to the Final Rule/Policy, use of the National ITS Architecture to create regional ITS architectures was voluntary. Per the Final Rule, the deadline for developing a RA was set for April 8, 2005, or within four years of the final design of a region's first ITS project. If the requirements for the Final Rule/Policy are not met, in general, Federal funds from the Highway Trust Fund, including the Mass Transit Account, cannot be used for ITS projects until a RA is developed.

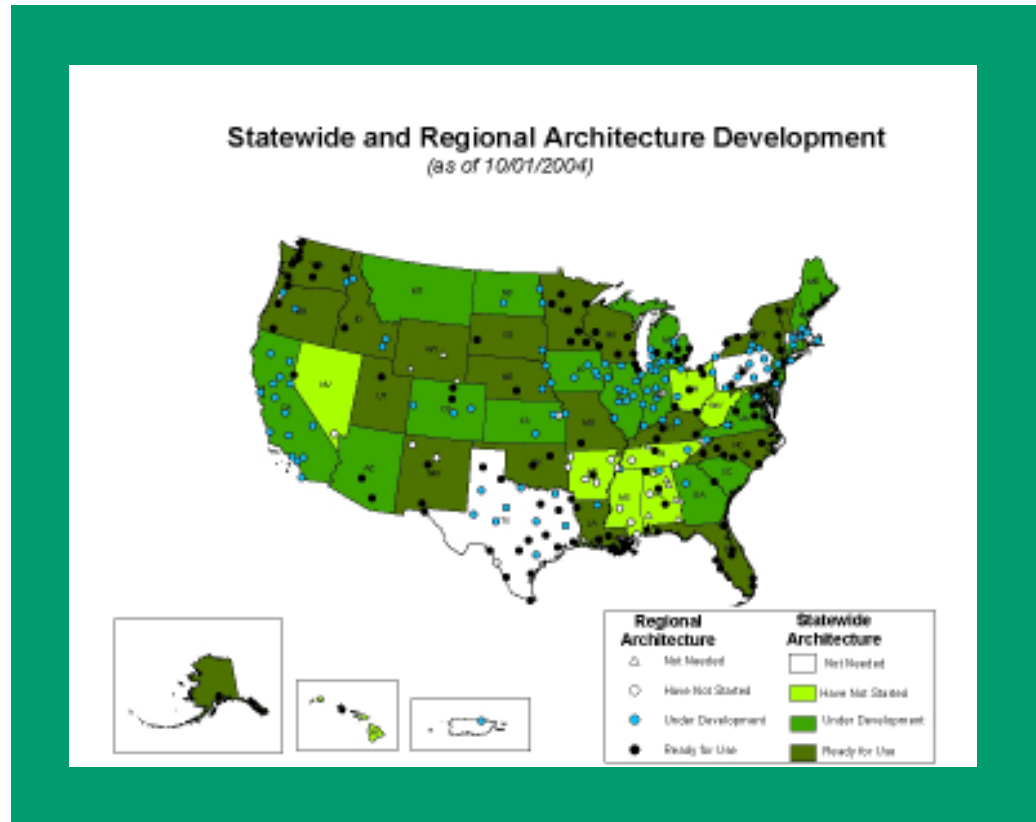
Throughout the last five years, in an effort to meet the requirements of the Final Rule as well as create a more inclusive architecture, many local governments and planning associations have worked together with their state DOTs to create a RA. Thus far, the majority of state DOTs have implemented some form of a regional ITS architecture to describe their existing and planned ITS components.

Regional Councils (RCs), Metropolitan Planning Organizations (MPOs), Regional Planning Organizations (RPOs) and Councils of Government (COGs) have taken a lead role in developing and maintaining these regional ITS architectures, because by definition their boundaries extend regionally (For the purpose of this article, these organizations will be referred as regional councils and MPOs). According to the FHWA, as of December 2004,

Regional Architecture

approximately 300 regional ITS architectures have been identified, with about 200 that are ready for use. Many of these regional architectures have been created by or in collaboration with regional councils and MPO's.

Many regional councils and MPOs, due to location, population demographics and dimensions, stakeholder involvement, political interest, monetary investment, as well as the expertise of their technical planning staff and diverse array of ITS technology deployed, have developed their regional ITS architectures differently from one another. In order to get a better understanding of regional ITS architectures and the discrepancies between them at the regional level, NARC conducted a survey of all regional councils and MPOs throughout the country. This article will discuss the findings from the forty six regional council and MPO responses.



Creation of Regional ITS Architectures

The results of the survey revealed that the majority of regional councils and MPOs went through a multi-pronged process in order to create a regional ITS architecture. Two important parts to this process were, the designation of who was going to develop the regional ITS architecture, and how it would involve all stakeholders in the area:

- The first step that regional councils and MPOs took was to assign or contract professionals who were capable of leading the technical development of the regional architecture. The majority of regional councils and MPOs used consultant services to help them develop their architecture or to train their staff to become proficient with ITS architecture software. For example, Denver Regional Council of Governments (DRCOG) tried to develop their regional architecture by themselves, or “in house”. But, after struggling with this task DRCOG contracted a consultant firm, and found that their guidance enabled them to create a better regional architecture. They remarked that the “consultant was far more knowledgeable about desired ‘outcomes’ than staff had been, and was also viewed as more neutral and credible than staff had been”. Although DRCOG switched to a consultant, many councils and MPOs feel comfortable with in house staff doing all the work. FHWA has also played an integral role in this process offering information and training workshops in order to help regional councils and MPOs create and maintain their RA.

Regional Architecture

■ Second, regional councils and MPOs took part in gathering all stakeholders connected to and invested in ITS technology. It is important to note that a valuable element of regional ITS architecture is not only the technical sharing of information; it is also the communication between stakeholders who are involved in the process, through the meeting of committees and advisory groups. In an interview between NARC and Pam Kordenbrock, FHWA's Architecture Implementation Program Manager, she explained this idea further stating that “the value of developing an RA is that it brings together all the stakeholders in a region to really talk about and decide how best to operate their transportation systems. It establishes the necessary technical and institutional mechanisms to exchange data and information.”

According to the Rockford Area Transportation Study (northern IL and southern WI), the greatest benefit of regional architecture for them has been “the awareness of resources that are available...Just knowing who the players are, what they have to offer, and what ITS initiatives are underway is worth the effort”. The Champaign County Regional Planning Commission (IL) added to this by stating that their committee has facilitated dialog and coordination between agencies that had never communicated before, such as ambulance services and the public works department. Examples of stakeholders involved in these committees are police, emergency services, EMS personnel, ITS planners, transportation planners, traffic information providers, weather services, local businesses, transit providers, financial institutions, systems engineers, system developers, technology specialists, consultants, local elected officials, etc.

In some cases, regional councils and MPOs have maintained successful ITS architecture development committees to manage other functional elements connected to ITS and additional traffic mitigation programs. For example, the Tri-County Regional Planning Commission in Lansing, Michigan voted to continue their ITS Architecture Development Taskforce as a Management and Operations Task Force. They have since taken on the roles of developing a Congestion Management System, safety conscious planning activities, updating and maintaining the ITS Architecture, certifying project consistency, etc.

Tools for Developing the Regional ITS Architecture

Three important tools exist in order to help the development of regional architecture. There is the National ITS Architecture (as discussed above), a guidance document entitled “Developing, Using and Maintaining an ITS Architecture for Your Region,” and the Turbo Architecture software. The National ITS architecture is a tool that provides a common framework for planning, defining, and integrating intelligent transportation systems. The National ITS Architecture reflects the contributions of a broad cross-section of the ITS community and has been updated several times since it was initially published. For example, after September 11, 2001 FHWA added several new components, including transportation security, because they felt that there were security elements that needed to be reconsidered and revised in order to enhance ITS operations.

The “Development, Using, and Maintaining and ITS Architecture for Your Region” document is a guide for transportation professionals who are involved in the development, use, or maintenance of regional ITS architecture with supporting examples of each architecture product. In its discussion of the uses of the regional ITS architecture, the document presents an approach for mainstreaming ITS into the transportation planning and project development processes.

The current software program that is used by most regional council and MPOs is called Turbo Architecture. Turbo Architecture is an interactive software application that assists transportation planners and system integrators, both in the public and private sectors, in the development of regional and project architectures using the National ITS Architecture as a starting point. Using Turbo Architecture provides an initial start towards both architecture development and consistency with the National ITS Architecture. The use of this software is not mandatory, and includes direct data entry, RA management, and reporting capabilities. While Turbo Architecture has evolved to keep pace with the National ITS Architecture, it is important to note that regional architectures can still function effectively with earlier versions of Turbo Architecture and regional councils and MPOs do not need to continuously update their software.

Regional Architecture

Differences in Scope and Coordination of Existing Regional Architectures

Depending on a variety of factors, regional councils and MPOs have created their regional architectures differently.

The majority of regional ITS architectures are derived directly from the borders set forth for the regional councils and MPOs. This way they can build the RA from its existing structure of bureaucratic organizations and institutions.

There are also regional councils and MPOs that are connected in a “super” regional framework that includes multiple adjoined planning regions. In these instances, state DOTs play a large role in the designation and coordination of these districts as well as the moderator between the various stakeholders. Tri-County Regional Planning Commission (TCRPC) in south central Pennsylvania is a good example of a “super” regional architecture that has been developed with the help of PennDOT. TCRPC’s boundaries extend through eight counties, four MPO’s, one RPO, and one nonaffiliated county. The development of their architecture has “encouraged more and better coordination between MPO, RPO, and county entities within the region”. Which they believe “will help facilitate coordination for other necessary multi-county efforts in the future”. It has also helped “transportation planning professionals to interact with key non-transportation stakeholders and get an idea of the issues they face that are ITS related”. These larger collaborations have also created opportunity among MPOs and regional councils for shared responsibility and monetary commitment between the various stakeholders. There are even regional councils and MPOs that coordinate planning across state and even national borders. For example, Southeast Michigan Council of Governments (SEMCOG) has developed planning coordination that goes into parts of Ohio and Canada. SEMCOG has taken the lead in the development of the regional architecture, but relies on the cooperation and collaboration between ITS planning entities across Michigan borders. Coordinating an architectural system with stakeholders is more difficult in this scenario, but it is critical in order to create safe and efficient roads. In the Midwest, for example, this is critical because roads have a tendency to freeze and accidents can be a major problem.



Time Frame to Complete Regional Architecture

The time taken to complete systems architecture is different for each regional council and MPO depending on a variety of factors, such as: population demographics and where the regional council and MPO is located; how many counties/cities are involved; how many stakeholders are involved and who they are; when they started the regional architecture; and whether they used a consultant or did the work “in house”. In general, regions that do not have an RA by April 8, 2005 will not be able to spend Federal money on ITS projects. The timeline for completion of a systems architecture has been anywhere from 8 months to 3 years. The survey results show that the majority of RA took from 1 to 1 ½ years to complete.

Cost of Development

There are two components to the price of a regional ITS architecture. The two components are consultant fees and “in house” fees. The price of consultant services vary greatly depended on many factors (as stated above in the Time Frame section). The range in price for a consultant services is anywhere from \$25,000 to \$500,000. Most architectures fell somewhere in the middle of this large discrepancy in price. In fact, many of the consultant services that helped in the development of the regional architectures were contracted and paid for by the state DOTs. It is much more difficult to quantify “in house” costs. Most regional councils and MPOs have one or two staff members who are consistently tied into ITS and the creation/maintenance of the regional architecture. Also,

many regional councils and MPOs have not begun to quantify cost of in house operations. According to Pam Kordenbrock , the most important component to the creation of a regional ITS architecture, is not the price, but that each regional council and MPO be happy with their final product and find it useful for future project development.

How to Create Successful Outcomes from Challenging Circumstances

Although there are many benefits that have come from RA, there have also been challenges that have made this process difficult. In some instances it was hard for regional councils and MPOs to get together all the necessary stakeholders in order to create the most comprehensive architecture. Even though their participation in critical, not all stakeholders want to be involved in the process or believe that their involvement is necessary. Additional challenges regional councils and MPOs found were communicating across state boundaries as well as allocating responsibility to all stakeholders involved.

In order to alleviate these problems, regional councils and MPOs have suggested a few important tips:

- Involve a wide range of stakeholders in the process and get them interested early on in the process—constant communication is necessary.
- Teach stakeholders (in simple terms) why ITS are important and why ITS architecture is an important step in the process of operations and maintenance of the technology.
- Consult state and/or federal DOT for help throughout the process. Several types of federal funds are eligible for RA development and maintenance.
- Create a website to house the architecture information so that people can utilize it. It can also help in the updating of architecture
- Outreach to community, especially local elected officials is a key element to the process.

The Department of Transportation An Incredible Resource on Regional ITS Architecture

The U.S. DOT understands that developing, using, and maintaining regional ITS architectures is new to many agencies, so we have created a bit of guidance, technical assistance, and training to help them.

*Pamela Kordenbrock
Federal Highway Administration
U. S. Department of Transportation*

Department of Transportation Technical Assistance Resources

For technical assistance and training, contact your FHWA Division office or FTA Region office ITS Specialist by visiting: www.ops.fhwa.dot.gov/its_arch_imp/index.htm for information, FAQs, example documents, training, and technical assistance. Check www.its.dot.gov/arch/arch.html for information on the National ITS Architecture, and Turbo Architecture.

Contacts at the federal level:

Pam Kordenbrock (FHWA) ~ 202.366.2199 ~ Pamela.kordenbrock@fhwa.dot.gov

Brian Cronin (FTA) ~ 202.366.0105 ~ brian.cronin@fta.dot.gov

Toll Free ITS Help Line: 1-866-367-7487

Conclusion

As vehicle miles traveled (VMT) and congestion has consistently gone up with no end in sight, precision technology has become integral for transportation planning. As urban areas expand and more roadways are interlinked with one another, operations and maintenance of this technology is imperative. Therefore regional architecture has emerged as the best way in which to oversee the physical and virtual networks interacting with ITS. At the same time that ITS technology grows so too will its counterpart of regional ITS architecture.

Regional councils and MPOs have the ability to facilitate the future expansion of regional ITS architecture. Already many regional councils and MPOs stand as illustrations of excellence in the creation and maintenance of regional ITS architecture and ITS technology in their region. As the demand for seamless transportation systems grow regional councils and MPOs have a great opportunity to take a lead role in the development of RA. NARC looks forward to working with its members on the development of their regional ITS architecture.

Additional Resources

Technical Assistance

Regional Architecture Process Seminar (1-day) and Workshop (2-day): Prepares key players and champions for the process of developing a regional architecture. Both the seminar and workshop are based on the Regional ITS Architecture Guidance Document, available on the ITS Document Library, #13598, at www.its.dot.gov. **FREE**

Direct Technical Assistance provided by FHWA and FTA Field staff. Contact your local FHWA Division office and/or your FTA Regional ITS Specialist for assistance. **FREE**

Peer Assistance through the Peer-to-Peer Program for assistance related to architecture development at www.its.dot.gov/peer/peer.html. **FREE**

Regional ITS Architecture Maintenance White Paper discusses the change management process associated with maintaining an updating a regional ITS architecture. It is available on the ITS Document Library, #13957, at www.its.dot.gov. **FREE**

Training

Introduction to the National ITS Architecture: An 8-hour web-based course that provides a broad overview of the National ITS Architecture and its role in planning, designing and implementing ITS. Available through the Consortium for ITS Training and Education (CITE) at: www.citeconsortium.org. **FREE**

Introduction to Systems Engineering: An overview of systems engineering, introducing basic concepts and technical practices, such as modeling, prototyping, trade-off analysis and testing, management practices, risk assessment and mitigation, and “best practices.” Available through the National Highway Institute (NHI) at: www.nhi.fhwa.dot.gov. \$270 per person

Applied Systems Engineering for Advanced Transportation Projects: Covers a more detailed understanding of the principles of systems engineering, particularly the benefits of alternative architectures, and the need to consider the principles of system reliability, maintainability and availability. Available through the CITE at: www.citeconsortium.org. \$275 per person

Using the National ITS Architecture for Deployment: A 2-day, classroom course introducing the concepts, terms, and tools of the National Architecture. Available through NHI at: www.nhi.fhwa.dot.gov. \$275 per person

Complying with the FTA’s Policy on ITS Architecture Consistency and its Impact on Project Planning and Implementation: A one-day course that provides an understanding of the Policy, the impact of transit ITS planning and development, and practical benefits and guidelines of conformance. Available through the National Transit Institute at: www.ntionline.com. **FREE**

Turbo Architecture 3.0 Software Training: A two-day classroom course on the Turbo Architecture 3.0 tool, an interactive software training program to assist transportation professionals in developing regional and project architectures with the National ITS Architecture as a starting point. Available through NHI at: www.nhi.fhwa.dot.gov. \$270 per person