Successful Integration of ITS in the Regional Transportation Planning Process

The Mid Region Council of Governments: Coordinated ITS Project Planning, Maintaining the Regional Architecture, and ITS Infrastructure Data Integration Using GIS

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Abstract

The experience at the Mid Region Council of Governments (MRCOG) has shown that coordination among ITS stakeholders at the planning, policy, and technical levels provides critical benefit to ensure that ITS is deployed in a fully integrated manner. To this end, our ITS stakeholders have involved themselves directly or indirectly at nearly all phases of project development ranging from initial project planning, project design and implementation, and finally with coordination among systems operators and data users at project completion. The MRCOG, as the Metropolitan Planning Organization (MPO), is responsible for carrying out a collaborative transportation planning process for agencies within the urbanized region. The supporting committee structure facilitated by MRCOG involves agency representation ranging from elected officials comprising the Metropolitan Transportation Planning Board (MTB) to the supporting technical committees comprised of all levels of staff such as department heads and technical project planners, engineers, managers, and the public. It is in this capacity as coordinating facilitator that the MPO's ability and opportunity to be a central point of regional transportation planning consensus has proven itself a powerful mechanism in the pursuit of coordinated ITS.

The successful integration of ITS into the MRCOG MPO's transportation planning process is most apparent in several key areas such as:

- the MPO's Transportation Planning and Project Programming Process (TIP and MTP)
- Congestion Management Process
- Maintenance of the Regional ITS Architecture
- ITS Infrastructure Management and Monitoring Activities in GIS

In 2000, MRCOG created the ITS Subcommittee as a subcommittee to the Transportation Coordinating Committee (TCC), thereby effectively establishing a direct link between ITS planners, engineers, and operators and the region's transportation decision making body, ie, the Metropolitan Transportation Board. The charge of the MPO as the transportation planning authority within the metropolitan area presents a unique opportunity to bring stakeholder agencies to the table in a collaborative manner. The subcommittee is directly involved in the Metropolitan Planning Organization (MPO) committee structure, thus establishing direct input for ITS planners and engineers to transportation planning and programming activities at the regional level. The committee is comprised of key representatives from each of the MPO member agencies, along with those in the consultant community with an interest in ITS. Agency representation mimics that of the other committees such as the TCC and TPTG.

Regional and agency ITS goals within the AMPA include:

- Arterial Management
- Freeway Management
- Transit Management
- Incident and Emergency Management
- Traveler Information
- Transportation Management Centers
- Roadway Operations and Maintenance

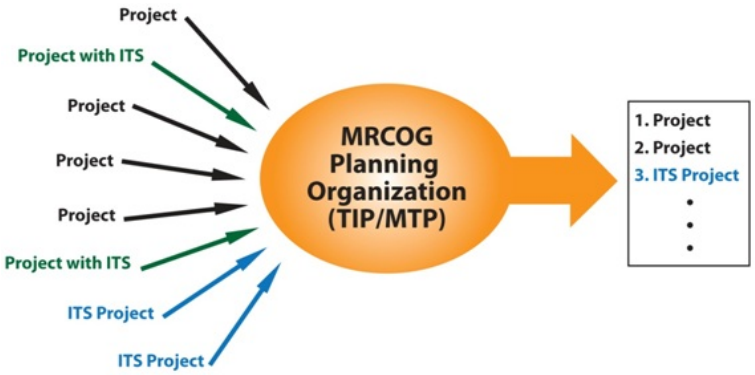
MRCOG member agencies comprise the ITS Stakeholders in the Albuquerque Metropolitan Planning Area (AMPA), along with a strong level of participation from the consultant community. A chapter of ITS America has recently been established and thus far, interest has been strong on both public and private levels of participation. Area first responders' participation has begun with the coordination of their respective dispatch, NMDOT Freeway Courtesy Patrols, and the TMC and is anticipated to continue to evolve as agency systems expand, putting in place the institutional and structural framework for these relationships. This presents a challenge for the MRCOG as they are not directly involved in the metropolitan transportation planning process, however, progress is afoot as the region pursues the establishment of a regional transportation management center where agency transportation and first responders will co-locate and share information and resources. At that point, fully coordinated Incident Management can be pursued to its maximum effectiveness.

The coordination of a regional multi-modal "transportation system" has led to a recognition that ITS projects have a greater chance of maximized project benefits for the maximum number of users if planned and implemented properly within the MRCOG Metropolitan Planning Organization.

Inclusion of ITS in the TIP/MTP Project Planning and Programming Process

The Transportation Improvement Program (TIP) (1) is a programming document that prioritizes all transportation funding, including federal funding, for projects within an urbanized area. The plan is compiled utilizing the collaborative Transportation Planning Process facilitated by the MPO and involving all member agencies. All projects within the Albuquerque Metropolitan Planning Area (AMPA) receiving federal highway or transit funding, state, or local funding must be in the TIP. The TIP is the region's mechanism of allocating its limited transportation resources to the multi-modal transportation needs using a clear set of short-term transportation priorities. It is considered the “short range” implementation portion of the long range planning Metropolitan Transportation Plan (MTP) (2). Projects are identified by project “type”, as in roadway, transit, maintenance/rehab, bicycle and pedestrian, and ITS so as to identify primary project “purpose” to assist in technical assessment and programming considerations. Discreet project categories streamlined the process, and the ITS category served larger the projects, however, those non-ITS projects that contained ITS elements were being programmed without consideration of the inclusion of ITS; that is, unless they were specifically identified with a “project type” of ITS those elements were undetected. The current process was inadequate resulting in many of the ITS components being “undetected” in the planning and programming process. This gap was also making the maintenance of the Regional ITS Architecture extremely difficult as it required cumbersome and exhaustive TIP program review and sponsoring-agency investigation of each project.

The answer was to expand ITS in the TIP development process, both with the inclusion of the ITS Subcommittee into the committee review process flow, as well as the necessary modifications to the project proposal form to assist in identifying a higher detail of ITS elements at the project submittal stage. Clearly, the process needed the robustness to identify ITS elements on obvious ITS project as well as “non-ITS” projects that contain ITS *mainstreaming*, ie, ITS components being included on other project types such as typical road improvements or transit expansions.



The TIP is developed on a 2-year cycle, and on 4 year cycles is tied to the development of the longer range Metropolitan Transportation Plan (MTP). At the beginning of each programming cycle, a call is made to the member agencies to submit their projects for consideration for funding in the program. Priorities are set forth through the process which is strongly rooted in the Congestion Management Process (CMP) (6) and includes growth projections, financial constraints associated with limited federal, state and local sources, and regional and agency priorities. The process is facilitated by another subcommittee to the TCC; the Transportation Technical Programming Group (TPTG). Of note is that many of the members of the TPTG are also on the ITS Subcommittee and the CMP Committee. The graphic below (**Figure 1)** shows the basic process flows related to the program development, and the insert points where the ITS Subcommittee is now involved.

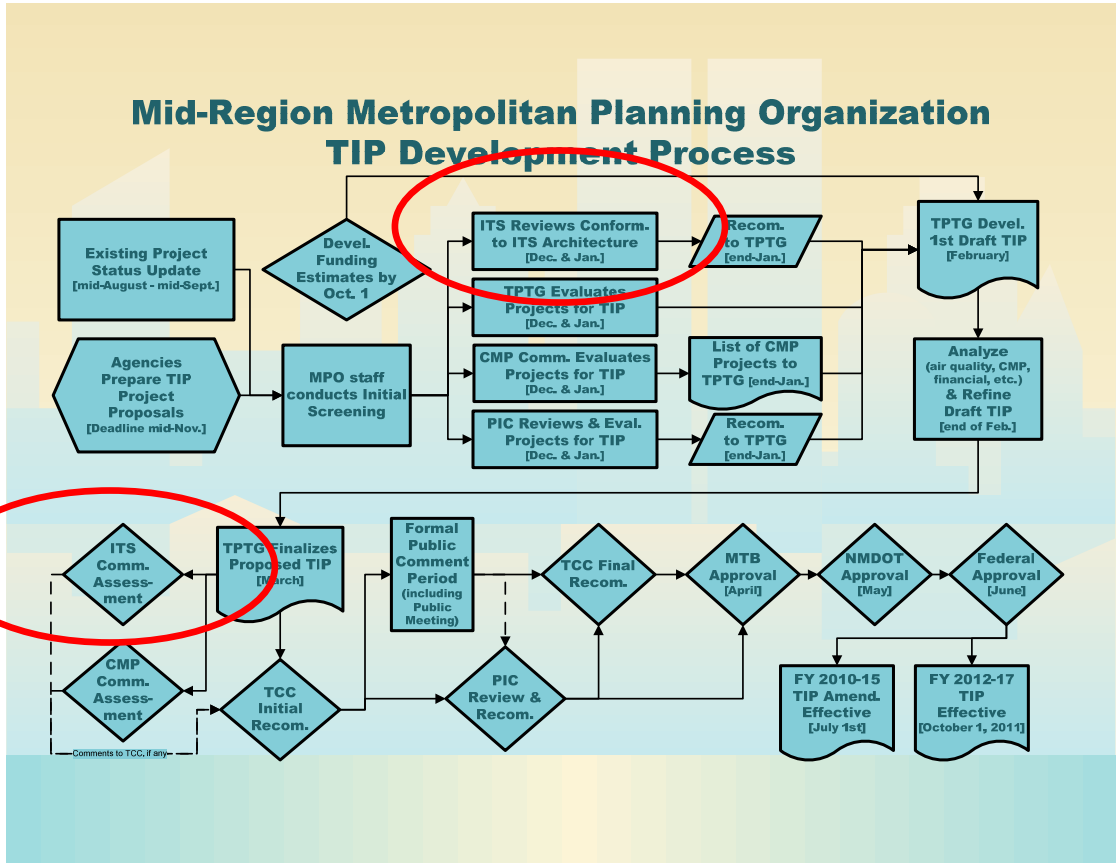
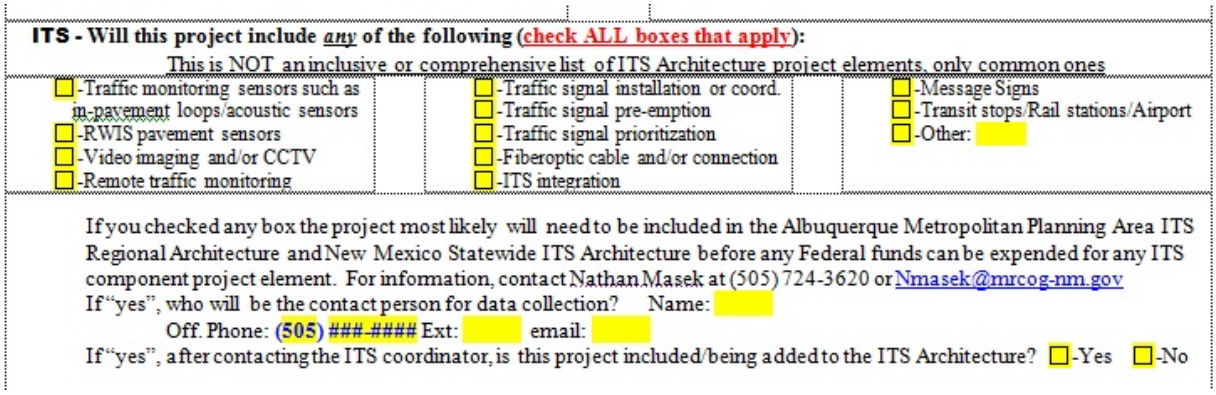


Figure 1. MRCOG's TIP Development Process, with ITS Subcommittee involvement identified (Source: MRCOG TIP Policy and Procedures)

After the initial project screening, the ITS Subcommittee reviews the total project list including those ITS elements identified as well as projects with the potential for ITS inclusion A review of the AMPA Regional ITS Architecture and mapping of the projects to the architecture and market packages is then performed which serves as a foundation effort in architecture maintenance. The ITS Subcommittee is given a

second review of the draft TIP before final recommendation to the TCC and then to the MTB for approval.

Modifications to the TIP Revision Proposal Form to accommodate necessary detail for ITS inclusion involved adding criteria that simply asks the applicant if their project includes any ITS elements. To save space on the form, specificity was given to the range of ITS Element options based on a review of the ITS Regional Architecture and regional ITS Goals, however, the form allows for all ITS elements to be specified. The ITS project "type" designation remains in the process for those projects that are identified with a clear and discreet ITS scope, however, this new project definition option affords the applicant the ability to detail any ITS "elements" included in the project regardless if the project scope warrants an "ITS" project type designation or not. This modification of the submittal form (and the TIP development process) has led to a significant increase in the amount of ITS elements being "captured" through the planning process. In fact, when first implemented, the capture rate increased from approximately 6 ITS projects in the 2008-2013 TIP to over 75 in the 2010-2015 TIP. At the time of this writing the 2012-2017 TIP is at completion and the number of ITS projects identified was 63. The section of the TIP Revision Proposal Form with the ITS detail is shown in **Figure 2** below. For more information, see the **TIP Policies and Procedures** (2).



ITS - Will this project include *any* of the following (check ALL boxes that apply):

This is NOT an inclusive or comprehensive list of ITS Architecture project elements, only common ones

☐ -Traffic monitoring sensors such as in-pavement loops/acoustic sensors	☐ -Traffic signal installation or coord.	☐ -Message Signs
☐ -RWIS pavement sensors	☐ -Traffic signal pre-emption	☐ -Transit stops/Rail stations/Airport
☐ -Video imaging and/or CCTV	☐ -Traffic signal prioritization	☐ -Other:
☐ -Remote traffic monitoring	☐ -Fiberoptic cable and/or connection	
	☐ -ITS integration	

If you checked any box the project most likely will need to be included in the Albuquerque Metropolitan Planning Area ITS Regional Architecture and New Mexico Statewide ITS Architecture before any Federal funds can be expended for any ITS component project element. For information, contact Nathan Masek at (505) 724-3620 or Nmasek@mrcog-nm.gov

If "yes", who will be the contact person for data collection? Name:

Off. Phone: (505) ###-#### Ext: email:

If "yes", after contacting the ITS coordinator, is this project included/being added to the ITS Architecture? ☐ -Yes ☐ -No

Figure 2. Excerpt of ITS Section from TIP Project Proposal Form (Source: MRCOG TIP Policy and Procedures)

ITS Corridors Map

The ITS Subcommittee has identified a network of prioritized corridors used in support of ITS planning and project implementation (**see Figure 3**). This map is updated as part of the architecture update process and is based on ITS priorities established by individual agencies as well as regional ITS planning efforts over the years including the ***Regional ITS Implementation Plan,* 2004** (3), and the current ***AMPA Regional ITS Architecture*** (4). Prioritized ITS corridors are identified, and the map legend includes corresponding reference to the ITS contact information for each stakeholder agency such that any planner, manager, or engineer has direct access to the appropriate ITS

contact person, whether it be in their own agency or another agency. The map is used for a wide range of planning and project development activities such as agency development review, land use plan updates, and project-specific support activities. A primary benefit of this map is that it effectively *extends the reach* of ITS to groups and/or planning and project development activities that are beyond the immediate purview of the ITS Subcommittee.

The format of the map has been through a few iterations as stakeholders have explored the best manner in which to "capture" ITS for input and comment at the key points in the transportation planning process. It has proven critical that this information be available to the broadest spectrum of planners, engineers, and managers, but more specifically, those not directly involved in ITS or who may not have familiar with the terminology, regional goals, etc. As such, a simplified version of the map would be needed. Originally, the regional ITS Corridors Map was a detailed product with a plethora of ITS information and symbology shown. Although that version of the map reflected regional priorities (based on previous studies) and whose content was clear to ITS staff, surprisingly, this level of detail became somewhat confusing and overwhelming when viewed by those in the planning process unfamiliar with ITS. The result was that ITS was going unchecked. Also, any ITS elements included in non-ITS projects were going undetected, resulting in lost ITS m*ainstreaming* opportunities. Ironically, by minimizing the level of detail shown on the map and simply identifying *corridors* along with the appropriate agency ITS contact information in the legend, the effectiveness of the map

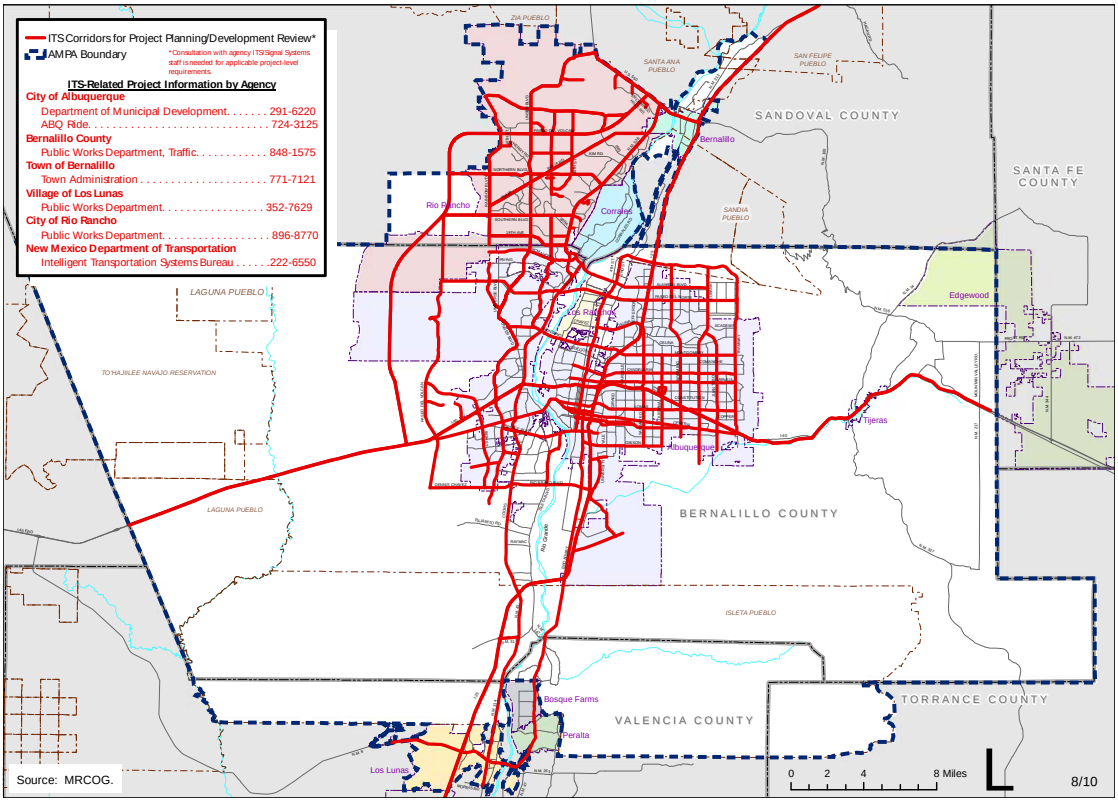


Figure 3, ITS Corridors Map V1.1 (Source: MRCOG ITS Subcommittee)

has expanded dramatically. The key in this approach has been to include the contact information on the map, and with direction given to each department manager to contact the appropriate ITS staff for input as necessary.

All member agencies of the MRCOG include the ITS Corridors map among their reference material when reviewing new project development proposals. An example of the effectiveness of this approach was demonstrated recently when a landscaping project being proposed by a municipalities' Parks and Recreation department crossed the desk of one of the development review/case planners. The ITS Corridors map was used to contact the appropriate ITS staff whereby the comment for the inclusion of fiber-optic conduit as part of this non-transportation project was made. Another example of ITS "project mainstreaming" and an opportunity for sharing the cost of ITS implementation.

ITS Corridor Profiles

Beginning this year (2011), the ITS Subcommittee initiated development of ITS Corridor Profiles comprising common ITS infrastructure and content data identified for existing and near-term deployment focused on a subset of top ranked CMP corridors (**Figure 4)**. Elements such as telemetry (fiber, conduit, etc), Dynamic Message Signs (DMS), Closed Circuit Television (CCTV) installations, ownership, transit service, and jurisdictional information are included, as well information such as current signal timing plans, memorandums of agreement currently in place or needed, etc. This collection of information when produced as a single-source ITS product in the form of a corridor "map" and associated deployment summary sheet is proving quite informative as "stand-alone" information that is being integrated into such efforts as the CMP Committee, presentations to other MRCOG committee such as the TCC and the MTB, agency staff review, or disseminating to the web via the ITS Subcommittee's page on the MRCOG site. Further, this data is proving useful for each agency's own infrastructure accounting and corridor planning efforts when viewing multi-agency corridors.

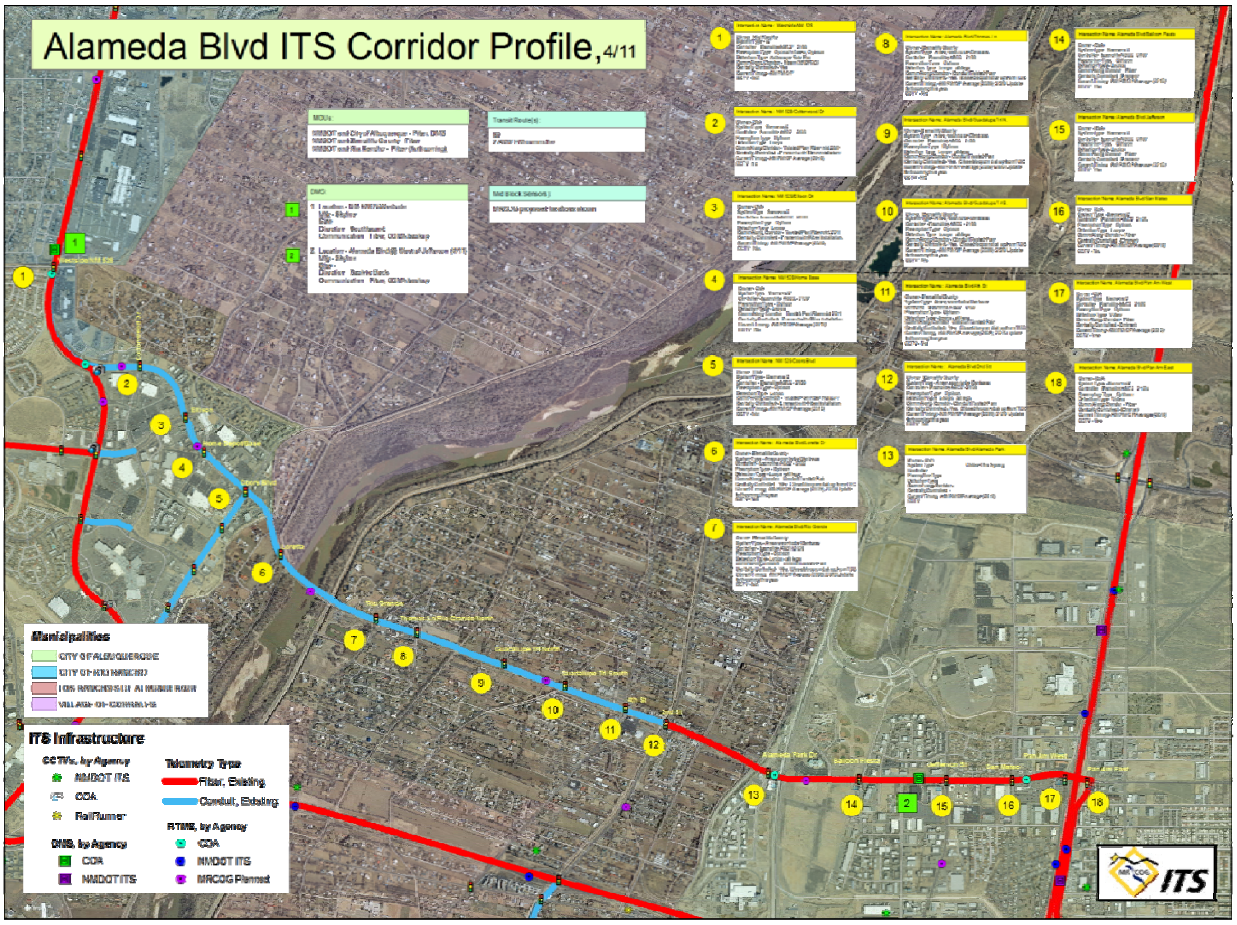


Figure 4, ITS Corridor Profile, Alameda Blvd, CMP Ranking #1 (Source: MRCOG ITS Subcommittee)

Another benefactor group for the ITS Corridor Profiles include CMP members or other staff who are not involved on the ITS Subcommittee or who may not have strong knowledge regarding ITS. The summary deployment maps are easily referenced in the absence of ITS staff and can be discussed effectively on a project and/or corridor basis. The product also supports FHWA initiatives as the Every Day Counts Initiative, and its Adaptive Signal Control component. The example corridor shown above has been considered for inclusion in that program.

The Convergence of Committees: ITS and CMP

Both the ITS Subcommittee and the CMP Committee are important participants in the MPO's Transportation Planning Process. They share the common strategy of Incident Management or Transportation Systems Management using operational improvements associated with the implementation of ITS. In fact, one of the strategies included in the CMP "Toolbox" is ITS.

The **CMP** (6**)** is a federal requirement of all MPOs and is used as a management tool for the identification and monitoring of congestion. It is intended to inform the transportation planning and programming process with a meaningful and objective data-driven process such that scarce transportation dollars are spent in areas of most need, both geographically and congestion/project type. The CMP is directly integrated in the MRCOG's transportation planning process and reflects the goals and objectives included in the long range MTP. A methodology is used to identify congestion, establish corridor ranking, and a methodology for monitoring is in place based on objective measurable criteria. Three measurable performance indicators utilize data collection programs conducted at MRCOG. These measures include: 1) volume to capacity ratios, 2) speed differentials, and 3) crash rates. The transportation system is evaluated and the top 30 "Congested Corridors" are identified. Next, the identification of direct project-level mitigation elements take form of a prioritization process (PPP) used for the ranking of projects proposed for the TIP based on these elements. The PPP was developed based on three goals from the MTP Goals; they include: *1. Preserve and improve Quality of Life, 2.Mobility of People and Goods, and 3. Support Economic Activity and Growth*. Underlying objectives for each goal further refine the project ranking criteria with objective as well as subjective indicators, and points are awarded to the project accordingly. A CMP "Toolkit" includes a matrix of 32 mitigation strategies comprising main 4 categories, as in:

- Active Roadway Management, 8 strategies total; 2 explicitly ITS
    - Traffic signal timing and coordination,
    - Traffic signal equipment modernization,
- Travel Demand Management/Alternative Travel Modes, 12 strategies total; 3 explicitly ITS
    - Transit queue jumper and priority,
    - Electronic fare collection,
    - Parking management,
- Incident Management, 2 strategies total; both ITS
    - Incident management plans,
    - Incident response and courtesy patrols,
- Physical Roadway Capacity, 10 strategies total, none ITS

Note in the categories list above, at least 7 ITS strategies easily fit within 3 of the 4 categories identified. For the full matrix, see **the Appendix**.

The 30 CMP corridors are identified using the measureable congestion indicators, and comprise the "CMP Network". The CMP Committee reviews the strategies from the matrix, and prioritizes the strategies as "high", "medium", or "low" for each corridor, resulting in a final recommendation matrix to assist in the identification of appropriate project improvements to be programmed in the Transportation Planning Process and the development of the TIP/MTP. The CMP network is continually monitored for changes in congestion based on growth and travel conditions, but more importantly, for any change or *improvement* resulting from projects identified as part of the CMP. The

2 year programming cycle of the TIP, combined with the ongoing data collection described above establishes a built-in monitoring mechanism that offers the opportunity to directly measure congestion mitigation strategies – an invaluable project programming tool for the MPO.

The **ITS Subcommittee** is comprised of ITS stakeholders in the MPO, and includes member agencies as well as some private sector participation. The inclusion of both private sector and public sector participants has been a windfall opportunity to build regional ITS support, as well as provide additional participation that introduces additional flexibility for the MPO. MRCOG created the ITS Subcommittee as a subcommittee to the Transportation Coordinating Committee, thereby effectively establishing a direct link between ITS planners, engineers, and operators and the region's transportation decision making body, ie, the Metropolitan Transportation Board. Monthly meetings address issues such as ITS projects, the AMPA Regional ITS Architecture including acting as the Architecture Maintenance Group, TIP/MTP project programming, ITS Architecture Standards and Systems Engineering, new and innovative ITS Practices, integration with the CMP, among other items. Much of the benefits of ITS result from the coordination and cooperation of all ITS "stakeholder" agencies within the region and the MRCOG ITS Committee has been established as the forum for ITS planning among MRCOG member agencies and other ITS stakeholders interested in participating.

Convergence of the two committees occurs within the transportation planning process with shared representation between MRCOG and agency staff attending at least one, but in some cases both meetings. Additionally, the two committees coordinate on many levels and MRCOG staff strategize with committee members to capitalize on shared common effort; development of the Congestion Management Process and project priorities, in particular. The "priority" ranking for ITS projects, and especially the identification of those projects that include ITS has been a result of the coordination between the two committees. Without the ITS Subcommittees input into the CMP project submittal criteria, critical ITS elements were at risk to go undetected in the programming process. Expansion of data collection and data archiving has benefitted from the two committees coordination efforts. A mentioned above, the CMP includes congestion data monitoring, and ITS project improvements such as new speed and volume sensors (MVDS), GPS based transit speed data collection, or crash-clearance time monitoring are continually referenced in CMP activities. Archiving of ITS data collection permits subsequent querying of the data, which is critical in the evaluation of project impact (before and after studies, for example).

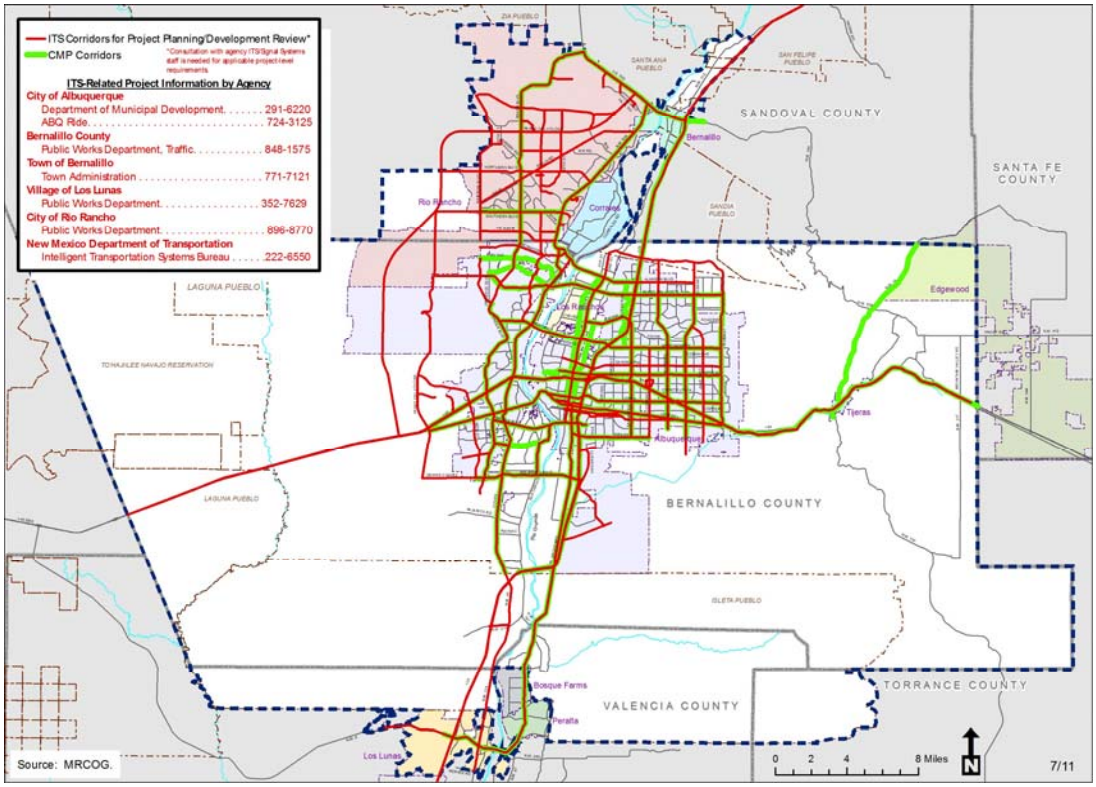


Figure 4, Combined ITS Corridors and CMP Corridors (Source: MRCOG ITS Subcommittee)

ITS Architecture Maintenance, Systems Engineering, and ITS project support in the Transportation Planning Cycle

The baseline Regional ITS Architecture was revised in 2004 with a review and identification of all stakeholders, reassessment of regional ITS goals, and updates based on the current architecture standards and newly adopted market packages. This update came at a time that presented renewed vigor to a maturing ITS planning and implementation effort in the AMPA as ITS project deployment was emerging beyond small scale individual agency projects to larger scale regionally-integrated projects. The NMDOT ITS Bureau was implementing a Transportation Management Center with local and statewide capabilities, and municipal stakeholders had their Transportation Operations Centers in varying stages of deployment. Systems Engineering requirements were becoming forefront in ITS project deployment and it was clear that the MRCOG MPO would have the best opportunity to support the regional integration of ITS consistent with federal requirements and regional ITS goals.

The 2004 baseline architecture established the framework for a renewed ITS planning and project implementation platform. A Maintenance Plan was developed that fully integrates ITS project development into the transportation planning process (as outlined

in the previous sections above). A maintenance "addendum" process was established coupled to TIP development that set forth all the mechanisms to ensure that ITS projects would be planned and coordinated with regional ITS goals and a high degree of stakeholder involvement. The biennial AMPA Regional ITS Architecture Addendum (5) serves as the current "snapshot" of ITS architecture for programmed projects in the following ways:

- ITS deployment summary statistics are developed
- ITS Market Packages are mapped to the projects in the current TIP
- Any changes, regional and national, to the Architecture are noted
- Existing ITS Infrastructure Maps are included
- Project-level Systems Engineering Project Certification guidance

An example of the TIP project-level Market Package mapping contained in the Addendum is shown in **Figure 5** below. The excerpt is for Category I projects, and shows the project description and "recommended" or "agency-proposed" market packages as programmed in TIP. The distinction between the "recommended" versus "agency proposed" project market packages permits for flexible/phased implementation of ITS within the guidance of the larger baseline Architecture. Projects are easily referenced for architecture mapping for Systems Engineering certification.

Category I. Traffic Management, Incident Management, Maintenance Operations Projects, and Studies					BLACK text = Completed or Projects in 2010-2015 TIP BLUE text = Projects programmed in 2012-17 TIP			
MTP/TIP Project Database Information					ITS Regional Architecture Information and TIP Project Descriptions			
Seq.	MPO ID	TIP Yr	Project Name in TIP	Lead Agency	Proj Type	Recommended MPs in Regional Architecture	Agency-Proposed Project Market Packages (MPs) – Use This Column for Project MPs	Market Package Description
1		all	NMRoads.COM	NMDOT ITS	ITS-TSM	ATIS01,2	ATIS01,2	Broadcast Traveler Information, Interactive Traveler Information
2	48.7	10	I-25 Safety Project	NMDOT ITS	ITS-TSM		ATMS01, ATMS06	Network Surveillance, Traffic Info Dissemination (DMS)
3	103.0	11-17	Albuquerque T M S	Abq DMD	ITS-TSM	ATMS01, 03	AMTS01, 3, 6, AD1, APTS9*	Network Surveillance, Surface St Control, DMS, ITS Data Mart, Transit Signal Priority
4	464.0	10-12	Unser Blvd Connection (Middle)	Abq DMD	Capacity	ATMS01, 3, APTS9*	ATMS01, 3, APTS9*	Network Surveillance, Surface St Control, Transit Signal Priority
5	585.1	11	Wyoming Blvd Widening Ph I	Abq DMD	Capacity	ATMS03	AD1, ATMS01, 3	ITS Data Mart, Network Surveillance, Surface Street Control
6	585.3	11	Wyoming Blvd Widening Ph II	Abq DMD	Capacity	ATMS01,3	AD1, ATMS01, 3	ITS Data Mart, Network Surveillance, Surface St Control
7	587.0	11-17	Great Streets	Abq DMD	misc		ATMS01, 3, 6, AD1, APTS9*	Network Surveillance, Surface St Control, DMS, ITS Data Mart, Transit Signal Priority
8	616.0	10	Coors Corridor Study	Abq DMD	misc		All MPs	

Figure 5, Example of ITS Project Market Package Mapping (Source: 5)

The ITS Subcommittee is in charge of maintaining the regional ITS Architecture, and the change management process associated with maintenance activities has proven robust enough to capture nearly all ITS planning and project compliance-related issues experienced thus far. Ease of use has been a priority of the effort such that the architecture compliance retains a "value added" and is a positive incentive to include ITS elements (unfortunately, ITS has historically suffered from being in the "first to go on the chopping block" category when project costs exceed available funding). As the process matures, the plan is to integrate additional performance improvement criteria into the project evaluation process the further promote ITS, particularly in the performance-based CMP project criteria.

Regional ITS Infrastructure Geodatabase

Increased ITS planning activity has necessitated the need for a robust approach to create a common framework to house agency ITS infrastructure deployment data for

the region. A central repository of ITS deployment data can serve planning purposes of the MPO 's regional coordination perspective, assist project integration, facilitate resource sharing, coordinate data collection, and promote integrated system management among all stakeholders.

ITS infrastructure is like any other capitol asset, and as such is included in agency database and inventory monitoring activities. The ITS Subcommittee identified additional capability needs beyond that of a simple flat-file inventory; the desired platform would need to provide expanded capability such as regional summaries and/or mapping of existing deployments in support of maintaining the Regional ITS Architecture, corridor-specific ITS deployment information to assist in ITS and other non-ITS project-level analysis and design, or ITS infrastructure gap-analysis to identify additional needs or functionality.

The choice was clear that the platform be in a geographic information system (GIS), and that it live in the ESRI ArcGIS world. The ESRI ArcGIS platform was chosen due to the widespread familiarity and extensive data development in New Mexico (we are considered an ESRI state, meaning that the vast majority of GIS users rely on ESRI's ArcGIS platform). Once the decision was made to proceed in GIS, key participants were identified from both ITS and GIS for each stakeholder and a user's group was formed.

Nearly all stakeholder agencies maintain GIS and as it turned out, some in GIS were beginning to include ITS assets in their infrastructure inventory and pavement management activities. An effort on the part of the City of Albuquerque to inventory their entire ITS infrastructure was taking shape, and similar efforts by the NMDOT, Bernalillo County, and Rio Rancho had begun. The opportunity was there for the ITS Subcommittee to facilitate an expansion of the City's project to a larger effort to incorporate regional needs by allowing the inclusion of additional GIS features identified by the stakeholders. A new level of inter-departmental coordination among ITS and GIS staff was emerging which would ensure that this effort to create a regional geodatabase (rgdb) for ITS Infrastructure would be successful. The user group involving GIS staff and ITS staff to develop and implement the rgdb meets regularly.

The first major step was to agree on the set of GIS "features" that would comprise the geodatabase. A universe of ITS elements was soon identified to satisfy all agency needs, and what was clear was that DOT and municipalities' database needs were different. A range of ITS feature classes with associated attributes necessary to meet the composite of agency needs was finalized in what is referred to in GIS terms as a "schema". These feature class elements include:

- Closed Circuit TVs (CCTVs) – point feature, with attributes
- Dynamic Message Signs (DMS) – point feature, with attributes
- Pole – point feature, with attributes as a central mounting device for ITS elements

- Pull-Boxes – point feature, with attributes
- Service Connections – point feature, with attributes
- System Cabinets – point feature, with attributes
- Telemetry – line feature, with attributes
- VDS/Sensors – point feature, with attributes

Each feature class contains an extensive set of detailed attributes such as owner, manufacture, type, serial identification, maintenance history, image, etc. such that the geodatabase will serve the planning and project development needs of ITS stakeholders as well as provide the level of detail that agency public works inventory and/or Roadway Management program requirements.

Initially, the desktop ArcGIS platform was identified, and, combined with the consistency of a common schema, was looking promising. Each stakeholder would develop and maintain their respective datasets, and the MRCOG would maintain the regional dataset comprised of all stakeholder inputs. ArcGIS Server would be employed to serve the composite regional geodatabase. A robust database maintenance framework was identified as critical to retaining accuracy and currency of the data. With these early decisions essentially made, focus continued on developing and refining the schema, and it was during that time and prior to any data integration that ESRI released the web-based **ArcGIS.com**, which provides a web-based platform with ease of use, and increased access and operability. With the new platform "on the cloud" and essentially free to users, many of the integration and maintenance hurdles facing the effort were lowered significantly.

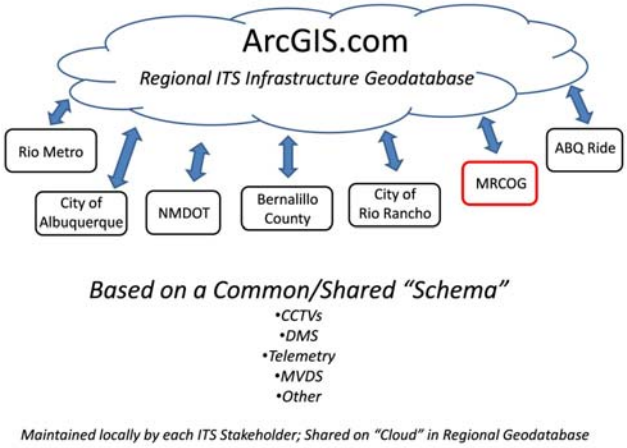


Figure 6, Regional Geodatabase; Structure, Stakeholders, and Data Flows

The unified schema has established regional congruency that brings all datasets into a common framework, which has provided utility for ITS project planning and project deployment monitoring, as well as other public-works related activities indirectly related

to ITS, such as communications sharing, infrastructure query, maintenance activities, and related infrastructure project development.

Figure 6 above shows the GIS environment and framework that supports the regional ITS gdb. Each stakeholder agency has GIS capabilities, and data maintenance activities remain in-house. The web-based ArcGIS.com environment allows for individual updates to the regional dataset by each agency, and permits the data to be uploaded to the "cloud", thus eliminating any concern over security, firewalls, etc.

Collaborative Transportation Planning Environment and ensuring the future success of ITS

In capitalizing on the collaborative environment of a Metropolitan Planning Organization (MPO) where all transportation agencies and all travel modes are represented, MRCOG has successfully integrated ITS project development into the transportation planning process in a manner that can ensure that ITS stakeholder needs are considered and efforts coordinated effectively. Further integration with ITS stakeholders in the MRCOG region will be had as ITS takes the next step with a near term project for a Regional TMC. This project will consolidate some transportation operations and roadway maintenance activities, will involve regional transit operators, and will also directly involve first responders and expanded Incident Management activities on freeways and arterials in the AMPA.

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APPENDIX:

CMP Strategies Matrix, MRCOG Congestion Management Process, 2011