



Michigan Department of Transportation
Regional ITS Architectures and Deployment Plans

Southwest Region and Portions of University Region

Final Regional ITS Architecture Report

Prepared by:



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of Michigan, Inc.



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TABLE OF CONTENTS

FINAL REGIONAL ITS ARCHITECTURE REPORT – SOUTHWEST REGION AND PORTIONS OF UNIVERSITY REGION

TABLE OF CONTENTS.....	I
LIST OF ACRONYMS	III
1. INTRODUCTION	1
1.1 Project Overview.....	1
1.2 Document Overview.....	1
1.3 Assessment	2
1.4 The Southwest Region and Portions of University Region.....	3
1.4.1 Geographic Overview.....	3
1.4.2 Transportation Infrastructure.....	3
1.4.3 Southwest Region and Portions of University Region ITS Plans	5
1.4.4 Stakeholders.....	5
2. REGIONAL ITS ARCHITECTURE DEVELOPMENT PROCESS.....	9
3. CUSTOMIZATION OF THE NATIONAL ITS ARCHITECTURE FOR THE SOUTHWEST REGION AND PORTIONS OF UNIVERSITY REGION.....	11
3.1 Systems Inventory	11
3.2 Regional Needs	12
3.3 Element Customization.....	12
3.3.1 Subsystems and Terminators	12
3.3.2 ITS Inventory by Stakeholder.....	13
3.3.3 Top Level Regional System Interconnect Diagram	26
3.4 Market Packages.....	28
3.4.1 Selection and Prioritization of Regional Market Packages.....	28
3.4.2 Customized Market Packages.....	31
3.4.3 Regional ITS Needs and Customized Market Packages	31
3.5 Architecture Interfaces.....	33
3.5.1 Element Connections	33
3.5.2 Data Flows between Elements.....	34
4. APPLICATION OF THE REGIONAL ITS ARCHITECTURE.....	36
4.1 Functional Requirements	36
4.2 Standards.....	36
4.3 Operational Concepts	39
4.4 Potential Agreements.....	47
4.5 Phases of Implementation	49
4.6 Incorporation into the Regional Planning Process	50
5. USE AND MAINTENANCE PLAN FOR THE REGIONAL ITS ARCHITECTURE	51
5.1 Process for Determining Architecture Conformity	51
5.2 Maintenance Process.....	52
5.3 Procedure for Submitting ITS Architecture Changes Between Scheduled Updates	54

APPENDIX A – NATIONAL ITS ARCHITECTURE MARKET PACKAGE DEFINITIONS

APPENDIX B – CUSTOMIZED MARKET PACKAGES

APPENDIX C – ELEMENT FUNCTIONAL REQUIREMENTS

APPENDIX D – STAKEHOLDER DATABASE

APPENDIX E – ARCHITECTURE MAINTENANCE DOCUMENTATION FORM

LIST OF FIGURES

Figure 1 - Study Area Boundaries	4
Figure 2 - Study Area ITS Architecture and Deployment Plan Development Process	9
Figure 3 - National ITS Architecture Physical Subsystem Interconnect Diagram	13
Figure 4 - Southwest and Portions of University Regional System Interconnect Diagram	27
Figure 5 - Example Market Package Diagram: Surface Street Control	31
Figure 6 - Example Interconnect Diagram: MDOT Traveler Information Website.....	34
Figure 7 - Example Flow Diagram: ATIS1-1 – MDOT Surface Transportation, Construction, Maintenance, Incident and Special Event Information System	35
Figure 8 - Process for Documenting Architecture Performance	55

LIST OF TABLES

Table 1 - Summary of Architecture Assessment Categories	2
Table 2 - County Maintenance Responsibility	5
Table 3 - Study Area Stakeholder Agencies and Contact	6
Table 4 - Study Area Stakeholder Descriptions	14
Table 5 - Study Area Inventory of ITS Elements	16
Table 6 - Study Area Market Package Prioritization by Functional Area	29
Table 7 - Regional ITS Needs and Corresponding Market Packages	32
Table 8 - Study Area Applicable ITS Standards	37
Table 9 - Southwest Region and Portions of University Region Stakeholder Roles and Responsibilities	40
Table 10 - Study Area Potential Agreements	49
Table 11 - Regional ITS Architecture and Deployment Plan Maintenance Summary.....	53

LIST OF ACRONYMS

AHS	Automated Highway System
AMBER	America's Missing: Broadcast Emergency Response
ANSI	American National Standards Institute
ATMS	Advanced Traffic Management System
AVL	Automated Vehicle Location
AWOS	Automated Weather Observing System
CCTV	Closed Circuit Television
CJIC	Criminal Justice Information Center
CRC	County Road Commission
DCM	Data Collection and Monitoring
DEM	Department of Emergency Management
DMS	Dynamic Message Sign
DNR	Department of Natural Resources
DPW	Department of Public Works
DSRC	Dedicated Short Range Communication
EOC	Emergency Operations Center
AASHTO	American Association of State Highway and Transportation Officials
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HAR	Highway Advisory Radio
HAZMAT	Hazardous Materials
HRI	Highway Rail Intersection
IDAS	ITS Deployment Analysis Software
IEEE	Institute of Electrical and Electronics Engineers
IMMS	Incident Management Message Sets
ISO	International Standards Organization
ISP	Information Service Provider
ITS	Intelligent Transportation System
MAC	Medium Access Control

MDT	Mobile Data Terminal
MIOC	Michigan Intelligent Operations Center
MOU	Memorandum of Understanding
MSP	Michigan State Police
NEMA	National Emergency Management Association
NOAA	National Oceanic and Atmospheric Administration
NTCIP	National Transportation Communications for ITS Protocol
NWS	National Weather Service
RWIS	Roadway Weather Information System
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible and Efficient Transportation Equity Act – A Legacy for Users
SDO	Standards Development Organization
STMF	Simple Transportation Management Framework
TCP/IP	Transmission Control Protocol/Internet Protocol
TEA-21	Transportation Equity Act for the 21st Century
TMC	Transportation Management Center
TOC	Traffic Operations Center
TSC	Transportation Service Centers
TIP	Transportation Improvement Program
UDP/IP	User Datagram Protocol/Internet Protocol
USDOT	United States Department of Transportation
VIVDS	Vehicle Imaging Video Detection Systems
XML	Extensible Mark-up Language

1. INTRODUCTION

1.1 Project Overview

Development of a regional intelligent transportation system (ITS) architecture is one of the most important steps in planning for and implementing ITS in a region. ITS architectures provide a framework for implementing ITS projects, encourage interoperability and resource sharing among agencies, identify applicable standards to apply to projects, and allow for cohesive long-range planning among regional stakeholders. The ITS architecture allows stakeholders to plan for how they want their system to work in the long-term, and then break out the system into smaller, more modular pieces that can be implemented over time as funding permits.

ITS architectures satisfy the conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) bill passed in 2005. In response to Section 5206(e) of TEA-21, the Federal Highway Administration (FHWA) issued a final rule and the Federal Transit Administration (FTA) issued a final policy that required regions implementing any ITS projects using federal funds to have an ITS architecture in place by April 2005. After this date, any ITS projects must show conformance with their regional ITS architecture in order to be eligible for funding from FHWA or FTA. Regions that had not yet deployed ITS were given four years to develop an ITS architecture after their first ITS project proceeded to final design.

In January 2007, the Michigan Department of Transportation (MDOT) began development of the Southwest and portions of University Regional ITS Architecture. The Regional ITS Architecture includes all of the MDOT Southwest Region, and Jackson and Shiawassee Counties of the University Region. The Regional Architecture focuses on a 15-year vision of ITS for the study area. In addition, a separate ITS Deployment Plan has been developed to identify and prioritize specific ITS projects recommended for the study area in order to implement the ITS architecture. The ITS Deployment Analysis Software (IDAS) was utilized to evaluate and prioritize the list of ITS projects outlined for the study area.

URS Corporation is the prime consultant. Cambridge Systematics will perform the IDAS software modeling for the deployment plan. Kimley-Horn is providing a continuity role with respect to the concurrent ITS architecture and deployment plans within other MDOT Regions.

1.2 Document Overview

The Southwest and portions of University Regional ITS Architecture report is organized into five key sections:

Section 1 – Introduction

This section provides an overview of the National ITS Architecture requirements, the Southwest and portions of University Regional ITS Architecture, and the key features and stakeholders in the study area.

Section 2 – Regional ITS Architecture Development Process

An overview of the key steps involved in developing the ITS architecture for the study area is provided in this section. These steps include a discussion of stakeholder involvement, architecture workshops, and the architecture development process.

Section 3 – Customization of the National ITS Architecture for Southwest and portions of University Region

This section contains a summary of regional needs and details the customization of the National ITS Architecture to meet the ITS vision for the study area. The market packages that were selected for the study area are included in this section and interconnects are presented, including the “sausage diagram” showing the relationships of the key subsystems and elements in the area.

Section 4 – Application of the Regional ITS Architecture

Functional requirements and standards that apply to the study area, as indicated by the Regional ITS Architecture, are presented in Section 4. Operational concepts identifying stakeholder roles and responsibilities have been prepared and potential agreements to support the sharing of data and resources have been identified.

Section 5 – Maintaining the Regional ITS Architecture

A use and maintenance plan has been developed for the Southwest and portions of University Regional ITS Architecture and is included in this section. The plan outlines the procedure for updating the ITS architecture over time.

The Regional ITS Architecture also contains five appendices:

- Appendix A – National ITS Architecture Market Package Definitions;
- Appendix B – Customized Market Packages;
- Appendix C – Element Functional Requirements;
- Appendix D – Stakeholder Database;
- Appendix E – Architecture Maintenance Documentation Form.

1.3 Assessment

In the Final Draft of the Southwest and portions of University Regional ITS Architecture and Deployment Plan, the document will be assessed based on twelve items derived from both the April 8, 2001 USDOT ITS Architecture and Standards Conformity Rule/Policy and from the architecture development process described in the *Regional ITS Architecture Guidance Document* (FHWA July, 2006). A listing of these items is shown in **Table 1**.

Table 1 - Summary of Architecture Assessment Categories

Content Criteria	Architecture Implementation Criteria
1. Architecture Scope	8. Implementation Plan (use)
2. Stakeholder Identification	9. Maintenance Plan
3. System Inventory	10. Agreements
4. Needs and Services	11. Standards Identification
5. Operational Concept	12. Project Sequencing
6. Functional Requirements	
7. Interfaces/Flows	

1.4 The Southwest Region and Portions of University Region

1.4.1 Geographic Overview

The study area is defined by the boundary of Lake Michigan to the west, the Grand Region to the north, the University Region to the east, and the State of Indiana to the south, as shown in **Figure 1**. The study area encompasses all 9 of the counties of the Southwest Region of Michigan as well as Jackson and Shiawassee Counties of the University Region.

The largest cities within the geographical boundaries of the study area are Kalamazoo, Battle Creek, Jackson, Benton Harbor and St Joseph. When identifying the stakeholder group, the project team coordinated with MDOT to invite the appropriate townships, cities, counties, state and federal agencies, area transit providers, and other agencies. **Table 3** identifies the stakeholders that participated in the process.

A 15-year vision for ITS in the Region was considered when developing the architecture. In the ITS Deployment Plan, the 15-year time frame was broken down into smaller time periods to prioritize and sequence the projects. The naming convention used for elements in the Southwest and portions of University Regional ITS Architecture is consistent with the naming convention that will be used in the North, Bay, Superior, and Grand Regions and the Statewide ITS Architecture. This consistency provides seamless connections to those other architectures without requiring that they be specifically called out. Statewide initiatives - such as statewide commercial vehicle operations and 511 traveler information service - are referenced in the regional ITS architecture, but will be addressed in further detail in the Statewide ITS Architecture.

1.4.2 Transportation Infrastructure

As illustrated in **Figure 1**, the study area is connected by several freeways and highways. The primary roadway facilities include I-94, I-196, I-69, US-131, US-31, and US-127.

I-94 is a major east-west roadway that connects most of the major cities in southern Michigan including: Port Huron, Detroit, Ann Arbor, Jackson, Battle Creek, Kalamazoo and St. Joseph/Benton Harbor. I-94 is a major route for truck traffic and international trade and serves traffic utilizing all three of Lower Michigan's international border crossings.

I-196 runs primarily north-south along the Lake Michigan coast and connects Grand Rapids, Holland, South Haven and I-94.

I-69 is a major roadway that connects Port Huron, Flint, Lansing, Marshall and Coldwater. I-69 intersects Indiana's I-80/90 toll road just south of the Michigan-Indiana border. I-69 is also a major route for truck traffic and international trade.

US-131 is a major north-south roadway that connects Grand Rapids, Kalamazoo and northern Indiana. US-131 is a freeway north of Portage where it then transitions to a divided highway, and is a two lane highway south of Three Rivers.

US-31 runs concurrently with I-196 for much of the study area but branches off in Benton Harbor where it continues south to the Michigan-Indiana border.

US-127 is a freeway north of Jackson and a two lane highway south of Jackson.

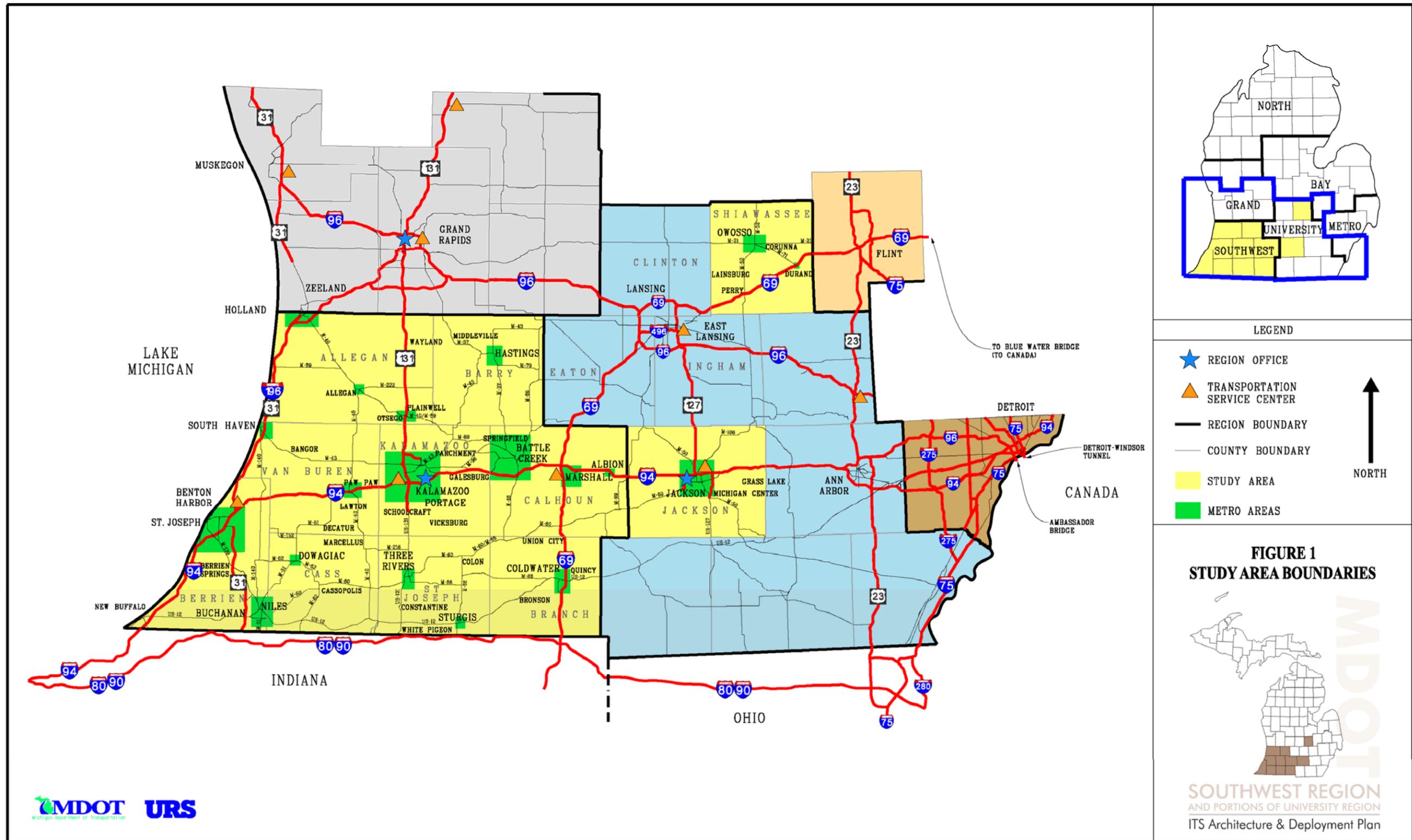


Figure 1 - Study Area Boundaries

1.4.3 Southwest Region and Portions of University Region ITS Plans

The Southwest Region and portions of University Region began the development of a Regional ITS Architecture when MDOT contracted with a consultant to develop several regional ITS architectures and deployment plans in the State of Michigan. Version 5.1 of the National ITS Architecture was used in the Architecture development.

In order for a region to receive funding for ITS projects from the Highway Trust Fund, the United States Department of Transportation (USDOT) requires that the region have an ITS architecture developed. This requirement only applies to regions with existing ITS infrastructure deployed. For regions that do not have any ITS infrastructure deployed, the USDOT requires that they have an ITS architecture within four years of their first ITS project entering final design.

There are no past ITS studies that include the study area. A pre-deployment plan was completed in 2002 for Ingham, Eaton, and Clinton counties, which are located adjacent to the study area. MDOT is currently conducting a statewide Advanced Traffic Management System (ATMS) software procurement and a statewide ITS architecture study, which will have an impact on the study area.

Funding for an ITS project in Calhoun County has been set aside as well as for transit related ITS projects. The completion of this report will secure these funds as well as provide the opportunity for additional funds for ITS related projects in the study area.

1.4.4 Stakeholders

Due to the fact that ITS often transcends traditional transportation infrastructure, it is important to involve stakeholders outside of transportation agencies in the architecture development and visioning process. Input from these stakeholders, both public and private, is a critical part of defining the interfaces, integration needs, and overall vision for ITS in a region.

The Southwest Region and Portions of University Region perform much of the maintenance functions on the state routes, which is somewhat different than the other MDOT Regions. **Table 2** describes the counties maintenance responsibility for state routes.

Table 3 contains a listing of stakeholders in the study area who have participated in the project workshops or provided input to the study team as to the needs and issues that should be considered as part of the Regional ITS Architecture. Other stakeholders that were invited to participate but were not able to attend were provided minutes of workshops to encourage their participation as much as possible.

Table 2 - County Maintenance Responsibility

County	Responsibility for Maintenance of MDOT Roads
Branch	County for all routes
Calhoun	County for all, except I-94 which is covered by MDOT
Barry	MDOT for all routes
Allegan	MDOT for all routes
Kalamazoo	MDOT for routes outside City of Kalamazoo, City for routes within City of Kalamazoo
St Joseph	MDOT for all routes
Cass	MDOT for all routes
Berrien	MDOT for all routes except 10 miles of US-31 at I-94 which is covered by the county
Van Buren	MDOT for all routes except M-51 at I-94 and M-152 which are covered by the county
Jackson	Jackson County for all routes
Shiawassee	Shiawassee County for all routes

Table 3 - Study Area Stakeholder Agencies and Contact

Stakeholder Agency	Address	Contact
Allegan County Road Commission	1308 Lincoln Rd, Allegan, MI 49010	William Nelson
Battle Creek Area Transportation Study (BCATS)	601 Avenue A, Springfield MI 49015	Andy Tilma
Battle Creek Emergency Services	20 North Division St, Battle Creek MI 49014	James Zoss
Battle Creek Transit	339 West Michigan Ave, Battle Creek, MI 49017	Jerry Hutchison
Battle Creek Transit	339 West Michigan Ave, Battle Creek, MI 49017	Richard Werner
Benton Harbor Police Department	200 East Wall Street, Benton Harbor MI 49022	Randy Pompey
Calhoun County	161 East Michigan Ave, Battle Creek MI 49014	Larry Utterback
Calhoun County Road Commission	13300 15 Mile Rd, Marshall MI 49068	Dennis Randolph
City of Battle Creek	150 South Kendall St, Battle Creek MI 49015	Max Phares
City of Kalamazoo	415 Stockbridge Ave, Kalamazoo MI 49001-2898	Frank Szopo
City of Kalamazoo	415 Stockbridge Ave, Kalamazoo MI 49001-2898	John Seelman
City of Kalamazoo	415 Stockbridge Ave, Kalamazoo MI 49001-2898	Michael Cross
City of Kalamazoo	415 Stockbridge Ave, Kalamazoo MI 49001-2898	Shahid Abbas
City of Marshall	323 West Michigan Ave, Marshall MI 49068	Carl Fedders
City of Portage	7719 South Westnedge Ave, Portage MI 49002	Muhammad Arif
City of Portage	7719 South Westnedge Ave, Portage MI 49002	Ray Waurio
City of South Haven	1199 8th Avenue, South Haven, MI 49090	Brian Dissette
Comstock Fire	6138 King Hwy, Kalamazoo, MI 49048	Rich Van Oosterum
Federal Highway Administration - MI	315 West Allegan St, Rm 201, Lansing MI 48933	Sarah Koepke
FHWA - Michigan	315 West Allegan, Room 201, Lansing, MI 48933	Morrie Hoevel
Indiana Department of Transportation	8620 East 21st Street, Indianapolis, IN 46219	Jay Wasson
Indiana Department of Transportation	8620 East 21st Street, Indianapolis, IN 46219	Troy Boyd
Jackson Transportation Authority	2350 East High Street, Jackson MI 49203	Cameron McCollum
Jackson Transportation Authority	2349 East High Street, Jackson MI 49203	Oliver Lindsay
Kalamazoo Area Transportation Study	3801 East Kilgore Road, Kalamazoo MI 49001	Jon Start
Kalamazoo Area Transportation Study	3801 East Kilgore, Kalamazoo, MI 49001	Steven Stepek

Stakeholder Agency	Address	Contact
Kalamazoo County Road Commission	3801 East Kilgore, Kalamazoo, MI 49001	Allan Galicia
Kalamazoo Metro Transit System	530 North Rose St, Kalamazoo, MI 49007	Carmine Lewis
Kalamazoo Metro Transit System	530 North Rose St, Kalamazoo, MI 49007	Tony Givhan
Kalamazoo Metro Transit System	530 North Rose Street, Kalamazoo, MI 49007	William Schomisch
Kalamazoo/Battle Creek International Airport	5235 Portage Road, Kalamazoo, MI 49002	Ron Shutler
Kimley-Horn	3001 Weston Parkway, Cary, NC 27513	Jeff Dale
Marshall Police Department	323 West Michigan, Marshall MI 49068	Brett Pehrson
Michigan Department of Transportation	15300 West Michigan Ave, Marshall, MI 49068	Annjanette Kremer
Michigan Department of Transportation	15300 West Michigan Ave, Marshall, MI 49068	Brad Wieferich
Michigan Department of Transportation	8885 Ricks Road Lansing, MI 48909	Collin Castle
Michigan Department of Transportation	1501 East Kilgore Rd, Kalamazoo, MI 49001	David Van Stensel
Michigan Department of Transportation	4701 West Michigan Ave, Jackson, MI 49201	Jennifer Foley
Michigan Department of Transportation	6345 American Ave, Portage, MI 49002	Kevin Roberts
Michigan Department of Transportation	5372 South 9th Street, Kalamazoo, MI 49009	Michael Bippley
Michigan Department of Transportation	1501 East Kilgore Rd, Kalamazoo, MI 49001	Paula Wiese
Michigan Department of Transportation	5372 South 9th Street, Kalamazoo MI 4909	Pete Pfeiffer
Michigan Department of Transportation	Van Wagoner Bldg, 425 West Ottawa St, Lansing, MI 48909	Rick Fowler
Michigan Department of Transportation	4701 West Michigan Ave, Jackson, MI 49201	Stephanie Palmer
Michigan Department of Transportation - Kalamazoo TSC	5372 South 9th Street, Kalamazoo MI 49009	Michelle O'Neill
Michigan Department of Transportation, Bureau of Aeronautics	2700 East Airport Service Dr, Lansing, MI 48906	Gary Ross
Michigan Department of Transportation, Coloma TSC	3880 Red Arrow Highway, Benton Harbor, MI 49022	Gary Loyola
Michigan Department of Transportation, Coloma TSC	3880 Red Arrow Highway, Benton Harbor, MI 49022	Sarah Woolcock
Michigan Department of Transportation, Grand Region	1420 Front Avenue, N.W., Grand Rapids, MI 49504	Joseph Finch
Michigan Department of Transportation, Jackson TSC	2750 North Elm Rd, Jackson, MI 49201-6802	Dee Parker
Michigan Department of Transportation, Jackson TSC	2750 North Elm Rd, Jackson, MI 49201-6802	Roslyn Chapman
Michigan Department of Transportation, Lansing TSC	1019 Trowbridge Rd, East Lansing, MI 48823	Larry Doyle
Michigan Department of Transportation, Lansing TSC	1019 Trowbridge Rd, East Lansing, MI 48823	Paul Steinman
Michigan Department of Transportation, Lansing TSC	1019 Trowbridge Rd, East Lansing MI, 48933	Steve Shaughnessy
Michigan Department of Transportation, ITS Program Office Support	Van Wagoner Bldg, 425 West Ottawa St, Lansing, MI 48909	Greg Krueger
Michigan Department of Transportation, MITS Center	1050 6th Street, Detroit, MI 48226	Mia Silver
Michigan Department of Transportation, Southwest Region	1501 East Kilgore Rd, Kalamazoo MI 49001-6300	Jason Latham
Michigan Department of Transportation, Southwest Region	1501 East Kilgore Road, Kalamazoo MI 49001	Zhizhen Liu
Michigan State Police	Bridgman Post, 9301 Red Arrow Highway, Bridgman MI 49106	Willie Mays
Michigan State Police (MSP)	610 West Columbia Avenue, Battle Creek, MI 49015	Dale Peet
Michigan State Police (MSP)	7119 North Canal Road, Lansing, MI 48913	Dan Smith
Michigan State Police (MSP)	109 West Michigan Ave, Paw Paw, MI 49079	Eric Wimbley
Michigan State Police (MSP)	504 West Allegan, Lansing, MI 48913	Gary Megge

Stakeholder Agency	Address	Contact
Michigan State Police (MSP)	108 West Michigan Ave, Paw Paw, MI 49079	James Campbell
Michigan State Police (MSP)	504 West Allegan, Lansing, MI 48913	Lance Cook
Michigan State Police (MSP)	108 West Michigan Ave, Paw Paw, MI 49079	Tracey McAndrew
Michigan Tech Research Institute	3520 Green Court, Ann Arbor MI 48105	Richard Wallace
National Weather Service	4899 Complex Dr, Grand Rapids, MI 49512	John Kowaleski
NTB Inc	1240 84 th Street, Byron Center, MI 49315	Daniel Wood
NTB Inc	1238 84 th Street, Byron Center, MI 49315	Jerry Warnemuende
NTB Inc	1239 84 th Street, Byron Center, MI 49315	John Wesche
Paw Paw Police Department	114 Harry L Bush Blvd, Paw Paw, MI 49079	Patrick Alspaugh
Region 2 Planning Commission	120 West Michigan Ave, Jackson, MI 49201	Steven Duke
South Central Michigan Planning Council	P.O. Box 2137, Portage MI 49081-2137	Rand Bowman
South Haven Police Department	539 Phoenix St, South Haven MI 49090	Rod Sommerlott
Southwest Michigan Planning Commission	185 East Main Street, Suite 701, Benton Harbor MI 49022-4440	Kelly Getman-Dissette
Southwest Michigan Regional Airport	1123 Territorial Road, Benton Harbor, MI 49022	Lee Scherwitz
St. Joseph Charter Township	3000 Washington Avenue, St. Joseph MI 49085	Ron Griffin
Van Buren County Central Dispatch	205 South Kalamazoo St, Paw Paw, MI 49079	Jeri Tapper
Van Buren County Central Dispatch	205 South Kalamazoo St, Paw Paw, MI 49079	Robert Kirk
Van Buren County Sheriff's Office	205 South Kalamazoo, Paw Paw, MI 49079	Bill Lux
Van Buren Public Transit	610 David Walton Drive, Bangor MI 49013	Anthony Dacoba
Western Michigan University	Department Of Civil & Construction Engineering 1903 West Michigan Ave, Kalamazoo MI 49008-5316	Jun-Seok Oh
Western Michigan Universit	1903 West Michigan Ave, Kalamazoo MI 49008-5316	Paul MacNellis

2. REGIONAL ITS ARCHITECTURE DEVELOPMENT PROCESS

Development of the Regional ITS Architecture and Deployment Plan for the study area relied heavily on stakeholder input to ensure that the architecture reflected local needs. A series of four workshops was held with stakeholders to gather input, and draft documents were made available to stakeholders for review and comment.

The process followed for the study area was designed to ensure that stakeholders could provide input and review for the development of the Region’s ITS Architecture and Deployment Plan. **Figure 2** illustrates the process followed.

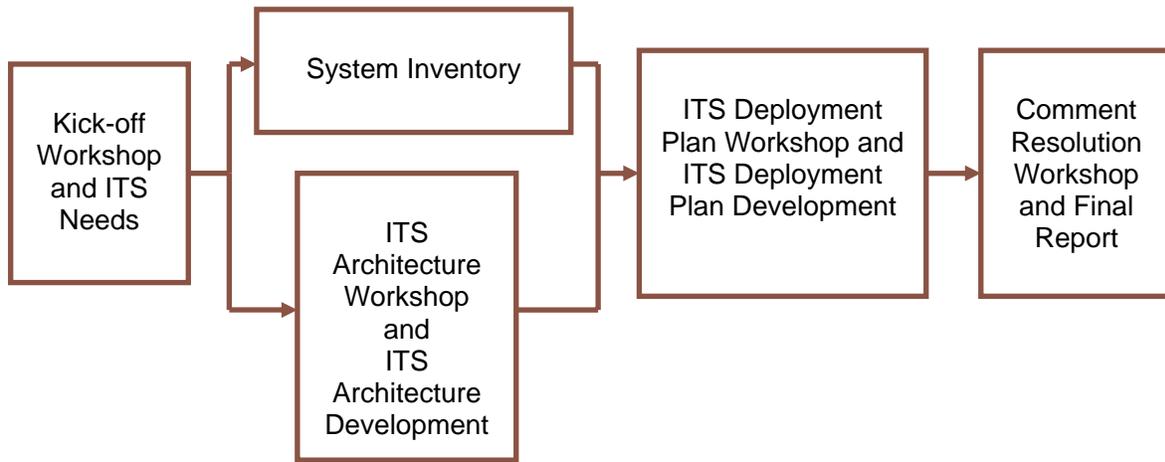


Figure 2 - Study Area ITS Architecture and Deployment Plan Development Process

A total of four workshops with stakeholders over a period of nine months were conducted to develop the Southwest and portions of University Regional ITS Architecture and Deployment Plan. These workshops included:

- A Kick-Off Workshop;
- A Regional ITS Architecture Development Workshop;
- A ITS Deployment Plan Workshop; and
- A Comment Resolution Workshop.

Key components of the process are described below:

Task 1 – Kick-Off Workshop and ITS Needs: A stakeholder group was identified that included representatives from regional transportation, transit, emergency management/public safety agencies, and other agencies. The group was invited to the project Kick-Off Workshop where ITS needs for the Region were identified.

Task 2 – System Inventory: Collecting information for the system inventory began at the Kick-Off Workshop through discussions with the stakeholders to determine existing and planned ITS elements in the Region. After the Kick-Off Workshop, follow-up calls were conducted with several local stakeholders to gather additional input.

Task 3 – ITS Architecture Workshop and ITS Architecture Development: The purpose of the Regional ITS Architecture Workshop was to review the system inventory with stakeholders and develop the Southwest and portions of University Regional ITS Architecture. Training on the National ITS Architecture was integrated into the workshop so that key elements of the architecture, such as market packages, could be explained prior to the selection and customization of these elements. The result of the Regional ITS Architecture Workshop was an ITS Architecture for the study area that included a system inventory, interconnect diagram, customized market packages, and relevant ITS standards. Following the workshop, a Draft Regional ITS Architecture document was prepared and sent to stakeholders for review and comment.

Task 4 – ITS Deployment Plan Workshop and ITS Deployment Plan Development: A draft project listing for the Region was presented to stakeholders at the Regional ITS Deployment Plan Workshop. Stakeholders were asked to provide input on the recommended projects, responsible agencies, associated costs, and deployment timeframe. Following the workshop, a Draft Regional ITS Deployment Plan document was prepared and sent to stakeholders for review and comment.

Task 5 – Comment Resolution Workshop and Final Report: A Comment Resolution Workshop was held with stakeholders to review the Draft Regional ITS Architecture and the Draft Regional ITS Deployment Plan. Next steps for the Region were also discussed. Comments were incorporated and a final Regional ITS Architecture and Regional ITS Deployment Plan were developed.

3. CUSTOMIZATION OF THE NATIONAL ITS ARCHITECTURE FOR THE SOUTHWEST REGION AND PORTIONS OF UNIVERSITY REGION

3.1 Systems Inventory

An important initial step in the architecture development process is to establish an inventory of existing ITS elements. At the Kick-Off Workshop and through subsequent discussions with agency representatives, stakeholders provided the team with information about existing and planned systems.

The National ITS Architecture has divided the market packages into eight service area groups. Existing, planned, and future systems in the study area were identified in the following service areas:

- **Traffic Management** – includes the West Michigan Traffic Management Center (WMTMC) in Grand Rapids as well as other existing and future TMCs and traffic operations centers (TOCs), detection systems, closed circuit television (CCTV) cameras, fixed and portable dynamic message signs, and other related technologies.
- **Emergency Management** – includes emergency operations/management centers, improved information sharing among traffic and emergency services, automated vehicle location (AVL) on emergency vehicles, traffic signal preemption for emergency vehicles, and wide-area alerts.
- **Maintenance and Construction Management** – includes work zone management, roadway maintenance and construction information, winter maintenance, and road weather detection systems.
- **Public Transportation Management** – includes transit and paratransit AVL, dispatch systems, transit travel information systems, electronic fare collection, and transit security.
- **Commercial Vehicle Operations** – includes coordination with Commercial Vehicle Information Systems and Networks (CVISN) efforts, and hazardous material (HAZMAT) management.
- **Traveler Information** – includes broadcast traveler information, traveler information kiosks, and highway advisory radio (HAR).
- **Archived Data Management** – includes electronic data management and archiving systems.
- **Vehicle Safety** – includes collision avoidance and automated highway systems.

3.2 Regional Needs

Needs from the study area were identified by stakeholders at the Kick-Off Workshop held in February of 2007. The needs identified provided guidance for determining which market packages should be included in the architecture. Stakeholders identified ITS needs for the study area in the following areas:

- Traffic management;
- Emergency management;
- Maintenance and construction management;
- Public transportation management;
- Commercial Vehicle Operations;
- Traveler information; and
- Archived data management.

Section 3.4.3 contains additional information about the specific needs identified and relates those needs to the market packages that document the corresponding ITS service.

3.3 Element Customization

The inventory and needs documented at the Kick-Off Workshop are the starting point for developing an ITS architecture for the study area. These ITS systems and components are used to customize the National ITS Architecture and create the architecture for the study area.

When developing customized elements, individual traffic, maintenance, and emergency management elements were not created for individual cities. The smaller communities in the study area were documented as part of the local agency elements. This documentation allows the communities to be included in the Regional ITS Architecture, and therefore eligible to use federal monies on potential future ITS deployments.

3.3.1 Subsystems and Terminators

Each identified system or component in the ITS inventory was mapped to a subsystem or terminator in the National ITS Architecture.

Subsystems are the highest level building blocks of the physical architecture, and the National ITS Architecture groups them into four major classes: Centers, Field, Vehicles, and Travelers. Each of these major classes includes various components that represent a set of transportation functions (or processes). Each set of functions is grouped under one agency, jurisdiction, or location, and correspond to physical elements such as: traffic operations centers, traffic signals, or vehicles. **Figure 3** shows the National ITS Architecture subsystems. This figure, also known as the “sausage diagram,” is a standard interconnect diagram, showing the relationships of the various subsystems within the architecture. A customized interconnect diagram for the study area is shown in **Figure 4** Communication functions between the subsystems which are represented in the ovals. Fixed-point to fixed-point communications include not only twisted pair and fiber optic technologies, but also wireless technologies such as microwave and spread spectrum.

Terminators are the people, systems, other facilities, and environmental conditions outside of ITS that need to communicate or interface with ITS subsystems. Terminators help define the boundaries of the National ITS Architecture as well as a regional system. Examples of terminators include: drivers, weather information providers, and information service providers.

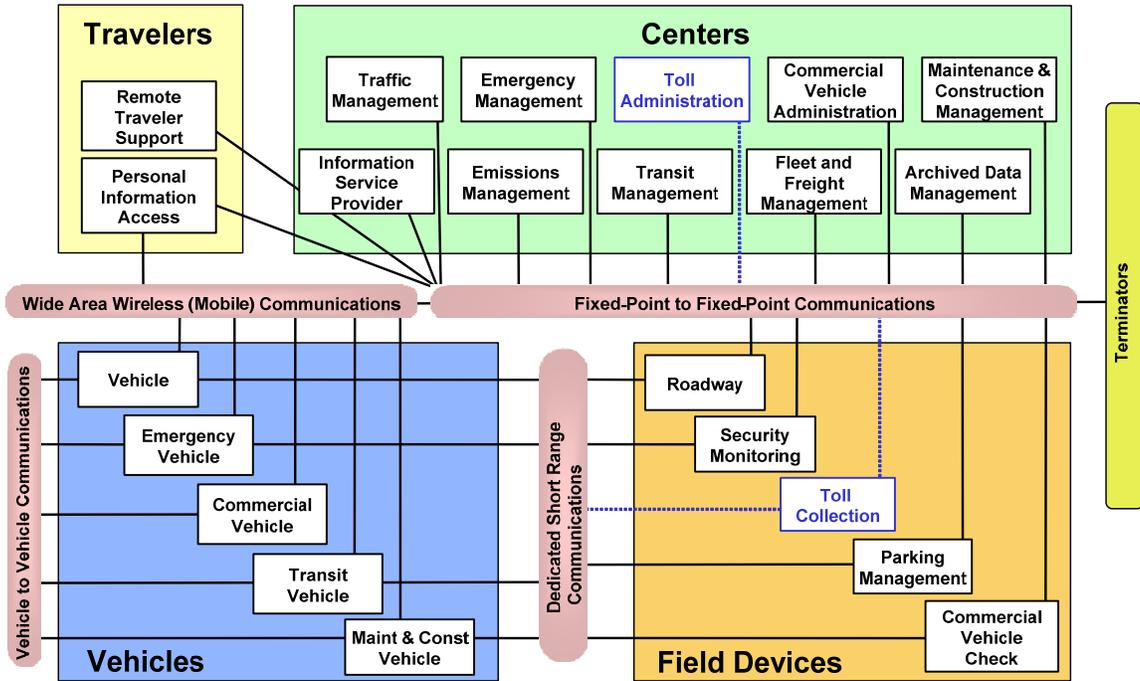


Figure 3 - National ITS Architecture Physical Subsystem Interconnect Diagram

3.3.2 ITS Inventory by Stakeholder

Each stakeholder is associated with one or more systems or elements (subsystems and terminators) that make up the transportation system in the study area. A listing of stakeholders as identified in the architecture can be found in **Table 4** along with a description of the stakeholder. A single stakeholder was created for local agencies which represents the cities and towns not specifically called out in the architecture, rather than individually documenting each of the smaller local agencies in the study area. **Table 5** sorts the inventory by stakeholder so that each stakeholder can easily identify and review all of the architecture elements associated with their agency. The table includes the status of the element. In many cases, an element classified as existing might still need to be enhanced to attain the service level desired by the study area.

Table 4 - Study Area Stakeholder Descriptions

Stakeholder	Stakeholder Description
MDOT	The Michigan Department of Transportation is responsible for the planning, design, construction, maintenance, and operation for all aspects of a comprehensive integrated transportation system in the State of Michigan. Some of these roles are achieved through contract services with local agencies and private entities.
Private Information Service Provider	Private sector business responsible for the gathering and distribution of traveler information. This service is typically provided on a subscription basis.
Media	Local media outlets. This can include television stations, newspapers, radio stations and their associated websites.
Local Agency	Local agency includes municipalities, counties, and townships and coverall departments within those agencies that deal with traffic, public safety, emergency management, public works and school transportation agencies. Local Agencies include: City of Kalamazoo, City of Battle Creek, City of Jackson, City of Benton Harbor, City of St Joseph, City of Niles, City of Marshall, City of Coldwater, Allegan CRC, Barry CRC, Van Buren CRC, Kalamazoo CRC, Calhoun CRC, Jackson CRC, Berrien CRC, Cass, CRC, St Joseph CRC, Branch CRC, and Shiawassee CRC.
NOAA	National Oceanic and Atmospheric Administration gathers weather information and issues severe weather warnings.
Battle Creek Transit	Transit provider that operates both fixed route and paratransit service in the Battle Creek Area.
Jackson Transportation Authority	Transit provider that operates both fixed route and paratransit service for all Jackson County.
Kalamazoo Metro Transit System	Transit provider that operates both fixed route and paratransit service for all Kalamazoo County.
Twin Cities Area Transportation Authority	Transit provider that operates fixed route service for the City of Benton Harbor, City of St. Joseph, Benton Township, part of St. Joseph Township, and Royalton Township
The Link	Transit provider that operates paratransit service for the City of Marshall.
Branch Area Transit Authority	Transit provider that operates both semi-fixed route and paratransit service for all Branch County.
Cass County Transportation Authority	Transit provider that operates paratransit service for all Cass County.
DART (Dowagiac Dial-a-Ride)	Transit provider that operates paratransit service for Dowagiac and Southwest Michigan College.
Barry County Transit	Transit provider that operates both semi-fixed route and paratransit service for all Barry County.
Benton Harbor Dial-a-Ride	Transit provider that operates paratransit service for the Cities and Townships of Benton Harbor and St Joseph.
Van Buren Public Transit	Transit provider that operates paratransit service for all Van Buren County.
Berrien Bus	Transit provider that operates both semi-fixed route and paratransit service for all Berrien County.

Stakeholder	Stakeholder Description
Buchanan Dial-a-Ride	Transit provider that operates both fixed route and paratransit service for Cities of Buchanan and Niles.
Niles Dial-a-Ride	Transit provider that operates paratransit service for the City of Niles.
Allegan County Transportation	Transit provider that operates paratransit service for most of Allegan County.
Interurban Transit Authority	Transit provider that operates paratransit service for the City and Township of Saugatuck.
Calhoun County Transit	Transit provider that operates paratransit service for most of Calhoun County.
Shiawassee Area Transportation Agency	Transit provider that operates paratransit service for Owosso, Corunna, Durand and Perry.
Private Transportation Providers	Private transportation service providers such as taxis and shuttle services.
MSP	Michigan State Police are responsible for traffic safety laws and commercial vehicle regulations on MDOT routes.
Rail Operators	Companies that operate trains and/or are responsible for the maintenance and operations of railroad tracks.
System Users	All of the users of the transportation system.
Private Operators	Private Parking Operators manage private parking facilities including the collection of fees.
Department of Homeland Security	The Department of Homeland Security is responsible for coordinating with multiple agencies to secure the nation's borders and protect the infrastructure and citizens.
DNR	Michigan Department of Natural Resources is responsible for the operations and maintenance of all Parks and Recreation facilities including infrastructure components on those properties. DNR utilizes some technologies to provide information to visitors at Parks and Recreation facilities.
Financial Institution	Banks involved in the transfer of funds for fare collection as well as for other fee based transportation services. Can handle the exchange of money for transit electronic fare collection or toll collection.
Cook Nuclear Plant	Nuclear power plant on the Lake Michigan shore in Bridgman.
Palisades Nuclear Power Plant	Nuclear power plant on the Lake Michigan shore in South Haven.
INDOT	The Indiana Department of Transportation is the agency responsible for ITS related equipment in the state of Indiana.
Other Elements	Other elements include potential obstacles, roadway environment and other vehicles.
Other Agencies	This stakeholder represents a wide variety of agencies. The associated elements are groups of agencies or providers that do not have a primary stakeholder agency.

Table 5 - Study Area Inventory of ITS Elements

Stakeholder Name	Element Name	Element Description	Status
Battle Creek Transit	Battle Creek Transit Data Archive	The transit data archive for Battle Creek Transit. Used by FTA and MDOT Office of Public Transportation.	Planned
Battle Creek Transit	Battle Creek Transit Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Battle Creek Transit. The center has an existing CAD system and GIS based AVL system for mapping vehicles.	Existing
Battle Creek Transit	Battle Creek Transit Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Existing
Battle Creek Transit	Battle Creek Transit Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
Battle Creek Transit	Battle Creek Transit Transit Center CCTV Surveillance	CCTV surveillance at the Battle Creek Transit Center.	Planned
Battle Creek Transit	Battle Creek Transit Vehicles	Transit Vehicles owned by Battle Creek Transit. AVL system is installed on transit vehicles. Electronic fare box is in place as well.	Existing
Battle Creek Transit	Battle Creek Transit System AVL	Automated Vehicle Location used to locate transit vehicles as well as estimate route times	Planned
Battle Creek Transit	Battle Creek Transit Website	Website with information about fares and schedules. At this time the website is static.	Existing
Battle Creek	Battle Creek Free Trade Zone Inland Port	Inland port is considering quick custom clearance deployments to speed up custom inspection times.	Planned
Battle Creek	Battle Creek TMC	The City of Battle Creek is planning to build a traffic management center to manage the city's traffic signal system	Planned
Department of Homeland Security	Department of Homeland Security	Responsible for coordinating with multiple agencies to secure the nation's borders and protect the infrastructure and citizens.	Existing
DNR	DNR HAR	Roadside equipment operated and maintained by the Department of Natural Resources used to transmit traveler information over a dedicated short range radio frequency.	Existing
DNR	DNR Weather Stations	Department of Natural Resources field equipment that collects weather data such as temperature and visibility.	Existing
Financial Institution	Financial Service Agency	Agency responsible for payment of transit fares for medical transportation as part of government subsidized medical care. This includes Medicare, and VA programs. Agencies also handle payment requests from commercial vehicle administration agencies.	Existing



Stakeholder Name	Element Name	Element Description	Status
Financial Institution	Financial Service Provider	Handles exchange of money for transit electronic payment collection.	Existing
FMCSA	FMCSA Safety and Fitness Electronic Records System	The FMCSA SAFER system provides company safety data and related services to industry and the public over the Internet. Users can search FMCSA databases, access the Hazardous Material Route registry, obtain National Crash and Out of Service rates for Hazmat Permit Registration, and find information about other FMCSA Information Systems.	Existing
INDOT	INDOT DMS	Dynamic message signs placed along Indiana Toll Road to display toll road pricing and other important messages.	Existing
INDOT	INDOT HAR	Highway Advisory Radio (HAR) system along Indiana Toll Road.	Existing
Jackson Transportation Authority	Jackson Transportation Authority Data Archive	The transit data archive for the Jackson Transportation Authority. Used by FTA and MDOT Office of Public Transportation.	Planned
Jackson Transportation Authority	Jackson Transportation Authority Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Jackson Transportation Authority.	Planned
Jackson Transportation Authority	Jackson Transportation Authority Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
Jackson Transportation Authority	Jackson Transportation Authority Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
Jackson Transportation Authority	Jackson Transportation Authority Transit Center CCTV Surveillance	CCTV surveillance at the Jackson Transportation Authority Transit Center.	Planned
Jackson Transportation Authority	Jackson Transportation Authority Transit Vehicles	Transit Vehicles owned by Jackson Transportation Authority. AVL system is installed on transit vehicles.	Existing
Jackson Transportation Authority	Jackson Transportation Authority AVL	Automated Vehicle Location used to locate transit vehicles as well as estimate route times.	Existing
Jackson Transportation Authority	Jackson Transportation Authority Website	Website with information about fares and schedules. At this time the website is static.	Existing
Jackson Transportation Authority	Kalamazoo / Battle Creek International Airport	International airport serving the Southwest Michigan area.	Existing
Kalamazoo Metro Transit System	Kalamazoo Metro Transit System Data Archive	The transit data archive for the Kalamazoo Metro Transit System. Used by FTA and MDOT Office of Public Transportation.	Planned
Kalamazoo Metro Transit System	Kalamazoo Metro Transit System Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Kalamazoo Metro Transit System. Dispatch center has an existing CAD system and radio communication with buses.	Existing



Stakeholder Name	Element Name	Element Description	Status
Kalamazoo Metro Transit System	Kalamazoo Metro Transit System Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
Kalamazoo Metro Transit System	Kalamazoo Metro Transit System Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
Kalamazoo Metro Transit System	Kalamazoo Metro Transit System Transit Center CCTV Surveillance	CCTV surveillance at the Kalamazoo Metro Transit System Transit Center.	Existing
Kalamazoo Metro Transit System	Kalamazoo Metro Transit System Vehicles	Transit Vehicles owned by Kalamazoo Metro Transit.	Existing
Kalamazoo Metro Transit System	Kalamazoo Metro Transit System AVL	Automated Vehicle Location used to locate transit vehicles as well as estimate route times.	Planned
Kalamazoo Metro Transit System	Kalamazoo Metro Transit System Website	Website with information about fares and schedules. At this time the website is static.	Existing
Local Agency	County 911 Dispatch	Central Dispatch is responsible for the dispatch of all public safety vehicles (police and fire). After hours Central Dispatch will also dispatch the Street Department on-call emergency responder. Counties included are Allegan, Barry, Van Buren, Kalamazoo, Calhoun, Jackson, Berrien, Cass, St Joseph, Branch, and Shiawassee.	Existing
Local Agency	County Road Commission	Contract agency managed by a county that oversees road maintenance and snow removal on local and MDOT facilities.	Existing
Local Agency	County Road Commission Vehicles	County Road Commission vehicles used in maintenance operations.	Existing
Local Agency	Local Agency CCTV	Roadside equipment on local routes used for traffic condition monitoring and management of incidents. CCTV deployed in Kalamazoo County.	Existing
Local Agency	Local Agency DPW	Contract agency managed by a local municipality that oversees road maintenance and snow removal on local and MDOT facilities.	Existing
Local Agency	Local Agency DPW Vehicles	Local Government vehicles used in maintenance operations.	Existing
Local Agency	Local Agency Field Sensors	Roadway equipment on local routes used to detect vehicle volumes and/or speeds. Vehicle detection technology is deployed in City of Portage and Kalamazoo County.	Existing
Local Agency	Local Agency HAR	Highway Advisory Radio operated by local agencies. HAR operated by City of Battle Creek along I-94 between Kalamazoo and Battle Creek.	Existing
Local Agency	Local Agency High Water Detection	Roadside equipment operated by local agencies that collect information about the water level on flood prone roadways.	Planned
Local Agency	Local Agency Parking Management Systems	System operated by a local agency that monitors available vehicle parking at key parking facilities.	Planned



Stakeholder Name	Element Name	Element Description	Status
Local Agency	Local Agency Public Safety Vehicles	Local law enforcement, fire and EMS vehicles. Includes the ITS equipment installed on the cruisers (AVL, MDTs, etc.).	Existing
Local Agency	Local Agency Public Safety/Law Enforcement	This element represents local law enforcement agencies throughout region.	Existing
Local Agency	Local Agency Ride Sharing Program	System used for matching riders with similar origins and destinations to promote carpooling.	Planned
Local Agency	Local Agency Roadway Barrier System	Roadside equipment operated by local agencies that close roadway segments automatically due to unsafe conditions such as flooding.	Planned
Local Agency	Local Agency RWIS	Roadside equipment operated by local agencies that collect information about the roadways such as temperature and moisture levels.	Planned
Local Agency	Local Agency School Transportation Agencies	Agencies responsible for operating school bus fleets.	Existing
Local Agency	Local Agency TOC	Local Traffic Operations Center responsible for municipal signal system operations.	Existing
Local Agency	Local Agency Traffic Signals	Coordinated signal systems operated by local agencies.	Existing
Local Agency	Local Agency Website	Website for the local agencies.	Existing
Local Agency	Local Emergency Operations Center	Operations Center for Local Agency Emergencies	Existing
Local Agency	Parking Traveler Card	Medium for collection of parking fares electronically.	Planned
Local Agency	Southwest Michigan Regional Airport	Regional airport located in Benton Harbor.	Existing
Local Agency	Kalamazoo Chamber of Commerce HAR	Uses HAR for tourism information.	Existing
Local Airport Authority	AWOS Stations	Automated Weather Observing System Stations are weather data collecting systems that are operated at local airports.	Existing
MDOT	MDOT Bridge Anti-Icing System	This system uses a variety of atmospheric and pavement sensors to detect when anti-icing and de-icing fluids should be applied to a bridge. The application is performed automatically using spray equipment mounted on the bridge. The system reports to maintenance personnel when fluids have been applied. Maintenance personnel are able to call into the system using cell-phones to monitor system status or activate the fluid application remotely. A system exists on a bridge at the Kent/Allegan County line.	Existing
MDOT	MDOT CCTV Cameras	Roadside equipment mounted on trailers used for traffic condition monitoring and management of incidents.	Existing
MDOT	MDOT Central Maintenance Office	MDOT Central Maintenance Office provides support to MDOT Region offices and TSCs to aid in establishing consistency for maintenance.	Existing



Stakeholder Name	Element Name	Element Description	Status
MDOT	MDOT Commercial Vehicle Parking Management System	System operated by MDOT that monitors available commercial vehicle parking at key rest area parking facilities.	Planned
MDOT	MDOT Commercial Vehicle Permitting System	MDOT system for tracking and monitoring oversize and overweight permits for commercial vehicles.	Planned
MDOT	MDOT Commercial Vehicle Probe Equipment	Probe data collection equipment that is planned to be placed on commercial vehicles traveling along Michigan roads and highways.	Planned
MDOT	MDOT DMS	Roadside equipment on MDOT routes used to share traveler information with motorists through dynamic messaging.	Planned
MDOT	MDOT Drawbridge Control Equipment	Roadside equipment located on MDOT drawbridges that close approaching roadways or stop traffic prior to the drawbridge opening to waterway traffic.	Existing
MDOT	MDOT Drawbridge Notification Equipment	Roadside equipment located on MDOT drawbridges that send notifications when the drawbridge is open for waterway traffic.	Existing
MDOT	MDOT Field Sensors	Roadway equipment located on MDOT roadways used to detect vehicle volumes and/or speeds. Permanent traffic recorders (PTRs) are deployed at 15 locations. Microwave detector located along I-94 at Portage measures volume, speed, and occupancy. This information is used in the operation of the traffic signal system and collected by the TOC. MDOT field sensors include VIVDS and any other vehicle detection.	Existing
MDOT	MDOT Frost Tube Sensors	Roadside equipment located along MDOT routes that collect data from frost tube sensors. Currently frost tubes are placed in 12 locations throughout the study area.	Existing
MDOT	MDOT West Michigan TMC	MDOT traffic management center located in Grand Rapids.	Existing
MDOT	MDOT Highway Advisory Radio	Highway Advisory Radio (HAR) will disseminate information to travelers via radio systems. This system is planned to operate together with DMS.	Planned
MDOT	MDOT Intercity Rail Systems	Intercity Rail System that is planned to operate along freeway medians along Michigan freeways.	Planned
MDOT	MDOT Maintenance and Construction Field Personnel	MDOT field forces that operate and maintain MDOT facilities.	Existing
MDOT	MDOT Maintenance Vehicles	Michigan Department of Transportation vehicles used in maintenance operations.	Existing
MDOT	MDOT Mobile Speed Monitoring Trailers	Trailers with mobile speed monitoring devices.	Planned
MDOT	MDOT Multimodal Crossing	Intersection between two modes of travel such as roadway and waterway.	Planned
MDOT	MDOT Office of Communications	Department responsible for the dissemination of traffic information to the media and public.	Existing



Stakeholder Name	Element Name	Element Description	Status
MDOT	MDOT Planning Division Data Warehouse	Archive that contains historical traffic data such as volume and speed information.	Existing
MDOT	MDOT Ramp Metering System	MDOT plans to operate ramp meters by 2008.	Planned
MDOT	MDOT Rest Area Wi-Fi	Rest areas located off Interstates that provide wireless internet access to travelers.	Existing
MDOT	MDOT Roadside Equipment for AHS	Equipment located along MDOT routes that allows communication between roadside devices and vehicles.	Planned
MDOT	MDOT Roadside Intersection Collision Avoidance Equipment	Equipment located along MDOT routes that communicates between multiple roadside devices and vehicles to alert of unsafe travel conditions or conditions conducive to crashes.	Planned
MDOT	MDOT Roadside Signing Equipment	Equipment located along MDOT routes that provide data through dynamic messaging or in-vehicle messaging.	Planned
MDOT	MDOT RWIS Sensors	Roadside equipment located on MDOT routes (Kent/Allegan County Line) that collect information about the roadways such as temperature and moisture levels.	Existing
MDOT	MDOT Security Monitoring Field Equipment	Roadside equipment located on MDOT routes that is used for monitoring key infrastructure elements from damage or attacks. These elements include structures such as the weigh station located near New Buffalo.	Existing
MDOT	MDOT Service Patrol Dispatch	Provides efficient use of resources to assist motorists in need on MDOT facilities.	Planned
MDOT	MDOT Service Patrol Vehicles	Fully equipped vehicles that provide motorist assistance to vehicles in need on MDOT facilities.	Planned
MDOT	MDOT Southwest & University Region Offices	The Southwest & University Region Offices serve as a data collection and dissemination point for traffic information. This includes coordination with other agencies such as public safety, emergency management, and transit.	Existing
MDOT	MDOT Southwest and University Region Transportation Service Centers – Coloma, Kalamazoo, Marshall, Lansing, and Jackson	MDOT field offices that oversee road construction and maintenance on MDOT facilities. Most maintenance and snow removal in this region is achieved through contract agencies.	Existing
MDOT	MDOT Statewide TMC - Lansing	MDOT traffic management center located in Lansing.	Planned
MDOT	MDOT Traffic Signals	Wireless interconnected traffic signal system located in Kalamazoo and operated by MDOT.	Existing
MDOT	MDOT Traveler Information Kiosks	Interactive kiosks that provides users the ability to request and receive transportation information.	Planned
MDOT	MDOT Traveler Information Website	Website for Michigan Department of Transportation.	Existing
MDOT	MDOT Weigh-in-Motion	In-road equipment that monitors vehicle weights.	Existing



Stakeholder Name	Element Name	Element Description	Status
MDOT	MDOT Work Zone Safety Monitoring Equipment	Portable ITS equipment that can be used in work zones to more efficiently manage traffic and provide traveler information. Includes CCTV, vehicle detection, and/or DMS.	Planned
MDOT	Michigan 511 System	511 Traveler information system central server.	Planned
MDOT	Michigan 511 Voice Response System	Michigan 511 Interactive Voice Response system. This is the customer interface component of the 511 system.	Planned
MDOT	Michigan Public Safety Communications System	MPSCS (Michigan Public Safety Communications System) is an 800 MHz radio network that utilizes state-of-the-art trunked technology to provide statewide interoperability in digital clarity to its members throughout Michigan.	Existing
MDOT	MITSC	MDOT traffic management center located in the Metro Region.	Existing
MDOT	Other Region MDOT TSCs	Local MDOT offices outside of the Study Area that oversee the operations and maintenance on MDOT facilities.	Existing
Media	Local Print and Broadcast Media	Local media that provide traffic or incident information to the public.	Existing
Michigan Metropolitan Planning Organizations	Kalamazoo Area Transportation Study Emissions Monitoring	Kalamazoo Area Transportation Study monitors air quality and emissions.	Existing
Michigan Metropolitan Planning Organizations	Kalamazoo Area Transportation Study Emissions Monitoring Sensor	Kalamazoo Area Transportation Study has one existing sensor in the area.	Existing
MSP	CJIC Database	Criminal Justice Information Center Database stores criminal justice data and can be accessed by multiple agencies.	Existing
MSP	MSP District 1 Dispatch - Lansing	Michigan State Police dispatch for the University Region. Provides call-taking and dispatch for public safety agencies.	Existing
MSP	MSP District 5 Dispatch - Paw Paw	Michigan State Police dispatch for the Southwest Region. Provides call-taking and dispatch for public safety agencies.	Existing
MSP	MSP Headquarters - East Lansing	Michigan State Police headquarters that oversees operations of MSP.	Existing
MSP	MSP Motor Carrier Division	Responsible for monitoring commercial vehicle regulations on MDOT routes.	Existing
MSP	MSP Motor Carrier Division Enforcement	Responsible for enforcing commercial vehicle regulations on MDOT routes.	Existing
MSP	MSP Office of Highway Safety Planning	Manages crash data for MDOT routes.	Existing
MSP	MSP Vehicles	Public Safety vehicles owned and operated by Michigan State Police. Includes the ITS equipment installed on the cruisers (AVL, MDTs, etc.).	Existing
MSP	MSP Winter Travel Toll-Free Number	Toll-free number operated by Michigan State Police that provides travel information to the public	Existing



Stakeholder Name	Element Name	Element Description	Status
MSP	MSP Winter Travel Advisory Website	Website operated by the Michigan State Police that provides travel information to the public.	Existing
MSP	Michigan Intelligent Operations Center (MIOC)	Provides 24 hour a day statewide information sharing among local, state, and federal public safety agencies	Existing
NOAA	National Weather Service	Provides official US weather, marine, fire and aviation forecasts, warnings, meteorological products, climate forecasts, and information about meteorology.	Existing
NOAA	National Weather Service Weather Stations	National Weather Service Field equipment that collects weather data such as temperature and visibility.	Existing
Other Agencies	Multimodal Service Provider	Agency that offers services across multiple transportation modes.	Existing
Other Agencies	Private Concierge Provider	Private entities that provides customized services to the traveler. This service is usually subscription based.	Existing
Other Agencies	Special Event Promoters	Special Event Sponsors that have knowledge of events that may impact travel on roadways or other modal means. Western Michigan University uses their DMS to display football announcements.	Existing
Other Elements	Other Vehicles	Vehicles outside of the control of the driver.	Existing
Other Elements	Potential Obstacles	Obstacles that could interfere with the safe operation of vehicles.	Existing
Other Elements	Roadway Environment	All objects and conditions in the vicinity of the traveler that can affect the operations of the traveler.	Existing
Private Information Service Providers	Private Sector ISP	Private entities that collect and disseminate traffic information.	Existing
Private Information Service Providers	Private Sector Traveler Information Systems	Website sponsored by a private entity. Often this information is provided through a subscription.	Existing
Private Operators	Contractor Smart Zone Equipment	Smart Work Zone Equipment owned by private contractor. Portable ITS equipment that can be used in work zones to more efficiently manage traffic and provide traveler information. Includes CCTV, vehicle detection, and/or DMS.	Existing
Private Operators	Private Fleet Operators	Private companies that proactively manage and operate their fleet routing. Includes reactions to incidents and possible delays.	Existing
Private Operators	Private Parking Operator	System operated on private property that monitors available commercial vehicle parking.	Existing
Private Transportation Providers	Private Transportation Providers	Private providers of transportation services in the Region such as taxis and intercity bus services.	Existing
Rail Operators	Rail Operator Wayside Equipment	Equipment located along the tracks including railroad crossing gates, bells, and lights as well as the interface to the traffic signal controller indicating the presence of a train.	Planned



Stakeholder Name	Element Name	Element Description	Status
Regional Demand Response Transit Providers	Regional Demand Response Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
Regional Demand Response Transit Providers	Regional Demand Response Transit Provider Vehicles	Transit Vehicles owned by the regional demand responsive transit providers.	Existing
Regional Demand Response Transit Providers	Regional Demand Response Transit Provider Website	Website with information about fares and schedules. At this time the website is static.	Planned
Regional Demand Response Transit Providers	Regional Demand Response Transit Providers Data Archive	The transit data archive for the Regional Demand Responsive Transit Providers Data Archive. Used by FTA and MDOT Office of Public Transportation.	Planned
Regional Demand Response Transit Providers	Regional Demand Response Transit Providers Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Regional Demand Responsive Transit Authorities.	Planned
Regional Demand Response Transit Providers	Regional Demand Response Transit Providers Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned
Regional Demand Response Transit Providers	Regional Demand Response Transit Providers Transit Center CCTV Surveillance	CCTV surveillance at the Regional Demand Response Transit Providers Center.	Planned
System Users	Archived Data Users	Those who request information from the data archive systems.	Existing
System Users	Commercial Vehicle	Privately owned commercial vehicles that travel throughout the Region. Included in the architecture to cover HAZMAT incident reporting.	Existing
System Users	Driver	Individual operating a vehicle on roadways within the region.	Existing
System Users	Private Travelers Personal Computing Devices	Computing devices that travelers use to access public information.	Existing
System Users	Private Vehicles	Vehicles operated by the public.	Existing
System Users	Traveler	Travelers along Michigan roads and highways.	Existing
Twin Cities Area Transportation Authority	Twin Cities Area Transportation Authority Data Archive	The transit data archive for Twin Cities Area Transportation Authority. Used by FTA and MDOT Office of Public Transportation.	Planned
Twin Cities Area Transportation Authority	Twin Cities Area Transportation Authority Dispatch Center	Transit dispatch center responsible for the tracking, scheduling and dispatching of fixed route and paratransit vehicles operated by Twin Cities Area Transportation Authority.	Existing
Twin Cities Area Transportation Authority	Twin Cities Area Transportation Authority Electronic Fare Payment Card	Medium for collection of transit fares electronically.	Planned
Twin Cities Area Transportation Authority	Twin Cities Area Transportation Authority Kiosks	Kiosks for dissemination of transit traveler information. Kiosks can also be used for the purchase and recharging of electronic fare payment cards.	Planned



Stakeholder Name	Element Name	Element Description	Status
Twin Cities Area Transportation Authority	Twin Cities Area Transportation Authority Transit Center CCTV Surveillance	CCTV surveillance at the Twin Cities Area Transportation Authority Transit Center.	Planned
Twin Cities Area Transportation Authority	Twin Cities Area Transportation Authority Transit Vehicles	Transit Vehicles owned by Twin Cities Area Transportation Authority.	Existing
Twin Cities Area Transportation Authority	Twin Cities Area Transportation Authority Website	Website with information about fares and schedules. At this time the website is static.	Existing

3.3.3 Top Level Regional System Interconnect Diagram

A system interconnect diagram, or “sausage diagram” (shown previously in **Figure 3**), shows the systems and primary interconnects in the study area. The National ITS Architecture interconnect diagram has been customized for the study area based on the system inventory and information gathered from the stakeholders. **Figure 4** summarizes the existing and planned ITS elements for the study area in the context of a physical interconnect. Subsystems and elements specific to the study area are called out in the boxes surrounding the main interconnect diagram, and these are color-coded to the subsystem with which they are associated.

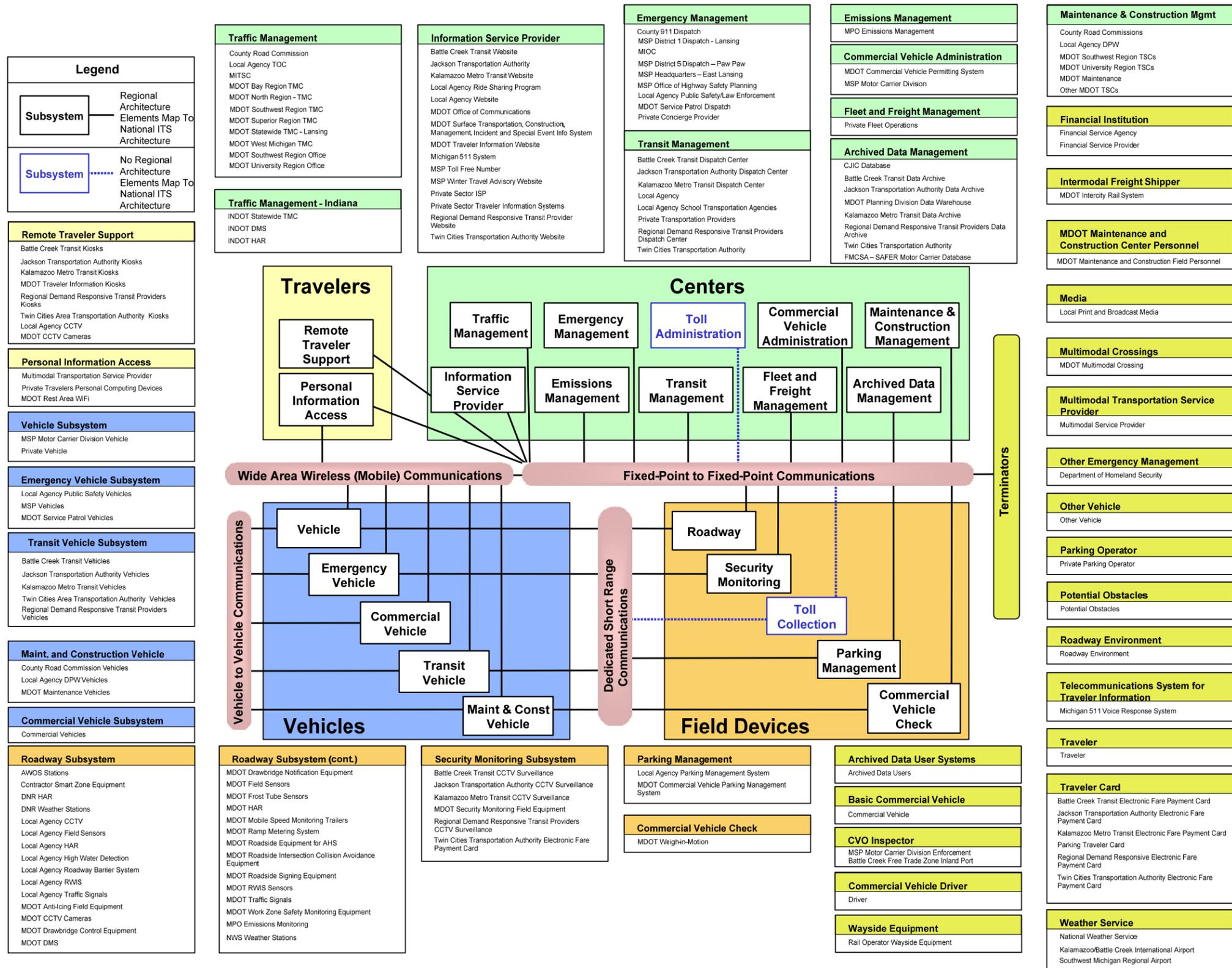


Figure 4 - Southwest and Portions of University Regional System Interconnect Diagram

3.4 Market Packages

Upon completion of the system inventory, the next step in the development of the architecture was to identify the transportation services that are important to the study region. In the National ITS Architecture, transportation services are referred to as market packages. Market packages can include several stakeholders and elements that work together to provide a service in the study area. Examples of market packages from the National ITS Architecture include Network Surveillance, Traffic Information Dissemination, and Transit Vehicle Tracking. There are currently a total of 85 market packages identified in the National ITS Architecture Version 5.1. **Appendix A** provides definitions for each of the National ITS Architecture market packages.

The market packages are grouped together into eight ITS service areas: Traffic Management, Emergency Management, Maintenance and Construction Management, Public Transportation Management, Commercial Vehicle Operations, Traveler Information, Archived Data Management, and Vehicle Safety.

3.4.1 Selection and Prioritization of Regional Market Packages

In the Southwest Region and portions of University Region, the National ITS Architecture market packages were reviewed by the stakeholders and selected based on the relevance of the service that the market package could provide to the study area. Sixty-five market packages were selected for implementation in the study area. They are identified in **Table 6**. Stakeholders prioritized the selected market packages during the workshop, and the table organizes the market packages into service areas and priority groupings. These priorities are based on the stakeholders' opinion of need and do not necessarily represent the timeframe for funding of the deployment. These priorities can also be affected by several other factors such as existing infrastructure, dependency on other systems, and the maturity of the technology associated with the market package.

After selecting the market packages that were applicable for the study area, stakeholders reviewed each market package and the elements that could be included to customize it for the study area. This customization is discussed further in the following section.

The updated National ITS Architecture Version 6.0 does not include the ATMS12 Virtual TMC and Smart Probe Data market package. This market package was omitted from the project.

Table 6 - Study Area Market Package Prioritization by Functional Area

High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
<i>Travel and Traffic Management</i>		
ATMS01 Network Surveillance ATMS03 Surface Street Control ATMS06 Traffic Information Dissemination ATMS07 Regional Traffic Control ATMS08 Traffic Incident Management System ATMS16 Parking Facility Management ATMS17 Regional Parking Management ATMS21 Roadway Closure Management	ATMS02 Probe Surveillance ATMS19 Speed Monitoring	ATMS04 Freeway Control ATMS11 Emissions Monitoring and Management ATMS13 Standard Railroad Grade Crossing ATMS14 Advanced Railroad Grade Crossing ATMS20 Drawbridge Management
<i>Emergency Management</i>		
EM01 Emergency Call-Taking and Dispatch EM02 Emergency Routing EM03 Mayday Support EM06 Wide-Area Alert EM08 Disaster Response and Recovery EM09 Evacuation and Reentry Management EM10 Disaster Traveler Information	EM05 Transportation Infrastructure Protection EM07 Early Warning System	EM04 Roadway Service Patrols
<i>Maintenance and Construction Management</i>		
MC01 Maintenance and Construction Vehicle and Equipment Tracking MC03 Road Weather Data Collection MC04 Weather Information Processing and Distribution MC05 Roadway Automated Treatment MC06 Winter Maintenance MC08 Work Zone Management	MC02 Maintenance and Construction Vehicle Maintenance MC07 Roadway Maintenance and Construction MC10 Maintenance and Construction Activity Coordination	MC09 Work Zone Safety Monitoring

High Priority Market Packages	Medium Priority Market Packages	Low Priority Market Packages
Public Transportation Management		
APTS1 Transit Vehicle Tracking APTS2 Transit Fixed-Route Operations APTS3 Demand Response Transit Operations APTS4 Transit Passenger and Fare Management APTS6 Transit Maintenance APTS8 Transit Traveler Information	APTS5 Transit Security APTS7 Multi-modal Coordination	
Commercial Vehicle Operations		
CVO01 Fleet Administration CVO04 CV Administration Process CVO10 HAZMAT Management CVO07 Roadside CVO Safety	CVO02 Freight Administration CVO03 Electronic Clearance CVO06 Weigh-in-Motion CVO11 Roadside HAZMAT Security Detection and Mitigation CVO12 Commercial Vehicle Driver Security Authentication CVO13 Freight Assignment Tracking	
Traveler Information		
ATIS1 Broadcast Traveler Information ATIS2 Interactive Traveler Information	ATIS5 ISP Based Route Guidance ATIS7 Yellow Pages and Reservation ATIS9 In Vehicle Signing	ATIS3 Autonomous Route Guidance ATIS4 Dynamic Route Guidance ATIS6 Integrated Transportation Management/Route Guidance ATIS8 Dynamic Ridesharing
Archived Data Management		
AD1 ITS Data Mart	AD2 ITS Data Warehouse AD3 ITS Virtual Data Warehouse	

3.4.2 Customized Market Packages

The market packages in the National ITS Architecture were customized to reflect the unique systems, subsystems, and terminators in the study area. Each market package is shown graphically with the market package name, local agencies involved and desired data flows included. Market packages represent a service that will be deployed as an integrated capability.

Figure 5 is an example of an ATMS market package for Surface Street Control that has been customized for the study area. This market package shows the two subsystems, Traffic Management and Roadway, and the associated entities (Local Agency TOC and Local Agency Traffic Signals) for surface street control in the study area. Data flows between the subsystems indicate what information is being shared. The remainder of the market packages that were customized for the study area is shown in **Appendix B**.

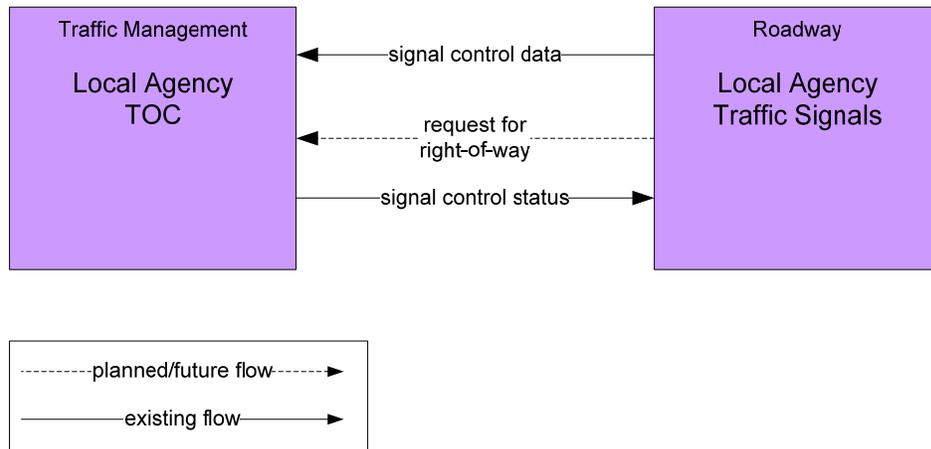


Figure 5 - Example Market Package Diagram: Surface Street Control

3.4.3 Regional ITS Needs and Customized Market Packages

Input received from stakeholders at the Architecture Workshop provided valuable input for the market package customization process. The specific needs identified are included in **Table 7**. The table also identifies which market package documents the particular ITS need.

Table 7 - Regional ITS Needs and Corresponding Market Packages

ITS Need	Market Package
Traffic Management	
Need driver notification for Bascule Bridge position in St Joseph	ATMS20
Need assistance building communications between agencies	ATMS06 ATMS07 ATMS08
Need capability to monitor prevailing speeds to support selective enforcement	ATMS19
Need more carpool and rest area lots	ATMS09
Truckers have difficulty finding adequate parking in rest areas	ATMS16 ATMS17
Public Transportation Management	
Need roadway closure information in timely manner for routing	APTS7
Need increased security at kiosks and in transit vehicles	APTS5
Need AVL for transit vehicles	APTS1
Need real time route status information for customers	APTS8
Emergency Management	
Need an incident management plan for all freeways, including emergency detour route signing	ATMS08 EM02
Need coordination/communication with counties/cities/MSP	ATMS08 EM01
Need coordination with local jurisdictions regarding alternative routes and control of traffic signals	EM02 ATMS07
Need video images of incident scene provided to dispatch centers	ATMS07
Need ITS assistance in case of emergency at area nuclear plants	EM06 EM07 EM08 EM09 EM10
Need different emergency responses to freeways with high truck volumes	ATMS08
Maintenance and Construction Management	
Need better field monitoring information to support winter maintenance decisions	MC03 MC04 MC05
Need better management system for snow plow operations during off hours	MC06
Need to provide real-time data to determine worst weather conditions	MC03
Commercial Vehicle Operations	
Need to provide assistance for truckers having difficulty finding parking in rest areas	ATMS16 ATMS17
Need to provide in-cab traveler information to truckers	ATIS9

ITS Need	Market Package
Traveler Information	
Need ITS software to illustrate where issues are at any given time	ATIS1 ATIS2
Need to provide traveler with information to make route choice decisions	ATIS1 ATIS2
Need to provide timely information to subscribers	ATIS ATIS2
Need to provide traveler with information at rest stops	ATIS1
Archived Data Management	
Need improved method for sharing crash data	AD1 AD3
Need method for sharing historical data	AD1 AD3

3.5 Architecture Interfaces

While it is important to identify the various systems and stakeholders as part of a regional ITS, a primary purpose of the architecture is to identify the connectivity between transportation systems in the study area. The system interconnect diagram shown previously in **Figure 4** showed the high-level relationships of the subsystems and terminators in the study area and the associated local projects and systems. The customized market packages represent services that can be deployed as an integrated capability and the market package diagrams show the information flows between the subsystems and terminators that are most important to the operation of the market packages. How these systems interface with each other is an integral part of the overall ITS architecture.

3.5.1 Element Connections

There are a large number of different elements identified as part of the Southwest and portions of University Regional ITS Architecture. These elements include traffic management centers, transit vehicles, dispatch systems, emergency management agencies, media outlets, and others—essentially, all of the existing and planned physical components that contribute to the regional ITS. Interfaces have been identified for each element in the Southwest and portions of University Regional ITS Architecture and each element has been mapped to those other elements with which it must interface. The Turbo Architecture software can generate interconnect diagrams for each element in the Region that show which elements are connected to one another. **Figure 6** is an example of an interconnect diagram from the Turbo database output. This particular interconnect diagram is for the MDOT Traveler Information Website.

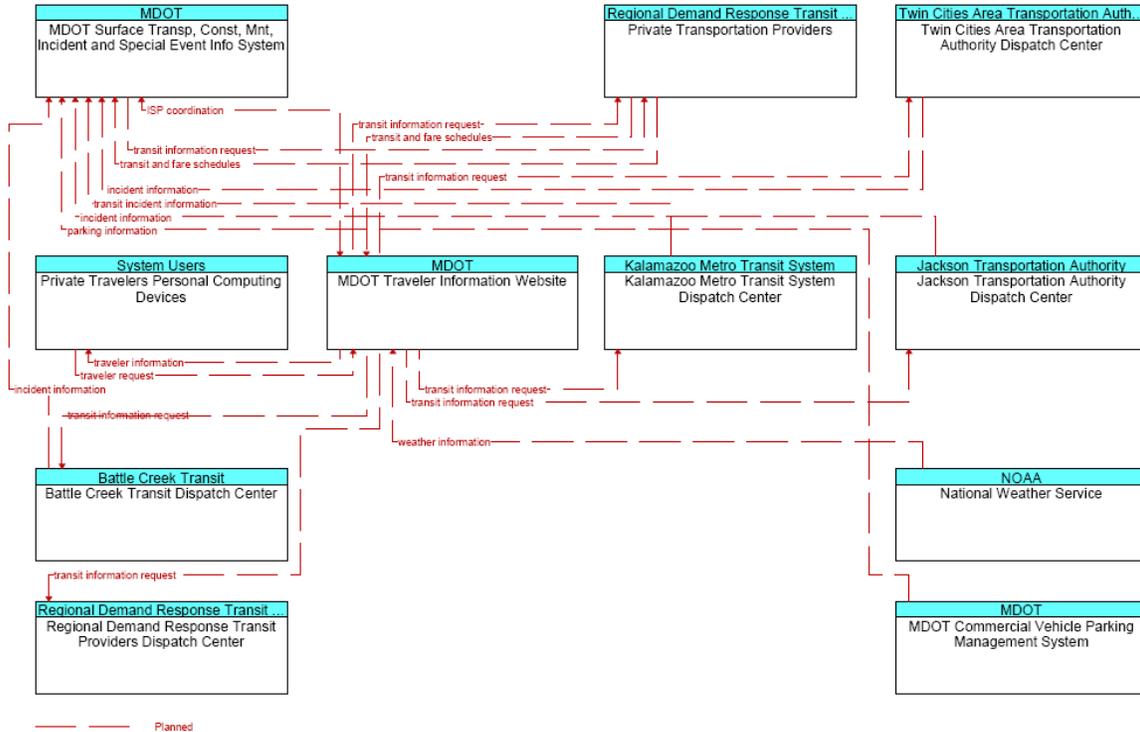


Figure 6 - Example Interconnect Diagram: MDOT Traveler Information Website

3.5.2 Data Flows between Elements

In the market package diagrams, flows between the subsystems and terminators define the specific information (data) that is exchanged between the elements and the direction of the exchange. The data flows could be requests for information, alerts and messages, status requests, broadcast advisories, event messages, confirmations, electronic credentials, and other key information requirements. Turbo Architecture can be used to output flow diagrams and can be filtered by market package for ease of interpretation; however, it is important to remember that custom data flows will not show up in diagrams that are filtered by market package. An example of a flow diagram for the MDOT Surface Transportation Management Incident Special Event Information System that has been filtered for ATIS1–MDOT Surface Transportation, Construction, Maintenance, Incident and Special Event Information System shown in **Figure 7**.

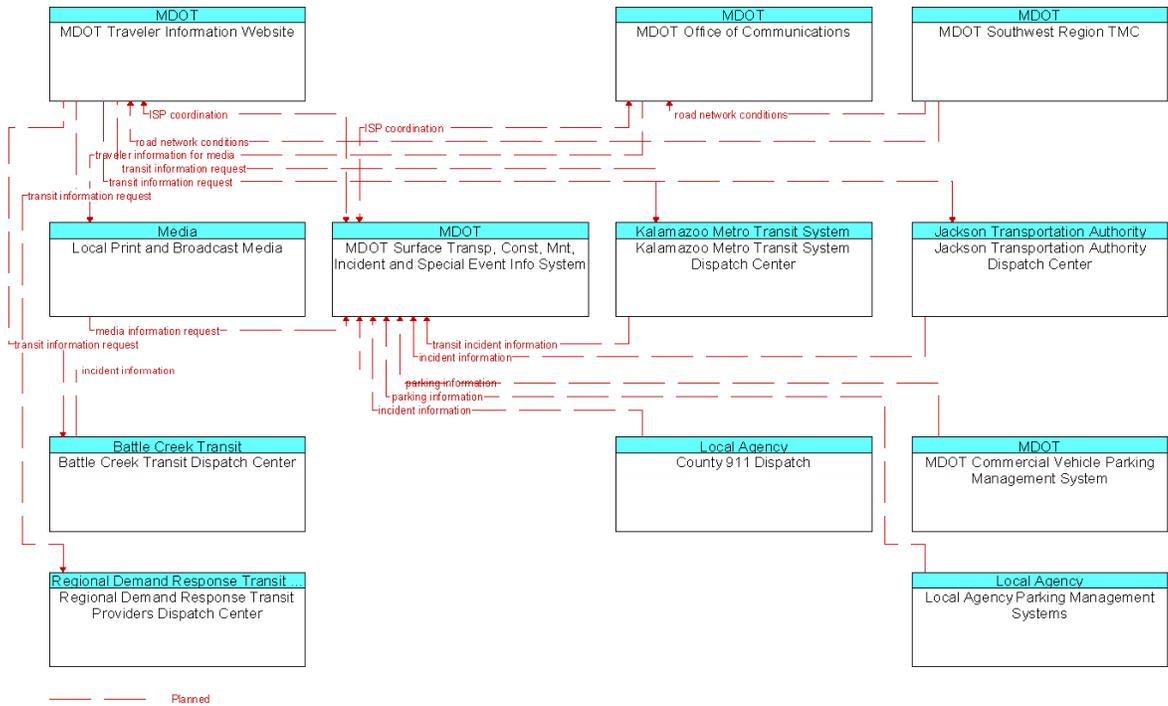


Figure 7 - Example Flow Diagram: ATIS1-1 – MDOT Surface Transportation, Construction, Maintenance, Incident and Special Event Information System

4. APPLICATION OF THE REGIONAL ITS ARCHITECTURE

Once a region has identified the desired components of ITS for their area and established which agencies and systems need to be connected, the structure of the National ITS Architecture assists with the region's planning and implementation. This section addresses the application of the Southwest and portions of University Regional ITS Architecture. The National ITS Architecture provides recommendations for standards and functional requirements that should be considered when implementing ITS elements. In addition, an operational concept has been developed for the study area and documents the roles and responsibilities of stakeholders in the operation of the study area's ITS. The implementation of ITS in the study area will likely require interagency agreements. Potential agreements have been identified based on the desired data flows identified in the study area. The ITS Architecture and ITS Deployment Plan developed as part of this process will be incorporated into the existing planning process for the study area to ensure that the maximum benefit is realized from the development effort.

4.1 Functional Requirements

Functions are a description of what the system has to do. In the National ITS Architecture, functions are defined at several different levels, ranging from general subsystem descriptions through somewhat more specific equipment package descriptions to Process Specifications that include substantial detail. Guidance from the USDOT on developing a Regional ITS Architecture recommends that each Region determine the level of detail of the functional requirements for their Region. In the Southwest Region and portions of University Region, it is recommended that the development of detailed functional requirements such as the "shall" statements included in Process Specifications for a system be developed at the project level. These detailed "shall" statements identify all functions that a project or system need to perform.

For the Southwest and portions of University Regional ITS Architecture, functional requirements have been identified at two levels. The customized market packages, discussed previously in Section 3.4.2, describe the services that ITS needs to provide in the Region and the architecture flows between the elements. These market packages and data flows describe what the ITS system in the study area have to do and the data that needs to be shared among elements.

Functional Requirements is generated from the Turbo database and included in **Appendix D** of the Final Report.

4.2 Standards

Standards are an important tool that will allow efficient implementation of the elements in the Southwest and portions of University Regional ITS Architecture over time. Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances, vendors change, and as new approaches evolve. The USDOT's ITS Joint Program Office is supporting Standards Development Organizations (SDOs) with an extensive, multi-year program of accelerated, consensus-based standards development to facilitate successful ITS deployment in the United States. **Table 8** identifies each of the ITS standards that could apply to the Southwest and portions of University Regional ITS Architecture. These standards are based on the physical subsystem architecture flows previously identified in Section 3.5.2.

Table 8 - Study Area Applicable ITS Standards

SDO	Document ID	Title
ANSI	ANSI TS286	Commercial Vehicle Credentials
AASHTO/ITE/NEMA	NTCIP 1101	Simple Transportation Management Framework (STMF)
	NTCIP 1102	Octet Encoding Rules Base Protocol
	NTCIP 1103	Transportation Management Protocols
	NTCIP 1104	Center-to-Center Naming Convention Specification
	NTCIP 1105	CORBA Security Service Specification
	NTCIP 1106	CORBA Near-Real Time Data Service Specification
	NTCIP 1201	Global Object Definitions
	NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller Units
	NTCIP 1203	Object Definitions for DMS
	NTCIP 1204	Environmental Sensor Station Interface Standard
	NTCIP 1205	Object Definitions for CCTV Camera Control
	NTCIP 1206	Object Definitions for Data Collection and Monitoring (DCM) Devices
	NTCIP 1208	Object Definitions for CCTV Switching
	NTCIP 1209	Data Element Definitions for Transportation Sensor Systems
	NTCIP 1210	Field Management Stations – Part 1: Object Definitions for Signal System Masters
	NTCIP 1211	Object Definitions for Signal Control and Prioritization
	NTCIP 1401	TCIP Common Public Transportation Objects
	NTCIP 1402	TCIP Incident Management Objects
	NTCIP 1403	TCIP Passenger Information Objects
	NTCIP 1404	TCIP Scheduling/Runcutting Objects
	NTCIP 1405	TCIP Spatial Representation Objects
	NTCIP 1406	TCIP On-Board Objects
	NTCIP 1407	TCIP Control Center Objects
	NTCIP 1408	TCIP Fare Collection Business Area Objects
	NTCIP 2101	Point to Multi-Point Protocol Using RS-232 Subnetwork Profile
	NTCIP 2102	Point to Multi-Point Protocol Using Frequency Shift Keying Modem Subnetwork Profile
	NTCIP 2103	Point-to-Point Protocol Over RS-232 Subnetwork Profile
	NTCIP 2104	Ethernet Subnetwork Profile
	NTCIP 2201	Transportation Transport Profile
	NTCIP 2202	Internet (TCP/IP and UDP/IP) Transport Profile
	NTCIP 2301	STMF Application Profile
	NTCIP 2302	Trivial File Transfer Protocol Application Profile
NTCIP 2303	File Transfer Protocol Application Profile	
NTCIP 2304	Application Profile for DATEX-ASN (AP-DATEX)	
NTCIP 2305	Application Profile for CORBA (AP-CORBA)	
NTCIP 2306	Application Profile for XML Message Encoding and Transport in ITS Center-to-Center Communications	
NTCIP 2501	Information Profile for DATEX	

SDO	Document ID	Title
AASHTO/ITE/NEMA (continued)	NTCIP 2502	Information Profile for CORBA
ASTM	ASTM E2158-01	Standard Specification for Dedicated Short Range Communication (DSRC) Physical Layer using Microwave in the 902-928 MHz Band
	ASTM E2259-xx	Standard Specification for Metadata to Support Archived Data Management Systems
	ASTM E2259-yy	Standard Specification for Archiving ITS Generated Travel Monitoring Data
	ASTM PS 105-99	Standard Provisional Specification for DSRC Data Link Layer
IEEE	IEEE 1512.1-2003	Standard for Traffic Incident Management Message Sets for Use by EOCs
	IEEE 1512.2-2004	Standard for Public Safety Incident Management Message Sets (IMMS) for use by EOCs
	IEEE 1512.3-2002	Standard for Hazardous Material IMMS
	IEEE 1512-2000	Standard for Common IMMS for use by EOCs
	IEEE 1570-2002	Standard for Interface Between the Rail Subsystem and the Highway Subsystem at a Highway Rail Intersection
	IEEE 1609.1	Resource Manager for DSRC 5.9 GHz
	IEEE 1609.2	Application Services (Layers 6,7) for DSRC 5.9 GHz
	IEEE 1609.3	Communications Services (Layers 4,5) for DSRC 5.9 GHz (Future Standard)
	IEEE 1609.4	Medium Access Control (MAC) Extension and the MAC Extension Management Entity for DSRC 5.9 GHz
	IEEE 802.11	Standard Specification for Telecommunications and Information Exchange Between Roadside and Vehicle Systems – 5 GHz Band DSRC MAC and Physical Layer Specifications
	IEEE 802.2	Logical Link (Layer 2) for DSRC 5.9 GHz
	IEEE P1512.4	Standard for Common Traffic Incident Management Message Sets for Use in Entities External to Centers
ISO	ISO 21210	Networking Services (Layer 3) for DSRC 5.9 GHz
SAE	ITE TM 1.03	Standard for Functional Level Traffic Management Data Dictionary
	ITE TM 2.01	Message Sets for External TMC Communication
	SAE J2266	Location Referencing Message Specification
	SAE J2354	Message Set for Advanced Traveler Information System (ATIS)
	SAE J2540	Messages for Handling Strings and Look-Up Tables in ATIS Standards
	SAE J2540-1	Radio Data System Phrase Lists
	SAE J2540-2	International Traveler Information Systems Phrase Lists
	SAE J2540-3	National Names Phrase List

4.3 Operational Concepts

An operational concept documents each stakeholder’s current and future roles and responsibilities across a range of transportation services, as grouped in the Operational Concepts section of Turbo Architecture, in the operation of the regional ITS. The services covered are:

- **Arterial Management** – The development of signal systems that react to changing traffic conditions and provide coordinated intersection timing over a corridor, an area, or multiple jurisdictions.
- **Highway Management** – The development of systems to monitor freeway (or tollway) traffic flow and roadway conditions, and provide strategies such as ramp metering or lane access control to improve the flow of traffic on the freeway. Includes systems to provide information to travelers on the roadway.
- **Incident Management** – The development of systems to provide rapid and effective response to incidents. Includes systems to detect and verify incidents, along with coordinated agency response to the incidents.
- **Emergency Management** – The development of systems to provide emergency call taking, public safety dispatch, and emergency operations center operations.
- **Maintenance and Construction Management** – The development of systems to manage the maintenance of roadways in the Region, including winter snow and ice clearance. Includes the managing of construction operations.
- **Transit Management** – The development of systems to more efficiently manage fleets of transit vehicles or transit rail. Includes systems to provide transit traveler information both pre-trip and during the trip.
- **Electronic Payment** – The development of electronic fare payment systems for use by transit and other agencies (e.g., parking).
- **Commercial Vehicle Operations** – The development of systems to facilitate the management of commercial vehicles (e.g., electronic clearance).
- **Traveler Information** – The development of systems to provide static and real time transportation information to travelers.
- **Archived Data Management** – The development of systems to collect transportation data for use in non-operational purposes (e.g., planning and research).
- **Advanced Vehicle Safety** – The development of systems to support private sector vehicle safety initiatives (e.g., intersection collision avoidance)

Table 9 identifies the roles and responsibilities of key stakeholders for a range of transportation services.

Table 9 - Southwest Region and Portions of University Region Stakeholder Roles and Responsibilities

Transportation Service	Stakeholder	Roles/Responsibilities
Surface Street Management	MDOT	Coordinate traffic information and control with Local Agency TOCs and other MDOT TMCs.
		Operate and maintain traffic signal systems on MDOT routes not managed by Local Agencies.
		Operate network surveillance equipment (CCTV Cameras, field sensors, etc.) on MDOT routes not managed by Local Agencies.
		Provide security monitoring of critical infrastructure for MDOT.
		Provide traffic information reports to regional information service providers.
	Michigan Metropolitan Planning Organizations	Organize and plan air monitoring activities within the Southwest Region. MPO monitors air quality, collects air data, and reports the data to the public.
	Rail Operators	Operate and maintain rail roadside equipment communicating with traffic signal systems or other traffic control devices at highway rail intersections.
	Local Agency	Coordinate HRI signal adjustments with Private Rail Operators.
		Operate network surveillance equipment (CCTV Cameras, field sensors, etc.) on local routes.
		Operate traffic signal systems on local routes.
		Coordinate traffic information with other local agencies.
		Coordinate traffic information and control with MDOT Southwest Region Office.
		Provide security monitoring of critical infrastructure for Local Agency.
		Provide traffic information to regional agencies including transit, emergency management, maintenance and construction, and the media. Provide traffic information to travelers through Local Agency.
		Provide traffic information reports to regional information service providers.
Freeway Management	MDOT	Operate network surveillance equipment (CCTV Cameras, field sensors, etc.) on MDOT highway routes.
		Provide traffic information to regional transportation agencies and the general public through traffic information devices (DMS, DNR Highway Advisory Radio).
		Operate network surveillance equipment (CCTV Cameras, etc.) and dynamic message signs (to convey traffic information to travelers) owned by MDOT.
	MDOT	Provide traffic information to regional information service providers.
	INDOT	Exchange traffic related information with MDOT.
		Share CCTV images with MDOT.
		Share control of ITS devices with MDOT.
	Local Agency	Coordinate traffic information and traffic control with other MDOT TMCs.

Transportation Service	Stakeholder	Roles/Responsibilities
Incident Management	MDOT	Coordinate maintenance resources for incident response with MDOT TSC Construction and Maintenance Operations.
		Perform network surveillance for detection and verification of incidents on MDOT routes.
		Provide incident information to travelers via traffic information devices on highways (e.g. MDOT DMS, DNR HAR).
		Provide incident information to regional emergency responders, including the MSP, EM, and local agencies.
	MSP	Coordinate incident response with other public safety agencies (local police, fire, EMS, sheriff) as well as MDOT.
		Dispatch MSP vehicles for incidents on highways.
		Perform incident detection and verification for the highways within the region and provide this information to traffic and other public safety agencies.
	Local Agency	Coordinate public safety resources for incident response on local routes.
		Dispatch the Local Agency emergency vehicles to incidents, including the Local Agency Police, Fire, and EMS/Rescue.
		Receive emergency calls for incidents on local routes.
		Coordinate incident response with other public safety agencies (fire, EMS, ambulance, etc.).
		Coordinate maintenance resources for incident response with MDOT Grand Region TSCs and Local Agencies.
		Perform incident detection and verification on local routes and provide this information to the Local Agency TOC.
		Perform network surveillance for detection and verification of incidents on local routes.
		Provide incident information to regional emergency responders, including the MSP and MDOT.
		Responsible for the development, coordination, and execution of special traffic management strategies during an evacuation.
	Battle Creek Transit	Report incident information to public safety agencies.
		Operate on-board security cameras, to remotely monitor the vehicles.
	Jackson Transportation Authority	Report incident information to public safety agencies.
		Operate on-board security cameras, to remotely monitor the vehicles.
	Kalamazoo Metro Transit System	Report incident information to public safety agencies.
		Operate on-board security cameras, to remotely monitor the vehicles.
	Twin Cities Area Transportation Authority	Report incident information to public safety agencies.
		Operate on-board security cameras, to remotely monitor the vehicles.
Regional Demand Response Transit Providers	Report incident information to public safety agencies.	
	Operate on-board security cameras, to remotely monitor the vehicles.	

Transportation Service	Stakeholder	Roles/Responsibilities
Emergency Management	MDOT	Provide 511 Traveler information system to MDOT motorists.
		Responsible for providing service patrol dispatch resources to assist motorists in need on MDOT transportation facilities.
	MSP	Aid in the coordination of region wide emergency plans, evacuation and reentry plans, and disaster management.
		Dispatch MSP vehicles to incidents within their jurisdiction.
		Receive AMBER Alert and other Wide Area Alert information from MSP Headquarters.
		Receive early warning information and threat information from the NWS and Local Agencies.
		Coordinate with regional emergency management providers, maintenance and construction providers, and regional traffic management providers for emergency plans and evacuation and reentry plans.
		Provide regional traffic, transit, emergency management, and maintenance operations with disaster information to disseminate to the traveling public.
	Local Agency	Dispatch Local Agency Fire/EMS/Police vehicles.
		Participate in the incident response, coordination, and reporting.
		Receive AMBER Alert and other Wide Area Alert information from MSP Headquarters.
		Perform incident detection and verification for arterials on local routes.
		Respond to transit emergencies/alarms on-board transit vehicles or at the transit facilities of Local Transit Agencies.
	Department of Homeland Security	Responsible for coordinating with multiple agencies to secure the nation's borders.
		Responsible to protect national transportation infrastructure and U.S. citizens.
	INDOT	Responsible for coordinating DMS and HAR messages with MDOT during wide-area emergency alerts.
NOAA	Issues severe weather warnings based on gathered weather information.	
Battle Creek Transit	Responsible for coordinating emergency and evacuation plans with local agencies.	
Jackson Transportation Authority	Responsible for coordinating emergency and evacuation plans with local agencies.	
Kalamazoo Metro Transit System	Responsible for coordinating emergency and evacuation plans with local agencies.	
Kalamazoo Metro Transit System	Responsible for coordinating emergency and evacuation plans with local agencies.	
Maintenance and Construction	MDOT	Collect road weather information with MDOT equipment and distribute it to regional traffic, maintenance, and transit agencies.
		Dispatch MDOT maintenance vehicles.
		Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, transit operations, emergency operations, rail operations, and the media.
		Manage work zones on all MDOT maintenance and construction activities, as well as monitor work zone safety with MDOT field devices and vehicles.

Transportation Service	Stakeholder	Roles/Responsibilities
Maintenance and Construction (continued)	MDOT (continued)	Perform maintenance of ITS field equipment owned by MDOT.
		Provide maintenance of state highways within the region, including pavement maintenance, winter maintenance, and construction activities.
		Receive vehicle location information from MDOT maintenance and construction vehicles.
		Receive vehicle maintenance conditions from MDOT maintenance and construction vehicle and coordinate fleet management the with MDOT equipment repair facility.
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive a request for maintenance resources for incident response from regional emergency management agencies.
	MSP	Disseminate winter weather advisories via website and phone number for motorists to call.
	Local Agency	Dispatch Local Agency maintenance vehicles.
		Provide maintenance of local routes and MDOT facilities (per contract), including pavement maintenance and construction activities.
		Receive vehicle location information from local agency DPW vehicles.
		Coordinate maintenance resources for incidents with other regional maintenance providers.
		Receive a request for maintenance resources for incident response from regional emergency management agencies.
	Private Operators	Distribute maintenance and construction plans and work zone information to regional information service providers, regional traffic operations, transit operations, emergency operations, rail operations, and the media.
		Perform maintenance of ITS field equipment owned by the Local Agency and MDOT (per contract).
		Coordinate maintenance and construction activities with other regional maintenance and construction agencies.
Manage work zones on local routes and monitor work zone safety with Local Agency owned field equipment and vehicles.		
Transit Services		Battle Creek Transit
	Coordinate transit service with other regional transit providers as well as regional intermodal terminals and the regional airport.	
	Provide fixed route bus service for Battle Creek Transit System.	
	Provide paratransit (demand response) bus service for the Battle Creek Transit System.	
	Provide schedule and fare information on Battle Creek Transit System.	
	Provide transit passenger electronic fare payment on all Battle Creek Transit System fixed route and demand response transit vehicles.	
	Track and evaluate schedule performance on all Battle Creek Transit System fixed route and demand response vehicles.	
	Coordinate emergency plans with the Local Public Safety Agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry)	
	Provide a demand response transit plan from the agency website.	
	Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Battle Creek Transit System fixed route and demand response vehicles.	

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Services (continued)	Battle Creek Transit (continued)	Provide transit schedule and fare information to the Battle Creek Transit System website and private sector traveler information service providers.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Local Public Safety Agency in addition to making it available on transit information kiosks.
	Jackson Transportation Authority	Collect and archive transit data from Jackson Transportation Authority transit operations.
		Provide fixed route bus service for Jackson Transportation Authority.
		Provide paratransit (demand response) bus service for the Jackson Transportation Authority.
		Provide schedule and fare information on Jackson Transportation Authority.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Track and evaluate schedule performance on all Jackson Transportation Authority fixed route and demand response vehicles.
		Coordinate emergency plans with the Local Public Safety Agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry)
		Provide a demand response transit plan from the agency website.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Jackson Transportation Authority fixed route and demand response vehicles.
		Provide transit passenger electronic fare payment on all Jackson Transportation Authority fixed route and demand response transit vehicles.
		Provide transit schedule and fare information to the Jackson Transportation Authority website and private sector traveler information service providers.
	Provide transit traveler information to the agency website, local private sector traveler information services, and the Local Public Safety Agency in addition to making it available on transit information kiosks.	
	Kalamazoo Metro Transit System	Collect and archive transit data from Kalamazoo Metro Transit System transit operations.
		Coordinate transit service with other regional transit providers as well as regional intermodal terminals and the regional airport.
		Provide fixed route bus service for the Kalamazoo Metro Transit System.
		Provide paratransit (demand response) bus service for the Kalamazoo Metro Transit System.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Coordinate emergency plans with the Local Public Safety Agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry).
		Provide a demand response transit plan from the agency website.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Kalamazoo Metro Transit System fixed route and demand response vehicles.

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Services (continued)	Kalamazoo Metro Transit System (continued)	Provide schedule and fare information on Kalamazoo Metro Transit System.
		Provide transit passenger electronic fare payment on all Kalamazoo Metro Transit System fixed route and demand response transit vehicles.
		Provide transit schedule and fare information to the Kalamazoo Metro Transit System website and private sector traveler information service providers.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Local Public Safety Agency in addition to making it available on transit information kiosks.
		Track and evaluate schedule performance on all Kalamazoo Metro Transit System fixed route and demand response vehicles.
	Twin Cities Area Transportation Authority	Collect and archive transit data from Twin Cities Area Transportation Authority Transit System transit operations.
		Coordinate transit service with other regional transit providers as well as regional intermodal terminals and the regional airport.
		Provide fixed route bus service for Twin Cities Area Transportation Authority Transit System.
		Provide paratransit (demand response) bus service for the Twin Cities Area Transportation Authority Transit System.
		Provide schedule and fare information on Twin Cities Area Transportation Authority Transit System.
		Provide transit passenger electronic fare payment on all Twin Cities Area Transportation Authority Transit System fixed route and demand response transit vehicles.
		Track and evaluate schedule performance on all Twin Cities Area Transportation Authority Transit System fixed route and demand response vehicles.
		Coordinate emergency plans with the Local Public Safety Agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry)
		Provide a demand response transit plan from the agency website.
		Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Twin Cities Area Transportation Authority Transit System fixed route and demand response vehicles.
		Provide transit schedule and fare information to the Twin Cities Area Transportation Authority Transit System website and private sector traveler information service providers.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Local Public Safety Agency in addition to making it available on transit information kiosks.
		Regional Demand Response Transit Providers
	Coordinate emergency plans with the Local Public Safety Agency and provide emergency transit services for evacuations, fires, and disasters (including re-entry)	
	Coordinate transit service with other regional transit providers as well as regional intermodal terminals and the regional airport.	
	Provide a demand response transit plan from the agency website.	
	Provide automated transit maintenance scheduling through automated vehicle conditions reports on all Regional Demand Responsive Transit Providers' fixed route and demand response vehicles.	

Transportation Service	Stakeholder	Roles/Responsibilities
Transit Services (continued)	Regional Demand Response Transit Providers (continued)	Provide schedule and fare information on Regional Demand Responsive Transit Providers.
		Provide transit passenger electronic fare payment on all Regional Demand Responsive Transit Providers' fixed route and demand response transit vehicles.
		Provide transit security on all transit vehicles and at transit terminals through silent alarms and surveillance systems.
		Provide transit traveler information to the agency website, local private sector traveler information services, and the Local Public Safety Agency in addition to making it available on transit information kiosks.
Commercial Vehicle Operations	MDOT	Provide permit information to regional emergency management providers and regional enforcement agencies.
		Provide regional permits (overheight/overweight and HAZMAT) to private fleet systems.
		Provide route restriction information to private fleet systems.
	MSP	Provide automated weigh-in-motion inspections for private fleet operations (both commercial vehicles and rail).
		Provide enforcement of regional permits for overheight/overweight or HAZMAT. Provide first response to commercial vehicle incidents and coordinate with DEM for HAZMAT conditions/clean-up.
	Michigan Trucking Association	Represents private fleet operators and trucking industry in the state of Michigan.
FMCSA	Responsible for the administration of safety-related initiatives and programs for the motor carrier industry.	
Traveler Information	MDOT	Collect traffic information (road network conditions), work zone information, travel times, and weather information.
		Coordinate and share traveler information with all other traveler information providers within the region.
		Provide broadcast information to travelers.
		Provide traveler information to the media.
	Provide traveler information to private travelers (through in vehicle, personal computing devices or kiosks) upon request.	
	MSP	Collect traffic information (road network conditions), work zone information, travel times, and weather information.
	Local Agency	Collect traffic information (road network conditions), work zone information, travel times, and weather information.
		Coordinate and share traveler information with all other traveler information providers within the region.
	Media	Collect travel-related information from the public sector and private information sources, and broadcast that information to their customers via TV, radio stations, news media, etc.
	NOAA	Make available weather forecast; issue warnings related to adverse weather conditions.
Private Information Service Providers	Collect travel-related information from the public sector and private information sources, and broadcast that information to their customers via a variety of user interface equipment.	
System Users	Receive travel-related information on various modes of transportation, including surface street, air, rail/transit, and non-motorized.	
Parking Management	MDOT	Operated by MDOT to provide commercial vehicle parking at key rest area parking facilities.
	Michigan Parking Association	Provides forum for sharing and disseminating information specific to the parking industry.
	Local Agency	Operate Downtown Jackson parking management system.
		Operate Downtown Kalamazoo parking management system.

Transportation Service	Stakeholder	Roles/Responsibilities
Archived Data Systems	MDOT	Collect and archive traffic information from regional traffic management centers.
		Collect and archive asset status information from all MDOT maintenance offices and MDOT asset management systems.
		Collect and archive traffic information from regional traffic management providers, emergency information, from MSP and Local Agency Police, and transit information from regional transit agencies for planning purposes.
	MSP	Collect and archive emergency (incident) information from MSP and the region's emergency responders.
	Battle Creek Transit	Collect and archive transit data.
	Jackson Transportation Authority	Collect and archive transit data.
	Kalamazoo Metro Transit System	Collect and archive transit data.
	Twin Cities Area Transportation Authority	Collect and archive transit data.
Regional Demand Response Transit Providers	Collect and archive transit data.	

4.4 Potential Agreements

The Regional ITS Architecture for the study area has identified many agency interfaces, information exchanges, and integration strategies that would be needed to provide the ITS services and systems identified by the stakeholders in the study area. Interfaces and data flows among public and private entities in the study area will require agreements among agencies that establish parameters for sharing agency information to support traffic management, incident management, provide traveler information, and perform other functions identified in the Regional ITS Architecture.

With the implementation of ITS technologies, integrating systems from one or more agencies, and the anticipated level of information exchange identified in the architecture, it is likely that formal agreements between agencies will be needed in the future. These agreements, while perhaps not requiring a financial commitment from agencies in the study area should outline specific roles, responsibilities, data exchanges, levels of authority, and other facets of regional operations. Some agreements will also outline specific funding responsibilities, where appropriate and applicable.

Agreements should avoid being specific with regards to technology when possible. Technology is likely to change rapidly and changes to technology could require an update of the agreement if the agreement was not technology neutral. Focus of the agreement should be on the responsibilities of the agencies and the high level information that needs to be exchanged. Depending on the type of agreement being used, agencies should be prepared for the process to complete an agreement to take several months to years. Agencies must first reach consensus on what should be in an agreement and then proceed through the approval process. The approval process for formal agreements varies by agency and can often be quite lengthy, so it is recommended that agencies plan ahead to ensure that the agreement does not delay the project.

When implementing an agreement for ITS, it is recommended that as a first step any existing agreements are reviewed to determine whether they can be amended or modified to include the additional requirements that will come with deploying a system. If there are no existing

agreements that can be modified or used for ITS implementation, then a new agreement will need to be developed. The formality and type of agreement used is a key consideration. If the arrangement will be in affect for an extended duration or involve any sort of long term maintenance, then written agreements should be used. Often during long term operations, staff may change and a verbal agreement between agency representatives may be forgotten by new staff.

Common agreement types and potential applications include:

- **Handshake Agreement:** Handshake agreements are often used in the early stage of a project. This type of informal agreement depends very much on relationships between agencies and may not be appropriate for long term operations where staff is likely to change.
- **Memorandum of Understanding (MOU):** A MOU demonstrates general consensus or willingness to participate as part of a particular project but is not typically very detailed.
- **Interagency and Intergovernmental Agreements:** These agreements between public agencies can be used for operation, maintenance, or funding of its projects and systems. They can include documentation on the responsibility of each agency, functions they will provide, and liability.
- **Funding Agreements:** Funding agreements document the funding arrangements for ITS projects. At a minimum, funding agreements include a detailed scope, services to be performed, and a detailed project budget.
- **Master Agreements:** Master agreements include standard contract language for an agency and serve as the main agreement between two entities which guides all business transactions. Use of a master agreement can allow an agency to do business with another agency or private entity without having to go through the often lengthy development of a formal agreement each time.

Table 10 provides a list of potential agreements for the study area based on the interfaces identified in the Regional ITS Architecture. It is important to note that as ITS services and systems are implemented in the study area, part of the planning and review process for those projects should include a review of potential agreements that would be needed for implementation or operations.

Table 10 - Study Area Potential Agreements

Status	Agreement and Agencies	Agreement Description
Future	Joint Operations/Shared Control Agreements (Public-Public or Public-Private)	These agreements would allow joint operations or control of certain systems and equipment. The agreement should define such items as hours of operation and time of day/day of week when shared control would take effect, circumstances, or incidents when shared control would take effect, notification procedures between the agencies agreeing to share control arrangements, overriding capabilities of owning agency, etc. Private agencies, such as information service providers that provide traffic reports, could also be part of this agreement.
Future	Data Sharing and Usage (Public-Public)	These agreements would define the parameters, guidelines, and policies for inter- and intra-agency ITS data sharing. This data sharing would support regional activities related to traffic management, incident management, traveler information, and other functions. The terms of this agreement should generally address such items as types of data and information to be shared, how the information will be used (traffic incident information to be shared, displayed on web site for travel information, distributed to private media, etc.), and parameters for data format, quality, security.
Future	Data Sharing and Usage (Public-Private)	These agreements would define the parameters, guidelines, and policies for private sector (such as the media or other information service providers) use of ITS data. This type of agreement is recommended to define terms of use for broadcasting public-agency information regarding traffic conditions, closures, restrictions, as well as video images. Agreements can also include requirements for the media to 'source' the information (i.e., using the providing agency's logo on all video images broadcast).
Future	Mutual Aid Agreements (Public-Public)	Mutual aid agreements often exist as either formal or informal arrangements. They are a routine practice among many public safety and emergency services agencies. Formal mutual aid agreements will become more important as agencies integrate systems and capabilities, particularly automated dispatch and notification. Formalized agreements should be considered as ITS or other electronic data sharing systems are implemented in the Region.

4.5 Phases of Implementation

The Regional ITS Architecture will be implemented over time through a series of projects led by both public sector and private sector agencies. Key foundation systems will need to be implemented in order to support other systems that have been identified in the Regional ITS Architecture. The deployment of all of the systems required to achieve the final Regional ITS Architecture build out will occur over many years.

A sequence of projects and their respective time frames have been identified in the Southwest and portions of University Regional ITS Deployment Plan. These projects have been sequenced over a 15-year period, with projects identified for deployment in 5-, 10- and 15-year timeframes.

Some of the key market packages that will provide the functions for the foundation systems in the study area are listed below. Projects associated with these and other market packages identified for the Region have been included in the Southwest and portions of University Regional ITS Deployment Plan.

- Network Surveillance;
- Maintenance and Construction Vehicle Tracking;
- Weather Information Processing and Distribution;
- Surface Street Control;
- Traffic Information Dissemination; and
- Transit Vehicle Tracking.

4.6 Incorporation into the Regional Planning Process

Stakeholders invested a considerable amount of effort in the development of the Regional ITS Architecture and Regional ITS Deployment Plan for the study area. The plans need to be incorporated into the regional planning process so that the ITS vision for the Region is considered when implementing ITS projects and to ensure that the Region remains eligible for federal funding for implementation of the projects.

As projects are added to the Transportation Improvement Program (TIP) each project should be evaluated to determine if the project includes any ITS elements. If the project contains an ITS element, then the Regional ITS Architecture needs to be reviewed to ensure that the project is in conformance. The MDOT Southwest Region Office and University Region Office will perform this examination as part of the planning process using the procedure outlined in Section 5.

5. USE AND MAINTENANCE PLAN FOR THE REGIONAL ITS ARCHITECTURE

The ITS Architecture developed for the study area addresses the Region’s vision for ITS implementation at the time the plan was developed. With the growth of the study area, needs will change and as technology progresses new ITS opportunities will arise. For example, at the time this architecture was developed MDOT did not operate any Highway Advisory Radios (HAR). As the system expands, MDOT may determine a need for HAR in specific locations and wish to install more. Shifts in regional needs and focus as well as changes in the National ITS Architecture will necessitate that the study area Regional ITS Architecture be updated to remain a useful resource for the Southwest and portions of University Region.

The following section outlines how the Regions and its stakeholders can work with the MDOT ITS Program Office to ensure projects are in conformity and also provide updates as ITS evolves in the region.

5.1 Process for Determining Architecture Conformity

The Southwest and Portions of University Regional ITS Architecture and Deployment Plan documents and customized market packages were developed as part of the ITS architecture process. To satisfy federal requirements and remain eligibility to use federal funds, a project must be accurately documented. To document the conformity of an ITS project with the regional architecture, MDOT's ITS Program Office will oversee the development of a regional architecture conformance form to guide project managers through the process. The project managers will be able to coordinate with the ITS Program Office and regional contact for additional assistance and guidance. The steps of the process are as follows:

- Identify the ITS components in the project;
- Identify the corresponding market packages(s) from the Regional ITS Architecture;
- Locate the component within the market package;
- Compare the connections to other agencies or elements documented in the ITS architecture as well as the information flows between them to the connections that will be part of the project;
- Assess the use of relevant standards; and
- Document any changes necessary to the ITS Architecture or the project to ensure there is conformance.

Identifying the ITS Components

ITS components can be fairly apparent in an ITS focused project such as CCTV or DMS deployments, but could also be included in other types of projects. For example, an arterial widening project could include the installation of signal system interconnect, signal upgrades, and the incorporation of the signals in the project limits into the MDOT’s signal system. These are all ITS deployments and should be part of the ITS architecture.

Identifying the Corresponding Market Packages

If a project was included in **Table 20** of the Deployment Plan, then the applicable market package(s) for that project are identified in a column. ITS projects are not required to be included in the ITS Deployment Plan in order to be eligible for federal funding; therefore, market

packages might need to be identified without the assistance of an ITS Deployment Plan. In that case, the market packages selected and customized for the Southwest and Portions of University Region are identified in **Table 6** of this document, detailed market package definitions are located in **Appendix A**, and customized market packages for the Southwest Region and Portions of University Region are included in **Appendix B**.

Identifying the Component within the Market Package

The customized market packages for the Southwest Region and Portions of University Region are located in **Appendix B**. Once the element is located on the market package, the evaluator may determine that the element name should be modified. This name change should be documented using the process outlined in Section 1.3.

Evaluating the Connections and Flows

The connections and architecture flows documented in the market package diagrams were selected based on the information available at the time the plan was developed. As the projects are designed, decisions will be made on the system layout that might differ from what is shown in the market package. These changes in the project should be documented in the ITS market packages using the process outlined in Section 1.3.

Relevant Standards

ITS Standards are documented guidelines or rules specifying the interconnections among elements and the characteristics of technologies and products to be used in ITS installations. Standards describe in detail what types of interfaces should exist between ITS components and how the components will exchange information and work together to deliver certain user services. The Southwest and Portions of University Regional ITS Architecture highlights the relevant standards based on the needs of the regions. These standards should be reviewed as part of this conformity exercise. Where standards can be utilized, they should be noted. Where standards are not or could not be utilized, an explanation of why also should be noted.

Documenting Required Changes

If any changes are needed to accommodate the project under review, Section 1.3 describes how those changes should be documented. Any changes will be incorporated during the next architecture update. Conformance will be accomplished by documenting how the market package(s) should be modified so that the connections and data flows are consistent with the project.

5.2 Maintenance Process

MDOT's ITS Program Office will be responsible for leading the maintenance of the Southwest and Portions of University Regional ITS Architecture and Deployment Plan in coordination with the regional contact. Maintenance includes modifications to the plan as well as complete updates. **Table 11** summarizes the maintenance process agreed upon by stakeholders in the Region.

Table 11 - Regional ITS Architecture and Deployment Plan Maintenance Summary

Maintenance Details	Regional ITS Architecture		Regional ITS Deployment Plan	
	Modification	Complete Update	Modification	Complete Update
Timeframe for Updates	As needed	Every 5 - 7 years	As needed	Every 5 - 7 years
Scope of Update	Update market packages to satisfy architecture conformance requirements of projects or to document other changes that impact the ITS Architecture	Entire ITS Architecture	Update project status and add or remove projects as needed	Entire ITS Deployment Plan
Lead Agency	MDOT ITS Program Office*		MDOT ITS Program Office*	
Participants	Stakeholders impacted by market package modifications	Entire stakeholder group	Entire stakeholder group	
Results	Market packages or other change(s) documented for next complete update	Updated Southwest and Portions of University Regional ITS Architecture document, Appendices, and Turbo Architecture database	Updated project table	Update Southwest and Portions of University Regional ITS Deployment Plan

* Transit related projects will be supported by MDOT's Bureau of Passenger Transportation

Modifications to the Regional ITS Architecture and Deployment Plan will often be necessitated by ITS projects that are receiving federal funding but do not conform to the Regional ITS Architecture. MDOT's ITS Program Office will take the lead in working with agencies that receive federal funding for ITS projects and will keep a record of any changes that are needed to the Regional ITS Architecture. Complete updates to the Regional ITS Architecture will occur approximately every five to seven years and will be led by the MDOT's ITS Program Office with support from the MDOT Southwest Region and Portions of University Region and other key stakeholders. The entire stakeholder group that was engaged to develop this first Regional ITS Architecture will be reconvened for the complete updates.

5.3 Procedure for Submitting ITS Architecture Changes Between Scheduled Updates

Updates to the Southwest and Portions of University Regional ITS Architecture will occur on a regular basis as described in Section 1.2 to maintain the architecture as a useful planning tool. Between complete plan updates, smaller modifications will likely be required to accommodate ITS projects in the Region. Section 1.1 contains step-by-step guidance for determining whether or not a project requires architecture modifications. For situations where a change is required, an ITS Architecture Maintenance Documentation Form was developed and is included in **Appendix F**. This form should be completed and submitted to the MDOT ITS Program Office whenever a change to the Regional ITS Architecture or Deployment Plan is proposed. Please note that MDOT's Bureau of Passenger Transportation also should be copied if the project has a transit related component. The Maintenance Documentation form identifies three levels of modifications. They include:

- Level 1 – Basic changes that do not affect the structure of the architecture. Examples include: Changes to stakeholder or element name, element status, or data flow status.
- Level 2 – Structural changes that impact only one agency. Examples include: Addition of a new market package or modifications to an existing market package that affects only one agency.
- Level 3 – Structural changes that have the potential to impact multiple agencies. Examples include: Addition of a new market package or modifications to an existing market package that involves multiple agencies or incorporation of a new stakeholder into the architecture.

While documenting the proposed change, the project manager completing the change form should coordinate with any of the other agencies that may be impacted by the modification. This communication between agencies will simplify the process of performing a complete plan update. MDOT's ITS Program Office will review and accept the proposed changes. When a complete update is performed by MDOT's ITS Program Office, all of the documented changes will be incorporated into the regional ITS architecture. **Figure 8** graphically illustrates this process.

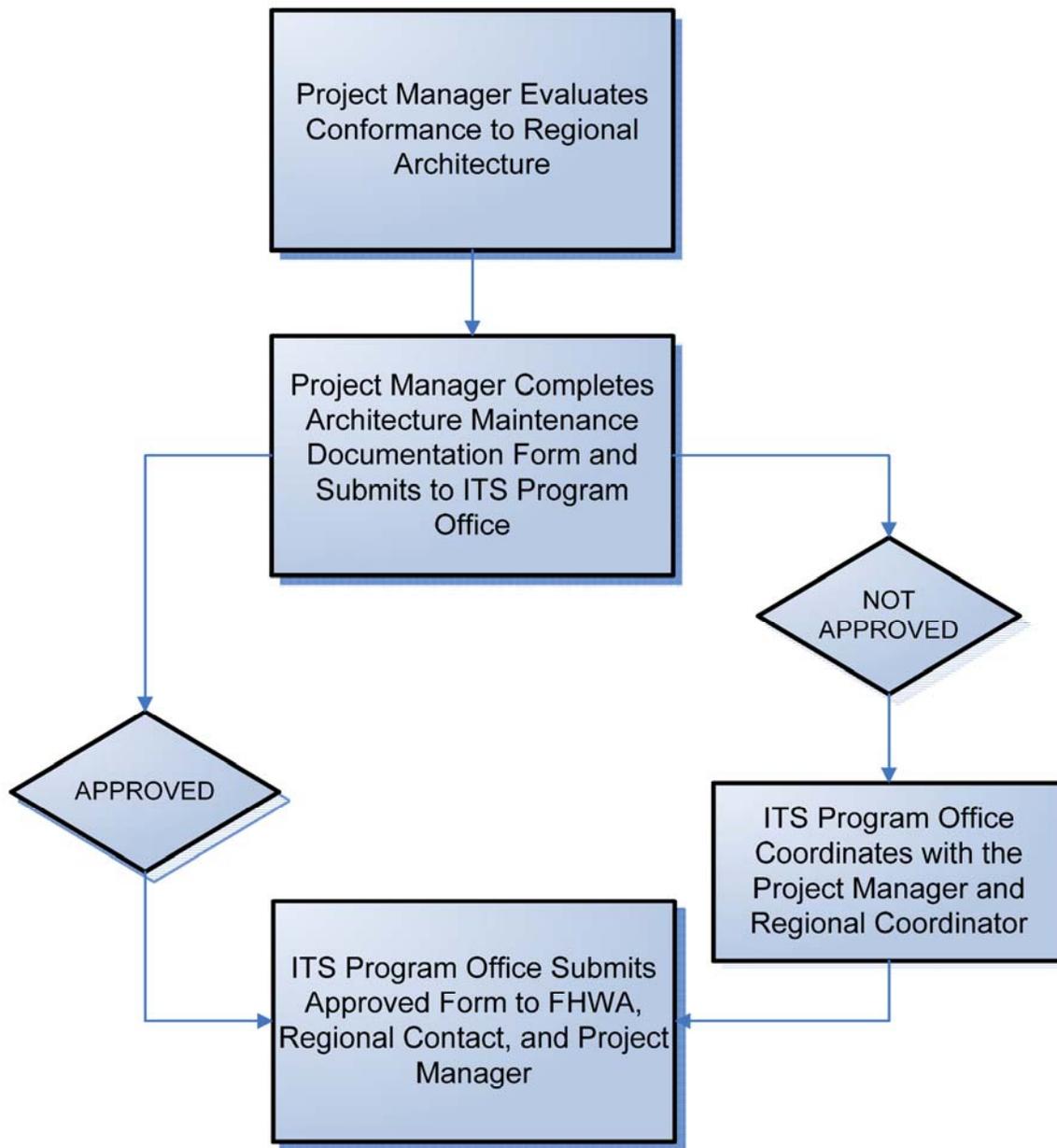


Figure 8 - Process for Documenting Architecture Performance