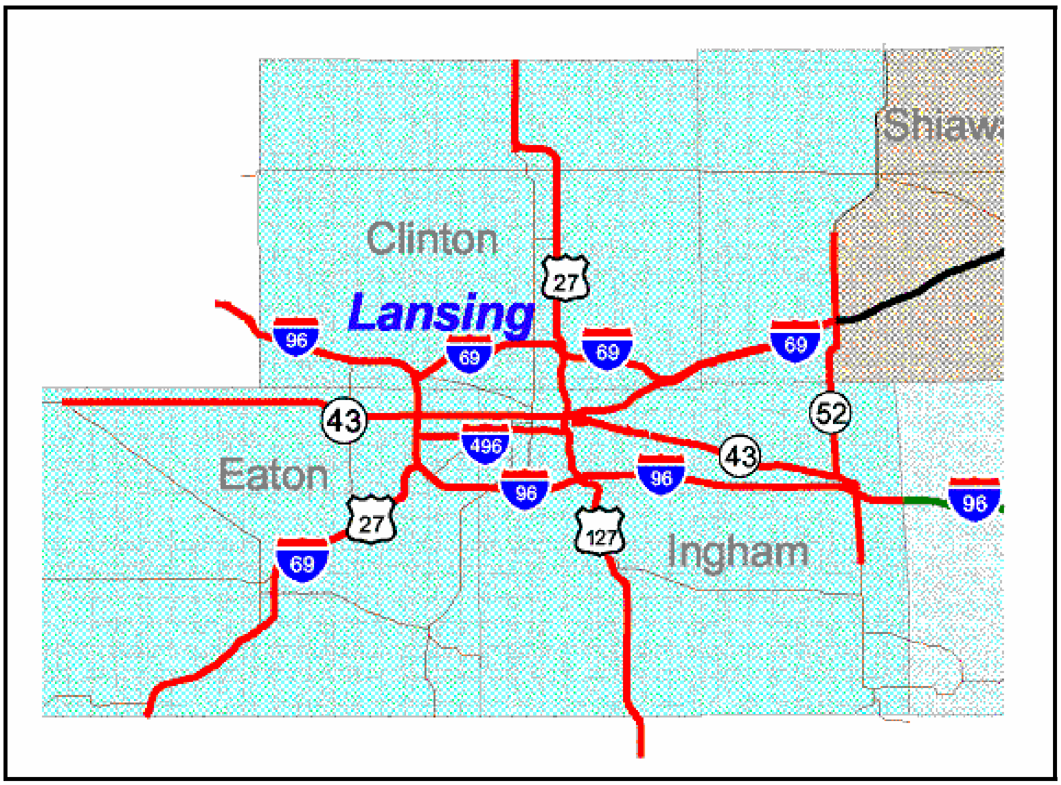
7.0 Lansing Sector Summary Report

The Lansing region consists of three counties (Ingham, Clinton, and Eaton) with a combined population of 450,000. Ingham County (population 279,000) has the majority of the region's population. All three counties come under the purview of the MPO for Lansing, the Tri-County Regional Planning Commission (TCRPC). The largest municipalities are the city of Lansing (population 119,000); East Lansing (46,500); Meridian Township (39,000); and Okemos Township (23,000). Major employers in the region include the State of Michigan, Michigan State University, and General Motors Corporation. Counties and major roadways are shown below in Figure 7.1.

Figure 7.1 Lansing Sector Map



The major employers in the Lansing region provide a high level of stability. However, State government employment has decreased over time and other sources are not growing rapidly either. As a result population growth in the region continues to be modest and major increases are not anticipated. However, there continues to be decentralization of residential and commercial activity into the smaller towns and rural townships of the region. This growth is having significant impacts in a number of areas including education, environmental resources, public facilities, and transportation. These impacts of are being considered in a major land use study currently being conducted in the region through the Tri-County Regional Planning Commission.

County	1990 Census Population	2000 Census Population	Percent Change
Ingham	281,912	279,320	-0.9%
Eaton	92,879	103,655	11.6%
Clinton	57,883	64,753	11.9%
Tri-County Region	432,674	447,728	3.5%

The Lansing Region is well served by limited access and arterial highways. The major east-west corridors in the Lansing area are I-96, I-69, I-496, and M-43. Route I-96 connects the Lansing metropolitan area with the Detroit metropolitan area to the east, and the Grand Rapids metropolitan area to the west. Route I-69 connects regions in southwest Michigan with Lansing, Flint, Port Huron, and the Blue Water Bridge at the Canadian border. M-43 is an arterial corridor that serves Michigan State University, connects the eastern suburbs of Lansing to the downtown area, and also serves as an alternate route to I-96 towards Grand Rapids. I-496 is an 8-mile east-west freeway serving downtown Lansing. Major destinations, including the Capitol complex and a major General Motors plant, make this a critical link in Lansing's transportation system.

I-496 was reconstructed during the spring and summer of 2001, including complete closure of the eastern portion of the highway. The purpose of the reconstruction was to rebuild bridges, rehabilitate pavement, and add a third (merge/weave) lane between U.S.-127 and Pennsylvania Avenue. With the support of an extensive public relations campaign and a temporary ITS system, MDOT minimized the traffic impacts of this construction project. A benefit/cost analysis of MDOT's construction mitigation efforts was performed and reported in Benefit/Cost Analysis of the Temporary ITS System for the Reconstruction of I-496, Lansing, Michigan, for MDOT, by Cambridge Systematics, Inc., November 2001.

North-south roadways include U.S.-127, U.S.-27, and M-52. U.S.-127 serves as a north-south highway connection between the Lansing and Jackson metropolitan areas, and as a radial collector for Lansing commuters who live south of the city. Within Lansing, it serves as part of the circumferential highway around the metropolitan area, and as a major north-south corridor for traffic within the cities of Lansing and East Lansing. U.S.-27 serves both as part of a major north-south highway corridor, and as an access route between Lansing and its northern suburbs. U.S.-27 also serves as a major recreational route for travelers going to resort areas of northern Michigan. M-52 serves as a north-south arterial connection between I-96, I-69, and M-43, east of the Lansing metropolitan area.

Overall travel in the region is estimated through the regional travel demand model to be 1.5 million person trips per day, 12.8 million daily vehicle miles of travel (VMT), and 290,000 daily vehicle hours of travel (VHT). Average trip length is approximately 8.5 miles, average trip time ranges from 11 to 12 minutes, and average speed ranges from 41 miles per hour in p.m. peak to 44 miles per hour in the off-peak period.

The region has very extensive freeway system, in addition to a good system of parallel arterials in the immediate Lansing/East Lansing area. Main routes to major generators that attract large numbers of visitors, such as the State Capitol complex and Michigan State University, are clearly signed. As a result, the region does not generally experience severe traffic congestion and commuting times are relatively short. However, there are a number of transportation-related needs in the region that must be addressed. These include major traffic disruption and safety problems from railroad grade crossings, special events traffic generated by Michigan State sports events and congestion resulting from construction activity and adverse weather. There are also a number of issues in the region related to arterial traffic signal control and emergency response activity.

The major provider of public transportation service in the region is the Capital Area Transportation Authority (CATA). CATA recently merged with the Michigan State University bus system. CATA provides 24 fixed routes in the Lansing area in addition to demand responsive service in rural areas. Annual ridership is approximately 6.5 million, representing one to two percent of person trips in the region. CATA is interested in deployment of ITS, particularly Automatic Vehicle Location (AVL) technology, to improve the efficiency of the larger system that it now operates.

7.1 Detailed Problems and Issues

7.1.1 Stakeholder Input

The methodology used to conduct the Lansing Metropolitan Area Sector study was similar to that used for the three Detroit area sector studies documented in Chapters 4 through 6. However, the Detroit area has a 180-mile freeway management system and control center already in place, while the Lansing region does not. This means that the needs identification task was geared towards the development of overall goals and objectives for a regional ITS program for the Lansing metropolitan region.

For the Detroit area, the basic study tasks included: 1) Needs assessment through review of existing studies, reports and other data sources, stakeholder input, and market research; and 2) Development and Evaluation of ITS Alternatives. The same basic work steps were adopted for the Lansing sector study, along with an additional task involving the development of a Regional ITS Architecture. The architecture development task overlapped with many of the planning tasks, including stakeholder input collection and development and prioritization of ITS projects. The results of the architecture task are documented in the report Lansing Sector ITS Architecture, prepared for Michigan DOT by Kimley-Horn & Associates (December 2001).

Information was collected from the stakeholders through on-site meetings, documents, coordination with ongoing regional transportation committees, and the regional architecture development process. TCRPC, which staffs the Metropolitan Planning Organization for the Lansing metropolitan region, served along with MDOT as the coordinating organization and facilitated the involvement of the regional stakeholders in the plan development process. TCRPC instituted a regional ITS task force, entitled the Capital Area Regional Transportation Study (CARTS) ITS Task Force with the long-range goals of:

- Mainstreaming ITS planning into the regular transportation planning process, and;
- Developing and sustaining an integrated regional ITS plan.

The stakeholder involvement process and the regional ITS architecture development process were closely connected through the project. The CARTS ITS Task Force participated in the Tier I and Tier II ITS architecture workshops. Key steps included an inventory of regional ITS deployments and further needs assessment to develop a framework for integrated ITS deployment and operation.

As part of these coordination efforts, questionnaires were distributed to the stakeholders to elicit input on the most pressing transportation and ITS needs, deficiencies, goals and objectives.

Representatives of numerous agencies participated during the study process, including MDOT, FHWA, the Tri County Regional Planning Commission (TCRPC), the Capital Area Transportation Authority (CATA), the Airport Authority, and representatives of County government, law enforcement and Michigan State University.

The architecture process and the sector study incorporated data collection instruments and activities designed to identify 1) transportation needs and issues; 2) goals and objectives for addressing transportation system problems and needs; and 3) potential solutions. Information was obtained from:

- Stakeholder questionnaires distributed through the architecture process;
- Input provided at architecture workshops and stakeholder meetings; and
- A telephone market research survey of 350 Lansing area commuters.

The ITS planning process and the regional ITS architecture development process for the Lansing sector led to the identification and development of set of high-level goals for a regional ITS program. Table 7.1 shows how goals and specific activities were combined into the high level ITS element provided for the Tri-County Regional Planning Commission's long-range plan. The elements included are based on the results of the stakeholder process, market research analysis, and the regional architecture process, all of which are described in subsequent sections of the report.

Table 7.1 TCRPC Lansing ITS Deployment Program Summary

Program Element	Description
Goals	• Use information technologies to better manage existing transportation resources and enhance the efficiency of the transportation system. • Improve the safety of the regional transportation system by: 1) detecting and reporting potentially hazardous conditions to system users and managers; and 2) improving the timeliness and effectiveness of emergency response. • Improve transportation system management during special events, incidents, weather, construction, or other non-recurring system disruptions. • Increase system capacity while minimizing the community and land use impacts of new infrastructure. • Manage parking demand and supply where parking is at a premium • Enhance the level of service and attractiveness of mass transit • Reduce energy consumption and the environmental costs of the transportation system
Identified Information or ITS Needs	• Coordinated and sequenced traffic signal control • Coordinated transportation operations • Incident management systems • Rail grade crossing improvements • Traveler en-route information (variable message signs, transit kiosks, in-vehicle displays, etc.) • Special events management (including roadway construction) • Traveler pre-trip planning information • Parking management systems • Automatic vehicle location • Transit security systems • Emergency vehicle signal preemption • Emergency vehicle management • Hazardous materials incident response • Automated roadside safety inspection
Evaluation Tools	The principal evaluation tool is the ITS Deployment Analysis Software (IDAS), which calculates the benefits and costs of deploying ITS technologies on a modeled network. IDAS uses two other evaluation tools as inputs: 1) the regional traffic forecast model is used to provide regional traffic flow; and 2) a regional market research survey is also used to determine factors that calibrate IDAS to the behavior of local system users.

Table 7.1 TCRPC Lansing ITS Deployment Program Summary (continued)

Program Element	Description
Long-Term Deployment Framework	• Arterial Traffic Management *(signal coordination, surveillance and verification, emergency vehicle signal preemption, railroad grade crossings, incident management coordination)* • Freeway Traffic and Incident Management *(detection, surveillance, verification, service patrols, reference markers, Dynamic Message Signs (DMS), Highway Advisory Radio (HAR))* • Portable Traffic Management *(special events, workzone management, portable detection, portable DMS)* • Regional Traveler Information *(Internet, kiosks, telephone, mobile user devices)* • Parking Management *(garage status monitoring, parking availability information, automated payment)* • Roadway Weather and Condition Monitoring and Management *(bridge icing detection, roadway flooding detection, motorist information and routing)* • Transit Management *(transit Automatic Vehicle Location (AVL) and Computer-Aided Dispatch (CAD), transit security, enhanced transit information, automated fare payment, vehicle condition monitoring and maintenance, transit vehicle signal priority)* • Emergency and Maintenance Vehicle Operations and Management *(AVL, CAD, snow and ice management)* • Advanced Infrastructure-Based Warning and Safety *(ramp rollover systems, curve warning systems, downhill speed)*
Priority Issues and Specific Deficiencies	• The City of Lansing's signal system has not been updated in some time, resulting in excessive delays due to poor signal coordination, and higher maintenance costs due to obsolete equipment. Traffic signal coordination is also a major concern in Meridian Township, the City of East Lansing, and Delta Township. • Numerous rail-grade-crossings create capacity and safety problems due to long and frequent road closures. This is particularly true in East Lansing and Charlotte, where entire sections of the community can be inaccessible to both general travelers and emergency personnel for up to a half hour at a time. • Stakeholders identified a need for parking management at the downtown capitol complex and on MSU's campus. The problem is more a lack of awareness of the location of available parking rather than an insufficient supply. The high percentage of out-of-town visitors (to both the capital and MSU) exacerbates this problem. • Stakeholders also identified a need for bridge icing detection on regional high-speed highways and at locations prone to freezing. This issue is particularly significant because of regional winter driving conditions, and the remote location of some roadway segments.
Priority Facilities	**Expressways** • U.S.-127 • I-496 • I-96 • I-69 • U.S.-27 **Arterials** • Grand River Avenue • Cedar Road • W. Saginaw Highway • Okemos Road • Waverly Road **Interchanges** • I-96 and Okemos Road • U.S.-127 and I-496 • I-496 and Saginaw • U.S.-127 and I-69

Table 7.1 TCRPC Lansing ITS Deployment Program Summary (continued)

Program Element	Description
Evaluation Criteria for Project Prioritization	• Most ITS deployments (such as freeway and arterial management systems) are programmed for "deficient" corridors in the study area. Deficiency is determined by two criteria: • Level of congestion, as indicated by the volume over capacity ratio (V/C) • Delays, as estimated by the ratio of average congested speed divided by the free flow speed • Some ITS deployments (such as parking management or transit enhancements) are assigned to unique facilities based on needs identified by the stakeholders. Other deployments (such as access to Internet-based traveler information) produce benefits for all roadways in the region. • Elements of the near-term strategy are prioritized within the long-term framework based on maximizing the expected benefit/cost, and within the context of priority-corridor, geographic continuity, and project financing considerations.
Near-Term Strategy	The near-term strategy consists of deploying the top priority services on the highest priority facilities. The top priority services include: • Arterial Traffic Management • Freeway Traffic and Incident Management • Portable Traffic Management • Regional Traveler Information • Parking Management – Roadway Weather and Condition Monitoring and Management In the near-term, these services are deployed on the priority facilities listed above, and generally concentrated in the densely settled area around the I-96/I-69/U.S.-127 loop.

7.1.2 Report Outline

This report is organized as follows:

- Section 7.1 provides an overview of the ITS plan development process and the overall goals of the ITS program for the Lansing metropolitan region;
- Section 7.2 provides a summary of the needs assessment conducted as part of the study, including the stakeholder involvement process, market research, and the review of plans, programs and studies;
- Section 7.3 details the development of the regional ITS architecture for the Lansing metropolitan region;

- Section 7.4 provides a summary of programmed projects for the transportation region, including those that could incorporate ITS elements;
- Section 7.5 illustrates the process of development, evaluation and prioritization of ITS alternatives to mitigate the identified needs and deficiencies, and to meet the goals of regional transportation providers.
- Section 7.6 summarizes the Lansing region ITS deployment plan, which delineates the long-term deployment framework, priorities, phasing and costs, anticipated benefits; short-term action items and priorities; the regional ITS architecture; future recommended action items, studies and coordination issues; and research and development programs.

7.2 Needs Assessment – Detailed Problems and Issues

The needs assessment was conducted using a combination of:

- Stakeholder interviews;
- Commuter survey (350 interviews of area commuters);
- Coordination with the CARTS ITS subcommittee;
- Review of related projects and studies primarily those relating to the I-496 Temporary Traffic Management System; and
- Development of the Regional Architecture process.

This chapter includes a brief summary of the methodology and key results of these efforts. Additional information can be found in two reports: 1) *Lansing Sector ITS Architecture*, prepared for Michigan DOT by Kimley-Horn & Associates (December 2001); and 2) *Lansing Sector Market Research Report*, prepared for Michigan DOT by Cambridge Systematics, Inc.,

7.2.1 Stakeholder Identified Needs and Priorities

Stakeholder Involvement Process

The purpose of the stakeholder process was to assemble a wide consortium of regional entities with a stake in transportation programming, planning, design, and operations, and compile a comprehensive summary of the needs, deficiencies, and priorities for the region. The interactive nature of the stakeholder process lent itself to further participation by the stakeholders in the form of review, comment, and input on the prioritization of ITS projects and programs that were identified as potential mitigation alternatives. Representatives of the following agencies participated in the study process:

- Regional Entities:
  - Michigan Department of Transportation (MDOT);
  - Federal Highway Administration (FHWA);
  - Tri-County Regional Planning Commission (TCRPC);
  - Federal Highway Administration (FHWA);
  - Capital Area Transportation Authority (CATA); and
  - Airport Authority.
- Counties:
  - Eaton County;
  - Ingham County; and
  - Clinton County.
- Local Agencies:
  - Cities of Lansing and East Lansing;
  - Delta Township; and
  - Village of Dimondale.
- Law Enforcement and Emergency Response Agencies:
  - Michigan State Police (MSP);
  - Meridian Township Police;
  - Meridian Township Police;
  - Meridian Township Fire Department;
  - East Lansing Police; and
  - City of Charlotte Police.
- Academic Institutions:
  - Michigan State University (MSU).
- Other Stakeholders:
  - Community Resource Volunteers; and
  - Wolverine Engineers.

Information was collected from the stakeholders through on-site meetings, e-mails and phone calls, coordination with ongoing regional transportation committees, and through the regional architecture development process. TCRPC, which serves as the MPO staff for the Lansing metropolitan region worked with MDOT to coordinate and facilitate the involvement of the regional stakeholders in the plan development process. TCRPC instituted a regional ITS task force, entitled the Capital Area Regional Transportation Study (CARTS) ITS Task Force in order to mainstream ITS planning into the regular transportation planning process, and to develop and sustain an integrated regional ITS plan. The stakeholder involvement process overlapped with the regional ITS architecture development process. The CARTS ITS Task Force served as the primary review body for the Tier I and Tier II ITS architecture although a number of additional stakeholders participated during the process. An inventory of regional ITS deployments was compiled, and further needs assessment was performed to develop a framework for integrated ITS deployment and operation.

As part of these coordination efforts, questionnaires were distributed to the stakeholders to elicit input on the most pressing transportation and ITS needs, deficiencies, goals and objectives. The content of the questionnaire was structured to elicit opinion and information through numerical rankings and open-ended questions. Topics included:

- ITS goals drawn from the National ITS Program Plan;
- ITS information, technologies and services that would help the stakeholders meet their goals and customer expectations;
- Operations and maintenance (O&M) considerations and priorities;
- Performance measures for ITS deployment and performance assessment; and
- Barriers to ITS deployment.

The results of the stakeholder involvement process are summarized below. The needs and priorities identified through the questionnaire and from meetings with stakeholders overlap with those identified through the ITS architecture development process. However, for the sake of completeness the needs and deficiencies identified through both processes are summarized in this report. These then fed into a comprehensive needs summary statement that includes the stakeholder process, market research, review of previous plans and studies, and the regional architecture.

Stakeholder Needs Summary

The three most important goals of the National ITS Program plan that were identified by stakeholders as important for their respective organizations were:

- Increase operational efficiency and capacity of the transportation system (88 percent of stakeholders stated as most important)Improve safety of the transportation system (88 percent); and
- Enhance personal mobility, and the convenience and comfort of the transportation system (81 percent).

The inputs obtained from the stakeholder process were synthesized into major programmatic themes, which are summarized in Table 7.2.

Table 7.2 Lansing Sector: Stakeholder Identified Needs and Priorities

Programmatic Theme	Identified Needs, Deficiencies and Priorities
Efficiency and Safety	• Congestion and safety on surface streets. – Coordination with local signal operations; – Congestion and safety issues on urban/suburban/rural arterials; – Growth/development issues on rural roads; – Major arterial corridors include Grand River Avenue, Saginaw Highway, Oakland Avenue, Lake Lansing Road, Cedar Road, Pennsylvania Avenue, Dr. Martin Luther King (MLK) Blvd., and West Saginaw Highway. • Congestion mitigation and accident reduction on all freeways and expressways. – Freeway surveillance, detection, incident management and traveler information systems. • Safety and accessibility of highway interchanges. – Inadequate access and interchange-related congestion; – Safety issues related to inadequate signage and driver behavior; – Priority interchanges are U.S.-127 @ I-69 and U.S.-127 @ I-496. Need to evaluate other expressway/surface street interchanges; and – Consideration of selective ramp metering at on-ramps to expressways/freeways to improve safety of merging and weaving maneuvers. • Better management of increasing commercial vehicle traffic through region. • Railroad grade crossing safety and traffic management. – Advanced signing and warning systems; – Modified gate arrangements; and – Planning/implementation of detour routes.

Table 7.2 Lansing Sector: Stakeholder Identified Needs and Priorities (continued)

Programmatic Theme	Identified Needs, Deficiencies and Priorities
	• Manage "demand peaks" caused by non-recurring events such as special events, incidents, weather, etc. – Special event traffic management and information coordination (standardized plans for event traffic management, event traffic diversion, event parking management, signal coordination and plans for faster clearance of event traffic; improved transit information for events); – Road construction information provision, recommended construction detour routes and integrated systems for work zone traffic control and management; and – Detection and warning of weather-related hazardous road conditions, especially in remote areas. • Better management of demand and supply by providing real-time information on traffic conditions and available choices. – Parking management at MSU and state capitol complex; – Continuous traffic information on radio; – Roadway incident notification; and – Up-to-date information on DMS. • Emergency "Mayday" systems. • Emergency vehicle signal preemption.
Improved Regional Coordination and Integrated Transportation Systems Management	• Coordinated incident management. • Coordination with construction projects and local activities. • Cost-effective solutions for management/operation of transportation infrastructure and the associated ITS projects and programs. • National ITS Architecture compliance.
Improve Transit Level of Service (LOS)and Attractiveness	• Transit ITS for efficiency, safety and security. – Computer Aided Dispatch (CAD) and Automatic Vehicle Location (AVL); – Security systems for buses; – Transit traveler information such as, real-time bus arrival information; and – Consideration of transit signal priority.
Reduce Energy Consumption and Environmental Costs of Transportation System	• Mitigate the adverse impacts of transportation congestion and safety problems on the environment and regional productivity, by reducing the down time of the transportation system.

7.2.2 Market Research Overview

Residents of the Lansing Sector were asked a series of questions in a telephone survey to determine their opinions about travel conditions in the Lansing region, their traveler information needs and their interest in different ITS technologies. The market research served as a tool to determine needs from the standpoint of regular commuters. A total of 350 commuters from the Lansing metropolitan region were surveyed between March 22 and April 2, 2001 within the greater Lansing region. Respondents were stratified by zip code into urban, suburban and rural categories. Findings across these groups were very similar, and are summarized in this section. For a more detailed account of the market research process and results, please refer to the Lansing Sector Market Research Report, prepared for Michigan DOT by Cambridge Systematics, Inc.

The summary below presents key findings of the market research conducted in Lansing and compares the findings with those in the outer suburbs of Detroit. Since there is limited deployment of ITS technology in Lansing, this comparison provides some idea of the impact that might be expected with additional deployment in Lansing. It is important to note, however, tolerance for traffic conditions is much higher in the Lansing region, due to the relatively low level of congestion. Survey results confirm that while Lansing commuters have alternate routes available and are as aware of them as Detroit area commuters are, they use them less frequently. Survey findings would imply a focus on deployment of ITS technologies that address specific issues relevant to Lansing such as railroad grade crossing delays, special events traffic, construction-related delays and adverse weather.

7.2.2.1 Market Research Findings.

The survey results can be divided into four major sections:

1. What Traffic Information Services do people Use;
2. What do people Think About Traffic Information;
3. What sources of Traffic Information do people Need; and
4. Does Advanced Traffic Information Change Habits.

What Traffic Information Services People Use. Respondents were asked whether they use various sources of traffic information. Respondents were asked open-ended questions and then were prompted if they did not mention one or more specific sources. As expected, radio continues to be the most utilized source of information.

The Lansing region does not have the type of regular radio and TV traffic reports found in the Detroit area, but incidents and major problems are reported. The percentage of survey respondents reporting use of media sources was lower than in Detroit, but still significant. A very small percentage of Lansing respondents reported use of the Internet and newspapers but DMS were not included due to the lack of permanent installations in the Lansing region.

Detroit area travelers mentioned the radio as the primary source of traffic information, followed by television. The Internet and Dynamic Message Signs (DMS) were other prominent sources mentioned. Respondents generally had to be prompted to identify DMS or Internet, while radio and TV were mentioned first. This indicates that the public still perceives traffic information as a function of the commercial media.

Detroit and Lansing respondents were equally satisfied with the quality and reliability of the information provided.

Tables 7.3 and 7.4 summarize the findings of this section of the survey:

Table 7.3 Summary of Traffic Information Source Data
Detroit Area

	Detroit Area		
Traffic Information Source	**Have ever used**	**Use more than once per week**	**Rating[1]**
Radio	92%	85%	7
TV	73%	58%	7
Internet	26%	10%	6
DMS	79%	56%	7

[1] Satisfaction in terms of quality and reliability on a scale of 10 with 10 as best.

Table 7.4 Summary of Traffic Information Source Data
Lansing Area

	Lansing Area		
Traffic Information Source	**Have ever used**	**Use more than once per week**	**Rating***
Radio	67%	48%	7
TV	50%	30%	7
Internet	Sample too small for analysis		
Newspaper	Sample too small for analysis		

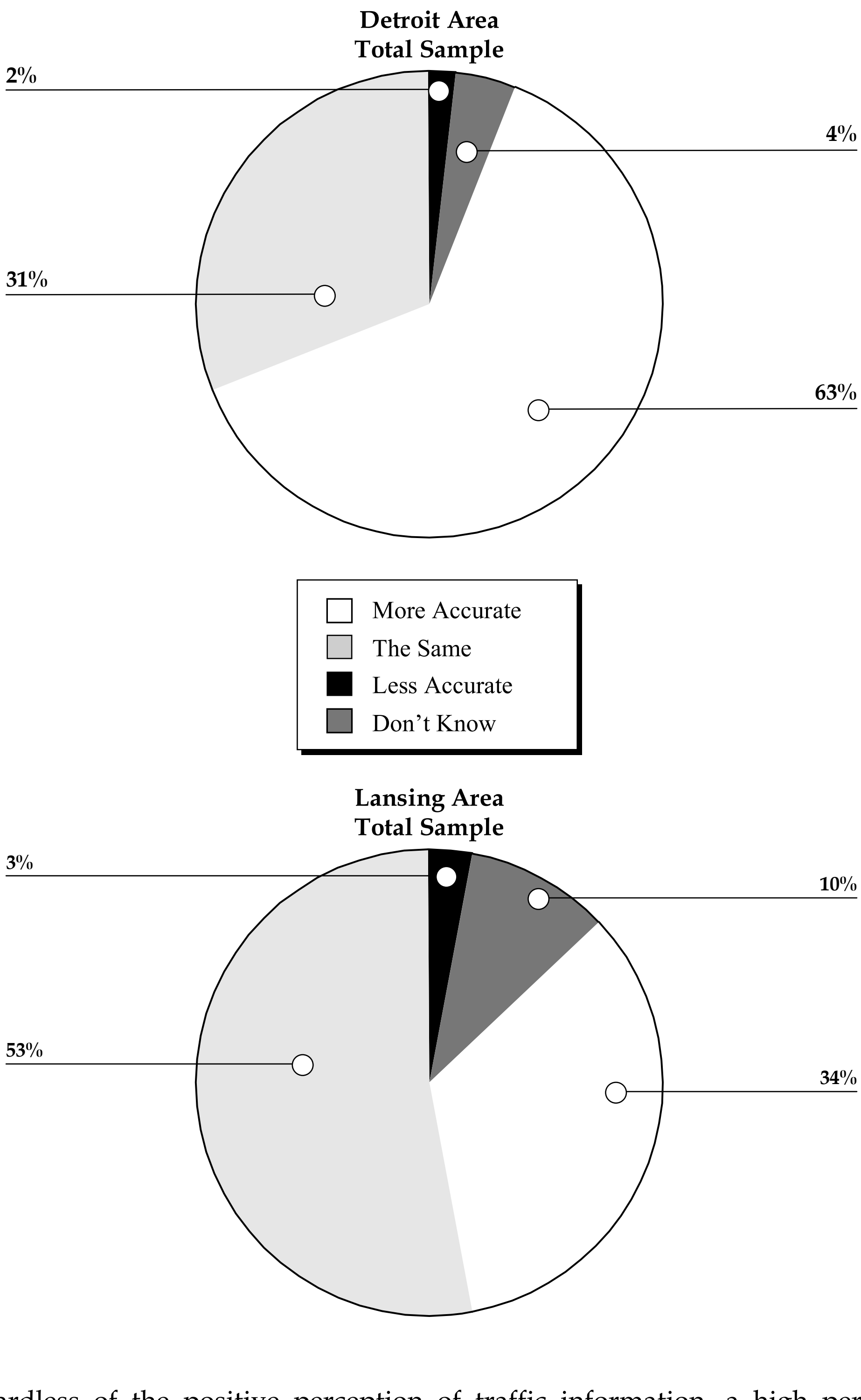
What do People Think about Traffic Information Sources? Travelers were asked to identify which sources of traffic information they prefer. *These preferences were independent of whether they actually had these services available.* Both Detroit and Lansing travelers identified radio as the preferred source of information. The second most preferred source for Detroit travelers was TV; for Lansing travelers, overhead message signs were identified as the second preferred information source. This strong preference for message signs in the Lansing region may have been generated by publicity for the I-496 construction project temporary traffic management system (the system included portable variable message signs at key locations along the Lansing area freeway system). Table 7.5 presents a summary of the results obtained for both areas.

Table 7.5 Most Preferred Source of Information

Traffic Information Source	Detroit	Lansing
Radio Stations	55%	47%
Overhead Electronic Message Signs	9%	23%
Television Stations	19%	14%
Highway Advisory Radio	9%	6%
In-vehicle Device for Traffic Information	6%	5%
Internet Site/Web Page	1%	4%
Telephone/Mobile Phone Dial-In Service	2%	1%

Travelers' perception of information accuracy over the last three years was quite positive, as shown in Figure 7.2, since most of those surveyed said that information was either more accurate or had remained the same. The perceived level of improvement was much higher in Detroit, indicating that investments made in the ITS system have had a positive impact on public perception. When asked about timeliness of traffic information, 49 percent of the Lansing respondents and 71 percent of Detroit respondents said that traffic information was more or somewhat up-to-date than three years ago. Concerning overall satisfaction with the quality and reliability of traffic information, 83 percent of Lansing and 91 percent of Detroit travelers responded they were very or somewhat satisfied.

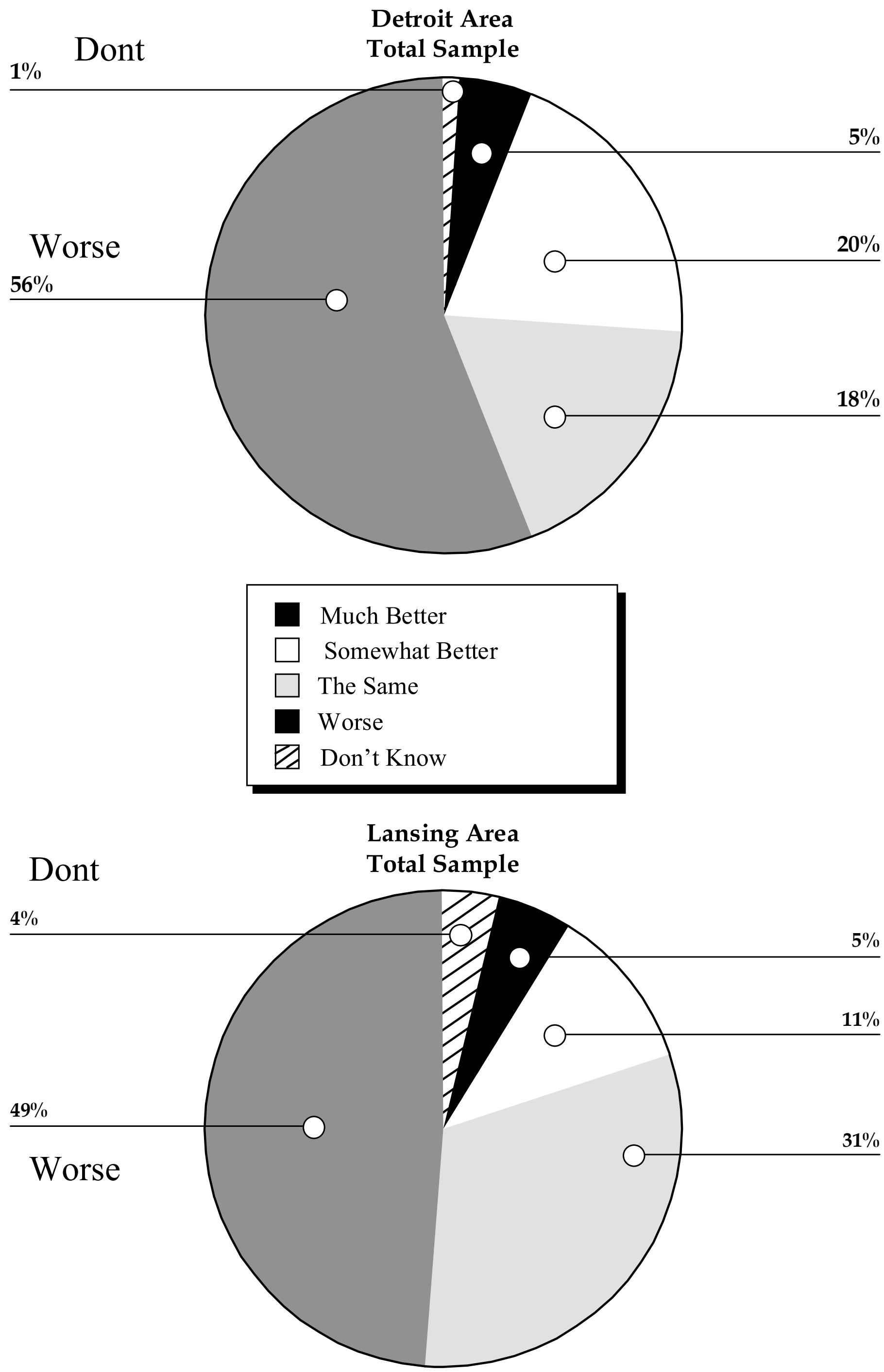
Figure 7.2 Accuracy of Traffic Information Provided Over the Past Three Years



Regardless of the positive perception of traffic information, a high percentage of the travelers said that congestion has increased in the past three years. Figure 7.3 shows that

56 percent of Detroit travelers and 49 percent of Lansing travelers believe that traffic conditions have worsened with time.

Figure 7.3 Perceived Traffic Conditions Over the Past Three Years



Finally, when asked an open-ended question about what could be done to improve traffic information currently provided, the options "more updated/accurate information"

(Lansing – 14 percent, Detroit – 11 percent), "more radio coverage/frequency" (Lansing – 11 percent, Detroit – 14 percent) and "more overhead message signs" (Lansing – nine percent, Detroit – 14 percent) were suggested more often.

What Sources of Information do People Need? A needs assessment analysis was conducted to determine what sources of information users consider important and which information services are deficient or not provided at all. Respondents showed high preferences for the following items. The first number shown is the rating on a scale of 1-10 for the Detroit region (with 10 being most preferred, and 1 being least preferred), the second is the similar number for the Lansing region (in bold):

- Having a variety of traffic information sources available (8.3, not asked in Lansing);
- Having access to alternate route information to provide relief from incidents, construction or bad weather (8.3, **7.8**);
- An emergency vehicle call capability (mayday) in the vehicle (8.1, **7.5**);
- Continuous traffic advisory information through the radio (8.0, **7.4**);
- Immediate access to traffic information in vehicle (7.8, **6.7**);
- Electronic highway message signs with traffic information (7.5, **7.6**);
- Immediate access to traffic information at home (7.3, **6.3**); and
- Having collision avoidance device in the vehicle (7.2, **6.6**).

The items receiving lowest ratings were:

- Traffic information on toll-free mobile phone (5.8, **6.5**)
- Customized paging service with information on driver routes (5.6, **5.0**)
- Accessing traffic information on the Internet (4.4, **4.8**)

Several more sophisticated analyses of needs were conducted, and are documented in detail in the market research reports for Detroit and Lansing. One of these is a "gap" analysis, that provides insight into the gap between what consumers want and what is actually being provided. The items with the highest "gaps" were:

- Having a device in the vehicle to call emergency number in case of accident;
- Having a collision avoidance device in the vehicle;
- Providing automatic traffic and incident reports on a device in your vehicle; and
- Having immediate access to traffic information in your vehicle.

The items showing the lowest gaps were:

- Obtaining information on public transportation at home or at work;
- Obtaining traffic information from a variety of sources such as radio, TV; and

- Accessing traffic information on the Internet.

A related "deficiency" analysis showed similar results, but also indicated a strong preference for additional electronic message signs in the Detroit area. Gap and deficiency analyses also show a strong interest in safety-oriented ITS devices. These include emergency "mayday" systems and in-vehicle collision avoidance technology. These technologies are being provided primarily through the private sector, but clearly have potential benefits for transportation and public safety agencies, as well as the general public.

Does Advanced Traffic Information Change Habits? Respondents were asked a series of questions about whether the traffic information they receive results in changed travel patterns. In order to shorten the length of the questionnaire, half the respondents were asked about their morning commute and half were asked about their afternoon commute. They were asked:

- Whether they changed routes based on traffic information – Of morning commuters, 60 percent of Lansing respondents and 77 percent of Detroit area respondents said they did. Detroit area commuters changed four times per month while Lansing commuters changed at about half that rate or two to three times per month. Afternoon commuters were slightly less likely to change their route (72 percent in Detroit and 55 percent in Lansing). However afternoon commuters in Detroit who changed did so more frequently that morning commuters (nearly six times per month). Afternoon commuters in Lansing changed slightly less often in the p.m. peak. Figures 7.4 and 7.5 present these results for both the morning and afternoon peak periods. For both areas, most of the respondents were aware of an alternate route that would save them six minutes or more of travel time.

Figure 7.4 Percent Changed Route Based on Traffic Information Received

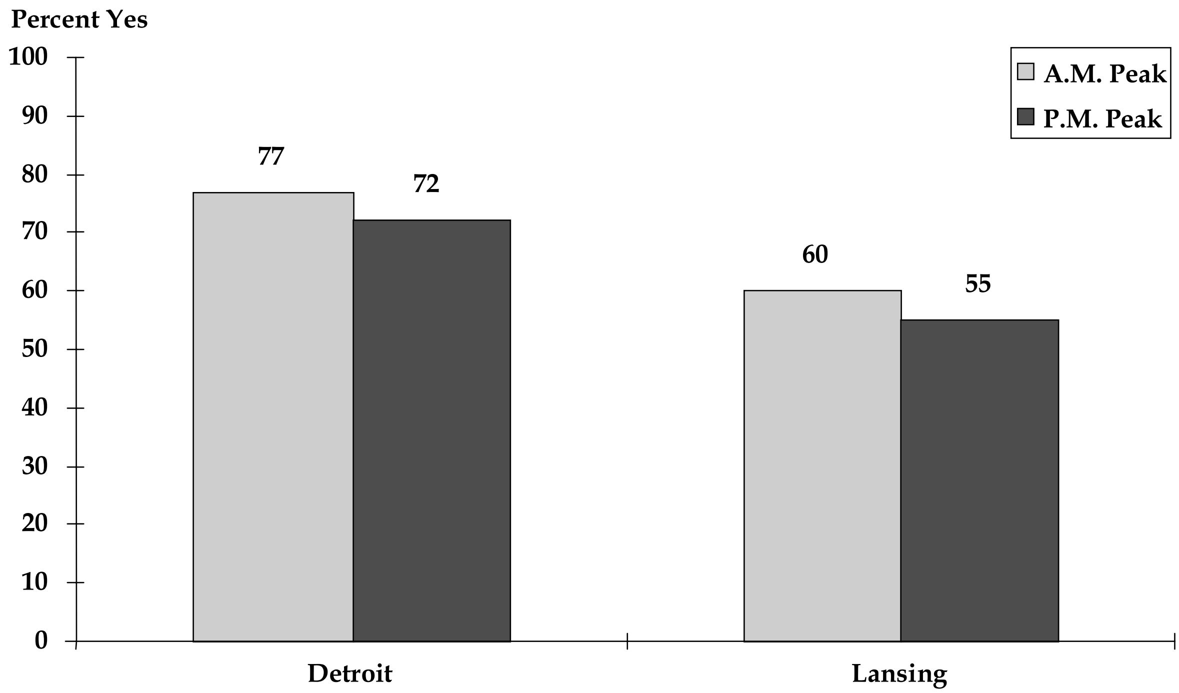
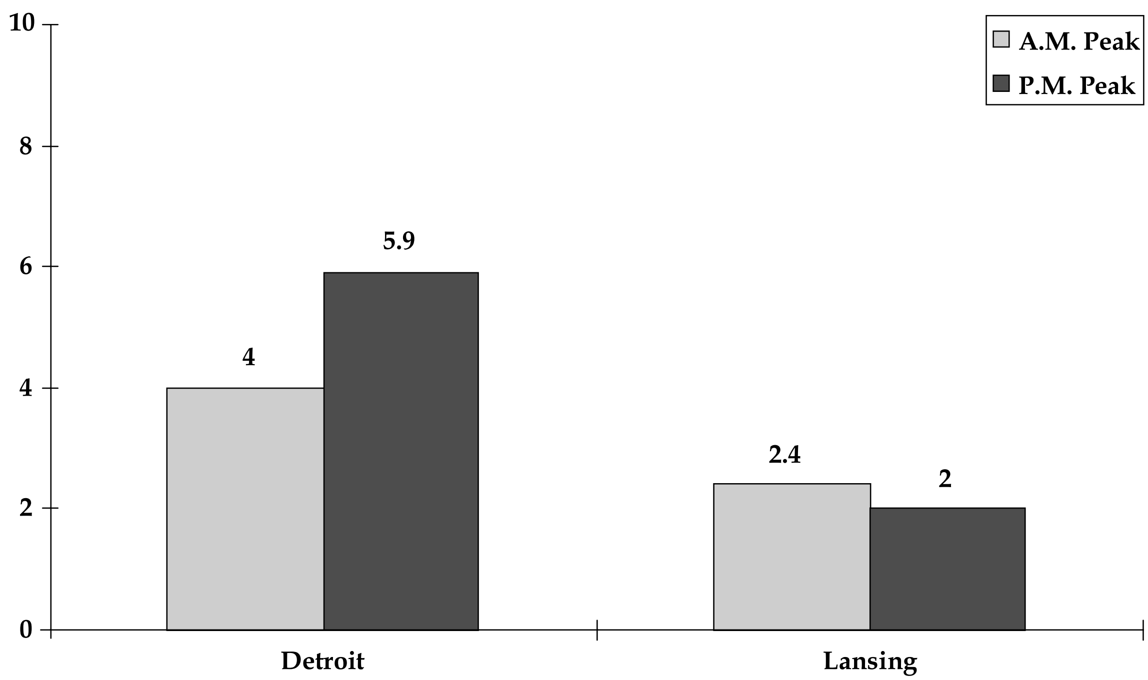


Figure 7.5 Mean Number of Times Changed Route in the Past Month



- Whether they changed departure time as a result of traffic information received – Half of the travelers in Lansing changed their morning departure time as a result of traffic information received, but only 28 percent reported changing their afternoon departure time. Similarly, 61 percent of Detroit travelers change their morning departure time due to traffic information, but only 38 percent changed their afternoon departure times.

- Reasons for changing their route or departure time – Tables 7.6 and 7.7 present the reasons for changing routes and departure times for both the morning and afternoon commute. In the Detroit area, the top three reasons for changing route or departure times for morning or afternoon commutes included traffic accidents/incidents, roadway construction and travel congestion. For Lansing commuters, in addition to the reasons listed above, bad weather was also mentioned as one of the most important reasons for changing route and departure time. Furthermore, it was the most important reason given by Lansing area commuters for changing both morning and evening departure times.

Table 7.6 Reasons for Changing Route

Reasons for Changing Routes	Detroit A.M.	Detroit P.M.	Lansing A.M.	Lansing P.M.
A traffic accident or incident	50%	48%	59%	59%
Bad Weather	6%	6%	31%	27%
Roadway Construction	40%	44%	26%	25%
Normal Traffic Congestion	18%	24%	16%	35%
Business or Personal Reasons	2%	3%	4%	8%
Other Reason	4%	6%	-	6%

Table 7.7 Reasons for Changing Departure Time

Reasons for Changing Departure Time	Detroit A.M.	Detroit P.M.	Lansing A.M.	Lansing P.M.
A traffic accident or incident	41%	48%	17%	16%
Bad Weather	19%	6%	74%	42%
Roadway Construction	35%	44%	12%	10%
Normal Traffic Congestion	23%	24%	2%	39%
Business or Personal Reasons	7%	4%	7%	7%
Other Reason	2%	5%	-	3%

7.2.2.2 Conclusions of Market Research

- The market research effort was very significant in identifying public attitudes and perceptions toward existing ITS deployments, ITS technology in general and general transportation system needs. Some of the key findings of the market research work are as follows:

The most prevalent methods for obtaining traffic information are through the radio and TV.

- Significant numbers of Lansing area commuters reported using radio and TV to obtain traffic information. However, these numbers are significantly lower than those found in Detroit.

Other than the radio and TV, there has been only a slight rise in commuters' awareness and usage of traffic information sources for trip planning purposes.

- Low levels of usage can be attributed to the fact that there are no regular traffic information services available in the Lansing region, as there are in greater Detroit.
- Recent publicity about the temporary ITS system installed for the reconstruction of I-496 has probably increased the awareness of traffic information services.

Still, commuters have a greater need for obtaining certain types of traffic information.

- Weather advisories and information regarding detour route conditions appear to be the highest priorities among commuters for traffic information.
- There appears to be significant interest in information and alternative routing for railroad grade crossings.
- Commuters prefer to receive information at home or in their vehicle for both pre-trip and en route planning purposes.

Travel habits are not dependent upon receiving traffic information due to the low occurrence of incident-related traffic problems in the region.

- While large numbers of Lansing area commuters occasionally change their routes as a result of information, and nearly all are aware of alternative routes, they change much less frequently than commuters in the Detroit region.
- Bad weather and incidents are given as the primary reasons for changing routes.

Since commuters have a high level of tolerance for any traffic congestion now occurring in the region, improving traffic information services will have a modest impact on the quality of life.

- Fewer Lansing commuters believe that the timeliness and quality of information has improved over the past three years compared to Detroit travelers.

- Lansing commuters are much more satisfied with traffic conditions in their region compared to Detroit, and do not feel that traffic conditions have deteriorated as much over the same time period.

Although travelers are satisfied with the information sources they use, there is an opportunity for MDOT to deploy ITS solutions that can better meet travelers' needs.

- Safety-related systems such as mayday and collision avoidance had a high level of interest among Lansing area commuters.

7.3 Regional ITS Architecture Development

7.3.1 Overview of Architecture Process

The regional architecture was developed based on the U.S. DOT recommended process, including identification of:

- Regional stakeholders;
- Regional transportation system needs and deficiencies;
- Existing, ongoing and planned ITS projects and programs;
- Future ITS projects and programs;
- Integration opportunities for integrated regional ITS deployment; and
- Projects and associated sequencing.

ITS architecture provides a framework for organizing transportation and information needs. ITS architecture helps to define interactions between three "layers" of infrastructure:

- Transportation – Physical transportation facilities and users;
- Communications – How information is shared between different elements of the transportation system; and
- Institutional – How transportation agencies operate their infrastructure and the working relationships between agencies.

As a result of TEA-21 and subsequent regulations, all projects using federal funds for ITS activities will require the development of a regional and/or statewide architecture that meets the needs and criteria set forth by the National ITS Architecture.

The following paragraph from The National Architecture for ITS: A Framework for Integrated Transportation into the 21st Century (Publication No. FHWA-JPO-96-012) provides a general description of the objectives of the National Architecture program.

"The program to develop a national architecture for ITS has been an effort to map out an organized approach to implementing, in a consistent manner across the U.S., the various ITS services envisioned for the next 20 years or more. The Architecture is the first step toward achieving the vision Congress put forth for ITS in 1991: a vision of a seamless, multimodal, national ITS that would have a consistent character across the country."

"An architecture, then, is a framework that lays out the boundaries, players, and strategies for that process of information management. And in the case of ITS, it has to have an intimate knowledge of the way transportation works as well, in order to get the new systems to work well with the existing ones. The framework can then guide us in developing standards and making deployment decisions that will result in efficiency, economies of scale and national interoperability."

The ITS Pre-deployment Study included the development of a regional architecture for the Lansing region. The consultant team, with MDOT and FHWA conducted a Tier 1 meeting in April 2001 and a Tier 2 meeting in May 2001. These efforts resulted in an architecture document that documents the process, includes a list of projects, a more detailed description of higher priority projects and detailed Turbo architecture output. This report is included as an appendix to the final report.

7.3.2 Tier I and Tier II Meetings

The first step to develop an ITS architecture is to establish a stakeholder coalition to develop a vision and define the goals and objectives for ITS in the region. The stakeholders input process involved multiple meetings and forums with key persons and agencies. Two meetings were held in the Lansing sectors as described below:

- **Tier I Meeting.** Attendees included agency stakeholders from the Lansing Sector as defined by the boundaries of the Tri-County area. Stakeholders were introduced to the National ITS Architecture process, details about the MDOT ITS Pre-Deployment Study and information concerning surveys conducted of road users in the Tri-County area. Attendees also participated in group exercises identifying and ranking transportation need in the area.

- **Tier II Meeting.** Attendees again included agency stakeholders from the Lansing sector. Stakeholders were reminded of the National ITS Architecture process, details about the MDOT ITS Pre-Deployment Study and information concerning surveys conducted of road users in the Tri-County area. Breakout exercises identified interconnects and information flows between the agencies represented.

The primary objective if the Tier I meeting was to identify and bring together the public and private ITS stakeholders in the region. Prior to the meetings, the invitees were surveyed to develop a list of existing and desired ITS deployments. Additionally, during discussions with stakeholders, a preliminary explanation of the architecture process was offered to promote continued dialogue over ITS needs within and among the invited agencies. Also, prior to the meeting, each stakeholder was interviewed to identify what ITS elements were either deployed or were planned for deployment (with funding) in the near future. This ITS inventory was presented to the stakeholders who gave their final comments on the inventory.

The meeting then went into two breakout sessions, with one session focusing on emergency management and transit, and the other on transportation management. Participants discussed the region's transportation need and potential ITS options to address those needs. After reconvening the tabulated rankings were presented to the stakeholders as a preliminary general regional transportation needs list to be used as a guideline in developing the regional ITS architecture. The final step in Tier I meeting was an overview of the objectives of the Tier II meeting.

Between the Tier I and Tier II meetings, the preliminary ranking was converted into user interfaces and in turn matched with market packages. Additionally, Turbo Architecture© software was used to create a draft regional ITS Architecture to present to the stakeholders at the Tier II meeting. This included incorporation of the inventory and the development of the regional interconnects and data flows between elements. Since communication was central to all of the needs discussed in the Tier I meeting, a quick reference document was prepared to enhance stakeholder understanding of the communications technology options. Stakeholders were reminded of the National ITS Architecture process, details about the MDOT ITS Pre-Deployment Study, and information concerning surveys conducted of road users in the Tri-County area. The draft of ITS Architecture developed for the region between the Tier I and II meetings was presented to each stakeholder present. Each stakeholder was responsible for reviewing the inventory, interconnects, and data flows, and for providing feedback. The discussions and feedback were used to adjust and correct the initial draft of the regional ITS architecture.

During the entire process, the stakeholders made a number of key decisions regarding the regional architecture. The first decision is to determine regional boundaries. This is done to set limits for the stakeholders and the process without making the ITS planning process burdensome. For the Lansing Sector, the regional ITS Architecture boundary consists of the counties of Eaton, Ingham, and Clinton.

7.3.3 User Services and Market Packages

One important goal of the stakeholder process was to develop a regional ITS architecture that could be implemented and also met the transportation needs expressed by the stakeholders. FHWA has identified 31 user services for urban areas and 63 market packages that describe projects and identify the information that must be shared between the various components.

In order to accomplish this goal, the architecture process was explained to stakeholders and a process undertaken to link their specific problems and concerns to the appropriate user services and market packages. Through the stakeholder process a set of generalized problem statements were developed and refined into a list of regional needs. The regional needs were then matched with potential projects and technologies, which could be inserted into the TIP/STIP and long-range regional plans.

The general system architecture was developed by selecting the appropriate user services and market packages. Grouping packages together produces the overall system architecture and shows the data that must pass between data elements and agencies. The user services generate categories of projects, such as traveler information while packages are more specific types of projects.

The ITS technology selection process began with identification of appropriate ITS user services. User services represent functions performed by performed by ITS technologies and organizations for the direct benefit of the traveling public. The national ITS program plan defines the term users as: "a wide range of individuals and organizations including drivers, travelers, service providers, and transportation policy makers." The National Architecture defines 31 user services for urban areas (a list can be found in the Lansing ITS architecture report) and seven were identified as critical for Lansing:

- Traveler Safety and Security – These technologies use in-vehicle sensors and information systems to alert drivers to hazardous conditions and dangers. The program features wide-area information dissemination of site-specific advisories and warnings.

- Tourism and Travel Information Services – Uses in-vehicle navigation and roadside communication systems to provide information to travelers who are unfamiliar with the local areas. These services can be provided at specific locations, en-route or prior to departure.

- Public Traveler/Mobility Services – These services improve the efficiency of transit services and their accessibility to residents. These services include better scheduling, improved dispatching, Smart Card readers and payment and computerized rideshare systems.

- Emergency Services – These services use satellites and advanced communications systems to automatically notify the nearest fire, police or rescue squad in case of a crash or other emergency.

- Fleet Operations and Management – These services improve the efficiency of vehicle fleets that operate in urban areas, such as utility readers, package delivery services, mail carriers and law enforcement.

- Commercial Vehicle Operations (CVO) – Satellites, computers and communications systems manage the movement and logistics of commercial vehicles, and locate and track these vehicles during emergencies.

- Infrastructure Operations and Maintenance – Services that improve the ability of highway workers to maintain and operate urban streets more efficiently. These services include severe weather information and immediate decision and notification of the public to dangers such as the presence of work zone crews.

Table 7.8 summarizes the specific ITS Market Packages under each of the program areas that apply to the Lansing Region.

Table 7.8 Applicable ITS Market Packages for the Lansing Sector

Critical Program Area	Specific ITS Market Packages
Traveler Safety and Security	• Traveler Security • Intersection Safety Warning • Intersection Collision Avoidance
Tourism and Travel Information	• Broadcast Traveler Information • Interactive Traveler Information • Yellow Pages and Reservations • Automatic Routine Guidance • In-vehicle signing
Public Traveler/Mobility Services	• Multimodal Traveler Information • Demand Response Transit Operations • Transit Passenger and Fare Management • Transit Security • Transit Maintenance
Commercial Vehicle Operations	• CVO Fleet Administration • Freight Administration • Fleet Administration • Electronic Clearance • HAZMAT Management
Emergency Services	• Emergency Response • Emergency Routing • Mayday Support
Infrastructure Operations and Management	• Incident Management • Traffic Information Dissemination • Probe Surveillance • Traffic Forecast and Demand Management • Advanced Railroad Grade Crossing • Road Weather Information System
Other	• ITS Planning

Prior to the Tier 1 meeting invitees were surveyed to develop a list of existing and desired ITS deployments. Interviews were also held to identify what ITS elements were either deployed or were planned for each deployment, with funding, in the near future. This ITS inventory was presented to the stakeholders for comment. The Tier 1 meeting was broken into two working groups, one on emergency management and transit, and the other on transportation management. Based on these breakout sessions a ranked list of transportation needs and projects was developed.

Six major issues were identified through this process, including:

- Rail crossing improvements;
- Communications;
- Interagency coordination;
- Funding;
- Long-range planning; and
- Surface street improvements.

In addition to these general issues, 54 specific needs were identified through the process as listed below:

- Traveler Information:
  - Need traveler information through media source, such as radio and TV;
  - Need 24-hour, accurate. Location-specific pre-trip traveler information;
  - Need to communicate delays due to train crossing;
  - Lack of 511 system definition/implementation;
  - Investigate possible functionality with manufacturer of in-vehicle systems;
  - Need rerouting motorists during train crossings;
  - Need in-vehicle warning system of emergency vehicle operations in vicinity;
  - Need information kiosks; and
  - Need in-vehicle communications for public travelers.
- CVO:
  - Need to integrate information systems relation to NAFTA;
  - Commercial vehicle just-in-time delivery; and
  - Need commercial vehicle routing information.

- Safety:
  - Need police on-board cameras with wireless direct-feed;
  - Need to improve pedestrian and bicycle safety;
  - Need work zone management;
  - Improve train/pedestrian interaction; and
  - Steep grades lead to rollovers at I-69/Lansing Street intersection.
- Rail:
  - Need management of high-volume rail traffic;
  - Need communication with railroad authority; and
  - Structural conflicts with high-speed and commuter rail.
- Freeway Management:
  - Need area-wide Freeway Management System;
  - Need freeway monitoring systems;
  - Need icing detection on I-69, I-96 and U.S.-127;
  - Need incident detection at freeway intersections;
  - Need I-69, I-96, Delta Township, and Windsor Township corridor freeway management systems;
  - Need freeway incident detection;
  - Need I-69/Lansing Street intersection ice detection system; and
  - Need I-96 (near De Witt) road-weather systems.
- Traffic Signal Control:
  - Improve signal progression to reduce travel time for commuters, including adding new signal coordination; and
  - Need to update signal control systems.
- Transit:
  - Need smart bus stops and kiosks; and
  - Need consumer responsive transit.
- Operations and Maintenance:
  - Need to establish hierarchy of road closures; and
  - Improve traffic monitoring for non standard peak periods.

- Interjurisdictional Coordination:
  - Need to share information between 911 and transportation agencies;
  - Improve cross-jurisdictional emergency services communications;
  - Need to interconnect county Emergency Management Centers;
  - Need to develop or adopt system communications protocol; and
  - Need interagency agreements for network access and control.
- Emergency Management:
  - Need rerouting of emergency vehicles during train crossings;
  - Need 911 coordination with transportation departments;
  - Need to develop a railroad incident response plan;
  - Emergency vehicle accidents;
  - Need standard emergency equipment across jurisdictions;
  - Need verification of 911 emergency phone calls;
  - Need surface street incident detection;
  - Need 911 coordination with the media;
  - Need to construct fire substations on the other side of the railroad tracks; and
  - Need hazardous materials rail/freight information.
- Parking Management:
  - Need special events management system;
  - Need municipal parking management; and
  - Need MSU Parking management system.

These needs were then ranked by the stakeholders. The top ranked needs were:

1. Improved signal progression;
2. Long-range transportation plan;
3. Communications master plan;
4. Updating signal control systems;
5. Rerouting of emergency vehicles during train crossings;
6. Cross-jurisdictional emergency services communication;
7. Develop 20-year ITS plan;
8. Interconnect county emergency management centers;
9. Pursue public/private funding mechanisms;

10. Improved traveler information through media sources (radio/TV);
11. Area-wide freeway management system;
12. Operations master plan;
13. Develop or adopt system communications protocols;
14. Freeway monitoring systems; and
15. Weather detection systems on U.S.-127/I-69.

Based on the transportation needs identified, the market packages and user services were recommended to assist in addressing these needs. Based on stakeholder rankings, incident management was considered the highest overall priority in the region and it is important to note that the majority of the traffic-related ITS deployments are tied to incident management. For example, needs that address traffic signal systems or ice detection will have an impact on incident management.

Ultimately tables were developed matching the full set of identified needs to market packages. These tables, which can be found in the Lansing ITS Architecture Report, provide the basis for inputs to TurboArchitecture and the detailed architecture diagrams showing the links between various programs and agencies.

One of the major issues that must be addressed is maintenance of the architecture database. Maintenance of ITS architecture is a critical step to ensure that the architecture provides the long-term benefits that can be achieved through a regional plan. The TCRPC plans to maintain its ITS committee to oversee both planning activities and future deployments.

7.4 Transportation Projects

The MDOT's *University Region Congestion Profile* and TCRPC's Regional Transportation Plan were used to identify those roadways that based on levels of usage and classification should receive priority treatment for ITS alternatives. Table 7.9 is a list of roadways and facilities within the study area that were identified as priority facilities for ITS deployment. These roads experience the highest volumes in the region, and in some cases are approaching capacity along various segments, especially in the Lansing CBD.

Table 7.9 List of Roadways
Lansing Sector

Facility Type	Facility Name
Expressways	U.S.-127
	I-496
	I-96
	I-69
	U.S.-27
Arterials	Grand River Avenue
	Cedar Road
	W. Saginaw Highway
	Okemos Road
	Waverly Road
Interchanges	I-96 and Okemos Road
	U.S.-127 and I-496
	I-496 and Saginaw
	U.S.-127 and I-69

Priority facilities were identified using various sources including:

- Michigan's Congestion Profile: State of the System Report (December 1998);
- MDOT's Five-Year Road and Bridge Program 2001-2005;
- MDOT web site: www.mdot.state.mi.us;
- Tri-County Regional Planning Commission Regional 2015 Transportation Plan (May 1995); and
- Tri-County Regional Planning Commission Regional 2020 Transportation Plan (June 2000).

The 2015 RTP for this sector identified as deficient the following roads: I-69BL, I-69, I-496, I-96, I-96BL, U.S.-27, U.S.-127, M-43 and M-100.

Programmed construction projects provide good opportunities to deploy ITS elements of a regional plan. Upcoming projects in the three county area as listed in MDOT's 2001-2005 Road and Bridge program are shown in Tables 7.10 through 7.12.

Table 7.10 Programmed Projects
Eaton County

Project Name	Location	Proposed Improvement	Time
I-496	Under Creyts Road NB, west of Lansing	Bridge overlay and approach work	2005
I-496	Under Snow Road, west of Lansing	Bridge deck replacement and approach work	2005
I-69 BL	M-50 to SB I-69	Reconstruction	2004
I-96	M-43 to Lansing Road plus four bridges	Reconstruction	2002
I-96	EB over Lansing Road	Bridge reconstruction and approach work	2002
I-96	EB/WB under Creyts Road, west of Ingham county line	Bridge overlay and approach work	2002
I-96	WB/EB over Canal Road, NW of U.S.-27	Bridge reconstruction and approach work	2002
I-96	Under Millet Road, South of I-496 and M-43	Bridge widening	2002
M-43	M-66 to Roxland Township line	Overlay	2005
M-43	Over Sebewa drain, east of Sunfield	Bridge superstructure replacement and approach work	2005

Table 7.11 Programmed Projects
Ingham County

Project Name	Location	Proposed Improvement	Time
Capitol Loop	Martin Luther King Blvd to Larch Street	Resurface	2003
I-69 BL	East of Hagadorn to Old M-78, East Lansing	Resurface	2004
M-43	Over Grand River, Lansing	Bridge miscellaneous rehabilitation and approach work	2004
U.S.-127	SB/NB over Conrail, North of M-36	Bridge miscellaneous rehabilitation and approach work	2004
U.S.-27 BR (Northeast St)	Over CSX railroad and WB I-96	Bridge miscellaneous rehabilitation and approach work	2002
M-43	Dobie Road to Cornell Road	Widen PE/ROW 2001	2002

Table 7.12 Programmed Projects
Clinton County

Project Name	Location	Proposed Improvement	Time
M-21	Pewamo east city limits to St. John's west city limits	Resurface	2005
M-21	U.S.-27BR to Clinton east county line	Resurface	2004
M-21	Over Lost Creek, west of Fowler	Bridge reconstruction and approach work	2005
M-21	St. Clair Road to Shepardsville Road	Passing relief lanes	2004
U.S.-27 BR	South of Lake Lansing Road to I-69	Resurface	2002
U.S.-27 BR	Over Central Michigan railroad, St. Johns	Bridge reconstruction and approach work	2004

Some of these projects, particularly those on freeway segments, present opportunities for deploying ITS elements, including temporary portable traffic management as part of the projects themselves and deployment of permanent elements for freeway traffic management.

7.5 Development of ITS Program Areas and Projects

The development of ITS programs and projects for the Lansing metropolitan region consisted of the following analysis steps:

- Development of ITS mitigation measures and identification and delineation of ITS *Program Areas* for the Lansing metropolitan region. Program areas are logical/functional classes of ITS deployments that involve management and operations of a particular aspect of the transportation system. Examples of program areas include, Arterial Management, Freeway Management, Transit Management, Regional Traveler Information and Parking Management. There are several program areas of ITS deployment defined by the U.S. DOT, and these are updated as and when newer technologies or services become available.

- Choice of most applicable *Program Elements/ITS applications** within each program area. These are the individual ITS applications/services that provide specific transportation operations and management functions or ITS services within program areas. For example, under the Arterial Management program area, possible program elements/ITS applications include traffic signal system coordination, surveillance, verification, arterial traveler information, railroad grade crossing management, emergency vehicle signal preemption, transit signal priority, arterial/freeway incident management coordination, and red-light violation automated enforcement.

- Development of *Projects** that apply to specific locations, areas or corridors, followed by evaluation of projects for ITS deployment (short-term and long-term), based identified needs and priorities. Projects are specific action items in the transportation plan required to implement the appropriate program elements/ITS applications.

- Performance of benefit/cost analysis[1] for the recommended program elements and (or) projects.

The above processes are described in the following sections.

7.5.1 Identification of ITS Program Areas for the Lansing Metropolitan Region

After identification of transportation system needs and deficiencies as detailed in the previous sections of this report, ITS mitigation measures were developed to address the needs and deficiencies. These mitigation measures were then grouped into logical/ functional groupings of program areas and program elements. The program areas correspond to those outlined in the National ITS Program Plan[2] developed by the U.S. DOT. The major ITS Program Areas for the Lansing metropolitan region are outlined in Table 7.13. The table lists each of the program areas along with a one-sentence description. Detailed accounts of their characteristics; components, technologies and services; and potential benefits are provided in Section 7.6.

---

1 The benefit/cost analysis was performed using the ITS Deployment Analysis Software (IDAS) software, which is dependent upon regional travel demand networks and models. At the time this study was conducted, the only available travel demand model for the Lansing metropolitan region was the year 2000 model, which was recently updated and validated. Future year travel demand models are in the process of being developed. Therefore, the benefit/cost analysis was performed only for the year 2000, assuming an opening day scenario, with all major ITS projects deployed on the current transportation network. It is highly recommended that an evaluation of phased ITS deployment is performed when the future year models (which will be representative of planned highway/transit improvements) become available. This will help evaluate the impacts of ITS projects on the future year transportation network(s), and may help prioritize or strategize ITS deployment to leverage maximum benefit by varying the location, intensity, timing, and type of ITS deployment.

2 The National ITS Program Plan outlines the National ITS deployment framework as envisioned by the USDOT. It is developed and updated by the USDOT, and provides a comprehensive planning reference for the application of intelligent transportation systems. The most recent update, entitled the "Ten-Year ITS Program Plan" was completed by ITS America. A copy of the plan may be obtained electronically or in print at www.itsa.org.

Table 7.13 ITS Program Areas for the Lansing Region

1. **Arterial Management.** Arterial management systems are used to manage traffic on arterial streets by deploying various detection, control and information dissemination devices.
2. **Freeway Management.** Freeway management systems encompass monitoring and control of freeway operations, supplemented by the dissemination of information to motorists.
3. **Portable Traffic Management.** Theses systems supplement transportation and traffic operations during planned or unexpected events that disrupt normal operations.
4. **Regional Traveler Information.** This involves the collection, assimilation and dissemination of traveler and traffic information, through several data sources and dissemination channels.
5. **Regional Incident Management.** This helps expedite the detection, response and clearance of roadway incidents, and improves transportation operations by coordinated incident response and traffic management.
6. **Regional Special Event Management.** This ensures regionwide consistency and standardization of traffic management and routing practices during special events like sporting events and concerts, which create a noticeable spike in the traffic demand.
7. **Construction Traffic Management and Information Coordination.** This consists of procedures and systems for traffic management, traveler information, and regional coordination for highway construction projects.
8. **Parking Management.** This involves the use of technology to better manage parking demand and supply through real-time parking availability information, and routing strategies.
9. **Roadway Weather and Condition Monitoring and Management.** These systems collect and disseminate information on weather-related road/pavement hazards to motorists.
10. **Transit Management.** Transit management systems broadly encompass a suite of ITS applications that are collectively grouped as Advanced Public Transportation Systems (APTS), and are used to improve the safety and operational efficiency of transit systems.
11. **Emergency and Maintenance Vehicle Operations and Management.** This involves the application of technologies to improve the efficiency and effectiveness of emergency vehicles, and that of agency-owned maintenance vehicles such as snowplows.
12. **Advanced Infrastructure-Based Warning and Safety Systems.** These systems provide hazardous conditions or site-specific safety-related information, such as downhill speed warning.
13. **ITS Data and Information Management.** This involves the collection, storage and distribution of ITS data for transportation planning, administration, policy, operation, safety analyses, and research.
14. **Regional ITS Deployment Program and Policy.** This includes all related program and policy elements that are required to develop, deploy and operate a sustainable and effective regional ITS plan.

7.5.2 Choice of Individual ITS Program Elements/ITS Applications within Program Areas

Each of the program areas listed in Table 7.13 includes a number of specific ITS applications, not all of which are relevant to the Lansing region. In order to choose the ITS applications that are most beneficial to the Lansing region, an evaluation effort was performed during the course of the study. This work was coordinated with the following study elements:

- Ongoing project coordination with MDOT, and the Lansing region stakeholders through the CARTS ITS Task Force meetings;
- Review of mobility, safety and transportation operations – needs, deficiencies and priorities from transportation planning documents;
- Meetings and interviews with individual stakeholders and stakeholder groups in the Lansing region;
- The Lansing regional ITS architecture workshops; and
- Prioritization and evaluation performed by the project team, based on past experiences, and lessons learned from previous ITS deployments nationally and regionally (including the Detroit Metropolitan area).

Based on this evaluation, applicable ITS applications were recommended for deployment in the Lansing region.

A tabulation and detailed description of the chosen ITS applications for each program area is provided in Section 7.6.

7.5.3 Development, Prioritization and Evaluation of Projects for Phased ITS Deployment

ITS Projects associated with specific locations, corridors and areas were developed to address identified needs in a systematic and phased manner. Projects were designed using the criteria and deployment philosophy documented in detail in Section 2.4 of the project report. These guidelines were designed to provide consistency in the approach to ITS deployment, and serve as a quick reference list of deployment criteria and parameters for different ITS applications. Deployments are classified as either high- or low-intensity[3].

[3] The high and low intensity classifications primarily apply to ITS applications that are deployed over an extended region for which the functionality of desired ITS services varies over the geographic extent of the deployment, for e.g., Freeway Management Systems, Arterial Management Systems, Transit Management Systems, etc. For ITS applications that are applied on a site-specific or need-specific basis, such as ramp-rollover systems, the deployment criteria

(Footnote continued on next page...)

The **intensity** of deployment is defined by the level of monitoring, the amount of deployment, and the specific services provided on a given roadway segment. The decisions to designate the level of intensity at a roadway segment depend on the congestion level, Level of Service, traffic volume, road classification, and population density. For more detailed information regarding the deployment philosophy and the development of ITS projects, please refer to Section 2.4 of the MDOT ITS Pre-Deployment Study report.

Projects were grouped into **two phases** based on identified level of need/priority, and stakeholder input. **Phase 1 addresses short-term needs** and provides a base for future deployments. **Phase 2 builds upon Phase 1**, and includes upgrade of Phase 1 deployments and geographic expansion of ITS deployments to new facilities. While **2010 and 2020 were used as horizon years for the respective phases** (for the purpose of graduated ITS deployment based on priorities), the deployments themselves do not have a target year. This approach provides MDOT and the Lansing region stakeholders greater flexibility in implementing these plans and taking advantage of deployment opportunities as they occur. An example is deployment of ITS in conjunction with major highway rehabilitation projects that have been programmed in the region's transportation improvement plan.

Since this plan represents the first integrated regional ITS planning effort for the Lansing region project details are provided only for Phase 1, which represents the short-term priority needs of the Lansing region. Project concepts for the long term (10- 20-year horizon) have been identified, but specific projects, and their associated costs and benefits are not provided. Lessons learned from the initial deployments and their evaluation will be used to better define long-term projects. The long-term plan also includes recommendations for the conduct of studies for identifying project needs.

7.5.4 Performance of Benefit/Cost Analysis for the Recommended Program Areas and Projects

Cost Estimation

Estimates for both capital, and annual operations and maintenance (O&M) costs were developed for most of the potential projects identified. Some projects involve the deployment of emerging ITS applications or certain location-specific ITS improvements. The costs for such systems varies significantly based on the type of deployment and the extent of services provided. In such cases, either unit cost estimates are provided, or an approximation of costs for a typical deployment is presented.

The cost estimates were developed for the overall MDOT ITS Pre-Deployment study using nationally available information on ITS costs, as well as customized deployment reports

---

are not absolutely divided into high and low intensity, but vary depending upon the specific needs at that particular location.

specific to Michigan. A detailed account on the estimation of ITS costs is provided in Section 2.5.2.2 of the overall Pre-Deployment study report. The different sources of cost information include:

- The National ITS Benefits and Unit Costs Database, which is maintained and updated by Mitretek systems for the FHWA[4].
- ITS cost information available in the IDAS model, which generates a **detailed inventory of ITS equipment**, identifies **potential cost-sharing opportunities**, and provides default values for a wide range of ITS cost elements along with a **life-cycle stream of costs** and **average annual costs**.
- Review of costs of ITS from previous and ongoing deployments (including the Detroit area regional ITS deployment).
- The **Michigan ITS Typical Deployment** report, which was developed as part of this project. The report which is included in Appendix E, includes descriptions, conceptual drawings and unit cost estimates for typical deployments of ITS components, including freeway management, arterial management, and some specialized applications such as railroad grade crossings and "smart" park-and-ride lots.
- The **System Communications** report (Appendix F) which was developed as part of this project. This report includes alternative operating and communications strategies for implementing different ITS deployments. While the typical mile report focuses on field deployment, this report focuses primarily on center-to-center requirements.

Based upon the synthesis of ITS cost information from the above sources, and after incorporation of the unique needs and characteristics of the transportation networks and operating conditions in Michigan, a set of typical capital costs and annual O&M costs were developed for field equipment, center equipment, associated communications equipment and staffing and labor needs. These costs are tabulated in Table 2.18 in Section 2.5.2.2 of the overall Pre-Deployment study report.

These costs were then applied to the specific projects recommended for the Lansing region and adjusted appropriately to reflect local transportation characteristics and operating parameters.

Benefits Estimation

The primary purpose of ITS is to leverage maximum performance from the existing transportation system. A typical example used is a freeway accident, which leads to congestion build-up and also undermines traffic safety due to increase in turbulence of traffic flow. Quick notification, response and clearance of the incident through the

---

[4] www.benefitcost.its.dot.gov/its/benecost.nsf, Mitretek Systems, U.S. DOT, 2001.

surveillance, communications and information dissemination that ITS offers, provides for faster incident response and quicker restoration of traffic flow. Following are the typical types of benefits that may be realized by the application of ITS:

- Mobility improvement:
  - Overall user mobility improvement;
  - Travel time savings; and
  - Travel time reliability savings.
- Safety improvement:
  - Reductions in accidents;
  - Reductions in costs of accidents to road-users;
  - Reductions in costs of accidents to public agencies; and
  - Improvement in the management and operations of incidents and other emergencies.
- Fuel/vehicle operational savings:
  - Fuel-consumption reduction; and
  - Non-fuel vehicle operating cost savings.
- Air-quality/environmental improvement:
  - Reduction in emissions of pollutants and particulate matter;
  - Reductions in vehicle-related noise pollution; and
  - Overall improvement in quality of life.
- Agency operational improvement:
  - Improvement in efficiency and effectiveness of transportation, public safety and other public agencies; and
- Customer satisfaction:
  - Overall improvement in the quality of life and customers perceptions of public agencies.

As part of the benefits estimation effort, the project team compiled a synthesis of the expected benefits of the recommended ITS program areas, by performing a review of nationally reported benefits of ITS.[5] This review provides a picture of the types and

---

[5] The impacts and benefits data presented in the following paragraphs is drawn primarily from the following sources: *ITS Direct Benefits, ITS Deployment Analysis System (IDAS) Release 2-2*,

(Footnote continued on next page...)

ranges of benefits that the Lansing metropolitan region may realize through ITS deployment.

Subsequently, benefits for individual projects were then estimated using the IDAS model[6], which is dependent upon regional travel demand networks and models. At the time this study was conducted, the only available travel demand model for the Lansing metropolitan region was the year 2000 model, which was recently updated and validated. Future year travel demand models are in the process of being developed. Therefore, the benefit/cost analysis was performed using the base year 2000 network, with all the major recommended ITS projects deployed on the current transportation network. It is recommended that an evaluation of phased ITS deployment be performed when the future year models (which will be representative of planned highway/transit improvements) become available.

The project descriptions provided in Section 7.6 of this report contain a discussion of their expected benefits ranges, and their respective benefits and benefit/cost ratios estimated using IDAS.

For a detailed account of the IDAS benefits analysis methodology, please refer to Section 2.5 (Subsection 2.5.2.2) of the overall MDOT ITS Pre-Deployment study report.

7.5.5 ITS Deployment Program and Framework

The Lansing metropolitan region ITS program areas and the recommended program elements/ITS applications within each program area shown in Table 7.14:

Cambridge Systematics, Inc., April 2001; *Intelligent Transportation Systems Benefits:2001 Update*, prepared by Mitretek Systems for FHWA, U.S. DOT, June 2001; *Intelligent Transportation Systems Benefits:1998 Update*, prepared by Mitretek Systems for FHWA, U.S.DOT, May 1999; www.benefitcost.its.dot.gov/its/benecost.nsf, Mitretek Systems, U.S.DOT, 2001; and *Benefits Assessment of Advanced Public Transportation System Technologies Update 2000*, FTA, November 2000.

[6] For location specific ITS projects on which sufficient deployment specifics are not available at this planning stage, complete benefit-cost analysis using IDAS was not performed. For such projects, benefit-cost analysis was performed either for a representative typical deployment, or by approximation based on previous deployment experiences. An example of such a deployment is the Portable Traffic Management Systems (PTMS) which are recommended for traffic management and operations during road construction projects. Upcoming road construction projects from MDOT's 5-year road and bridge program have been identified for the deployment of PTMS. However, since actual project specifics are not available at this time, a range of expected costs and benefits is provided to serve as a decision making guideline.

Table 7.14 Lansing Sector Program Areas and Program Elements

Program Area	Program Elements / ITS Applications
Arterial Management	• Traffic Signal System Coordination • Detection, Surveillance and Verification • Arterial Incident Management • Arterial/Intersection Safety Systems • Railroad Grade Crossing Operations and Coordination
Freeway Management	• Detection, Surveillance and Verification • Freeway Service Patrols (FSP) • Reference and Ramp Markers • Dynamic Message Signs (DMS) • Freeway Incident Management • Freeway-Arterial Incident Management Coordination • Regional Traffic Management Center
Portable Traffic Management	• Portable Detection, Surveillance and Verification • Portable Information Dissemination – DMS and/or HAR
Regional Traveler Information	• Internet • Traveler Information Kiosks • Telephone Traveler Information (511 program) • Highway Advisory Radio (HAR) • Mobile User Devices
Regional Incident Management	• Incident Management Plan and Coordination
Regional Special Event Management	• Special Event Management Plan and Coordination
Parking Management	• Garage Status Monitoring • Regional Parking Availability Information • Automated Payment • Special Event Parking Management
Roadway Weather and Condition Monitoring and Management	• Road and Bridge Icing Detection • Roadway Flooding Detection • Visibility Hazard Detection • Obstacles and Hazard Detection/Removal • Motorist Information and Routing

Table 7.14 Lansing Sector Program Areas and Program Elements (continued)

Program Area	Program Elements / ITS Applications
Transit Management	• Transit Automatic Vehicle Location (AVL) and Computer Aided Dispatch (CAD) • Transit Security • Enhanced Transit Information • Automated Fare Payment • Vehicle Condition Monitoring and Maintenance • Transit Signal Priority • Demand Response and Paratransit Operations • Incident Management Coordination and Real-time Routing • Special Event Transit Coordination
Emergency and Maintenance Vehicle Operations and Management	• Emergency Vehicle AVL and CAD • Emergency Vehicle Signal Preemption • Incident Management Coordination and Real-time Routing • Maintenance Vehicle AVL and CAD (for optimization of snowplowing and other maintenance activities) • Emergency Vehicle and Maintenance Vehicle Condition Monitoring and Maintenance
Advanced Infrastructure-Based Warning and Safety Systems	• Ramp Roll-over Systems • Curve Warning Systems • Downhill Speed Detection and Warning Systems
Regional ITS Deployment Program and Policy	• Long-range Transportation Plan • Transportation Operations, and ITS Planning and Programming • ITS Evaluation Program • ITS Communications Master Plan • Incident Management Committee • Special Event Management Committee • Arterial Operations Coordination Committee • Road Construction/Maintenance Operations Coordination Committee • Intercity Traveler Information and Operations Coordination

The needs served by the different program areas and their respective program elements are illustrated in Table 7.15.

Table 7.15 Needs Served by the Lansing Region ITS Program Plan

● = Direct impact on meeting need
⊙ = Indirect impact on meeting need

Program Element/ITS Application	Congestion Reduction	Safety Improvement	Better Informed Travelers	Accessibility Improvement	Improved Regional Coordination	Improved Transit LOS and Attractiveness	Reduced Energy and Environmental Impacts	Agency Efficiency Improvement	Demand and Supply Management
Program Area – Arterial Management	●	●	●	●	⊙	⊙	⊙	⊙	●
Traffic Signal System Coordination	●	⊙		●			⊙	⊙	●
Detection, Surveillance and Verification	●	●	⊙	●	⊙		⊙	⊙	●
Arterial Incident Management	●	●	●	●	●		⊙	●	●
Arterial/Intersection Safety Systems	⊙	●	⊙	⊙				⊙	
Railroad Grade Crossing Operations and Coordination	●	●	●	●	⊙	⊙	⊙	⊙	⊙
Program Area – Freeway Management	●	●	●	●	●	⊙	⊙	●	●
Detection, Surveillance and Verification	●	●	●	●	⊙		⊙	●	●
Freeway Service Patrols (FSP)	⊙	●					⊙	⊙	
Reference and Ramp Markers	⊙	⊙	⊙	⊙	⊙		⊙	⊙	
Dynamic Message Signs (DMS)	●	⊙	●	●			⊙	⊙	⊙
Freeway Incident Management	●	●	●	●	●		⊙	●	●
Freeway-Arterial Incident Management Coordination	●	⊙	●	●	●		⊙	⊙	●
Regional Traffic Management Center	●	●	●	●	●	⊙	⊙	●	●
Program Area – Portable Traffic Management	●	●	●	●	●	⊙	⊙	⊙	●
Portable Detection, Surveillance and Verification	●	●	●	●	⊙	⊙	⊙	●	●
Portable Information Dissemination (DMS/HAR)	●	⊙	●	●			⊙	⊙	⊙

Table 7.15 Needs Served by the Lansing Region ITS Program Plan (continued)

● = Direct impact on meeting need
⦿ = Indirect impact on meeting need

Program Element/ITS Application	Congestion Reduction	Safety Improvement	Better Informed Travelers	Accessibility Improvement	Improved Regional Coordination	Improved Transit LOS and Attractiveness	Reduced Energy and Environmental Impacts	Agency Efficiency Improvement	Demand and Supply Management
Program Area – Regional Traveler Information	⦿	⦿	●	●	⦿	⦿	⦿	⦿	⦿
Internet	⦿	⦿	●	●	⦿	⦿	⦿	⦿	⦿
Traveler Information Kiosks	⦿	⦿	●	●	⦿	⦿	⦿	⦿	⦿
Telephone Traveler Information (511 program)	⦿	⦿	●	●	⦿	⦿	⦿	⦿	⦿
Highway Advisory Radio (HAR)	●	⦿	●	⦿			⦿	⦿	⦿
Mobile User Devices	⦿	⦿	●	●	⦿	⦿	⦿	⦿	⦿
Program Area – Regional Incident Management	●	●	●	●	●		⦿	●	●
Incident Management Plan	●	●	●	●	●		⦿	●	●
Program Area – Regional Special Event Management	●	⦿	●	●	●	⦿	⦿	●	●
Special Event Management Plan	●	⦿	●	●	●	⦿	⦿	●	●
Program Area – Parking Management	⦿	⦿	●	●	⦿			⦿	●
Garage Status Monitoring			●	●					●
Regional Parking Availability Information	⦿	⦿	●	●	⦿			⦿	●
Automated Payment				●				⦿	
Special Event Parking Management	⦿	⦿	●	●	⦿			⦿	●

Table 7.15 Needs Served by the Lansing Region ITS Program Plan (continued)

● = Direct impact on meeting need
⊙ = Indirect impact on meeting need

Program Element/ITS Application	Congestion Reduction	Safety Improvement	Better Informed Travelers	Accessibility Improvement	Improved Regional Coordination	Improved Transit LOS and Attractiveness	Reduced Energy and Environmental Impacts	Agency Efficiency Improvement	Demand and Supply Management
Program Area – Roadway Weather and Condition Monitoring and Management	⊙	●	●	⊙				⊙	
Road and Bridge Icing Detection		●	●	⊙				⊙	
Roadway Flooding Detection		●	●	⊙				⊙	
Visibility Hazard Detection		●	●	⊙				⊙	
Obstacles and Hazard Detection/Removal		●	●	⊙				⊙	
Motorist Information and Routing	⊙	●	●	⊙				⊙	
Program Area – Transit Management	⊙	⊙	●	⊙	⊙	●	⊙	●	⊙
Transit AVL and CAD		⊙	●	⊙		●	⊙	●	⊙
Transit Security		●		⊙		●		●	
Enhanced Transit Information	⊙	⊙	●	●	⊙	●		⊙	⊙
Automated Fare Payment				●	⊙	●		⊙	
Vehicle Condition Monitoring and Maintenance		●				●		●	
Transit Signal Priority				⊙	⊙	●			
Demand Responsive and Paratransit Operations	⊙	⊙	●	⊙	⊙	●	⊙	●	⊙
Incident Management Coordination and Real-time Routing	⊙	⊙	●	⊙	⊙	●	⊙	●	●
Special Event Transit Coordination	⊙		●	●	●	●	⊙	⊙	●
Program Area – Emergency and Maintenance Vehicle Operations and Management		⊙			⊙			●	
Emergency Vehicle AVL and CAD					⊙			●	
Emergency Vehicle Signal Preemption		●	⊙		⊙			●	
Incident Management Coordination and Real-time Routing		⊙			⊙			●	
Maintenance Vehicle AVL and CAD		⊙			⊙			●	

Table 7.15 Needs Served by the Lansing Region ITS Program Plan (continued)

● = Direct impact on meeting need
⊙ = Indirect impact on meeting need

Program Element/ITS Application	Congestion Reduction	Safety Improvement	Better Informed Travelers	Accessibility Improvement	Improved Regional Coordination	Improved Transit LOS and Attractiveness	Reduced Energy and Environmental Impacts	Agency Efficiency Improvement	Demand and Supply Management
Emergency Vehicle and Maintenance Vehicle Condition Monitoring and Maintenance		●						●	
Program Area – Advanced Infrastructure-Based Warning and Safety Systems	⊙	●	⊙	⊙				⊙	
Ramp Roll-over Systems	⊙	●	⊙	⊙				⊙	
Curve Warning Systems	⊙	●	⊙	⊙				⊙	
Downhill Speed Detection and Warning Systems	⊙	●	⊙	⊙				⊙	
Program Area – ITS Data and Information Management	⊙	⊙	⊙	⊙	⊙	⊙	⊙	●	⊙
Centralized ITS Data Collection and Warehousing Repository	⊙	⊙	⊙	⊙	⊙	⊙	⊙	●	⊙
Decision-Support Systems	⊙	⊙	⊙	⊙	⊙	⊙	⊙	●	⊙
Program Area – Regional ITS Deployment Program and Policy	●	●	●	●	●	●	●	●	●
Long-range Transportation Plan	●	●	●	●	●	●	●	●	●
Transportation Operations, and ITS Planning and Programming	●	●	●	●	●	●	●	●	●
ITS Evaluation Program	⊙	⊙	⊙	⊙	⊙	⊙	⊙	●	⊙
ITS Communications Master Plan	⊙	⊙	⊙	⊙	●	⊙	⊙	●	⊙
Incident Management Committee	●	●	●	●	●	⊙	⊙	●	●
Special Event Management Committee	⊙	⊙	●	●	●	⊙	⊙	●	●
Arterial Operations Coordination Committee	●	●	⊙	●	●	⊙	●	●	●
Road Construction/Maintenance Operations Coordination Committee	●	●	●	●	●	⊙	⊙	●	●
Intercity Traveler Information and Operations Coordination	⊙	⊙	●	●	●		⊙	⊙	●

7.6 Description of ITS Program Areas and Projects

This section provides a brief description of each program area along with the purpose, anticipated benefits, chosen program elements/ITS applications[7] and the recommended projects categorized by deployment phase.

7.6.1 Program Area 1 – Arterial Management

Arterial management systems are used to manage traffic on arterial streets by deploying various detection and control devices. The functions performed by arterial management systems include surveillance, traffic control, incident management coordination, and in some cases, provision of traveler information using audio or visual dissemination methods. Traffic signal control systems are primarily upgraded to improve traffic flow, simplify system management, improve safety and reliability and reduce motorist frustration. Upgrades to arterial systems include the deployment of actuated traffic responsive or traffic adaptive control systems, sharing of information and coordination of arterial corridor management across jurisdictions, highway-rail intersection operational and safety improvements, and automated enforcement programs to increase compliance with speed limits and traffic signals. Transit signal priority and emergency vehicle signal preemption also may be categorized under the arterial management program area. However, since the majority of the benefits of transit signal priority systems and emergency vehicle preemption systems are realized by transit agencies and emergency response agencies, they are included in the Transit Management and Emergency and Maintenance Vehicle Operations and Management program areas respectively.

It is generally understood that incident management systems are deployed on freeways and expressways, but it is important to keep in mind that incident management programs including (detection, surveillance, response, management, clearance and information dissemination) can be devised for arterial streets[8] as well.

Benefits of arterial management systems range from reduction in stops and delay, reduction in travel times, improvement in intersection safety, increase in throughput, avoidance of delay through better information, and reduction in delays associated with traffic diversion to arterials during incidents. From the public agency perspective, arterial systems increase operational reliability of traffic signal systems, reduce agency operating

---

[7] While this section lists out the chosen program elements/ITS applications for the Lansing region, the deployment guidelines for these applications may be found in the “Deployment Philosophy” in section 2.4.2 of the overall Michigan ITS Pre-Deployment Study report.

[8] For the Lansing region, Grand River Avenue (M-43/BR-96), Saginaw Highway (M-43/BR-69), Cedar Street (BR-96/East Street/BR-27), and Martin Luther King Jr. Boulevard (M-99/Logan Road/Dewitt Road), which carry a significant volume of through traffic, are prime candidates for deployment of arterial incident management systems.

and maintenance costs, and increase customer satisfaction. Arterial management systems also produce energy conservation and air-quality benefits, although minimal in comparison to those realized through freeway management and incident management systems.

A nationally prominent example of an arterial management program is Oakland County, Michigan, which shares the strain of having the highest percentage of single-occupancy-vehicle use in the nation. The program is better known as Faster and Safer Travel Through Advanced Routing and Control (FAST-TRAC). FAST-TRAC's mission is to integrate an Advanced Transportation Management System (ATMS) and an Advanced Traveler Information System (ATIS) together and to provide synergistic benefits to travelers in the county. The program includes the Sydney Coordinated Adaptive Traffic System (SCATS) for signal control, which became operational in Troy, Michigan on June 2, 1992. FAST-TRAC helps to relieve some of the problems experienced by the county, including improving safety, reducing delay, and improved operational efficiency. By controlling traffic signals, the program has improved safety by reducing accidents (particularly those resulting in severe injuries). Preliminary floating car studies showed a decrease of 33 percent in the number of stops in system corridors, as well as increased average speeds, particularly during off-peak periods. Seventy-two percent of the surveyed drivers said they are better off for having FAST-TRAC. Other benefits appear to have been gained in the areas of governmental relations and public/private cooperation.

Program Elements/ITS Applications

The recommended program elements/ITS applications under the arterial management program area for the Lansing region are as follows:

- Traffic Signal System Coordination;
- Detection, Surveillance and Verification;
- Arterial Incident Management;
- Arterial/Intersection Safety Systems; and
- Railroad Grade Crossing Operations and Coordination.

Projects

The projects identified for the Lansing metropolitan region under the arterial management program area are listed as follows:

- Project 1.1 Corridor Traffic Signal Systems;
- Project 1.2 Regional Advanced Traffic Signal Systems;
- Project 1.3 Arterial Incident Management Systems;
- Project 1.4 Arterial/Intersection Safety Systems; and
- Project 1.5 Railroad Grade Crossing Coordination Systems.

The project descriptions and deployment specifics are discussed in the following paragraphs.

Project 1.1 Corridor Traffic Signal Systems

This involves the deployment of traffic signal system coordination technologies along the major arterial thoroughfares in the area. Signal system coordination along these corridors is designed to provide a unified approach to traffic management and control along the major arterial thoroughfares in the region. Since many of these corridors pass through multiple jurisdictions, the effective implementation of corridor traffic signal system coordination calls for interjurisdictional signal system operations coordination.

Based upon identified needs and priorities, the corridors were segmented for deployment in the short term (0–10 years), and long term (10–20 years).

Short-Term Deployment (Phase 1)

- In the short term, it is recommended that traffic signals along the following corridors be interconnected and coordinated:
  - Grand River Avenue (BR-96/M-43);
  - Saginaw Highway (Grand Ledge Highway/M-43/ALT-69);
  - Oakland Avenue;
  - Lake Lansing Road/High Street;
  - Michigan Avenue (M-143);
  - West Michigan Avenue;
  - Meridian Road;
  - Okemos Road;
  - Hagadorn Road;
  - Pennsylvania Avenue;
  - Cedar Street/Larch Road (BR-96/N. East Street/BR-27);
  - U.S.-27;
  - MLK Boulevard (M-99/Logan Road/Dewitt Road);
  - Waverly Road (Airport Road);
  - Lansing Road (BR-27);
  - M-21 (parts Blue Water Highway);
  - M-36 (parts Dansville Road);
  - M-79 (parts Lawrence Highway);
  - M-78 (parts Butterfield Highway);

  - M-99 (parts Michigan Road, parts Clinton Trail); and
  - M-100 (Hartel Road/Wright Road).

- For the short term, it is recommended that the mode of operation for the coordinated traffic signal systems be **Traffic Actuated and Centrally Controlled** signal systems. However, in order to facilitate efficient and economic future system enhancements, it is recommended that the chosen signal controller, communications, detection and integration technology be expandable for future deployment of adaptive signal control (if required).

- Several arterial corridors that pass primarily through undeveloped areas, and do not carry heavy traffic have also been recommended for deployment of advanced traffic signal systems in the short term. This is based on needs identified:

  - By stakeholders, and
  - Information gathered on mobility and safety deficiencies from MDOT, TCRPC and other plans and documents.

The recommended intensity of deployment for the majority of such corridors is low-intensity. The deployment strategy for such corridors primarily focuses on spot-specific improvements like isolated traffic-actuated signals, and spot-specific roadway and intersection safety deployments.

Since there are several arterial corridors that have been identified for the deployment of advanced traffic signal systems, the **corridor arterial traffic signal system projects** that are recommended for deployment in the **short term** are **categorized into two priority levels – Priority Level 1 and Priority Level 2**. This categorization is based on the identified urgency of the needs, and provides a guideline for phased deployment, and for selection of individual projects for **immediate inclusion in the regional transportation plan**.

The following two tables summarize the recommended arterial traffic signal system coordination projects for the short term. Table 7.16 summarizes the Priority Level 1 projects, while Table 7.17 presents the Priority Level 2 projects.

Table 7.16 Arterial Corridor Traffic Signal System Coordination: Short-Term Projects (Phase 1)
Priority Level 1 Projects

No.	Corridor	Primary Direction	Extent	Deployment Intensity	Estimated Cost: Capital	Estimated Cost: Average Annual O&M	Estimated Cost: Total Average Annual Cost	Anticipated Annual Benefit ($) [B/C Ratio]
	MDOT Roads							
1.	**Grand River Avenue (BR-96/M-43)**	E-W			**822,250**	**58,500**	**190,978**	**901,068 [4.72]**
a.	Grand River Avenue (BR-96)		From Wright Road (M-100) to Oakland Avenue	High				
b.	Grand River Avenue (M-43)		From U.S.-127 @ Saginaw Hwy to Meridian Road	High				
c.	Grand River Avenue (M-43)		From Meridian Road to Ingham/ Livingston County Border	Low				
2.	**Saginaw Hwy (Grand Ledge Hwy/M-43/ALT-69)**	E-W			**495,750**	**43,197**	**116,204**	**652,219 [5.61]**
a.	Saginaw Hwy (M-43)		From Oneida Road to I-69/I-96	High				
b.	Saginaw Hwy (M-43/BR-69)[9]		From I-69/I-96 to U.S.-127	High				
c.	Saginaw Hwy (ALT 69)		From U.S.-127 to Clinton/Shiawasee County Border	High				
3.	**Oakland Avenue[10]**	E-W	From Saginaw Hwy (City of Lansing) to U.S.-127	High	**154,000**	**12,675**	**40,704**	**76,355 [1.88]**

9 Certain improvements including controller upgrade were performed on Saginaw Avenue where it forms a one-way pair with Oakland Avenue. These improvements were performed in 2001 as part of the mitigation for the I-496 reconstruction project in downtown Lansing. The cost estimate provided in this table discounts the costs for these improvements.

10 Certain improvements including controller upgrade were performed on Oakland Avenue where it forms a one-way pair with Saginaw Avenue. These improvements were performed in 2001 as part of the mitigation for the I-496 reconstruction project in downtown Lansing. The cost estimate provided in this table discounts the costs for these improvements.

Table 7.16 Arterial Corridor Traffic Signal System Coordination: Short-Term Projects (Phase 1) (continued)
Priority Level 1 Projects

					Estimated Cost			
No.	**Corridor**	**Primary Direction**	**Extent**	**Deployment Intensity**	**Capital**	**Average Annual O&M**	**Total Average Annual Cost**	**Anticipated Annual Benefit ($) [B/C Ratio]**
4.	**Michigan Avenue (M-143)**	E-W	From Capitol Loop to Grand River Avenue	High	**279,250**	**21,465**	**62,604**	**74,902 [1.20]**
5.	**West Michigan Avenue**	E-W	From Creyts Road to MLK Boulevard	High	**158,500**	**11,880**	**33,663**	**71,492 [2.12]**
6.	**Cedar Street/Larch Road (BR-96/N. East Street/BR-27)**	N-S			**394,000**	**28,390**	**89,932**	**731,197 [8.13]**
a.	Cedar Street/N. East Street (BR-96/BR-27)		From I-96 to State Road	High				
b.	N. East Street (BR-27)		From State Road to I-69	Low				
7.	**MLK Boulevard (M-99/Logan Road/Dewitt Road)**	N-S			**283,000**	**21,000**	**62,253**	**370,282 [5.95]**
a.	Logan Road (M-99)		From I-96 to I-496	High				
b.	MLK Boulevard/N. Logan Road		From I-496 to State Road	High				
8.	**Lansing Road (BR-27)**	N-S			**116,500**	**8,775**	**25,694**	**25,861 [1.01]**
a.	Lansing Road (BR-27)		From I-69 to I-96	Low				
b.	Lansing Road/BR-27		From I-96 to I-496	High				
9.	**M-100 (Hartel Road/Wright Road)**	N-S	From I-69 to I-96	Low	**173,250**	**13,212**	**47,149**	**64,228 [1.36]**
	Other Local Roads							
10.	**Lake Lansing Road/High Street**	E-W	From BR-27 to Marsh Road	High	**244,750**	**19,025**	**54,634**	**261,095 [4.78]**

Table 7.16 Arterial Corridor Traffic Signal System Coordination: Short-Term Projects (Phase 1) (continued)

Priority Level 1 Projects

No.	Corridor	Primary Direction	Extent	Deployment Intensity	Estimated Cost: Capital	Estimated Cost: Average Annual O&M	Estimated Cost: Total Average Annual Cost	Anticipated Annual Benefit ($) [B/C Ratio]
11.	**Okemos Road** NOTE: The intersections of Okemos Rd with Jolly Road, Mt. Hope Road and Grand River Avenue have been specifically identified as high congestion locations. Coordination and interconnection of these intersections may yield significant benefits.	N-S	From I-96 to Lake Lansing Road	High	**175,750**	**13,175**	**37,723**	**326,888 [8.67]**
12.	**Hagadorn Road**	N-S	From I-96 to Lake Lansing Road	High	**141,250**	**10,575**	**29,593**	**119,262 [4.03]**
13.	**Pennsylvania Avenue**	N-S	From I-96 to Grand River Avenue	High	**262,000**	**20,220**	**58,594**	**223,814 [3.82]**
14.	**Edgewood Boulevard**	E-W	From Logan Road (M-99) to Cedar Street (BR-96)	High	**57,250**	**4,275**	**10,816**	**58,696 [5.43]**

Table 7.17 Arterial Corridor Traffic Signal System Coordination: Short-Term Projects (Phase 1)
Priority Level 2 Projects[11]

No.	Corridor	Primary Direction	Extent	Deployment Intensity
	MDOT Roads			
1.	**Grand River Avenue (BR-96/M-43)**	E-W	From Clinton/Ionia County Border to Wright Road (M-100)	Low
2.	**Saginaw Hwy (Grand Ledge Hwy/M-43/ALT-69)**	E-W	Grand Ledge Highway (M-43), from M-66/Eaton County Western Border to Oneida Road (just west of Grand Ledge)	Low
3.	**Cedar Street (BR-96/N. East Street/BR-27)**	N-S	Cedar Street (BR-96), from M-36/Dansville Road (in Mason) to I-96	Low
4.	**U.S.-27**	N-S	From I-69 to Cutler Road/Round Lake Road	Low
5.	**M-21 (parts Blue Water Highway)**[12]	E-W	From Clinton/Ionia County Border to Clinton/Shiawasee County Border	Low
6.	**M-99 (parts Michigan Road, parts Clinton Trail)**	N-S	Michigan Road, from Wilbur Highway to I-96	Low
7.	**MLK Boulevard (M-99/Logan Road/Dewitt Road)**	N-S	Dewitt Road, from State Road to Cutler Road/Round Lake Road	Low
8.	**M-36 (parts Dansville Road)**	E-W	From Cedar Street (BR-96) in Mason to M-52 (Stockbridge Road)	Low
	Other/Local Roads			
9.	**Meridian Road**	N-S	From I-96 to I-69	Low
10.	**Okemos Road**	N-S	From N. Jefferson St. (in Mason) to I-96	Low
11.	**Hagadorn Road**	N-S	From Howell Road (in Mason) to I-96	Low

[11] Benefit/cost information is not provided for Priority Level 2 projects.

[12] Road construction is expected soon on this corridor, including road milling, resurfacing and bridge work. This presents an opportunity for spot improvements where necessary, and for the installation of communications conduits and other required infrastructure for the future deployment of advanced traffic signal systems.

Table 7.17 Arterial Corridor Traffic Signal System Coordination: Short-Term Projects (Phase 1) (continued)
Priority Level 2 Projects[13]

No.	Corridor	Primary Direction	Extent	Deployment Intensity
12.	**Waverly Road (Airport Road)**	N-S		
a.	Waverly Road NOTE: Safety problems identified on Waverly Road between Grand River and Bishop Highway, and on the exit off I-496 to Waverly road.		From Michigan Road (M-99) to State Road	High
b.	Airport Road		From State Road to Cutler Road	Low

Long-Term Considerations (Phase 2)

This section outlines the considerations and project concepts for deployment of corridor arterial traffic signal systems in the long term. Given that this ITS deployment plan is the earliest integrated ITS planning effort for the Lansing region, specific projects, and their associated costs and benefits for the long term are not provided. This approach will lay the foundation for the next phase of ITS deployment by using the lessons learned from the initial deployments and by evaluating the needs of the region a few years from now. The long-term elements identified in this report however, are comprehensive enough to lay out the regional priorities and focus areas/corridors. The following are the long-term considerations for the region:

- The long-term focus for the region includes the review of needs and identification of additional corridors for deployment of advanced traffic signal systems. This includes the following:
  - The consideration of high-intensity deployments along corridors that are slated for low-intensity in the short term;
  - Develop policies for periodic refinement of operations and revision of signal system settings and timings;

[13] Benefit/cost information is not provided for Priority Level 2 projects.

- Refinement of operations and increase integration across all major corridors; and
- Evaluation of the feasibility and practicality of deploying Traffic Adaptive Signal Systems Technology, followed by deployment as appropriate.

- In the long term, there is significant land development expected on unimproved rural roads, which may lead to congestion and safety problems if left unattended. It is therefore essential that land-development plans are closely tied with roadway infrastructure improvement in order to ensure accessibility, mobility, and safety. The deployment of coordinated traffic signal systems along such corridors on a pro-active basis (along with roadway infrastructure improvements) will ensure the preservation of the quality of service provided to road users.

- The Lansing region has the opportunity to test and deploy several emerging applications of ITS as well as test innovative transportation operations and management concepts. Stakeholders identified the following access-related mobility and safety issues on arterial corridors:

  - Ingress and Egress issues from non-signalized driveways; and
  - Lack of dedicated left turn lanes at intersections.

Such problems may be solved by the integration of "Access Management" with ITS. Examples of such applications include:

- Time-based pro-active access barriers for turn restrictions; and
- Time-based electronic turn prohibition signs (for prevention of left turns from mainline corridors during restricted hours).

- Based on identified needs and priorities, additional corridors are recommended for consideration for the deployment of advanced traffic signal systems in the long term. The recommendations are tabulated in Table 7.18. Some of these project concepts include the intensification of low-intensity corridors to high-intensity.

Table 7.18 Arterial Corridor Traffic Signal System Coordination: Long-Term Considerations (Phase 2)

No.	Corridor (MDOT Roads in Bold)	Primary Direction	Extent	Phase 1 Deployment Intensity (if deployed in Phase 1)	Phase 2 Deployment Intensity
	MDOT Roads				
1.	**Grand River Avenue (M-43/BR-96)**	E-W			
a.	Grand River Avenue		From Clinton/Ionia County/ Border to Wright Road (M-100)	Low	High
b.	Grand River Avenue (M-43)		From Meridian Road to Ingham/Livingston County Border	Low	High
2.	**Saginaw Hwy (Grand Ledge Hwy/M-43/ALT-69)**	E-W	Saginaw Hwy (ALT 69), from Clinton/Shiawasee County Border to I-69, just east of M-52 (in Shiawasee County)	Not Deployed	Low
3.	**Cedar Street (BR-96/N. East Street/BR-27)**	N-S			
a.	Cedar Street (BR-96)		From M-36/Dansville Road (in Mason) to I-96	Low	High
b.	N. East Street (BR-27)		From State Road to I-69	Low	High
4.	**U.S.-27**	N-S			
a.	U.S.-27		From I-69 to Cutler Road/Round Lake Road	Low	High
b.	U.S.-27		From Cutler Road/Round Lake Road to St. Johns corporation line (south)	Not Deployed	Low
c.	U.S.-27		From St. Johns corporation line (south) to U.S.-127	Not Deployed	High
d.	U.S.-27		From U.S.-127 to Clinton County north boundary	Not Deployed	Low
5.	**M-99 (parts Michigan Road, parts Clinton Trail)**	N-S			
a.	M-99 (Michigan Road)		From Clinton Trail (M-50) in Eaton Rapids to Wilbur Highway	Not Deployed	Low
b.	M-99 (Michigan Road)		From Wilbur Highway to I-96	Low	High
6.	**MLK Boulevard (M-99/Logan Road/Dewitt Road)**	N-S	Dewitt Road, from State Road to Cutler Road/Round Lake Road	Low	High

Table 7.18 Arterial Corridor Traffic Signal System Coordination: Long-Term Considerations (Phase 2) (continued)

No.	Corridor (MDOT Roads in Bold)	Primary Direction	Extent	Phase 1 Deployment Intensity (if deployed in Phase 1	Phase 2 Deployment Intensity
7.	**Lansing Road (BR 27)**	N-S			
a.	Lansing Road		From M-79 in Charlotte to I-69	Not Deployed	High
b.	Lansing Road (BR-27)		From I-69 to I-96	Low	High
8.	**M-21 (parts Blue Water Highway)**	E-W			
a.	M-21		From Clinton/Ionia County Border to Clinton/Shiawasee County Border	Low	High
b.	M-21		From Clinton/Shiawasee County Border to Owosso corporation limit (west)	Not Deployed	Low
c.	M-21		Through Owosso	Not Deployed	High
9.	**M-36 (parts Dansville Road)**	E-W	From Cedar Street (BR-96) in Mason to M-52 (Stockbridge Road)	Low	High
10.	**M-100 (Hartel Road/Wright Road)**	N-S	From I-69 to I-96	Low	High
11.	**M-78 (parts Butterfield Highway)**	E-W	From Eaton County western boundary to I-69	Not Deployed	Low
12.	**M-79 (parts Lawrence Highway)**	E-W			
a.	M-79 (Lawrence Highway)		From Eaton County western boundary to the Charlotte corporation line (west)	Not Deployed	Low
b.	M-79 (Lawrence Highway)		From the Charlotte corporation line (west) to Lansing Road (BR-27)	Not Deployed	High
13.	**M-52 (parts Stockbridge Road)**	E-W			
a.	Stockbridge Road (M-52)		From Dansville Road to I-96	Not Deployed	Low
b.	M-52		From I-96 to I-69	Not Deployed	High
c.	M-52		From I-69 to Owosso corporation line (south)	Not Deployed	Low
d.	M-52		Through the town of Owosso	Not Deployed	High
e.	M-52		From Owosso corporation line (north) to Johnstone Road	Not Deployed	Low

Table 7.18 Arterial Corridor Traffic Signal System Coordination: Long-Term Considerations (Phase 2) (continued)

No.	Corridor (MDOT Roads in Bold)	Primary Direction	Extent	Phase 1 Deployment Intensity (if deployed in Phase 1)	Phase 2 Deployment Intensity
14.	**M-50 (parts Clinton Trail)**	E-W			
a.	M-50 (Clinton Trail)		From Grand Ledge Highway (M-43) to Charlotte corporation line (north)	Not Deployed	Low
b.	M-50		Through the town of Charlotte	Not Deployed	High
c.	M-50 (Bell Highway / Clinton Trail)		From I-69 in Charlotte to Eaton Rapids corporation line (west)	Not Deployed	Low
d.	M-50		Through the town of Eaton Rapids	Not Deployed	High
e.	Clinton Trail (M-50/M-99)		From Eaton Rapids corporation line (south) to Eaton county southern boundary	Not Deployed	Low
15.	**M-188 (V.F.W. Road)**	E-W	From M-50 in Eaton Rapids to Waverly Road	Not Deployed	High
	Other/Local Roads				
16.	**Meridian Road**	N-S			
a.	Meridian Road		From I-96 to I-69	Low	High
b.	Meridian Road		From M-36 to I-96	Not Deployed	Low
c.	Meridian Road		From I-69 to Cutler Road	Not Deployed	Low
17.	**Okemos Road**	N-S	From N. Jefferson St. (in Mason) to I-96	Low	High
18.	**Hagadorn Road**	N-S	From Howell Road (in Mason) to I-96	Low	High
19.	**Waverly Road (Airport Road)**	N-S	Airport Road, from State Road to Cutler Road	Low	High
20.	**St. Joe Highway**	E-W			
a.	St. Joe Highway		From Irish Road in Sunfield Township to Wright Road (M-100)	Not Deployed	Low
b.	St. Joe Highway		From M-100 (Wright Road) to I-496	Not Deployed	High

Table 7.18 Arterial Corridor Traffic Signal System Coordination: Long-Term Considerations (Phase 2) (continued)

No.	Corridor (MDOT Roads in Bold)	Primary Direction	Extent	Phase 1 Deployment Intensity (if deployed in Phase 1)	Phase 2 Deployment Intensity
21.	**Mt. Hope Road**	E-W			
a.	Mt. Hope Road		From Eaton County western border to Wright Road (M-100)	Not Deployed	Low
b.	Mt. Hope Road		From Wright Road (M-100) to Okemos Road	Not Deployed	High
22.	**Jolly Road (Kelly Highway / Needmore Highway / Davis Highway)**	E-W			
a.	Kelly Highway / Needmore Highway		From Eaton County western boundary to Wright Road (M-100)	Not Deployed	Low
b.	Davis Highway/Jolly Highway		From M-100 to Meridian Road	Not Deployed	High

Project 1.2 Regional Advanced Traffic Signal Systems[14]

While the projects identified in Project group 1.1 involve the deployment of advanced traffic signal systems along major corridors, Regional Advanced Traffic Signal Systems are deployed on a regionwide basis in cities and towns. They cover all traffic signals that fall under the operational responsibility of the respective cities or towns.

[14] It is to be noted that the individual cities or towns may have the responsibility of designing, building and operating the traffic signals along the major corridors as they pass through their respective jurisdictions. Therefore, the regional advanced traffic signal systems will be integrated with the corridor traffic signal systems as and when they are respectively deployed. For the purpose of cost and benefits estimation, the costs for the major arterial corridors are accounted as part of the corridor improvements, and not as part of the regional advanced traffic signal systems.

The short-term and long-term recommendations for this project group are summarized below.

Short-Term Deployment Recommendations (Phase 1)

- The following regional advanced traffic signal systems are recommended for deployment in Phase 1:
  - City of Lansing Advanced Signal System;
  - City of East Lansing Advanced Signal System
  - Meridian Township Advanced Signal SystemDelta Township Advanced Signal System; and
  - MSU Advanced Signal System.
- For the short term, it is recommended that the mode of operation for these regional advanced traffic signal systems be **Centrally Controlled signal systems with traffic responsive (actuated) control philosophies**. However, in order to facilitate efficient and economic future system enhancements, it is recommended that the chosen signal controller, communications, detection, and integration technology be expandable for future deployment of adaptive signal control (if required).
- The recommended intensity of deployment for these regional advanced traffic signal systems is **High-Intensity**.
- The following table summarizes the recommended regional advanced traffic signal system projects for the short term:

Table 7.19 Regional Advanced Traffic Signal Systems: Short-Term Projects (Phase 1)[1]

Number	Jurisdiction
1.	City of Lansing Advanced Signal System
2.	City of East Lansing Advanced Signal System
3.	Meridian Township Advanced Signal System
4.	Delta Township Advanced Signal System
5.	MSU Advanced Signal System

[1] Benefit/cost information is not provided for regional traffic signal system projects, as the deployment specifics may vary greatly by individual agency. The costs for deploying regional advanced traffic signal systems varies from $20,000 to $100,000 per intersection, depending on the current signalization status, and the type of traffic signal system hardware, software and communications infrastructure chosen for deployment.

The City of Lansing has procured funding amounting to $3 million for the deployment of a regional traffic management center (TMC) for its traffic signal system.

The maintenance and operations of township roads and streets in Michigan is the responsibility of the respective Counties to which they belong. Therefore, the Ingham County Road Commission and the Eaton County Road Commission will respectively be responsible for the advanced traffic signal system deployments in Meridian Township and Delta Township respectively. Alternatively, the Meridian Township system may be combined with that of the City of East Lansing, and the Delta Township system may be combined with that of the city of Lansing.

MSU is currently responsible for the operation and maintenance of the traffic signal system on its campus. There is a central traffic signal control center, with an extensive fiberoptic communications backbone on campus. The signals are not interconnected and the current mode of operation is time-based control (TBC). This presents an opportunity for co-location of the city of East Lansing traffic signal control center along with MSU.

Long-Term Considerations (Phase 2)

The following are the long-term considerations for the deployment of advanced regional traffic signal systems:

- It is recommended that the following jurisdictions be considered for the deployment of advanced regional traffic signal systems in the long term:

Table 7.20 Regional Advanced Traffic Signal Systems: Long-Term Considerations (Phase 2)

High-Priority Considerations	Low-Priority Considerations
• Ingham County • Williamston • Mason • Eaton Rapids • Charlotte • Potterville • Dimondale • Grand Ledge • Dewitt	• Clinton County • Eaton County • St. Johns • Weberville • Owosso (Shiawasee County)

- The following are additional planning and deployment strategies for the advanced regional traffic signal systems identified for long-term deployment:
  - Consider advancing the deployment of these systems, based on review of needs and on availability of time and resources. One way to advance the deployment is to conduct the preliminary engineering studies for these systems in the short term.
  - Consider collaborating/combining these regional systems with those of larger jurisdictions for joint planning, deployment, and operations. This presents a significant opportunity for saving resources and time, especially in the development of plans, specifications, and estimates (PS&E) and in the procurement of equipment. Such a strategy will also bring about regional consistency in system operating and control philosophies.

Project 1.3 Arterial Incident Management Systems

It is generally understood that incident management systems are deployed on freeways and expressways, but incident management programs including (detection, surveillance, response, management, clearance, and information dissemination) are increasingly being deployed on major arterial corridors as well.

For the Lansing region, Grand River Avenue, Saginaw Highway (M-43/BR-69), Cedar Street (BR-96/East Street/BR-27), and Martin Luther King Jr. Boulevard (M-99/Logan Road/Dewitt Road), which carry a significant volume of through traffic are prime candidates for deployment of arterial incident management systems.

Short-Term Deployment Recommendations (Phase 1)

The following are the short-term recommendations for arterial incident management for the Lansing region:

- Conduct a study to determine the need for and feasibility of deploying arterial incident management systems along the following corridors:

  - Grand River Avenue (M-43/ BR-96);
  - Saginaw Highway (M-43/BR-69);
  - Cedar Street (BR-96/East Street/BR-27); and
  - Martin Luther King Jr. Boulevard (M-99/Logan Road/Dewitt Road).

  Since these corridors are recommended for the deployment of corridor traffic signal systems in the short term, there exists an opportunity for the coordinated deployment of arterial incident management systems along with corridor traffic signal systems.

  It is recommended that the study address the following issues that are related to arterial incident management systems:

  - Conduct a literature research on other national deployments of arterial incident management systems in order to assess the state-of-the-art and the state-of-the-practice.
  - Conduct an analysis of crashes along these corridors to identify high crash locations; and to obtain an understanding of the types of crashes (total crashes/minor incidents/fatal accidents/injury accidents/PDO accidents), and the traffic flow patterns associated with the occurrence of crashes.
  - Identify key decision points and traffic patterns along these corridors.
  - Identify and evaluate alternate arterial corridors that may be used as alternate routes. For example, both St. Joe and Willow Highways may serve as alternate routes for and Saginaw Highway, while Eaton Highway may be considered as an alternate route for Grand River Avenue.
  - Based on the identified needs, if it is established that the arterial incident management systems will provide mobility and safety benefits to the region, develop an implementation plan for arterial incident management along the four major corridors. Address integration issues with the corridor traffic signal systems for the respective corridors.
  - This study is estimated to cost $150,000.

Table 7.21 Arterial Incident Management Systems: Short-Term Projects (Phase 1)

Number	Project	Estimated Cost ($)
1.	Arterial Incident Management Needs and Feasibility Study for: • Grand River Avenue (M-43/ BR-96); • Saginaw Highway (M-43/BR-69); • Cedar Street (BR-96/East Street/BR-27); and • Martin Luther King Jr. Boulevard (M-99/Logan Road/ Dewitt Road).	$150,000
	Total	**$150,000**

Long-Term Considerations (Phase 2)

If the arterial incident management feasibility and needs study establishes the potential benefits, the feasibility and the value of arterial incident management, it is recommended that deployment be initiated by conducting a pilot project along a high-priority (as identified by the study) section of Grand River Avenue. The pilot project may include the following components:

- CCTV surveillance cameras at designated locations;
- Arterial DMS (smaller than freeway DMS) at key intersections and decision points to advice motorists on downstream incidents and provide recommendations on alternate routes;
- Development of incident management information coordination and message display codes and procedures;
- Integration with the corridor traffic signal system for Grand River Avenue; and
- Regional incident management coordination.

The cost of this pilot deployment is estimated to be $500,000. This cost includes the following assumptions:

- Two arterial DMS – approximately $50,000 total;
- Communications and hardware integration, and integration with corridor traffic signal system – approximately $100,000;
- Four CCTV cameras – approximately $50,000 total;

- Incident management, detection and communications software integration – approximately $100,000;
- Operations and Maintenance (O&M) costs for two years – approximately $125,000; and
- Study for evaluation of the pilot project, and for the development of recommendations for future enhancement and expansion – approximately $75,000.

Further, it is recommended that the results of the evaluation of the pilot arterial incident management deployment along Grand River Avenue be used to make decisions on expansion of the system – both geographically and functionally. The lessons learned from the pilot deployment may then be adapted for deployment of arterial incident management along the other three priority corridors as identified above, and along new corridors as deemed appropriate.

Project 1.4 Arterial/Intersection Safety Systems

ITS technologies may be used as a low-cost alternative for the mitigation of safety problems at intersections and on hazardous locations along arterial corridors. ITS solutions may provide a "quick fix" while the long-term capital improvement projects are underway for the improvement of arterial and intersection safety.

Such low-cost spot improvements are especially applicable to unsignalized intersections, where safety is a major concern. Intersection collisions are one of the most common types of crashes, and in the United States, they account for nearly two million accidents and 6,700 fatalities every year[15]. However, a fully signalized intersection can sometimes be hard to justify in rural areas, due to the cost of installation, maintenance, and added delays to traffic on the major through streets. Intersection collision warning systems constitute a potentially less expensive approach to improving safety in these situations.

The types of projects in this group primarily include spot-specific deployments, including:

- Red-light running enforcement systems;
- Speed warning systems at hazardous locations on narrow (typically two-lane highways) roadway sections;
- Advanced detection and warning systems for **high-speed** rural intersections for intersection collision detection and avoidance; and
- Isolated traffic actuated (semi-actuated) signals at rural intersections.

---

[15] "*Intersection* Collision *Warning System*," Publication No. FHWA-RD-99-103; FHWA Contact: Tim Penney, HRDS, (703) 285-2174.

Short-Term Deployment Recommendations

- In the short term, it is recommended that a regionwide study[16] be conducted to identify high crash locations that are candidates for mitigation through ITS. This study will involve the analysis of crashes, crash types and patterns, and the identification of the probable causes of these crashes. Based on this review, ITS solutions may be devised to mitigate the impact of the crashes. The following corridors and intersections have been identified as problem areas in terms of safety – it is therefore recommended that the study focus on these corridors and intersections:
  - Grand River Avenue (M-43);
  - Saginaw Highway (M-43/BR-69);
  - M-52 (parts Stockbridge Road);
  - Intersections located in the MSU campus (pedestrian and bicycle safety issues);
  - Intersection of U.S.-27 BR and M-21;
  - Intersection of M-43 and M-100 in Grand Ledge;
  - Intersection of M-50 and M-99 in Eaton Rapids;
  - Intersection of Creyts Road and End Road;
  - Intersection of Washington Street and Bridge Street; and
  - Intersection of Park St and M-36 in the city of Mason, where poor visibility has been cited as a cause for crashes.

This study is estimated to cost $75,000.

- It is recommended that arterial/intersection safety systems be deployed on an as needed basis, based on the results of the above study. For costing purposes, it is assumed that a total of 10 systems will be deployed at an approximate cost of $20,000 each.

---

[16] During meetings conducted as part of this ITS Pre-Deployment study, the project team was made aware of an intersection analysis for identifying high accident locations that was being performed by Michigan State University (MSU) engineers for the street network in the MSU campus. It is recommended that the region collaborate with MSU to share information on the study methodology and recommendations, so as to consider adapting the same for the purposes of the regional study.

Table 7.22 Arterial/Intersection Safety Systems: Short-Term Projects (Phase 1)

		Estimated Cost ($)			
No.	**Project**	**Capital**	**Average Annual O&M**	**Total Average Annual Cost**	**Anticipated Annual Benefit ($) [B/C Ratio]**
1.	Arterial/Intersection Safety Systems – Needs and Feasibility Study	75,000	N/A	N/A	N/A
2.	Selected Arterial/Intersection Safety Systems NOTE: For the sake of benefit/cost analysis, the intersection of M-43 and M-100 in Grand Ledge, was analyzed as a typical scenario. The results were then extrapolated to obtain an estimate for deployment at 10 locations.	20,000 (per location)	3,000 (per location)	5,848 (per location)	10,653 [1.82] (per location)
	Total (assumed 10 locations)	**200,000**	**30,000**	**58,480**	**106,530**

Total Benefit/Cost Ratio = 1.82:1

Project 1.5 Railroad Grade Crossing Coordination Systems

The goals of ITS application at highway-rail intersections are to increase safety and to improve coordination between rail operations and traffic management functions. Basic deployments include warning systems, signal preemption systems, and basic traveler information services. Deployments may be extended to incorporate advanced features like train arrival detection systems, incursion detection systems, automated barriers and gate closures integrated with traffic management and traveler information services such as advanced signal preemption, real time traveler information and alternate routing services.

Advanced systems at highway-rail intersections are expected to increase safety and reduce crashes, improve coordination between traffic management (particularly surface street and signal control) and rail operations, and thereby improve traveler information dissemination and overall travel comfort. Transportation agencies and railroad companies stand to benefit by enhanced reliability of highway-rail intersection operations, advanced crash notification and increased time reliability of both highway and rail traffic.

The following are the key issues associated with at-grade railroad crossings for the Lansing region:

- Safety issues at all railroad grade crossings in the region.
- Railroad grade crossing related traffic backup and delays.

- The following are specific problems that were identified during the course of this study:
  - Railroad grade crossings in Meridian Township;
  - Railroad grade crossings in Delta Township[17];
  - Railroad grade crossings in the city of Lansing;
  - Waverly Road railroad grade crossing in the vicinity of the Capital City Airport; and
  - Railroad grade crossings in the city of East Lansing, and on campus in MSU.[18]

Short-Term Deployment Recommendations (Phase 1)

The short-term project recommendations for the deployment of advanced railroad grade-crossing coordination systems in the Lansing region are summarized below.

- The following pilot advanced railroad grade crossing coordination projects are recommended for deployment in the short term:
  - **Grand Trunk railroad grade crossings in Meridian Township.** Potential locations include:
    - Grand River Avenue, Okemos Road, Marsh Road, and Haslett Road.
  - **Grand Trunk railroad grade crossings in Delta Township.** Potential locations include:
    - Creyts Road, Millett Highway, Wardell Road, Mt. Hope Highway and Waverly Road.
  - **Conrail railroad grade crossings in the city of Lansing.** Potential locations include:
    - Aurelius Road, Jolly Road, Cavanaugh Road and Mt. Hope Road.
  - **Chesapeake and Ohio (C&O) railroad grade crossing at Waverly Road** in the vicinity of the Capital City Airport.

---

[17] In 2000, EMS units in Delta Township, Michigan were blocked by a train for a few extra minutes as a boy burned to death on the other side of the crossing.

[18] MSU experiences congestion throughout the day due to rail traffic that passes through the campus. Severe congestion occurs at rail crossings approximately 70 times per day, especially during class change intervals. This problem is further exacerbated during special events. Railroad at-grade crossing safety is also a growing issue of concern, with several fatal crashes having occurred in the last 5 years. When trains cross the campus on the CN or CSX tracks all north/south traffic comes to a stop, which sometimes poses a problem for emergency response vehicles as well.

  - **C&O and Grand Trunk railroad grade crossings in the city of East Lansing and MSU.** Potential locations include:
    - Harrison Avenue, Bogue Lane, Hagadorn Road (Grand Trunk only), and Mt. Hope Road (C&O only).

- The purpose of these pilot projects is to kick-start the deployment of advanced railroad grade crossing systems in the Lansing region, as railroad grade-crossing mobility and safety have been identified as high-priority needs for the region.

- It is recommended that the intensity of deployment for the above systems be high-intensity[19]. The technologies to be adopted for all the listed pilot projects include:

  - Modified gate arrangements (four-quadrant gates);
  - Coordination/preemption at nearby traffic signals;
  - Pedestrian warning signal and gates;
  - Detection of vehicles trapped in crossing; and
  - Coordination of emergency response with railroad grade crossing operations.

- Further, the following additional deployments and strategies are recommended for the MSU and East Lansing systems, and the Waverly Road system in the vicinity of the Capital City Airport:

  - Planning / implementation of detour routes.
  - Use of advanced warning and information using arterial DMS at key approaches/intersections to the grade crossing.
  - Use of both "proactive" and "informational" control strategies to detour traffic away from the railroad grade crossing, during train crossing times. An example of a proactive strategy is to preempt traffic signals that are located upstream (in advance locations) of the grade crossing so as to detour vehicles away to alternate routes, much in advance of the grade crossing. An example of an informational strategy is to provide real-time train arrival information on arterial DMS located upstream (in advanced locations) of the grade crossing, along with expected delay time. Motorists can then make a decision to detour or stay on the same road as they wish.

- In addition to the above discussed pilot projects, it is recommended that the region initiate a study to identify other railroad grade crossings for the deployment of advanced safety and monitoring systems, and to track and evaluate the ongoing pilot projects. It is recommended that the study include the following analyses:

---

[19] Refer Chapter 2.0 ("Deployment Philosophy" section) of the overall MDOT ITS Pre-Deployment Study report for detailed information on deployment intensities.

  - Identification of railroad grade crossings in the region for the deployment of advanced safety and monitoring systems;
  - Tracking and evaluation of the ongoing pilot projects and development of best practices and recommendations for regional deployment and expansion of advanced railroad grade crossing systems; and
  - Identification of opportunities for regional integration and coordination with incident management, special event management and emergency response.
  - This ongoing study is estimated to cost $200,000.

- The estimated costs and anticipated benefits for a sample advanced railroad grade crossing project (at one railroad grade crossing location) is presented in Table 7.23.

Table 7.23 Railroad Grade Crossing Coordination Systems: Short-Term Projects (Phase 1)

		Estimated Cost ($)			
No.	**Project**	**Capital**	**Average Annual O&M**	**Total Average Annual Cost**	**Anticipated Annual Benefit ($) [B/C Ratio]**
1.	Railroad Grade Crossing Needs Identification and Pilot Project Tracking/Evaluation Study	200,000	N/A	N/A	Benefits rolled into the pilot deployments
2.	Pilot advanced railroad grade crossing at GT Railroad and Harrison Avenue in the MSU campus.	552,500	43,400	99,055	299,939
	Benefit/Cost Ratio per Railroad Grade Crossing Location = 3.03:1				

Notes:

Key elements of the proposal demonstrated are listed below:

- The costs and benefits presented in this table are for a representative railroad grade crossing location. The **Grand Trunk railroad grade crossing at Harrison Avenue within the MSU campus** was chosen as the analysis case for cost and benefit estimation.
- A total of 11 electronic message signs strategically placed in advance of key decision points leading to the grade crossing are assumed. It is assumed that these DMS are relatively low-cost electronic signs, which are much smaller in size and functionality compared to regular freeway or arterial DMS, and can be mounted on existing sign or traffic signal structures. These signs will provide real-time information on expected train arrival times, and resultant estimate of wait time and delay at the grade crossing. Motorists may therefore choose to divert away from the grade crossing when a train is expected, thereby resulting in travel time savings. These electronics signs are assumed at: Northbound (NB) Harrison at Mt. Hope; Westbound (WB) and Eastbound (EB) Mt. Hope at Harrison; EB Trowbridge at Harrison; Southbound (SB) Harrison at Kalamazoo; EB and WB Kalamazoo at Harrison; WB Shaw at Harrison; WB South Service Road at Harrison; WB Stadium Drive at Harrison; and WB Wilson at Harrison.
- It is also assumed that the operation of the traffic signals located upstream of the grade crossing (from all directions) are coordinated with train arrival times.

Long-Term Considerations (Phase 2)

It is recommended that the short-term deployment experiences and the needs identification study be used to expand (both geographically and functionally) the deployment of advanced railroad grade crossing systems.

7.6.2 Program Area 2 – Freeway Management

Freeway management systems encompass services that include monitoring, surveillance, and control of freeway operations. This is supplemented by the dissemination of information to motorists via Dynamic Message Signs (DMS), Highway Advisory Radio (HAR), and other communication means. Typical control and management strategies include ramp metering, variable speed limit signage, incident management, automated enforcement, and traveler information dissemination.

Incident management systems have been widely deployed in urban areas throughout the nation, and have been shown to provide some of the highest benefit levels of any ITS deployments. **It is estimated that over 60 percent of all urban congestion delay is caused by non-recurring incidents. This percentage is typically even higher in smaller urban areas with less recurring congestion.** Incident back-ups result in increased travel time, increased emissions and fuel use, increased accident risk due to deteriorating traffic conditions, and travelers diverting to less-safe surface streets and local roads, and decreased customer satisfaction. Freeway management systems have demonstrated improvements to safety, reductions in travel time and its variability, increased throughput, and improved flow.

Program Elements/ITS Applications

The chosen program elements/ITS applications under the freeway management program area for the Lansing region are as follows:

- Detection, Surveillance and Verification;
- Freeway Service Patrols (FSP);
- Reference and Ramp Markers;
- Dynamic Message Signs (DMS);
- Highway Advisory Radio (HAR);
- Freeway Incident Management;
- Freeway-Arterial Incident Management Coordination; and
- Regional Traffic Management Center.

Recommended Projects

The following are the freeway management projects recommended for the Lansing region:

- Project 2.1 Freeway and Incident Management System (FIMS);
- Project 2.2 Freeway Service Patrols;
- Project 2.3 Regional Traffic Management Center; and
- Project 2.4 Freeway-Arterial Incident Management Coordination.

The project descriptions and deployment specifics are discussed in the following paragraphs.

Project 2.1 Freeway and Incident Management System (FIMS)

This involves the deployment of the necessary information collection, processing, and dissemination technologies for implementing management and control strategies for the region's freeway system. The individual components that constitute the FIMS are listed as follows:

- FIMS Infrastructure:
  - Detection, surveillance and verification devices, including loop detectors, non-contact traffic sensors (microwave radar, image detection, acoustic sensors) and CCTV cameras.
  - Reference and Ramp Markers[20] that serve the purpose of location identification and referencing.
  - En-route roadside information dissemination devices, primarily Dynamic Message Signs (DMS).
  - Associated communications infrastructure[21] (fiberoptic cable, telephone drops, and wireless devices), and information processing hardware and software.
- Development of a **Freeway Incident Management Plan**, which outlines:
  - Standard operating policies and procedures for detection, response, management and clearance of freeway incidents;
  - Alternate routes for traffic diversion;
  - Interagency coordination requirements between traffic operations, emergency response and law enforcement agencies; and
  - Information dissemination requirements, strategies, and policies and procedures during incidents, using all the different channels and possible media sources.

The short-term and long-term recommendations for the FIMS are outlined below.

Short-Term Deployment Recommendations (Phase 1)

The general deployment strategy that is recommended for the short term is provision of regional coverage for areas with greater need (urban/suburban core which represents the key activity centers). Low-density and spot coverage is recommend for other sections of highway, which have a demonstrated history of safety or congestion problems. The following are the recommended deployment action items for the FIMS in the short term:

---

[20] It is recommended that the MDOT standard statewide reference marker spacing standards be adopted for the Lansing region interstate highway system.

[21] Refer to the MDOT ITS Pre-Deployment Study Communications Report for specific more information on communications requirements for ITS deployment.

- It is recommended that the above mentioned FIMS infrastructure be deployed on the following freeway corridors in the short term:

  – High-Intensity[22] Corridors:

    - I-96: from the Okemos Road interchange to the I-96/I-69 split southwest of the region;
    - I-69: from the U.S.-27 (Lansing Road) interchange to the I-96/I-69 split southwest of the region;
    - I-96/I-69: from the I-96/I-69 split southwest of the region, to the I-96/I-69 split northwest of the region;
    - I-496: from the I-96/I-69 interchange to the U.S.-127 interchange;
    - I-69: from the N. East Street (BR-27) interchange to Chandler Road/Abbott Road; and
    - U.S.-127: from the I-96 interchange to the I-69/U.S.-27 interchange.

  – Low-Intensity Corridors:

    - I-96: from the M-52 interchange to the Okemos Road interchange;
    - U.S.-127: from the M-36 (Hogsback Road) interchange in Mason to the I-96 interchange;
    - I-69: from the M-50/M-79 interchange in Charlotte to the U.S.-27 (Lansing Road) interchange;
    - I-96: from the M-100 (Wright Road) interchange to the I-96/I-69 split northwest of the region;
    - I-69 from the I-96/I-69 split northwest of the region to the N. East Street (BR-27) interchange; and
    - I-69 from Chandler Road/Abbott Road to the Saginaw Highway (ALT-69) interchange.

  – Freeway Dynamic Message Sign (DMS) Locations. It is recommended that DMS be located sufficiently ahead of key decision-making points that are used for location reference below. This will provide enough decision time for motorists, and will avoid sudden and drastic maneuvers.

    - Westbound I-96, east of Okemos Road;
    - Northbound U.S.-127, south of I-96;
    - Northbound I-69, south of the I-96/I-69 split southwest of the region;
    - Northbound I-96/I-69, south of I-496;

---

[22] Please refer to Section 2.0 ("Deployment Philosophy" section) of the overall MDOT ITS Pre-Deployment Study report for detailed information on deployment intensities.

- Southbound I-96/I-69, north of Saginaw Highway (M-43);
- Eastbound I-496, west of MLK Boulevard;
- Westbound I-496, east of MLK Boulevard;
- Eastbound I-96, north of the I-96/I-69 split northwest of the region;
- Southbound U.S.-27, north of I-69;
- Westbound I-69, east of U.S.-27/U.S.-127;
- Westbound I-69, east of Saginaw Highway (ALT-69) – remove;
- Southbound U.S.-127, north of Lake Lansing Road – remove and
- Northbound U.S.-127, south of I-496 – remove.

- The development of a comprehensive freeway incident management plan, as discussed previously is also recommended for the short term. This freeway incident management plan will be integrated with the overall regional incident management plan for the Lansing region.

Long-Term Considerations (Phase 2)

In the long term, it is recommended that the FIMS deployments be extended geographically and intensified as required. Certain freeway sections that are identified for low-intensity deployment in the short term may be converted to high-intensity in the long term, as the need arises. It is recommended that an evaluation of the regional FIMS be conducted so as to use the lessons learned to develop a performance-based expansion and intensification plan in the long term.

Project 2.2 Freeway Service Patrols (FSP)

Broken-down vehicles and car accidents are two of the biggest factors contributing to highway congestion. Just one disabled vehicle can lead to hours of traffic headaches. In addition, these incidents tie up police resources unnecessarily. Freeway service patrols (FSP) help avoid some of the delays and inefficient use of personnel by provision of free motorist assistance service during breakdowns and other minor incidents. FSPs include vans or trucks that patrol the region's freeways on designated routes and times, looking for broken down vehicles, debris, and obstruction and to provide immediate motorist assistance. FSPs have been unanimously accepted as early-winners in regional ITS programs throughout the country because of significant positive response from road users and a sense of cooperation and appreciation from law enforcement and emergency response agencies. The following are the different range of services that FSPs may provide:

- Motorist assistance services including, provision of gasoline, access to phone, emergency roadside assistance, minor vehicle breakdown repair, debris removal, and removal of vehicle away from traveled lanes.

- Certain agencies require their FSP drivers to be Automotive Service Excellence (ASE) certified mechanics and trained Emergency Medical Technicians (EMT). This facilitates the provision of minor automobile repair services and first-aid at the roadside.

- Some FSPs provide towing services, or have working agreements with local towing companies for expedited towing.

- FSPs are normally dispatched and routed from the regional Freeway Traffic Management Center (TMC), and they maintain constant radio communications with the TMC as well as other FSP units. Certain FSPs can communicate with and listen in to the radio communications channels of local fire and police agencies. This proves very beneficial for coordinated incident management and response.

- FSPs may also serve as probe vehicles for traffic data collection [using Geographical Positioning Systems (GPS) based Automatic Vehicle Location (AVL)], and may sometimes provide traffic management, control and routing functions, through the use of DMS mounted in the rear of the vans or trucks.

- The hours of operation and the intensity of freeway coverage vary greatly across the country, ranging from complete freeway system coverage 24 hours a day, seven days a week, to selective system coverage only during weekday peak periods.

Table 7.24 summarizes the recommended range of services to be provided by the Lansing FSPs:

Table 7.24 Freeway Service Patrols (FSP): Recommended Range of Services

Basic Motorist Assistance including, provision of gasoline, access to phone, emergency roadside assistance, minor vehicle breakdown repair, debris removal, and removal of vehicle away from traveled lanes.
Requirement of FSP drivers to be ASE certified mechanics and trained EMT'S.
Establishment of working agreements with local towing companies for expedited towing.
Coordination of the FSPs with the regional incident management plan, with well-defined roles for FSPs in incident detection, response, management, and clearance.
Constant radio communications with the TMC as well as other FSP units. Communication links to the radio communications channels of local fire and police agencies.
Deployment of AVL on FSP vehicles for centralized dispatching from the TMC, and to serve as mobile data probes.
Installation of DMS in the rear of FSP vehicles to provide minor lane diversion and traffic notification services.

Short-Term Deployment Recommendations (Phase 1)

- In the short term, it is recommended that FSPs be deployed on the following freeway routes in the region:
  - The Lansing freeway loop and the central artery comprised of I-96, I-69, U.S.-27, and I-496.
  - About six miles out from the freeway loop-around on each of the freeway spurs leading in and out of the region, including I-96 from the east, I-69 from the southwest, I-96 from the northwest, U.S.-27 from the north, and I-69 from the northeast.
- The recommended hours of operation are the a.m. peak period and the p.m. peak period during weekdays. The recommended periods of operation are:
  - Weekdays from 6:30 a.m. to 9:30 a.m.;
  - Weekdays from 3:00 p.m. to 6:00 p.m.; and
  - During special events, holidays and as required for emergency situations.
- Based on review of deployments in and around the country, it is determined that an average FSP vehicle can traverse about 80 miles during one three-hour period. Therefore, it is estimated that **two FSP vehicles** are required to traverse each section of the above mentioned freeway corridors, at least once during each three-hour peak period. This is based on the general assumption that one FSP vehicle can traverse up to 80 miles, one-way (accounting for stops and assists) during one three-hour period. The approximate two-way mileage of the freeway loop-around and the I-496 central artery is 80 miles, while that of the freeway spurs leading in and out of the City is 200 miles.

Long-Term Considerations

It is recommended that the region evaluate the need for increasing the scope of services provided by the FSPs and the need for expansion of the hours of operation. Appropriate service enhancements may then be performed as needed.

Project 2.3 Regional Traffic Management Center (TMC)

A regional traffic management center (TMC) serves as the nerve center of transportation and traffic operations and management for the region. It centrally houses all the hardware, software and personnel that are required for the day-to-day operations and management of the regional freeway/incident management system and traveler information program. TMC's traditionally were functionally specific, for example, either freeway traffic management only or arterial traffic management only. However, an increasing trend is to co-locate several management functions associated with transportation system management and operations. A successful example in Michigan is the MITS Center in Detroit, where the regional 911 dispatch center for the MSP is co-located with the freeway traffic management center. Such co-location results in economies of scale, increased interjurisdictional and interagency cooperation, and maximization of the capabilities of the TMC, thereby resulting in better service provision to the region.

Short-Term Deployment Recommendations (Phase 1)

The following are the short-term recommendations for the deployment of a regional TMC for the Lansing region:

- It is recommended that a TMC be deployed in tandem with the deployment of the field devices required for the regional FIMS.

- It is recommended that the following strategies be considered for the deployment of the regional TMC:

  – The city of Lansing intends constructing a traffic management center for its advanced traffic signal system. It is recommended that MDOT, TCRPC and the regional stakeholders investigate the possibility of co-location of the freeway TMC with the city of Lansing's arterial TMC.

  – It is recommended that co-location of MSP's 911 dispatch center, and other local emergency response dispatch centers, with the regional be considered. If physical co-location is not feasible, it is highly recommended that the different centers be connected via wireline communications for exchange and interchange of information related to traffic operations, traveler information and emergency and incident management. Links should also be provided to the CATA transit operations center.

  – It is recommended that the TMC maintain either wireline or wireless communications (as appropriate) with all other regional emergency response/law enforcement dispatch centers, and other local TMC's.

  – It is also recommended that the regional TMC maintain communications with other regional TMC's in including, Detroit, Ann Arbor, Flint, Pontiac and Grand Rapids.

Long-Term Considerations

For the long term it is recommended that the region re-evaluate regional needs for centralized traffic management, and enhance and expand the functional capabilities and geographic influence of the regional TMC.

Project 2.4 Freeway-Arterial Incident Management Coordination

This involves the deployment of trailblazer systems and arterial DMS in advance of key entry points to Freeways/Expressways. This provides an improved ability to manage traffic flows in case of incidents and minimize the impact of such incidents on the system. The use of freeway DMS to divert traffic away from incidents onto pre-determined arterial corridors becomes practical when the arterial corridor is capable of handling the spike in traffic demand. Arterial DMS placed strategically in advance of key freeway access points, can provide incident-related information routing motorists around sections of freeway during incidents. Even though the primary benefit of freeway/arterial incident management coordination is experienced on freeways, the use of trailblazer systems and special signal timing plans for incident management re-routing also benefits traffic flow on arterials, as they are better equipped to handle the spikes in traffic demand. The capabilities of the freeway-arterial incident management coordination system may also be extended for special events and for managing high traffic demand during peak travel that occurs during holiday weekends.

Short-Term Deployment Recommendations (Phase 1)

In the short term the following two pilot projects are recommended for the Lansing region:

- **Freeway-Arterial Incident Management Coordination for westbound traffic on I-96 headed towards Lansing and East Lansing.** The following are the issues to be considered for incorporation in the system:
  - Use of the recommended freeway DMS and other traveler information channels to move traffic between I-96, Grand River Avenue, and other corridors, in case of incidents or major congestion. Specific investments include:
    - Deployment of trailblazer signs at key intersections along the respective north-south corridors and Grand River Avenue.
    - Integration of the trailblazer systems with the regional freeway TMC.
    - Development of specialized incident traffic responsive traffic signal timing plans along the chosen corridors.
- **Arterial DMS on approaches to I-96 access points along the above listed key north-south arterial corridors.** The following are the issues to be considered for incorporation in the system:
  - Use of arterial DMS to provide information on incident location and traffic diversion away from the affected sections of freeway.
  - Integration of the arterial DMS with the trailblazer systems and the regional freeway TMC.
- **Conduct of a study for evaluating the needs for and feasibility of deploying freeway-arterial incident management coordination systems** for other freeway-arterial pairs in the region. It is recommended that the study include an evaluation of the two pilot projects listed above. Based on the recommendations from the study, and the lessons learned from the pilot deployments, more systems may be deployed if deemed necessary.

Long-Term Considerations

In the long term it is recommended that the recommendations from the needs and feasibility study and the evaluation of the pilot projects be used for decision-making on continuation of the freeway-arterial incident management projects and for functional and geographic expansion.

Summary of Freeway Management: Short-Term Projects (Phase 1)

The short-term deployment details and project specifics for freeway management are tabulated in Tables 7.25 and 7.26.

Table 7.25 Freeway Management: Short-Term Projects (Phase 1)

No.	Project	Deployment Intensity	Estimated Cost ($) Capital	Estimated Cost ($) Average Annual O&M	Estimated Cost ($) Total Average Annual Cost	Anticipated Annual Benefit ($) [B/C Ratio]
2.1	*Freeway and Incident Management System (FIMS)*					
	FIMS Infrastructure Deployment					
1.	**I-96**					
a.	• I-96: from the M-52 interchange to the Okemos Road interchange. • DMS Location: Westbound I-96, east of Okemos Road.	Low	389,000	147,910	199,606	653,433 [3.27]
b.	• I-96: From the Okemos Road interchange to the I-69 interchange.	High	633,979	398,430	498,038	698,450 [1.40]
c.	• I-96: From the M-100 (Wright Road) interchange to the I-96/I-69 split northwest of the region. • DMS Location: Eastbound I-96, north of the I-96/I-69 split northwest of the region.	High	331,646	113,980	157,737	397,004 [2.52]
2.	**I-69**					
a.	• I-69: from the M-50/M-79 interchange in Charlotte to the U.S.-27 (Lansing Road) interchange.	Low	169,792	103,175	130,999	287,318 [2.19]
b.	• I-69: from the U.S.-27 (Lansing Road) interchange to the I-96/I-69 split southwest of the region. • DMS Location: Northbound I-69, south of the I-96/I-69 split southwest of the region.	High	334,875	122,292	163,142	311,735 [1.91]
c.	• I-69 from the I-96/I-69 split northwest of the region to the N. East Street (BR-27) interchange.	Low	192,083	123,465	152,685	169,945 [1.11]

Table 7.25 Freeway Management: Short-Term Projects (Phase 1) (continued)

No.	Project	Deployment Intensity	Estimated Cost ($) Capital	Average Annual O&M	Total Average Annual Cost	Anticipated Annual Benefit ($) [B/C Ratio]
d.	• I-69: From the N. East Street (BR-27) interchange to Chandler Road/Abbott Road. • DMS Location: Westbound I-69, east of U.S.-27/U.S.-127.	High	286,417	84,845	118505	323,147 [2.73]
e.	• I-69 from Chandler Road/Abbott Road to the Saginaw Highway (ALT-69) interchange. • DMS Location: Westbound I-69, east of Saginaw Highway (ALT-69).	Low	321,042	110,350	152,043	305,626 [2.01]
3.	**I-96/I-69**					
a.	• I-96/I-69: From the I-96/I-69 split southwest of the region, to the I-96/I-69 split northwest of the region. • DMS Locations: – Northbound I-96/I-69, south of I-496. – Southbound I-96/I-69, north of Saginaw Highway (M-43).	High	671,625	240,490	326,340	603,963 [1.85]
4.	**I-496**					
a.	• I-496: From the I-96/I-69 interchange to the U.S.-127 interchange. • DMS Locations: – Eastbound I-496, west of MLK Boulevard. – Westbound I-496, east of MLK Boulevard.	High	1,114,125	547,410	703,472	710,576 [1.01]
5.	**U.S.-127**					
a.	• U.S.-127: From the M-36 (Hogsback Road) interchange in Mason to the I-96 interchange. • DMS Location: Northbound U.S.-127, south of I-96.	Low	311,333	101,940	141,217	234,394 [1.66]

Table 7.25 Freeway Management: Short-Term Projects (Phase 1)

			Estimated Cost ($)			
No.	**Project**	**Deployment Intensity**	**Capital**	**Average Annual O&M**	**Total Average Annual Cost**	**Anticipated Annual Benefit ($) [B/C Ratio]**
b.	• U.S.-127: From the I-96 interchange to the I-69/U.S.-27 interchange. • DMS Locations: – Southbound U.S.-27, north of I-69. – Southbound U.S.-127, north of Lake Lansing Road. – Northbound U.S.-127, south of I-496.	High	1,107,188	429,715	574,699	1,015,821 [1.77]
	Freeway Incident Management Plan					
6.	Development of Freeway Incident Management Plan	N/A	$ 150,000	50,000	71,357	Benefits rolled into FIMS
2.2	***Freeway Service Patrols***					
	Two FSP vehicles to patrol the Lansing freeway loop and the central artery comprised of I-96, I-69, U.S.-27, and I-496.	N/A	200,000	10,000	28,879	Benefits rolled into FIMS
2.3	***Lansing Regional TMC***					
	Deployment of a regional TMC for the Lansing region. It is assumed that a new facility will not be constructed, rather that the TMC will either be co-located with the city of Lansing TMC, or will be housed in an existing MDOT facility. The cost estimated here is that required to operate the freeway management system.	N/A	1,500,000	425,000	775,000	Benefits rolled into FIMS
	Total FIMS, FSP and TMC		**7,713,000**	**3,009,000**	**4,194,000**	**5,711,411**
			Overall Benefit/Cost Ratio for FIMS, FSP and TMC = 1.36:1			

Table 7.26 Freeway-Arterial Incident Management Coordination: Short-Term Projects (Phase 1)

		Estimated Cost ($)			
No.	**Project**	**Capital**	**Average Annual O&M**	**Total Average Annual Cost**	**Anticipated Annual Benefit ($) [B/C Ratio]**
2.4	Freeway-Arterial Incident Management Coordination				
1.	• Freeway-Arterial Incident Management Coordination for westbound traffic on I-96 headed towards Lansing and East Lansing. • Arterial DMS on approaches to I-96 access points along the above listed key north-south arterial corridors. • Conduct of needs and feasibility study (cost of this study is assumed as $75,000, and is included in the capital cost estimate shown in this table).	718,250	49,250	120,647	401,800

Benefit/Cost Ratio for Freeway-Arterial Incident Management Coordination = 3.33:1

7.6.3 Program Area 3 – Portable Traffic Management

Portable traffic management systems (PTMS) supplement transportation and traffic operations on specific sections of highway or in specific areas during planned or unexpected events that disrupt normal operations. They typically include self-contained portable surveillance, detection, data-processing, information dissemination, and communications equipment that can be deployed with very little effort. They are normally designed so that they can be monitored and controlled in a coordinated fashion from the TMC. This integration is made possible by the use of wireless communications devices that exchange information with the TMC. PTMS are typically used for work zone traffic management and construction traveler information; and special event traffic management and coordination. Some agencies use these systems for traffic management and re-routing during natural disasters and emergencies (for e.g., re-routing traffic away from roadways that are cordoned off due to flooding or away from areas that have suffered excessive flood-damage). Although primarily deployed for freeway construction projects, PTMS may also be deployed on surface street reconstruction projects that are expected to have a substantial level of disruption.

The application of portable systems for workzone management and safety is gaining widespread application across the nation. These systems enhance the planning and management of work zones by gathering and archiving real-time information on workzones for dissemination to travelers. This may include information on alternative routes as well. These systems may also include enhanced roadside technologies that may be used to better predict temporary lane closures, enforce speed limits, and detect vehicle intrusions to provide advanced warning to workers.

Portable systems may also be used in conjunction with existing parking management and information systems for directing traffic to and from special event sites.

The Michigan DOT deployed a temporary traffic management system (TTMS) for work zone traffic and incident management and traveler information for a major re-construction project along the I-496 corridor in downtown Lansing during the spring and summer of 2001. The $ 42.4 million reconstruction project was conducted in two phases, one of which involved the closure of an entire section of I-496. The TTMS included traffic detection, CCTV surveillance, communications, queue detection, construction zone intrusion detection, a central TMC, and information dissemination through portable DMS, the Internet and on kiosks at key locations. The total cost of the TTMS deployment along with the associated public information campaign was about $2.9 million. The services provided by the system included: provision of real-time traffic information to enable drivers to make better driving decisions on approaches to and throughout the construction influence area; analysis of the traffic data (e.g., traffic volumes, queue lengths), and display of traffic information (e.g., delay information, queue lengths, alternate route messaging) to the motorists via portable DMS, video monitoring stations and the Internet; and the use of construction zone intrusion detection devices to ensure work crew safety. An impacts and benefits analysis was performed for the TTMS using the IDAS model. It was estimated that approximately 1,000 hours daily of user mobility savings were achieved during Phase 1 of the construction, with an additional 300 hours added during Phase 2. Approximately 500 hours daily of travel time savings from unexpected delay were estimated during Phase 1, with a similar additional amount gained during Phase 2. While no major incidents occurred during the construction period, it is likely that the advanced information provided helped motorists to avoid delays, particularly those who do not travel on a daily basis and may have been less familiar with the construction condition. The advance information may also have helped to prevent incidents by making motorists aware of closures and lane restrictions. It was estimated that a two 2.0 percent reduction in fatalities resulted from the advanced notification provided by the TTMS. Fuel savings of approximately 1.5 percent were estimated, while emissions reductions of approximately 1.5 percent to 2.0 percent for hydrocarbons, Carbon Monoxide and Nitrous Oxides were estimated as a result of the TTMS. The monetized value of the estimated benefits was estimated to be approximately $9.5 million, resulting in a B/C ratio of 3.23; 1.

Proposed Projects

It is recommended that PTMS be deployed for all roadway construction projects that exceed a certain threshold of capacity reduction, and expected delay and queuing. The deployment of PTMS should be considered for such projects at the early stages of planning and programming different road construction projects, so that they may be included in the regional transportation improvement program. MDOT should consider alternative procurement methodologies for PTMS including turnkey planning, design, implementation, and operations on a project by project basis.

Short-Term Deployment Recommendations

- Table 7.27 provides a list of upcoming road construction projects that are planned until 2005. Of the projects listed in the table, the projects that appear to have the greatest potential for the deployment of PTMS are highlighted.

Table 7.27 Planned Road Construction Projects
*(Until 2005)**

No.	Corridor	Type of Road Work	Year
1.	M-21 from BR-27 to East Clinton County Line	Road milling and resurfacing	2004
2.	M-21 between St. Johns and Owosso	Passing relief lanes	2004
3.	M-21 from Pewamo to St. Johns	Resurface	2005
4.	M-21 (four bridges in Clinton County)	Replacement	2005
5.	I-69BL (Over Butternut Creek)	Replacement	2005
6.	I-69 BL (Lansing Road) from M-50 to SB I-69	Reconstruct	2005
7.	BR-69 (Lansing Road) from M-50 to Tully Brown Road	Road milling and resurfacing	2004
8.	I-96 (3 bridges in Delta township)	Bridge replacement and approach work	2004
9.	U.S.-127 (over Conrail in Alaiedon Township)	Bridge – overlay, pin and hanger and approach work	2004
10.	I-96 from Wacousta Road to M-43	Reconstruct	2004
11.	M-43 from M-66 to Saginaw Highway	Major Rehabilitation	2005
12.	M-43 (Over grand river in Lansing)	Rehabilitate	2004
13.	M-43 (Over Sebewa Drain)	Replacement	2005
14.	U.S.-27 BR (Over Central Michigan Railroad in St. Johns)	Replace bridge with culvert	2004
15.	I-496 (Under Dreyts Road)	Rehabilitation	2005
16.	I-496 (Under Snow Road)	Deck Replacement	2005

- Additional road projects may be considered for the deployment of PTMS as appropriate.

- It is also recommended that MDOT, TCRPC and the regional stakeholders develop a systematic process for the identification of the need for the deployment of PTMS for different road construction projects at the programming stage, so that they may be included in the regional transportation improvement plan and in MDOT's five-year

Road and Bridge Program. This process may then be used to identify possible projects for the 2005 to 2010 and subsequent transportation improvement programs.

- Upcoming road construction projects from MDOT's five-year road and bridge program have been identified for potential deployment of PTMS. However, since actual project specifics are not available at this time, a range of expected costs and benefits is provided to serve as a decision-making guideline. The following table provides a summary of the costs and benefits for a representative PTMS deployment:

Table 7.28 Portable Traffic Management Systems: Representative Costs and Benefits

Project	Cost Estimate – Capital and O&M ($)	Anticipated Benefit
Generic PTMS Deployment	Varies from **$500,000 to $1.5 million** depending on the complexity, duration and the expected level of disruption of road construction project	Typical **returns on investment** range from **three times the cost to six times the cost**, resulting in a **Benefit/Cost ratio of 3:1 to 6:1**

Long-Term Considerations

It is recommended that MDOT, TCRPC, and the regional stakeholders continue to deploy PTMS for road construction projects as needed. It is also recommended that the region continue to identify new and alternative means and technologies for mitigation of the mobility and safety impacts of road construction projects. Research on alternate procurement methods, including the purchase of a suite of PTMS for regional deployment on an as needed basis is also recommended for consideration in the long term. These systems if purchased, may be integrated with the regional TMC, thereby facilitating cost-efficient and effective integration.

7.6.4 Program Area 4 – Regional Traveler Information

This broadly involves the collection, assimilation, and dissemination of traveler and traffic information through a wide variety of data sources and dissemination channels. Provision of traveler information is a key function of ITS in that it serves as the front end of the services provided, and facilitates an interface between the traveling public and the various transportation agencies and information service providers. Traveler information services cut across most of the other ITS program areas resulting in an integrated and flexible delivery of services to customers. Traveler information may be disseminated using dynamic message signs (DMS), highway advisory radio (HAR), the Internet, traveler advisory telephone service (e.g., 511), pagers, personal digital assistants (PDA), in-vehicle video and audio devices, and traveler information kiosks. Further, traffic information may also be provided through traditional media sources, such as TV and radio channels, which is a popular practice in several areas.

The key feature of regional multimodal traveler information is the collection and assimilation of a traveler and traffic information from all possible sources and modes, for dissemination to the larger public using different channels. For example, regional information on upcoming and planned construction projects or special events, may be stored and disseminated through the regional traveler information system, and can be accessed by users as needed.

Providing information regarding various modes of travel can be beneficial both to the traveler and service providers. Traffic management centers provide information on current traffic conditions and expected travel times. Several transit agencies have started using traveler information kiosks and web sites to provide schedules, expected arrival times, expected trip times and route planning services to patrons. These services allow users to make more informed decisions for trip planning, including trip departures, routes, and mode of travel. This is particularly important during severe weather conditions. Traveler information services have been shown to increase transit usage, and may help reduce traffic congestion when travelers choose to defer or postpone trips, or to select alternate routes. The delivery of traveler information can either be pre-trip or en-route, and both sources of information produce significant benefits to the traveling public.

Proposed Projects

Short-Term Deployment Recommendations (Phase 1)

The following are the regional traveler information system projects that are recommended for the Lansing region in the short term:

- Internet Traveler Information. This includes the provision of regional traveler information on all routes and areas in the region, where there is sufficient infrastructure for the collection of traffic and travel conditions data. Other considerations include the provision of customized e-mail alerts on a subscription basis on specific routes and corridors as chosen by subscribers.

- Telephone Traveler Information (511 program). This includes the provision of regional traveler information via telephone access, both land-line and wireless on all routes and areas in the region, where there is sufficient infrastructure for the collection of traffic and travel conditions data. It is recommended that TCPRC and the regional stakeholders obtain this service through MDOT's statewide 511 deployment initiative. This will result in standardization of information collection, processing and dissemination processes and procedures, and will result in economies of scale and efficiency in the planning, procurement, and implementation of the program.

- Highway Advisory Radio (HAR). The purpose of HAR is to provide traveler and traffic information on an as needed basis (in the form of standardized radio broadcasts on a dedicated channel) in areas and on routes where the deployment level of ITS infrastructure is not significant. If planned and deployed effectively, HAR has the potential to provide valuable traveler information in remote area in a very cost-effective manner. HAR will stand to benefit long-distance commuter traffic, and remote areas especially during inclement weather, natural disasters, major incidents, and emergencies.

  The following are the deployment recommendations for HAR:

  - It is recommended that a total of four HAR transmission towers be deployed, one each in the following quadrants of the region:
    - Southeast Quadrant;
    - Southwest Quadrant;
    - Northwest Quadrant; and
    - Northeast Quadrant.
  - Since the areas and corridors approaching the heavily traveled routes and more densely populated localities in the region have been identified for the deployment of extensive traffic management and traveler information infrastructure, it is recommended that the HAR transmission towers be stationed such that they can provide information to the outlying corridors and areas in the region.
  - The type of information to be provided on the HAR includes, road weather and condition information, incident-related information, emergency and disaster information, regional intercity traveler information, special event traffic re-routing information.
  - HAR flashers are recommended at all major decision points along the following corridors, leading in and out of the region from all directions:
    - I-96;
    - U.S.-127;
    - I-69; and
    - U.S.-27.

- Other general considerations for the regional traveler information system include:

  - It is recommended that the regional traveler information system collect and provided traveler and traffic information from all possible sources, including the freeway management system, arterial management systems, transit traveler information, road weather sensors, road construction projects, special events and incidents, and intercity traveler information for long-distance commuters and commercial traffic.

- There are several business models for the deployment of traveler information systems. It is recommended that a review of available business models and strategies be conducted to choose the most appropriate model for the region.
- It is recommended that voice-activated and hands-free information access and retrieval be incorporated into the planning and design of the 511 telephone traveler information system.
- It is recommended that the traveler information services also provide Travel and Tourism services. Tourism and travel Information focus on the needs of the travelers who may be unfamiliar with the area they are traveling through. These services address the issues of mobility and convenience of the traveler, and may also improve the economy and productivity of rural and tourist areas.
- It is recommended that the traveler information be distributed to all media sources, including television and radio.

- Table 7.29 summarizes the short-term deployment recommendations for the regional traveler information system:

Table 7.29 Regional Traveler Information System (RTIS): Short-Term Projects Phase 1

		Estimated Cost ($)			
No.	**Project**	**Capital**	**Average Annual O&M**	**Total Average Annual Cost**	**Anticipated Annual Benefit ($) [B/C Ratio]**
1.	Internet Traveler Information	8,000	96,000	96,755	900,,000
2.	Telephone Traveler Information (511 Program)[1]				
3.	Highway Advisory Radio (HAR) NOTE: Cost estimate is four HAR towers and the associated transmission, communications and flasher equipment. Please see the project write-up for deployment details.	396,000	26,400	63,780	390,691
4.	Information Service Provider (ISP) co-located with the Regional TMC.	516,500	242,560	304,249	Benefits rolled into the above listed deployments
	Total	**920,500**	**364,960**	**464,784**	**1,290,691**
	Overall Benefit/Cost Ratio for the Regional Traveler Information System = 2.78:1				

[1] To be incorporated with MDOT Statewide Program.

The FIMS and its TMC serve as the backbone for the collection and dissemination of traveler information. Therefore, a significant percentage of the capital cost of the Internet and telephone traveler information system is assumed to be shared by the Freeway/Incident Management TMC. It is therefore important to view the benefits and costs of both the FIMS and the regional traveler information system from the perspective of their working as integrated systems.

Long-Term Considerations (Phase 2)

The following are the long-term deployment expansion and intensification considerations for the region:

- Consider the following additional traveler information services:
  - Deployment of traveler information kiosks at key traffic generators including the downtown Capitol complex, sports stadiums, and on the MSU campus and in rest areas along major freeway routes.
  - Coordinate with the private industry to develop and promote business models and strategies for the provision of customized/personalized traveler information through mobile user devices, personal information access devices, and in-vehicle traveler information devices.
- Consider expansion (geographical and functional) and intensification of the range of traveler information services provided in the region.

7.6.5 Program Area 5 – Regional Incident Management

The purpose of incident management is to expedite the detection, response and clearance of roadway incidents, and to improve the associated transportation operations by coordinated incident response and traffic management. Incident management systems have been widely deployed in urban areas throughout the nation, and have been shown to provide some of the highest benefit levels of any market packages. It is estimated that over 60 percent of all urban congestion delay is caused by non-recurring incidents. This percentage is typically even higher in smaller urban areas with less recurring congestion. These incident back-ups result in increased travel time, increased emissions and fuel use, increased accident risk due to deteriorating traffic conditions and travelers diverting to less safe surface streets and local roads, and decreased customer satisfaction. It is generally understood that incident management systems are deployed concurrently with freeway management systems, but it is important to keep in mind that arterial streets can be included in incident management programs as well.

Incident management systems provide benefits primarily in two ways. First, by detecting and responding to accidents more quickly, injured persons may receive medical attention sooner, thus saving lives and limiting the extent of some injuries. Secondly, by responding to incidents faster, the duration of the incident back-up may be reduced.

National data indicates an average 55 percent reduction in incident duration for facilities with incident management systems.

Proposed Projects

The regional incident management program for the Lansing region is intended to provide coordinated incident response and management for all the key freeway and arterial corridors in the region. The incident management program will bring transportation and traffic operations, emergency response (police, fire, HAZMAT), transit operations under one coordinated umbrella of regional incident management. The incident management program will overlap with most other program areas (freeway management, arterial management, portable traffic management, regional traveler information, transit management, etc.) to deliver services and information to system users using the existing hardware/software resources that are already part of all other program areas. In other words, the incident management program area will serve as a virtual coordinator of plans, policies, procedures and action items to be implemented under incident circumstances.

Short-Term Deployment Recommendations (Phase 1)

The following are the short-term recommendations for the regional incident management plan:

- It is recommended that a regional incident management plan be developed for regionwide coordinated incident detection, response, management and clearance.

- The following are the considerations to be incorporated in the regional incident management plan:

  - Initiate the incident management plan development process by developing a freeway incident management and response plan for the entire region immediately. This plan should include strategic and tactical considerations for incident detection, response, management, and clearance. Standardized plans for re-routing traffic and development of standardized traveler information procedures for specific incident locations/corridors are also recommended. The incident management plan needs to address the needs of long-distance and through-traffic, as well as the needs of local commuters.
  - The next step in the development of the regional incident management plan is to expand the plan to include arterial corridors as well.
  - It is recommended that the development of the regional incident management plan be closely coordinated with all the other program areas and ITS planning and deployment efforts.

- Table 7.30 provides the project summary for the regional incident management plan:

Table 7.30 Regional Incident Management: Short-Term Projects (Phase 1)

No.	Project	Estimated Cost ($) Capital	Estimated Cost ($) Annual O&M	Anticipated Annual Benefit ($) [B/C Ratio]
1.	Regional Incident Management Plan	150,000	50,000	Benefits rolled into the FIMS
2.	Total	150,000	50,000	Benefits rolled into the FIMS

The freeway incident management plan has already been included in the freeway management program area as a separate project. The capital cost estimate for the regional incident management plan is exclusive of that for the freeway incident management plan.

Long-Term Considerations

The following are the long-term considerations for the regional incident management plan:

- Continued revision and enhancement of the regional incident management plan, based upon review of needs, priorities and technology trends. Increased integration with all other program areas and projects is recommended.

- Development of an expert system version of the incident management plan that is accessible to all regional agencies involved in incident management. This will increase the availability and application of the plan. This will also facilitate periodic electronic update of the plan.

7.6.6 Program Area 6 – Regional Special Event Management

This ensures regionwide consistency and standardization of traffic management and routing practices during special events like sporting events and concerts, which create a noticeable spike in the traffic demand. Regional special event management is similar to the regional incident management program area, in that it involves the development and implementation of regionwide coordinated practices, plans and policies effectively managing spikes in traffic demand. The purpose of this program area is to facilitate efficient traffic management, routing, and demand and supply management during special events which place unusually high demand levels in a concentrated area of the transportation network. The special event management program area, will work in conjunction with all other program areas (freeway management, arterial management, portable traffic management, parking management, transit management, etc.) to route traffic in and out of the event site efficiently and safely.

Analogous to the incident management program, special event management will deliver services and information to system users using the existing hardware/software resources that are already part of all other program areas. In other words, the special event management program area will serve as a virtual coordinator of plans, policies, procedures and action items to be implemented for managing special events in the region.

Proposed Projects

For the Lansing region, the primary generators of special-event traffic are the Michigan State University (MSU), Oldsmobile Park (Lansing Lugnuts), the State Capitol building, and downtown events.

Short-Term Deployment Recommendations

The following are the short-term deployment recommendations for regional special event management in the Lansing region:

- **Regional Special Event Management Plan.** It is recommended that a plan be developed, implemented and periodically updated. The following are the considerations to be included in the plan:
  - Identification of current special event practices.
  - Documentation of all the special events and types of special events in the region.
  - Identification of all the major stakeholders that are affected by and are involved in the planning of these special events, and the stakeholders responsible for planning and management of transportation operations during special events.
  - Identification of all routes and highway corridors that serve as major access roadways for the different special events.
  - Analysis of traffic patterns and flows associated with special events.
  - Development of a coordinated regional traffic management and operations plan for special event traffic management.
  - Development of a centralized repository of information where information on special events and their respective needs and plans for traffic management can be stored and accessed by agencies.
  - Integration of the special event plan with parking management plans and systems.
  - Coordination of transit for special event transit service provision and detour routing for buses.
  - All other considerations included for the regional incident management plan apply to the regional special event management plan as well.

- The following table summarizes the short-term recommendations for regional special event management:

Table 7.31 Regional Special Event Management: Short-Term Projects (Phase 1)

No.	Project	Estimated Cost ($) Capital	Estimated Cost ($) Annual O&M	Anticipated Annual Benefit ($) [B/C Ratio]
	Regional Special Event Management Plan and Information Database	150,000	50,000[23]	N/A*
	Total	**150,000**	**50,000**	**N/A***

Benefits rolled into arterial management, freeway management and traveler information.

Long-Term Considerations (Phase 2)

It is recommended that the regional special event management plan continue to be reviewed and updated as necessary in the long term. Increased integration with all other program areas and projects is recommended.

7.6.7 Program Area 7: Parking Management

This area involves the use of technology to better manage parking demand and supply through real-time parking availability information, and routing strategies. This program area provides enhanced monitoring and management of parking facilities. The equipment is used in the management of parking operations, coordination with transportation authorities, and support for electronic collection of parking fees. This is performed by sensing and collecting current parking facilities status, sharing the data with information service providers and traffic operations, and automatic fee collection using short-range communications with the same in-vehicle equipment utilized for electronic toll collection.

For the Lansing region, the State Capitol complex located in downtown Lansing, MSU, and the Capital City Airport are prime candidate generators for deployment of parking management systems. The coordination of parking management with the regional

[23] This is the annual cost associated with inter-agency coordination for regional special event management and for the Regional Special Event Management Committee discussed in Program Area 14, and for periodic update and review of the special event management plan.

traveler information program, the regional special event management program and the portable traffic management program, will lead to integrated operation of the transportation system, and benefits to the system users as well as transportation agencies.

The Baltimore Washington International (BWI) airport recently deployed a parking garage monitoring system that provides real-time information and route guidance on parking availability for the different parking garages in the airport. The system has been deployed on a test basis, and is being refined for optimization of operations. The system includes vehicle sensors that have been deployed at individual parking "spaces," which detects whether a particular parking space is occupied or not, using vehicle detection technology. Based upon this parking occupancy information, messages on parking availability in specific garages are transmitted to DMS's leading to the garage. Once vehicles have entered a particular garage, specific instructions on parking space availability is provided via smaller DMS located within the confines of the garage. Preliminary user feedback indicates increased customer satisfaction. A technical evaluation of the system indicated possible inconsistencies in the vehicle detection for space availability ascertainment.

Several other airports in the nation have deployed real-time parking availability information programs, which are based on a simple entry/exit automated vehicle counting system.

Proposed Projects

Short-Term Deployment Recommendations (Phase 1)

The following are the short-term recommendations for parking management:

- It is recommended that a study be conducted to develop a plan for the implementation of regional parking management systems in the **downtown Capitol complex area**, and in the **MSU campus**. These parking management systems will include the following components:
  - Garage Status Monitoring.
  - Regional Parking Availability Information – static and real time.
  - Automated Payment.
  - Special Event Parking Management (consider use of portable DMS for this purpose if necessary).
  - Transit and parking coordination for special events.
  - This plan development effort is expected to cost about $100,000.
- Since adequate deployment specifics are not available at this plan development stage, cost estimates cannot be developed for the regional parking management systems. However, a range of costs is provided in Table 7.32 below, to serve as a decision-making guide. Further, adequate benefits information is not available to develop an estimate of the anticipated benefits of the regional parking management systems. The

following are the benefits that may be realized by the deployment of parking management systems:

– Better informed travelers – availability of both static and real-time information on a more timely basis (both pre-trip and en-route);

– Increase in overall accessibility of the transportation system, especially during high parking demand situations, such as special events;

– Better planning and coordination of parking and parking facilities;

– Better planning and coordination of special events (event parking management);

– Better demand and supply management;

– Increase in customer satisfaction;

– Reduction in special event traffic management costs; and

– Increased regional productivity through time and cost savings.

- The following table summarizes the short-term project recommendations for parking management, and provides a range of costs for the deployment of parking management systems:

Table 7.32 Parking Management: Short-Term Projects and Range of Costs (Phase 1)

		Cost Estimate ($)	
No.	**Project**	**Capital**	**Annual O&M**
1.	Plan development for the **Downtown Capitol Complex** and MSU Parking Management Systems	100,000	N/A
2.	Range of cost estimates for a representative parking management system. Typical components include: • Entrance/exit ramp meters • Tag Readers • Database and software for billing and pricing • Parking monitoring system • Hardware	30,000 to 82,500	N/A
	Total	**130,000 to 182,500**	**N/A**

Long-Term Considerations (Phase 2)

- In the long term it is recommended that the lessons learned from the short-term deployments be utilized to consider deployment of parking management systems in other parts of the region, including the Capital City Airport, and other traffic generators like shopping centers.
- Intensification and expansion (geographical and functional) of the existing parking management systems is also recommended for the long term.

7.6.8 Program Area 8 – Roadway Weather and Condition Monitoring and Management

These systems collect and disseminate information on weather-related road/pavement hazards to motorists. These systems may either be deployed on a network, or on a location-specific basis, for example, bridges that have a history of icing up in cold weather. Information from these systems can be used to implement roadway control strategies, such as emergency road closings or variable speed limits. The primary benefits of weather motorist warning and information systems are enhancement of the safety of the transportation network. As a result of accurate information provision, crashes may be avoided, and in the event of an incident, traffic in the transportation network may be efficiently diverted. The resulting benefits are reduced congestion, increased motorist awareness, and improved customer satisfaction and overall quality of life. Many operational tests to examine the effectiveness of such systems are currently underway. Some of these tests are starting to report impacts and benefits, while most are still undergoing development, implementation, or evaluation.

Overall Priority Corridors/Areas

All sections of roadway and corridors that are prone to weather-related accidents and safety issues should be accounted for in this program area. Bridges that are prone to icing, underpasses/culverts that are prone to flooding, and sections of roadway that experience weather-related visibility problems (for e.g., fog), need to be identified for deployment of road weather information sensors (RWIS).

Stakeholders identified U.S.-127 as a corridor with safety issues related to poor visibility. Further, the following corridors and locations were identified as potential candidates for deployment of icing detection systems by stakeholders during the ITS architecture workshops:

- Freeway corridors U.S.-127 and I-96;
- Section of I-69 near Potterville;
- Interchange of I-69 and Lansing Road (U.S.-27); and
- Section of I-96 near DeWitt Road.

Proposed Projects

Short-Term Deployment Recommendations (Phase 1)

The following are the short-term deployment recommendations:

- **Deployment of Road Weather Information Network on all freeway corridors in the region.** It is recommended that an extensive road weather information collection network be deployed on all freeway corridors in the region. Road weather information collection followed by provision of advisory information and warning to motorists is particularly relevant for the Lansing region, because of the extreme winter weather conditions that the region experiences. The fact that several of these corridors pass through rural undeveloped areas also has an impact on the severity of road-weather-related crashes because of high traffic speeds. Further, there is a Federal focus on the implementation of road weather information systems, which may expedite the region's eligibility for Federal funding for this project. The following are the deployment considerations:

  – Development of deployment criteria and spacing standards for road weather information sensors (RWIS) at appropriate intervals along all the freeway corridors in the region.

  – Performance of road and bridge icing detection at key locations.

  – Provision of motorist information and routing services associated with road weather conditions.

- The road weather sensor stations will communicate directly with the regional TMS. It is expected that the hardware and software associated with the processing of road weather information will reside in the regional TMC. Road weather-related traveler information can be provided through the existing traveler information dissemination channels including DMS, HAR, Internet, 511 telephone service, and the media. It is recommended that road weather information in areas that are not completely instrumented with DMS be provided through HAR. It is also recommended that the communications between the RWIS and the TMC be through wireless devices for remotely located RWIS stations.

- It is recommended that the road weather and condition monitoring project also include **Obstacles and Hazard Detection and Removal.** This involves the use of the existing roadway surveillance sources including CCTV, FSPs and motorist reports to detect and clear roadway obstacles and debris that may prove hazardous. Removal of such hazards and obstacles may be performed by using police vehicles and FSP vans. FSP, traffic operations personnel and police are normally on high alert during bad weather where the chances of debris on roadways are high. This does not involve a significant additional cost. It is a coordinated way to exchange information between different entities to expedite the removal of debris and hazards.

- **Study for identification of road weather sensor needs on arterial corridors.** It is recommended that a study be conducted for identification of RWIS needs on arterial corridors, especially on rural high-speed arterial corridors with high weather-related crash history.

- Since adequate deployment specifics are not available at this plan development stage, cost estimates cannot be developed for the road weather information and management system. However, a range of costs is provided in Table 7.33 below, to serve as a decision-making guide. Further, adequate benefits information is not available to develop an estimate of the anticipated benefits of road weather information and management systems. The following are the benefits that may be realized by the deployment of such systems:
  - Highway safety improvement – reduction in weather-related crashes;
  - Better informed travelers – availability of both static and real-time information on a more timely basis (both pre-trip and en-route);
  - Availability of real-time route-specific road conditions and weather information that may be used for optimization of winter weather maintenance activities, as well as for road construction and maintenance activities; and
  - Increase in customer satisfaction.
- The following table summarizes the short-term deployment recommendations for the road weather information project and provides ranges for representative costs for the deployment of road weather information and management systems:

Table 7.33 Road Weather and Condition Monitoring and Management: Short-Term Projects (Phase 1)

		Cost Estimate ($)	
No.	**Project**	**Capital**	**Annual O&M**
1.	Arterial Corridors RWIS Needs Study	75,000	N/A
2.	Representative costs for the deployment of road weather information and management and systems. Components include:		
	• Environmental Sensor Station (per location)	10,000 to 50,000	1,900 to 4,100
	• Road weather information system and network (for the entire deployment)	25,000 approx.	400 to 2,500

Long-Term Considerations (Phase 2)

The following are the recommended long-term considerations:

- Use the results of the arterial RWIS needs study to make decisions on arterial RWIS deployment needs. Integrate the resultant deployments (if any) with the regional traveler information system.
- Identify the need for more specialized applications including Bridge Icing Detection and Visibility Hazard Detection.
- Expand (both functionally and geographically) the existing RWIS infrastructure.

7.6.9 Program Area 9: Transit Management

Transit management systems broadly encompass a suite of ITS applications that are collectively grouped as Advanced Public Transportation Systems (APTS), and are used to improve the safety and operational efficiency of transit systems. Real time monitoring of transit vehicles and passenger activity enhances the safety and security of passengers. Automated Vehicle Location (AVL) and Computer Aided Dispatch (CAD) serve as the backbone of transit ITS applications and facilitate efficient scheduling, improved schedule adherence, and automated maintenance of fleet vehicles. Remote performance monitoring and in-vehicle diagnostics give a new dimension to routine maintenance as well as response to unexpected mechanical failures. Transit signal priority and electronic fare payment are an extension of transit ITS applications to serve the traveling public better by increasing the attractiveness of transit as a transportation mode.

Transit management systems have demonstrated their capability to reduce travel time, both by improving the operation of transit vehicles and that of the transportation network. Transit management systems improve schedule adherence of transit vehicles and thereby reduce passenger anxiety by dissemination of both static and real time schedule and route information to passengers. These impacts translate to better trip planning, reduced wait times and improved transfer coordination for transit users. The most significant benefit of transit management systems from the perspective of transit agencies is reduced cost of system operations and maintenance by improving staff productivity and maximizing the utilization of facilities, equipment and other resources.

Proposed Projects

Short-Term Deployment Recommendations (Phase 1)

The following are the short-term deployment recommendations for Transit Management:

- **Deployment of Transit AVL and CAD for the Entire CATA System.** Since AVL and CAD form the backbone for any advanced transit management system, it is recommended that CATA deploy AVL on all its buses and develop a CAD for the real-time management and operations of its transit service. It is recommended that the AVL and CAD be deployed for CATA's fixed-route operations as well as demand responsive and paratransit services.

- **Provision of Enhanced Transit Information.** CATA currently provides several enhanced customer services, including trip planning, detour information, and link service between downtown Lansing parking areas. Spec-tran, CATA's paratransit system, currently takes reservation via phone for scheduled pick-ups. CATA also provides, van, car-pooling and rider matching services.

- In addition to the above services, it is recommended that CATA provide enhanced transit traveler information (both real-time and static) to its riders. The deployment of AVL and CAD facilitate the availability of real-time information on bus schedules, arrival times, travel times and delays. It is recommended that the enhanced transit information be provided through the regional traveler information system and through transit DMS.

- **Real-time Bus Arrival Information Pilot Project.** It is recommended that transit DMS be installed at selected high-demand bus-stops for provision of real-time bus arrival information. Based on the deployment experience of this pilot project, this service may be extended to all other bus stops in the region, in the long term.

- **Incident Management Coordination and Real-time Routing of Buses.** This service can be provided, based on information available from the AVL system and on information from the regional incident management system. It does not require a significant additional cost, but is a value added service provision through better regional coordination and integration.

- **Special Event Transit Coordination.** This involves the provision of special event transit services and incentives. A typical application is the provision of shuttle buses from remote parking lots to special event sites in order to reduce the volume of low-occupancy vehicles approaching the special event site. This may also include charter services and detour routing for special events.

- The following table summarizes the short-term deployment recommendations for transit management:

Table 7.34 Transit Management: Short-Term Projects (Phase 1)

		Cost Estimate ($)		
No.	**Project**	**Capital**	**Average Annual O&M**	**Anticipated Annual Benefit**
	CATA Transit AVL and CAD and coordination and re-routing; and Enhanced Transit Information	4,534,000	579,182	1,504,632
	Total	4,534,000	579,182	1,504,632

Note: Deployment specifics on the Real-time Bus Arrival Information Pilot Project; the Incident Management and Bus Re-routing Coordination Project; and the Special Event Transit Coordination Program are not available at this time, benefit and cost information is not provided for these projects.

Long-Term Considerations (Phase 2)

The following are the recommended long-term considerations for transit management:

- Automated trip scheduling system for demand response and paratransit services.
- Use of AVL-equipped buses as probes for traffic data.
- Additional deployment of transit DMS for real-time bus-arrival and scheduling information.
- Transit Security.
- Automated Fare Payment.
- Vehicle Condition Monitoring and Maintenance.
- Transit Signal Priority.

7.6.10 Program Area 10 – Emergency and Maintenance Vehicle Operations and Management

This involves the application of technologies to improve the efficiency and effectiveness of emergency vehicles, and the operation and maintenance of agency-owned maintenance vehicles, such as snowplows.

The purpose of emergency management services is to improve notification, dispatch, and guidance of emergency (or other response) personnel and equipment when an incident occurs. The benefits of emergency management are sometimes dependent upon integrated deployment of incident management systems, which often detect the need for emergency response to incidents on the transportation network. ITS applications for emergency management typically consist of Automatic Vehicle Location (AVL), Computer Aided Dispatch (CAD), fleet management, and vehicle guidance systems. The application of traffic signal preemption for emergency vehicles is also a rapidly advancing technology, especially for downtown locations, high-speed and high-accident intersections and near hospitals. The integrated deployment of emergency management systems results in an overall reduction in emergency response times, improvement in treatment administration efficiency, improvement in coordinated emergency management and reduction in incident clearance times.

Many state DOTs implement ITS programs to optimize both winter weather maintenance and regular maintenance operations. ITS applications in this program area typically consist of Automatic Vehicle Location (AVL), Computer Aided Dispatch (CAD), fleet management, and vehicle guidance systems. This program area is similar to the Transit Management program area, in that, it involves the improvement of the operation and maintenance of agency-owned vehicles. The deployment of CAD/AVL and vehicle performance monitoring systems reduces the operating and maintenance costs for agencies responsible for highway maintenance, resulting in the maximization of available resources and equipment. Further, the deployment of vehicle self-diagnostics can alert mechanics to potential problems. Fleet operators can also use AVL devices to improve the scheduling of maintenance activities.

This program area could apply to all emergency response (Police/Fire/Paramedical) agencies and highway maintenance agencies (including MDOT, County Road Commissions and Cities/Townships) in the Lansing region.

Proposed Projects

Short-Term Recommendations (Phase 1)

The following are the short-term recommendations for the emergency vehicle and maintenance vehicle management program area:

- Conduct a study to ascertain the state-of-the-art and state-of-the-practice in emergency and maintenance vehicle operations and management. An example of such a deployment is the Southeast Michigan Snow and Ice Management (SEMSIM) program, which is a partnership between the Road Commission for Oakland County (RCOC), Wayne County Department of Public Services, the city of Detroit, and the Road Commission for Macomb County.

- Development of a strategy and identification of funding mechanisms for the deployment of emergency and maintenance vehicle management systems.
- Development of a strategy for the integration of the emergency vehicle management systems with regional emergency dispatch centers and the regional incident management program.
- The following table summarizes the short-term deployment recommendations for this program area:

Table 7.35 Emergency and Maintenance Vehicle Management: Short-Term Projects (Phase 1)

No	Project	Cost Estimate ($)	Anticipated Benefit
1.	State-of-the-Art, Feasibility, Strategy and Funding Study	100,000	N/A*

There are no direct benefits associated with the conduct of the study. Benefits will be realized through the implementation of the resulting deployment recommendations.

Long-Term Considerations

Based on the results of the study conducted in Phase 1, it is recommended that the deployment of emergency and maintenance vehicle management systems be pursued as appropriate.

7.6.11 Program Area 11: Advanced Infrastructure-Based Warning and Safety Systems

Infrastructure-based warning and safety systems provide information on hazardous roadway conditions, or site-specific safety-related information. This is based on information collected by surveillance and detection equipment deployed at pre-determined locations with a history of safety-related issues. Typical examples of site-specific safety systems are downhill speed warning systems, ramp rollover systems and advanced curve warning systems. This program area may also be extended to include remote surveillance and monitoring of park-and-ride lots, rest areas, and other public sites. Information from these systems could assist in evacuation and disaster management plans, where timely information is critical. Information from these services can be used to implement roadway control strategies, such as emergency road closings or variable speed limits. The integration of such systems with a regional traffic management center facilitates the monitoring of problem locations in a coordinated fashion, and the dissemination of regionwide traveler information in the event of an incident. These systems may also be extended to surface street intersections for the provision of real-time pro-active information on collision avoidance.

The primary benefit of motorist warning and information systems is the enhancement of the safety of the transportation network. As a result of accurate information provision, crashes may be avoided, and in the case of an incident, traffic in the transportation network may be efficiently diverted. The resulting benefits are increased motorist awareness, improvement in transportation safety, better response to incidents in remote areas, and improved customer satisfaction and overall quality of life. Many operational tests to examine the effectiveness of such systems are currently underway. Some of these tests are starting to report impacts and benefits, while most are still undergoing development, implementation, or evaluation. Such systems were originally intended for deployment in rural and remote areas, but are however being extended to urbanized metropolitan areas as well.

It is recommended that these systems be deployed at all locations where there is a documented safety need that requires real-time monitoring of traffic so as to prevent the occurrence of crashes. Sections of highway with steep gradients or sharp curves, and interchanges with a history of ramp-rollover accidents are prime candidate locations for such deployment.

The following locations were identified for the possible deployment of infrastructure-related safety and warning systems during the ITS architecture workshops:

- The interchange of U.S.-127 and I-496;
- The interchange of U.S.-127 and I-69; and
- Ramp Rollover issues related to steep grades at the interchange of I-69 and Lansing Road (U.S.-27).

Proposed Projects

Short-Term Deployment Recommendations (Phase 1)

The following are the short-term deployment recommendations for this program area:

- **Ramp-Rollover System at the interchange of I-69 and Lansing Road (BR-27).**
- Conduct of **Study for Identification of High Crash Locations Related to Deficient Highway Geometry.** This study will perform an analysis of crashes by type and identify high hazard locations for different types of crashes. The crashes will be mapped to their possible causes, including weather, visibility, and bad geometry.

Potential location-specific infrastructure-based ITS solutions for mitigation will then be recommended for deployment.

- The following table summarizes the short-term deployment recommendations for this program area:

Table 7.36 Advanced Infrastructure-Based Warning and Safety: Short-Term Projects (Phase 1)

		Estimated Cost ($)			
No.	**Project**	**Capital**	**Average Annual O&M**	**Total Average Annual Cost**	**Anticipated Annual Benefit ($) [B/C Ratio]**
1.	I-69 and Lansing Road (BR-27) Ramp Rollover System	293,000	14,650	48,305	50,402
	Benefit/Cost Ratio for Ramp Rollover System at I-69/Lansing Road = 1.04:1				
2.	Study for Identification of High Crash Locations Related to Deficient Highway Geometry	75,000	N/A	N/A	N/A*

Long-Term Considerations (Phase 2)

The following are the long-term considerations for infrastructure-based safety and warning systems:

- Use of the results of the Phase 1 study for deployment of systems as necessary.
- Consideration of Curve Warning Systems and Downhill Speed Detection and Warning Systems.
- Consideration of safety warning systems at:
  - The interchange of U.S.-127 and I-496; and
- The interchange of U.S.-127 and I-69Deployment of additional systems on rural high-speed arterial corridors with a proven history of crashes.

7.6.12 Program Area 12: Regional ITS Deployment Program and Policy

This includes all related program and policy elements that are required to develop, deploy and operate a sustainable and effective regional ITS plan. The development of regional policies, procedures and plans for transportation management and operations stands to benefit both transportation agencies and the traveling public, by standardization of traffic management and situational responses across the region. Transportation agencies may be able to attain economies of scale through the sharing of resources and management strategies, ultimately resulting in agency cost savings and better interjurisdictional cooperation. This in-turn, results in better service provision to the commuters in the region.

One of the key factors that affect successful ITS deployment and continued vitality of the program is the periodic upgrade and update of the region's ITS program plan in conjunction with the update of the region's transportation plan. This ensures the integration of ITS planning into the transportation planning process. It is essential to periodically evaluate the performance of the program with respect to attainment of stated objectives, so as to develop solutions for improvement and enhancement of the program. Another key aspect of successful ITS deployment is interjurisdictional cooperation and coordination. The ultimate goal of the various transportation service providers in the region is to provide for an efficient and safe transportation system that is seamless across jurisdictional boundaries. Transportation operations and ITS play a significant role in such service provision, in that, they bring diverse stakeholders together to work on a day-to-day basis – sharing information, control, responsibilities and management procedures. It is therefore essential to institute regional committees and task forces that represent a broad cross-section of stakeholders for the development of standardized procedures and policies for the management and operations of a particular aspect of the transportation system. Typical examples of such committees include incident management, special events management, arterial operations coordination, etc.

Communications, and Operations and Maintenance (O&M) respectively serve as the *backbone* and *life-lines* of an ITS program. It is therefore essential that an ITS Communications Master Plan and a regional O&M plan be developed for the region.

Program Elements/ Recommended Projects

Short-Term Recommendations (Phase 1)

The program elements/projects that are recommended for the effectiveness and sustenance of the Lansing region ITS program plan are below. Some of the recommended committees may be instituted in the CARTS ITS Task Force as sub-committees. The following are the recommended action items and committees:

- **Long-range Transportation Plan.**

- **ITS Communications Master Plan.** The expected one-time cost for this effort is $200,000.

- **Transportation Operations, and ITS Planning and Programming.** It is expected that the initial operations master plan development effort will cost $100,000, while annual costs for coordination, sustenance and update are estimated at $50,000.

- **ITS Evaluation Program.** The one-time cost for the institution and development of the program is estimated at $50,000, while the annual ITS program evaluation budget is estimated to be $100,000. This annual budget may be assigned for data collection, evaluation and validation of specific aspects of the regional ITS program plan.

- **Institution of Regional Incident Management Committee.** The annual cost associated with interagency coordination for regional incident management and for periodic update and review of the incident management plan is estimated at $50,000. This cost has already been accounted for under Program Area 5, Regional Incident Management. This may be instituted in the CARTS ITS Task Force as a subcommittee.

- **Institution of Regional Arterial Operations Coordination Committee.** The annual cost associated with interagency coordination for regional arterial operations coordination estimated at $25,000. This may be instituted in the CARTS ITS Task Force as a subcommittee.

- **Intercity Traveler Information and Operations Coordination.**

It is expected that the benefits of the above recommended programs and committees will be realized through all the recommended projects across all program areas.