STRATEGIC PLAN
FOR INTELLIGENT TRANSPORTATION SYSTEMS

APPENDIX A

EXISTING MDOT ITS PROGRAM FUNCTIONS

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A. EXISTING MDOT ITS PROGRAM

The following sections provide a brief overview of the current state of MDOT's ITS Program (referred to herein as "the Program").

A.1 MDOT ITS Network

The MDOT ITS Network spans the entire state, with devices and communications equipment deployed from the Indiana and Ohio borders to as far north as Phoenix, MI in the Upper Peninsula. The expansive network consists of three TOCs that utilize numerous device types and communication methods to collect and disseminate real-time traveler information and support incident management. Michigan's mature ITS network is approaching saturation of existing transportation technologies (e.g., DMS, CCTV, and MVDS) on interstates in major metropolitan areas, such as metro Detroit, Grand Rapids, and Lansing. Figure A-1 provides a map showing a high-level coverage of the ITS network, which is focused on metropolitan areas with less build-out in rural areas. Each icon on the map represents an ITS device.

FIGURE A-1. ITS DEVICES IN MICHIGAN

A.1.1 ITS Devices

The Program operates a variety of ITS devices to support the management of MDOT's roadways. The purpose of MDOT's ITS devices is provided below.

Environmental Sensor Stations (ESS) collect and disseminate weather data at points along the road network. This data is utilized to prioritize maintenance needs and provide accurate traveler information and driving conditions to motorists.

Roadside Units (RSU) transmit safety information from roadside infrastructure to connected vehicles equipped with On Board Units (OBU). RSUs use Dedicated Short Range Communications (DSRC) or other alternative wireless communication technologies.

Closed-Circuit Television (CCTV) Cameras transmit live video feeds to MDOT's TOCs for monitoring roadways and supporting traffic incident management.

Microwave Vehicle Detection Systems (MVDS) sense the presence of vehicles and provide information regarding traffic volume, speed, and spacing of vehicles at a given location.

Dynamic Message Signs (DMS) provide motorists real-time information typically regarding traffic conditions, travel times, lane closures, work zones, incidents, weather advisories, or other pertinent information.

Lane Control Signs (LCS) communicate dynamic lane control, variable speed advisory, and dynamic shoulder use on MDOT's Flex Route.

There are many supporting devices present at each ITS site which enable the end devices to transmit and receive information. These include but are not limited to ITS device cabinets, surge protectors, uninterruptible power supplies, communication methods, managed/unmanaged ethernet switches, and more. All devices present at each ITS site are necessary for the site to function properly and are operated and maintained by the Program.

The total number of devices in the MDOT ITS Network is constantly changing, particularly with the construction of new ITS projects. Figure A-2 provides a snapshot of the number of each device type by MDOT Region. LCSs are not included on this figure.

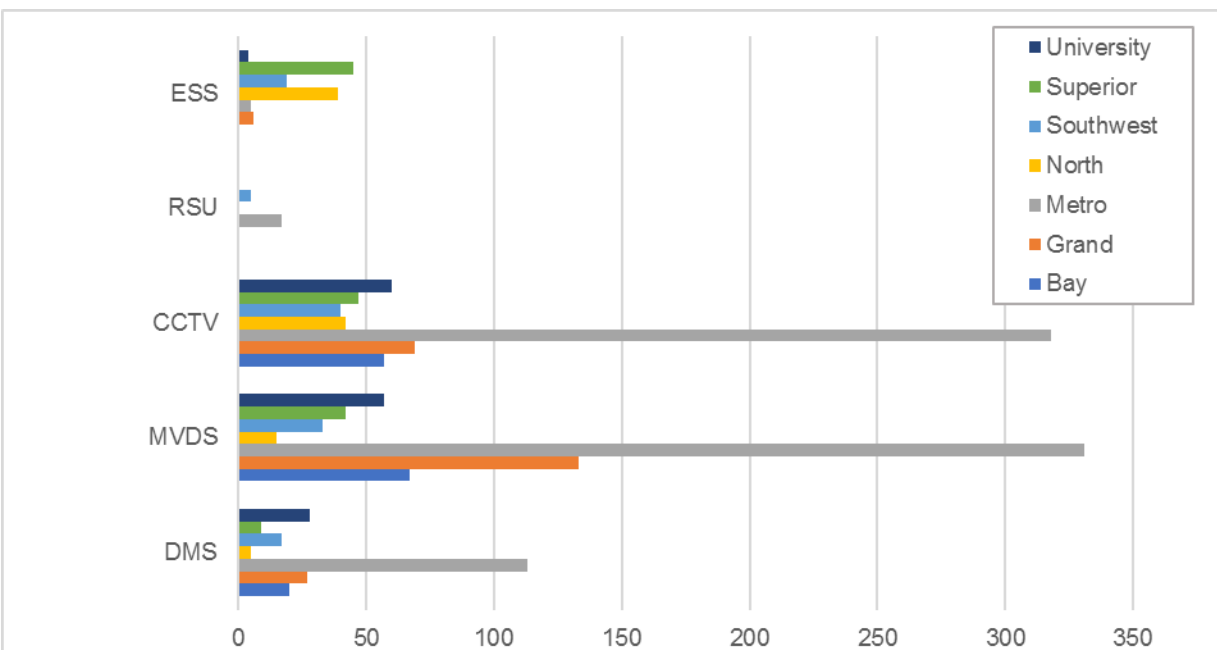


FIGURE A-2. ITS DEVICES BY REGION AS OF JANUARY 2018

A.1.2 Communications Network

The Program is dependent on a reliable communications network to effectively operate and realize the full potential of each device. The main communications methods that comprise the MDOT ITS network to link each device to the TOC are provided below:

- Licensed Wireless Backhaul
- Unlicensed Wireless Radios
- Fiber Optic-Based Communications
- Cable Modem-Based Services
- Cell Modem-Based Services
- Leased-Line Services (Ethernet Private-Line Services)
- Telco (T-1)
- Dedicated Short-Range Communications

The MDOT ITS network spans across all seven MDOT regions and consists of approximately 25 nodes, 3 hubs, and a host of cable and cell modem sites strategically deployed to meet the needs of the various projects in each region. Communications methods are strategically selected for each ITS site to provide efficient and reliable communication to the associated TOC. The selected communications methods are intended to maximize data throughput capability while minimizing costs.

A.1.3 Advanced Traffic Management System (ATMS) Software

The ATMS software integrates operations of MDOT's ITS devices through a single interface. TOC operators utilize the software for real-time monitoring of MDOT's ITS infrastructure, such as DMSs, CCTV cameras, and MVDSs. The information collected and disseminated is used to support incidents, work zones, special events, and weather events. Advancements continue to become available to support the real-time management of freeway congestion through state-of-the-art sensing, communications, and data processing technologies.

A.1.4 TOC Operations

MDOT's three TOCs effectively utilize ITS devices to monitor traffic and manage traffic incidents 24 hours a day and seven days a week. The TOCs maintain communication with law enforcement agencies, roadway maintaining agencies, emergency response personnel, freeway courtesy patrol (FCP), and other stakeholders to quickly detect, verify, manage, and clear incidents on MDOT roadways. The TOCs monitor real-time travel conditions with ITS devices such CCTV and MVDS, provide information to motorists via DMS and travel time signs, actively manage traffic using LCS, and provide truck parking availability via dedicated signs. In addition to MDOT's three TOCs, the Southeast Michigan Transportation Operations Center (SEMTOC) operates a satellite location, Blue Water Bridge Operations Center (BWBOC), to serve motorists entering and exiting the United States via the Blue Water Bridge. A map of MDOT's TOCs along with associated coverage areas is provided in Figure A-3.

MDOT maintains a TOC Standard Operating Procedures (SOP) document that identifies the purposes of, policies for, and procedures associated with the operation of MDOT's TOCs. The TOC SOP is updated quarterly and is available to all TOC staff. The SOP provides consistency to the operation and allow MDOT to provide stakeholders with quality services. The document supports TOC workforce development through new employee orientation and training; position descriptions with roles and responsibilities; and career planning.

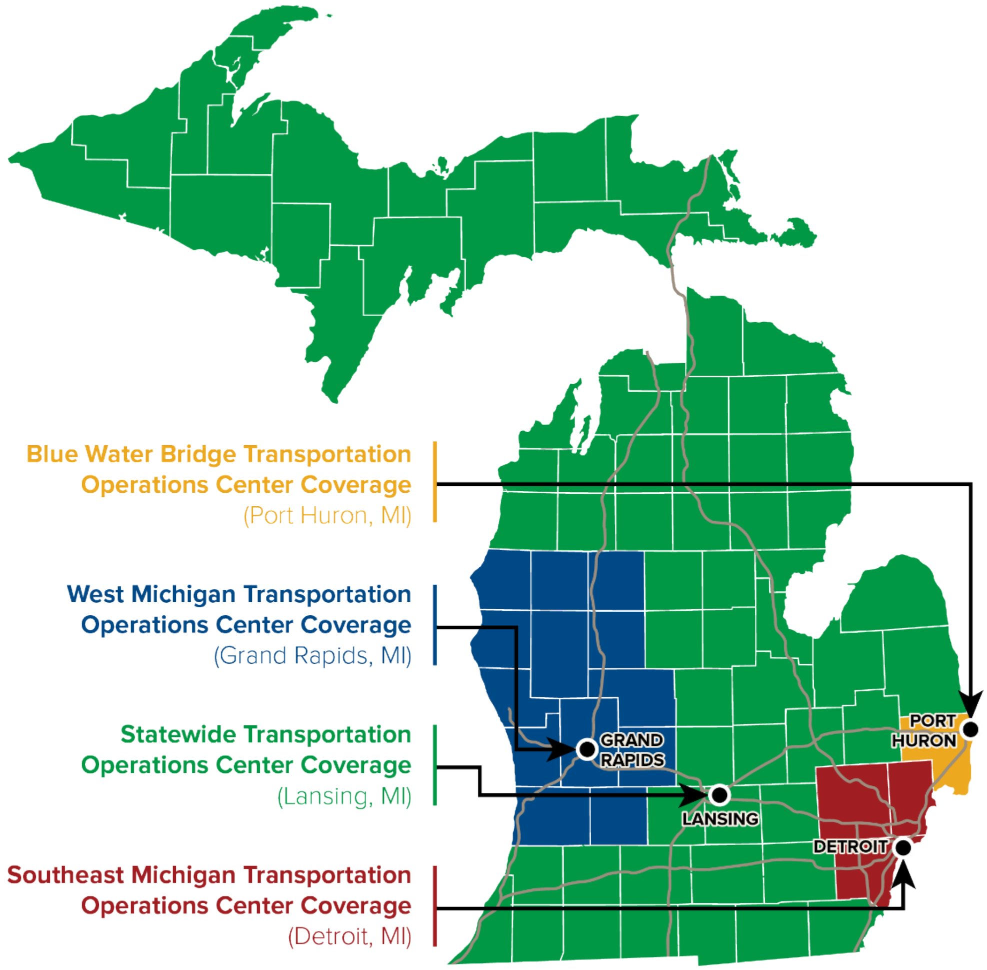


FIGURE A-3. TOC COVERAGE AREAS

A.2 Innovative Projects

The Program's primary focus is to improve safety, operational performance, and integrate MDOT's transportation system. The Program demonstrates proactive, effective, and visible leadership through the deployment of innovative, emerging transportation solutions. Examples include the state's first ATM corridor, connected vehicle deployments, real-time parking availability, and weather response systems. These solutions are both a catalyst and response to a rapidly transforming industry.

A.2.1 Flex Routes

MDOT's Flex Routes are ATM corridors designed to manage recurring and nonrecurring congestion, and improve roadway efficiency and safety. Flex Routes are considered in Michigan if they positively impact mobility, reliability, safety and/or environmental factors while providing a benefit-to-cost ratio over one. In addition to mitigating traditional roadway capacity constraints and high-crash locations, ATM strategies can positively impact incident management, special events, evacuations, weather events and other unique circumstances.

US-23 FLEX ROUTE

MDOT's first Flex Route, US-23 Flex Route, uses four ATM strategies: dynamic lane control, dynamic shoulder use (also known as part-time shoulder use or hard shoulder running), variable speed advisories (VSA), and queue warning. Dynamic shoulder use allows driving on the shoulder during certain times of the day. US-23 Flex Route utilizes gantries over the roadway with lane control signs over each lane to indicate if the lane or shoulder is open to traffic, as shown in Figure A-4. The deployed ATM strategies provide additional capacity, improve incident response, speed harmonization, and advanced notice to drivers of upcoming conditions. The US-23 Flex Route is approximately 9 miles between Brighton and Ann Arbor in MDOT's University Region, as shown in Figure A-5.

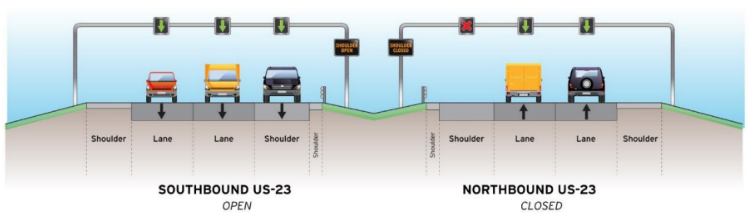


FIGURE A-4. EXAMPLE OF AN ATM "FLEX ROUTE" SYSTEM

I-96 FLEX ROUTE

A second MDOT Flex Route is in the design process for I-96 between Milford Road in New Hudson and the M-5/I-275/I-696 interchange in Novi. The system will operate similar to the US-23 Flex Route and will also feature adaptive ramp metering to manage platooning at key ramps within the corridor. The I-96 Flex Route is being developed to improve safety, reduce directional peak hour congestion, and improve travel time reliability. Figure A-5 shows the future I-96 Flex Route corridor.

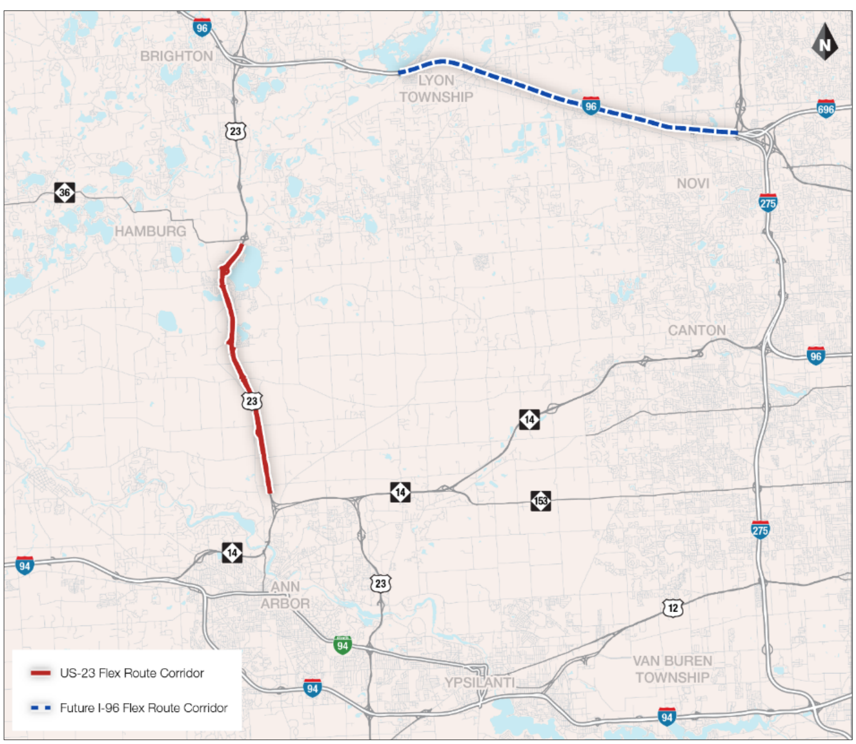


FIGURE A-5. MAP OF MDOT FLEX ROUTES

A.2.2 Active Transportation and Demand Management (ATDM)

ATDM is defined by FHWA as the dynamic management, control, and influence of travel demand, traffic demand, and traffic flow on transportation facilities. ATDM is made up of active demand management, ATM, and active parking management strategies to manage traffic flow and traveler behavior to delay breakdown conditions, improve safety, promote alternate travel modes, balance demand with available capacity, and reduce emissions. Table A-1 provides a few sample ATDM strategies.

TABLE A-1. ATDM STRATEGIES

Active Demand Management	Active Traffic Management	Active Parking Management
Dynamic Ridesharing	Dynamic Lane Use	Dynamically Priced Parking
Predictive Traveler Information	Adaptive Ramp Metering	Dynamic Way-Finding
Integrated Corridor Management	Adaptive Traffic Signal Control	Real-Time Parking Availability

I-94 ATDM

The I-94 Modernization project will make improvements for 6.7 miles of I-94 between I-96 and Conner Ave over a period of approximately 20 years. An Active Transportation and Demand Management (ATDM) system is being planned as part of the project to improve safety, support incident management, enhance reliability, mitigate congestion and provide traveler information, both during freeway reconstruction and in the corridors final configuration. The ATDM strategies being considered include VSA, queue warning, traveler information, integrated corridor management (ICM), and adaptive traffic signal control (ATSC). The ATDM system is under development and may include additional strategies, such as dynamic merge control and dynamic junction control shown in Figure A-6.

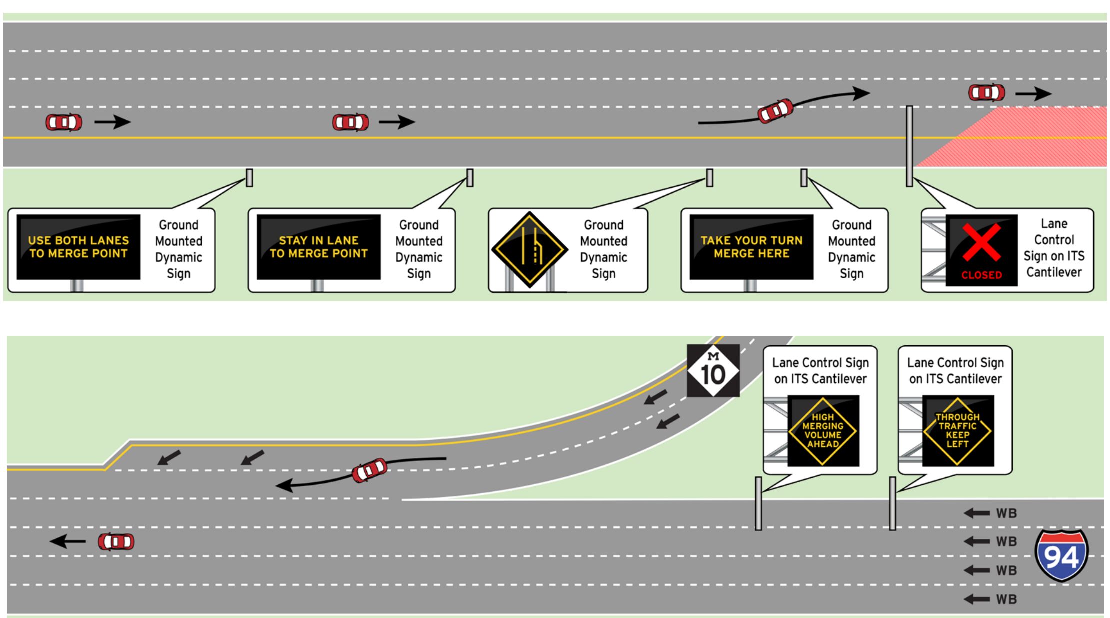


FIGURE A-6. EXAMPLE ATDM STRATEGIES

A.2.3 Truck Parking Information and Management System

MDOT's Truck Parking Information and Management System (TPIMS) aligns commercial truck drivers with safe and convenient parking. Truck drivers frequently report challenges to complying with their federal rest regulations, including difficulty finding safe and convenient parking options where needed. Truck drivers also report inadequate information regarding parking availability and way-finding. This can result in trucks parking along interstate ramps and on shoulders creating a safety hazard.

MDOT's TPIMS pilot project has served commercial drivers operating on I-94 in southwest Michigan since 2014. The TPIMS provides real-time truck parking availability information through dynamic truck parking availability signs, websites, and mobile applications. From the success of the I-94 pilot TPIMS project, an eight-state consortium competed for and received a federal TIGER grant to develop a regional TPIMS in the Midwest. This project, the Mid America Association of State Transportation Officials (MAASTO) TPIMS, will expand the system to the University, Bay, and Metro Regions by early 2019. Figure A-7 shows a truck parking information sign on I-94 in southwest Michigan.

FIGURE A-7. TRUCK PARKING INFORMATION SIGN

In addition, MDOT is currently developing a real-time parking information and management system (PIMS) that provides the delivery of real-time parking availability information at a carpool lot. The number of available parking spaces would be provided via DMS, MDOT's Mi-Drive website, and MDOT partner websites and smartphone applications.

A.2.4 Wrong-Way Driver Warning System

Wrong-way driver crashes claim an average of 360 lives each year on United States roadways. These crashes are often caused by impaired or confused drivers. As wrong-way crashes become more commonplace, traffic professionals have been tasked with preventing these deadly collisions.

There are several wrong way driver warning systems on the market to assist agencies in reducing wrong way driver incidents. These systems range in complexity from a passive blinker sign that provides a higher level of visibility for the "Wrong Way" sign to an intelligent warning system which will activate when a wrong-way event is detected and can send alerts to first responders.

In the Metro Region, MDOT is currently working with the Michigan State Police (MSP) and SEMTOC to determine the most appropriate locations and measures to prevent wrong-way drivers.

A.2.5 Border Wait Time Information System

In 2014, MDOT in conjunction with the Canadian Ministry of Transportation Ontario (MTO) installed a border wait time system at the Blue Water Bridge which connects Port Huron, Michigan with Sarnia, Ontario, Canada. The system is designed to measure and disseminate wait times at the border utilizing Bluetooth readers, vehicle detection, and a predictive algorithm.

The system is divided into two separate communications networks with all devices for the Canada (east) bound direction on the MDOT network and all devices on the US (west) bound direction on the MTO network. MDOT utilizes MDOT BWB Twitter and DMS to disseminate information to users while the Canada Border Service Agency utilizes their website.

A.2.6 Weather Responsive Traveler Information System (Wx-TINFO)

MDOT is in the development process of a weather responsive traveler information system (Wx-TINFO) to provide real-time environmental data to efficiently manage road maintenance activities and disseminate travel information. The system collects data from mobile MDOT fleet vehicles and fixed environmental sensor stations (ESS). In Michigan, road weather information system (RWIS) was first deployed in the Upper Peninsula in 2007 using ESS placed at locations along routes to alert maintenance crews and motorists of adverse road conditions. Since 2007, roughly 120 ESS have been installed throughout the state. New methods such as connected vehicle technology, mobile device apps, intelligent fleets, and commercial weather service providers are being developed to improve data collection and delivery techniques with the goal to provide more accurate, real-time updates and forecasts, as shown in Figure A-8. Figure A-9 provides a sample RWIS web interface.

In addition to standard roadside application, MDOT deploys ESS at select bridges to detect bridge surface conditions. The deployments typically include a DMS placed on either side of the bridge to warn travelers of potentially icy bridge conditions. The newly constructed US-2 bridge over the Escanaba River features the bridge deck warning system.

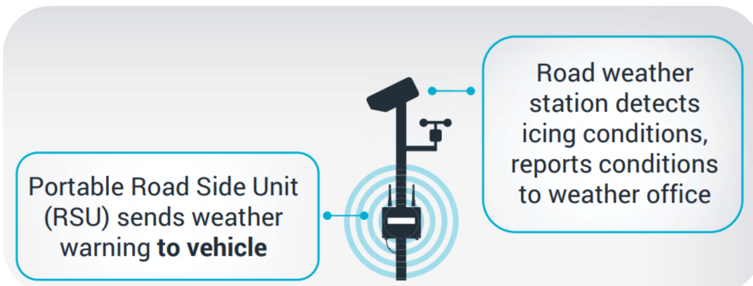


FIGURE A-8. ESS APPLICATION

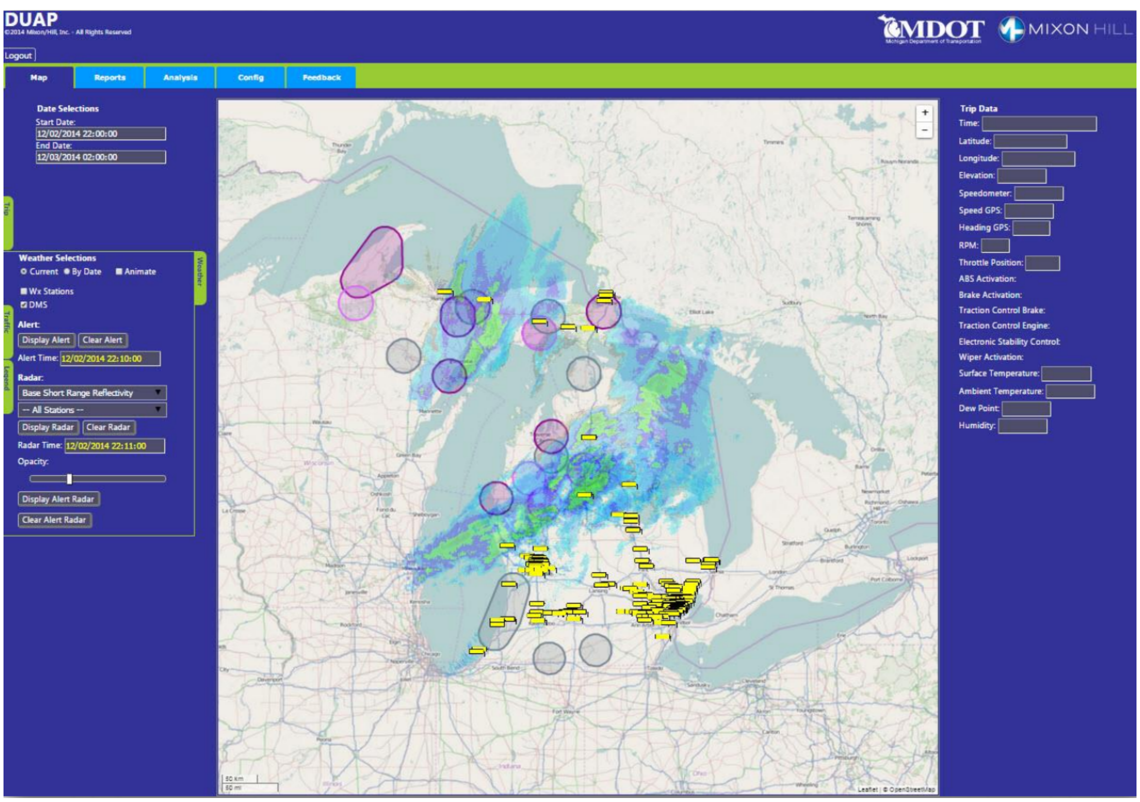


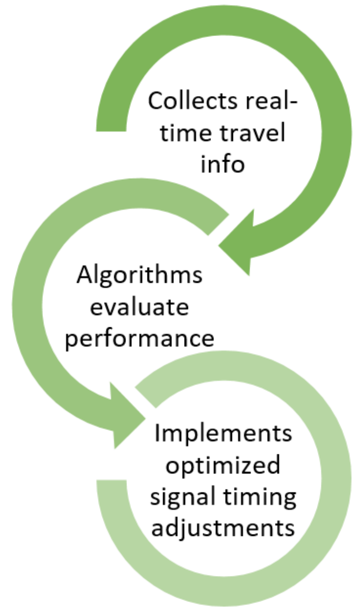
FIGURE A-9. RWIS WEB INTERFACE

A.2.7 Adaptive Traffic Signal Control

Adaptive traffic signal control (ATSC) technology collects real-time traffic demand data, evaluates performance using system specific algorithms, and then adjusts traffic signal timings in real-time to optimize traffic flow. The benefits of ATSC include improvements to safety, traffic delay, average travel speeds, reliability, and vehicle emissions. In contrast to traditional timed systems, adaptive traffic signal control technologies react to traffic incidents, special events, road construction, and other occurrences.

MDOT has implemented two ATSC systems to date, which include M-43 (Saginaw Highway) from Marketplace Boulevard to Rosemary in Lansing and M-84 (Bay Road) from Walmart Drive to Weiss Street in Saginaw. Both systems are operated by Adaptive Control Software Lite (ASC-Lite) software and have been operational since 2012.

An ATSC system for US-31 (Division Street) and M-72 (Grandview Parkway/Front Street/Munson Avenue) in Traverse City is in the design phase and is expected to become operational in 2019. Another ATSC system for M-3 (Gratiot Avenue) and US-12 (Michigan Avenue) in Detroit is currently being evaluated for potential implementation, which would occur in 2021.



A.2.8 Traffic Responsive System

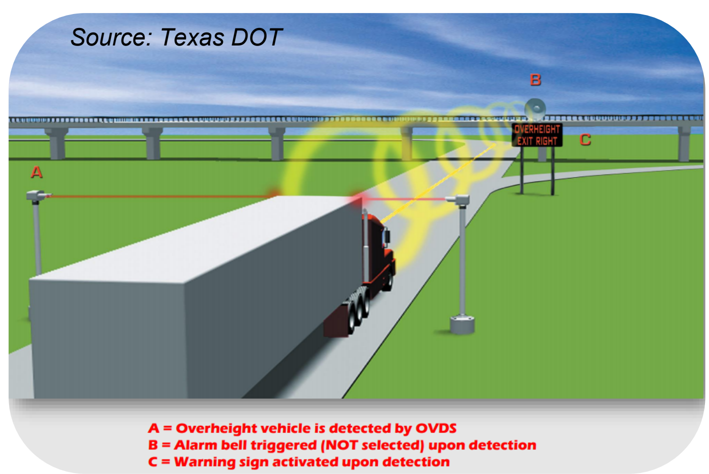
A traffic responsive signal system utilizes real-time traffic detection to select the appropriate pre-defined traffic timing plan based on the traffic conditions. Traffic responsive plan selection (TRPS) normally selects timing plans which are housed in a field master controller or a central computer system. When the master or computer selects a new timing plan, it instructs all traffic signal controllers in a coordinated group to change to the new timing plan simultaneously to ensure coordination is maintained.

MDOT is currently designing a traffic responsive system along Stadium Drive from 11th Street to South Street in Kalamazoo. The west end of this corridor has a large commercial shopping area and an interchange with US-131 while the east end of the corridor serves Western Michigan University, including Waldo Stadium. These types of traffic generators tend to generate unpredictable and inconsistent traffic volumes and patterns. A traffic responsive system will help MDOT and local authorities better manage the traffic conditions along the corridor.

A.2.9 Over-Height Warning System

There are many critical bridges in Michigan that are vulnerable to high load hits from vehicles that are higher than the provided bridge under clearance. MDOT has reported over 700 high-load hits between 2001 and 2013. The severity of damage varies, from minor damage to emergency bridge removal.

To protect MDOT's bridge assets, over-height vehicle detection systems can be placed in advance of bridges susceptible to high-load hits. The systems consist of a detection station, usually an infrared beam across the roadway at a designated threshold height and a warning sign with flashers located approximately 1000' downstream from the detection station. When the system detects an over height vehicle, the flashers on the warning sign(s) are triggered to instruct the driver to exit the roadway prior to the bridge. In addition, the system can provide automated text/email alerts.



A.2.10 Integrated Corridor Management

ICM is used to support the efficient movement of people and goods through integrated, proactive management to utilize unused capacity, typically in the form of parallel routes, single occupant vehicles, and transit service. Taking an ICM approach, MDOT can manage the transportation network as a multimodal system and dynamically shift operational strategies based on changing traffic conditions to benefit the entire network. For example, while driving an ICM corridor, a traveler could be informed in advance of congestion ahead and be informed of alternative transportation options such as a nearby transit facility's location, timing and parking availability.

MDOT is currently managing three ICM projects that are in various stages. In 2014, MDOT began implementing ICM along I-696 from I-94 to Dequindre Rd in Macomb County to assist during incident management efforts. The system is designed to route traffic onto parallel service drives during a major traffic incident. In addition, MDOT has an ICM project on I-75 between 14 Mile and Rochester Road in Oakland County and on I-75 involving 8 Mile and Woodward in Wayne County. A sample ICM system is provided in Figure A-10.

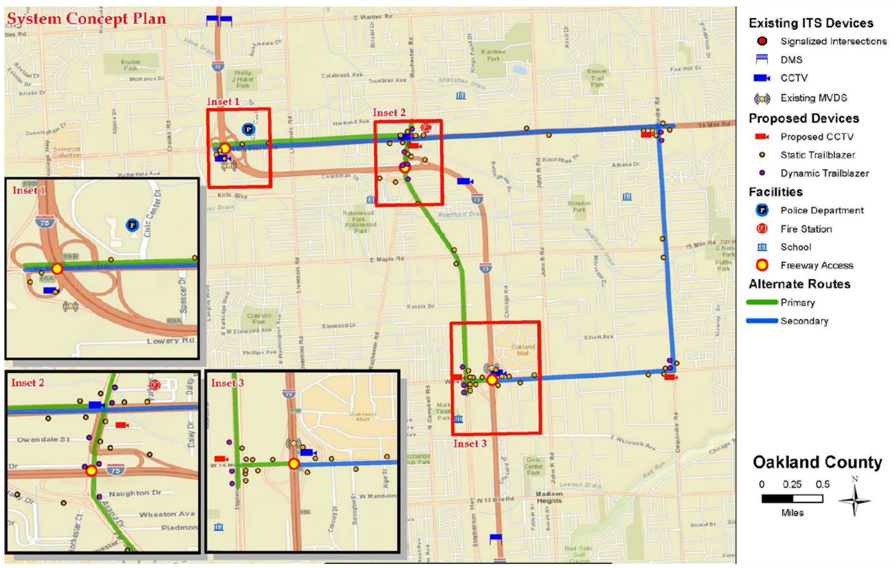


FIGURE A-10. ICM SYSTEM

A.2.11 Connected and Autonomous Vehicles

In the last several years, the Program has been involved in the development and deployment of multiple connected vehicle systems around Michigan. Refer to MDOT's CAV Program Strategic Plan 2017 for more information.

A.2.12 Curve Speed Warning System

Curve speed warning systems use a variety of roadside detectors and electronic warning signs to warn drivers at dangerous speeds in advance of significant curves, typically those with historically high crash rates. Systems can range in complexity from basic speed sensing with a roadside warning sign to lane-by-lane guidance incorporating local environmental and pavement condition sensors. An example of a warning sign is shown in Figure A-11. Michigan has deployed the following curve speed warning systems:

- Northbound I-75 mainline ramp at the I-375 interchange
- Northbound I-75 between 8 Mile Rd and 9 Mile Rd
- Southbound I-75 between 9 Mile Rd and 8 Mile Rd
- Northbound US-23 ramp to westbound I-96
- Southbound US-23 ramp to eastbound I-96

FIGURE A-11. EXAMPLE OF A CURVE SPEED WARNING SIGN

A.2.13 Connected and Autonomous Vehicles

In the last several years, the Program has been involved in the development and deployment of multiple connected vehicle systems around Michigan. Refer to MDOT's CAV Program Strategic Plan 2017 for more information.

A.2.14 Data Use Analysis and Processing (DUAP)

As technology advances in the transportation industry, the amount of data available is exponentially increasing. MDOT has developed the DUAP program to evaluate ways to leverage available data to increase the efficiency of data driven processes in the management and operation of Michigan's roadways. The DUAP program integrates the wealth of data from ITS, CV, mobile, and fixed data sources, and analyzes and processes the data to support different MDOT business areas, such as pavement management, weather advisory, and traffic conditions. Figure A-12 provides a snapshot of data sources that are fused together by the DUAP program. Data sources include MDOT's integrated mobile observations (IMO), Vehicle-Based Information and Data Acquisition System (VIDAS), and Automated Vehicle Locator (AVL).

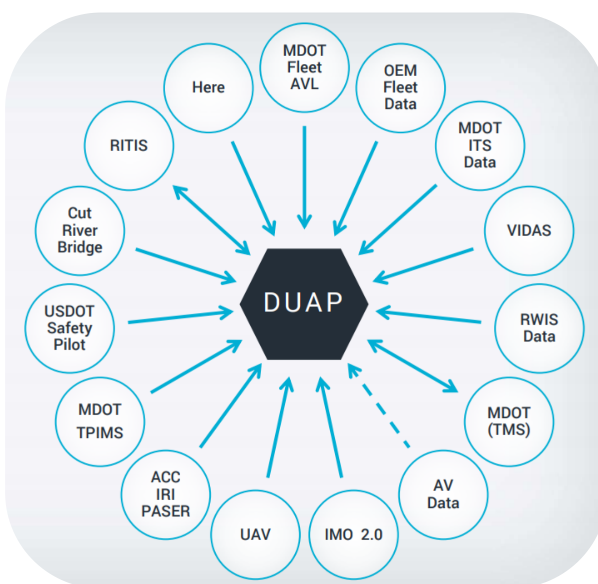


FIGURE A-12. MDOT DUAP PROGRAM DATA SOURCES

A.3 Program Activities

The Program's activities, operation and maintenance processes include device maintenance, network/facility security, network/software updates, communications coordination, system monitoring, and more.

A.3.1 ITS Maintenance

Maintenance processes include proactive procedures to keep the ITS system operating efficiently, including periodic testing, repairs, preventive maintenance, device replacement, and more. MDOT's ITS maintenance contractor is responsible for limiting the amount of "down" time devices experience. This consists of minimizing the amount of time a device is unusable by TOC operators due to circumstances such as power loss, communications loss, and device malfunction.

A.3.2 Asset Management

The MDOT ITS Asset Management Database (AMD) is the online system used by the Program to monitor and maintain the deployed ITS devices in the following ways.

- System Inventory: the AMD displays the location of devices using a graphical interface as shown in Figure A-13.
- System Performance: MDOT uses the database to run reports and monitor overall device function. A dashboard displays device statistics, such as device uptime.
- Work Orders: MDOT's TOC operators use the database to create and track work orders for devices that require maintenance. Maintenance contractors are notified when a new work order is created by a TOC operator and provide updates when device maintenance is complete. A dashboard displays the average work order response time, open work orders by device type, and open or completed work orders.
- Spare Parts Inventory: the AMD features a spare parts inventory to catalogue spare ITS parts and devices. Spare parts and devices are tracked by their physical storage location, such as warehouse or maintenance truck. When a part is replaced at a site as part of a work order, the part or device is transferred from the warehouse or truck to the site, and tracked through the work order.
- Planning Tool: the AMD features a planning function to input future "planned" ITS infrastructure and estimate capital and recurring costs by device type.

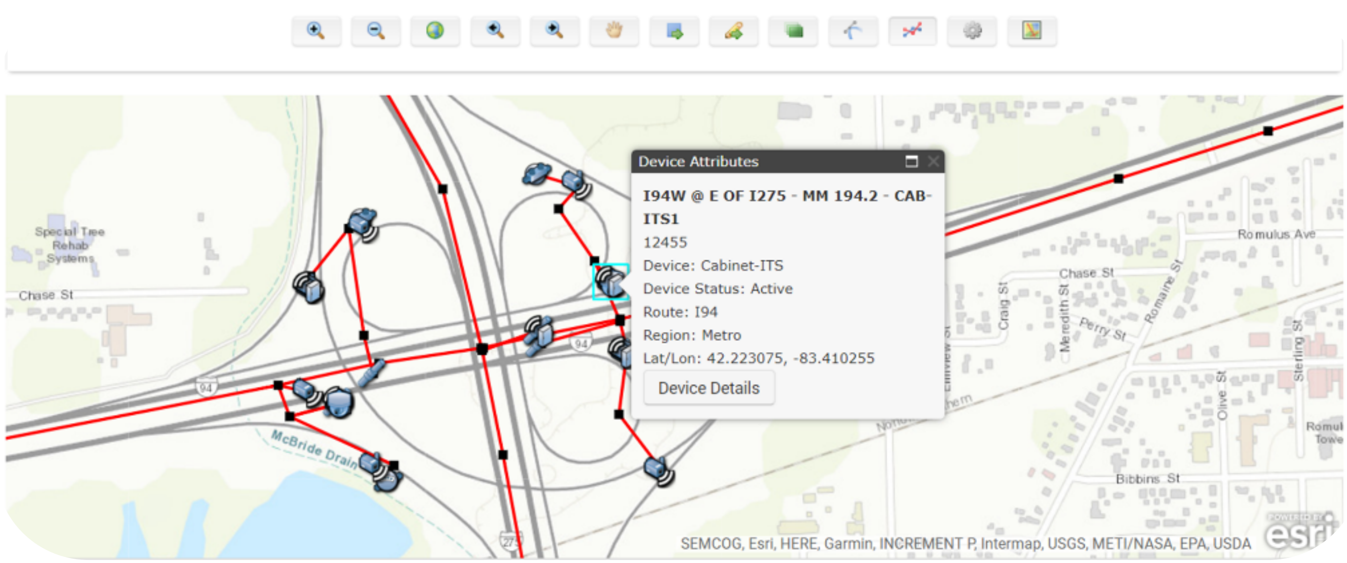


FIGURE A-13. MAPPING COMPONENT OF THE AMD

A.3.3 Developing and Maintaining Standards

One of the many responsibilities of the IPO is to develop, maintain, and update the standards for design and construction of ITS facilities on Michigan roadways. Frequently used special provisions are updated on an annual basis while project specific and previously approved special provisions are reviewed and updated on a project-by-project basis. The ITS standard details for construction are updated as standards in the industry change or issues arise in construction that necessitate a change to the detail. The IPO also reviews and approves project-specific and new ITS standard details.

Additionally, the IPO is responsible for establishing, maintaining, and updating the design standards for ITS projects. This includes items such the number and size of conduit, the size of hand hole to be used based on the intended use of the conduit, ITS cabinet size, etc. These design standards are updated periodically to keep up with industry standards. MDOT's ITS standard details are provided here.

A.3.4 ITS Architecture

ITS architecture provides a definitive and consistent framework to guide the planning and deployment of ITS. The National ITS Architecture provides structure and guidance for regions to develop customized ITS architectures. These customized ITS architectures enable a regional approach transportation challenges by bridging together stakeholders, needs, and solutions for ITS projects. The ITS architecture represents a long-range, shared vision between agencies on how to integrate information and resources to provide solutions that help move travelers through the region safely and efficiently. ITS projects that utilize federal funds are required to conform to the regional ITS architecture. MDOT's current Regional ITS Architectures and Deployment plans are provided here.

The Program's goal is to implement an architecture update every 5 to 7 years that focus on the following:

- Format changes – conforming the Target Region ITS Architecture with the National ITS Architecture
- Content update – adding or revising agency names and inventory statuses, revising current stakeholder relationships, and identifying new stakeholders and their relationships
- Project confirmation – confirming completed projects have been incorporated into the regional ITS architecture and identifying upcoming short-term projects (5-6 years) conform to the regional ITS architecture

The Regional ITS Architecture Conformance and Maintenance Documentation Form (MDOT Form 2560) must be completed for ITS projects (provided here).

A.4 Collaboration and Communication Efforts

The Program enhances its effectiveness through collaboration and communication through intra- and inter-departmental coordination and inclusion of stakeholders and other ITS-related organizations.

A.4.1 MDOT Initiative Support

As emerging transportation technologies become more commonplace, the Department relies on the Program to play an integral role. A few MDOT initiatives are provided below.

TSMO

MDOT's TSMO initiative is adding advanced transportation technologies and partnerships to provide efficient commutes, clear routes, safer construction zones, easier-to-use traveler information, fewer wasted gallons of gas, and cost-effectively reduce congestion, increase safety and provide Michigan residents with measurable benefits.

TOWARD ZERO DEATHS (TZD)

MDOT's TZD campaign is focused on improving safety of Michigan's roadways with an ultimate vision of eliminating traffic fatalities. MDOT uses DMS to display fatal statistics as an eye-opening tactic to highlight the importance of focused driving. In addition, emerging transportation technologies are the path to drastically reducing fatal crashes that are a result of driver behavior. Over 1,000 fatalities occurred on Michigan's roadways in 2016.

A.4.2 Inter-Departmental Coordination

Inter-departmental coordination is typically required in support of new ITS deployments. This coordination is critical to ensure the project receives the appropriate approvals to avoid schedule delays.

DTMB	The Department of Technology, Management, and Budget (DTMB) maintains the State of Michigan network. DTMB administers MDOT's ATMS software, including enhancements and upgrades to the software. Coordination with DTMB occurs primarily when new devices are being integrated into the MDOT ITS network. DTMB's Office of Infrastructure Protection is responsible for security measures and management of emergency situations in all DTMB-managed facilities, including the MDOT ITS Network. Security for the MDOT ITS network is strategically established through a system of firewalls and safety measures maintained by DTMB.
FHWA	The Federal Highway Administration (FHWA) requires ITS projects that are federally funded to be in conformity with a regional ITS architecture and follow the Systems Engineering process. FHWA's systems engineering process provides guidance for planning, designing, and implementing ITS projects.
FCC	The Federal Communications Commission (FCC) provides primary authority for communications law, regulation and technological innovation. The FCC allocated the 5.9 GHz band to the auto industry in 1999 and established licensing requirements for DSRC and ITS projects utilizing the 5.9 GHz band. The Program must coordinate with the FCC for any communications methods which require use of the 5.9 GHz band. FCC licensing is required to operate a radio on a licensed frequency.
FAA	The Federal Aviation Administration (FAA) requires Notice of Proposed Construction or Alteration (FAA Form 7460-1) to be submitted if proposed structures meet the defined factors on height, proximity to an airport, location, frequencies emitted from the structure, and other items. The Program must coordinate with the FAA if any ITS structures meet these factors to verify that construction is permitted.

A.4.3 Industry Participation and Leadership

MDOT participates in a number of industry and trade organizations, with leadership roles in many of them. The list of organizations with MDOT participation includes but is not limited to:

- SAE Standards
- V2I Deployment Coalition
- Connected Vehicle PFS
- IOO/OEM Forum
- AASHTO Special Committee on Wireless Communications Technology
- TIA Michigan
- National Operations Center of Excellence (NOCE)
- ITS Program Advisory Committee to USDOT
- Engineering Society of Detroit
- NEC
- AASHTO AV Legislation
- ITE
- ITS America
- ASCE
- ISMA

Additionally, department staff are involved with several government sponsored programs like FHWA's Transportation Pooled Fund (TPF) Program and National Cooperative Highway Research Program (NCHRP) studies.

The TPF Program allows federal, state, and local agencies and other organizations to combine resources to support transportation research studies. One such effort is the *ENTERPRISE Pooled Fund Study*, which includes Illinois DOT, Iowa DOT, Kansas DOT, Michigan DOT, Minnesota DOT, Ontario (MTO), Pennsylvania DOT, Texas DOT, and Transport Canada. The main purpose is to use the pooled resources of its members and partners to develop, evaluate and deploy ITS. Recent studies completed in 2017 include but are not limited to: assessing speed data for traffic management, automated classification of winter road conditions, communications to support rural ITS, and real-time integration of arrow board messages.

A.4.4 Michigan Partner Support

The Program actively partners with several Michigan initiatives, programs, organizations, and other stakeholders to promote safe, efficient, and reliable roadways. A few example partnerships are provided below.

PLANETM	MEDC's PlanetM initiative is a partnership of mobility organizations, communities, educational institutions, research and development, and government agencies working together to develop and deploy the mobility technologies driving the future.
UMTRI	The University of Michigan Transportation Research Institute (UMTRI) is dedicated to achieving safe and sustainable transportation for a global society. With a multimillion-dollar research program, broad faculty expertise, and multiple collaborators, UMTRI is committed to interdisciplinary research that will ultimately increase driving safety and further transportation systems knowledge. UMTRI and MDOT have partnered on several initiatives such as: integrated mobile operations (IMO), truck parking information and management system, ATMS evaluation, etc. In addition, UMTRI houses the Center for Connected and Automated Transportation (CCAT). The center's goal is to gain a better understanding of future transportation needs and challenges through research, science, education, training, and deployment of connected and automated transportation.
MCITY	Mcity is a 32- acre site on the campus of University of Michigan and is the first purpose-built CAV test facility with simulated urban and suburban driving environments. MDOT worked closely with the University of Michigan on the design of the Mcity Testing Facility, for testing connected and automated vehicle systems, and provided funding to support construction of the facility. In addition, MDOT and U-M work closely on the development and implementation of connected vehicle test beds in Southeast Michigan which will provide a platform for research involving vehicle-to-vehicle and vehicle-to-infrastructure communications on highways across the region. MDOT's Director is a member of the executive board.
ACM	The American Center for Mobility (ACM), currently under development, will be a purpose-built facility focused on testing, verification and self-certification of connected and automated vehicles technologies at the 335-acre historic Willow Run site in Ypsilanti Township in Southeast Michigan. ACM has a collaborative approach that brings together private industry, government, and institutions of higher learning. One of the objectives of this U.S. DOT designated proving ground is to provide a variety of real-world environments under controlled conditions. The first phase included construction of a 2.5 mile highway loop, 700-foot curved tunnel, two double overpasses and exit/entrance ramps. Future phases of construction may include urban, rural, commercial, residential, and off-road driving environments.

SMART BELT COALITION	The Smart Belt Coalition is a collaboration in the ongoing development of connected and automated vehicles. The coalition consists of transportation agencies and academic institutions in Michigan, Ohio, and Pennsylvania.
CAR	An independent, non-profit organization producing industry-driven research and fostering dialogue on issues facing the automotive industry.
MTC	The Mobility Transformation Center (MTC) is building on a two-year deployment of approximately 3,000 vehicles to create a major V2V deployment of 9,000 vehicles in Ann Arbor. The Center is working with MDOT and industrial partners to provide sufficient V2I infrastructure in SE Michigan to support an unprecedented deployment of 20,000 connected vehicles.
OCCVTF	The OCCVTF was launched in 2014 to work with companies and stakeholders in automotive technology to create a business model for investing in connected vehicle technology and connected vehicle infrastructure.
ITS MICHIGAN	The Intelligent Transportation Society of Michigan (ITS Michigan) is dedicated to improving the safety, security and efficiency of the state's transportation system for the traveling public through the deployment of Intelligent Transportation Systems (ITS).

A.4.5 Public Outreach

There are many ways that MDOT provides information to the public. One of these methods of communication is the MDOT website, which provides information to both the public and companies looking to do business with MDOT. The site contains pages which are devoted to connected vehicle and ITS (www.michigan.gov/its).

MIDRIVE

MDOT's MiDrive is a traffic and construction information resource center for driving Michigan's roads. The MiDrive tool is provided to the public via the MiDrive website. As of February 2018, the Mi Drive mobile app has been discontinued. Th MiDrive website provides real time traffic and construction information, as well as live feeds from surveillance cameras statewide. MiDrive users can select several layers of information to display including incidents, snowplows, truck parking, carpool lots, CCTV camera views, DMS messages, and several additional levels as shown in Figure A-14. These selectable levels allow the user to personalize their experience and display only relevant information.

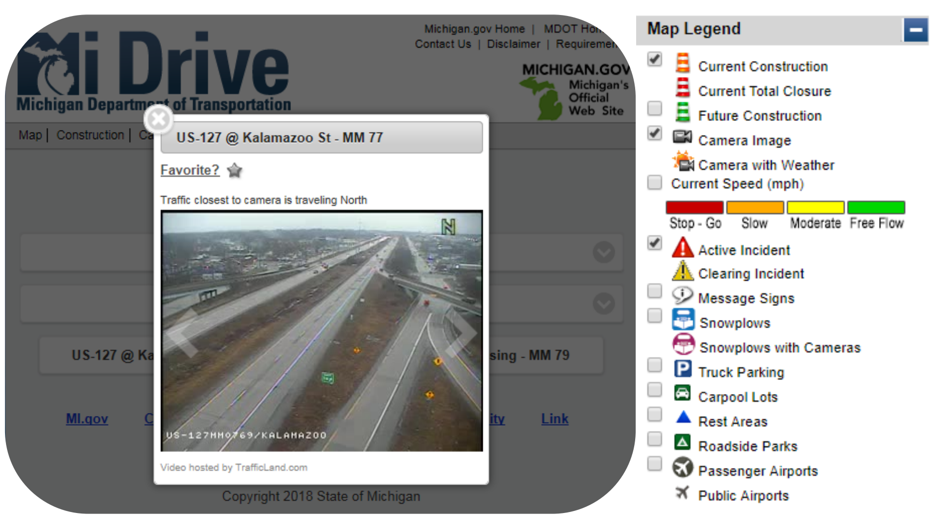


FIGURE A-14. MIDRIVE CAMERA VIEW AND LEGEND

A.4.6 Video Sharing

MDOT has partnered with Skyline Technology Solutions to share CCTV video streams within the Department as well as with other media, first responders, local partners, and web/mobile applications. The video sharing platform normalizes and distributes a streaming solution that is scalable, secure, and reliable. In addition to streaming video sharing, Michigan's CCTV cameras can be viewed on MiDrive via the web or mobile device.

A.4.7 Data Sharing

The Waze Connected Citizens Program (CCP) is a free, two-way data exchange empowering municipal decisions to achieve concrete community impact. Initially launched in October 2014 with 10 city partners, MDOT joined the expanded program in 2017 which now includes over 450 partners including city, state and country government agencies, nonprofits and first responders. The goals of the data exchange are to support data-driven infrastructure decisions, reduce congestion, increase efficiency of incident response, and quickly know what is happening on MDOT's roads.