

Intelligent Transportation Systems Technical Report Summary



Background

What is an Intelligent Transportation System?

An Intelligent Transportation System (ITS) improves transportation safety and mobility and enhances productivity through the use of advanced communications technologies. It encompasses a broad range of wireless and wire line communications-based information and electronic technologies. When integrated into the transportation system's infrastructure, and in vehicles themselves, these technologies relieve congestion, improve safety and enhance American productivity. The system is made up of 16 types of technology based systems. These systems (application areas) are divided into intelligent infrastructure systems and intelligent vehicle systems.

Intelligent Infrastructure

- ❖ Arterial Management
- ❖ Freeway Management
- ❖ Transit Management
- ❖ Traffic Incident Management
- ❖ Emergency Management
- ❖ Electronic Payment and Pricing
- ❖ Traveler Information
- ❖ Information Management
- ❖ Crash Prevention and Safety
- ❖ Roadway Operations and Maintenance
- ❖ Road Weather Management
- ❖ Commercial Vehicle Operations
- ❖ Intermodal Freight

Intelligent Vehicles

- ❖ Collision Avoidance Systems
- ❖ Driver Assistance Systems
- ❖ Collision Notification Systems

Definitions

The following application area definitions were obtained from the Intelligent Transportation Systems Joint Program Office website, located within the U.S. Department of Transportation Research and Innovative Technology Administration. The definitions provide a brief overview of the 16 types of technology based systems.

Arterial Management

Arterial management systems manage traffic along arterial roadways, employing traffic detectors, traffic signals, and various means of communicating

information to travelers. These systems make use of information collected by traffic surveillance devices to smooth the flow of traffic along travel corridors.

Freeway Management

Motorists are now able to receive relevant information on location specific traffic conditions in a number of ways, including dynamic message signs, highway advisory radio, in-vehicle signing, or specialized information transmitted only to a specific set of vehicles.



Courtesy of the Genesee County Road Commission

Transit Management

Transit ITS services include surveillance and communications, such as automated vehicle location (AVL) systems, computer-aided dispatch (CAD) systems, and remote vehicle and facility surveillance cameras, which enable transit agencies to improve the operational efficiency, safety, and security of the nation's public transportation systems.

Traffic Incident Management

These systems can reduce the effects of incident-related congestion by decreasing the time to detect incidents, the time for responding vehicles to arrive, and the time required for traffic to return to normal conditions.

Emergency Management

ITS applications in emergency management include hazardous materials management, the deployment of emergency medical services, and large and small-scale emergency response and evacuation operations.

Electronic Payment and Pricing

These systems employ various communication and electronic technologies to facilitate commerce between travelers and transportation agencies, typically for the purpose of paying tolls and transit fares. Pricing refers to charging motorists a fee or toll that varies with the level of demand or with the time of day.

Traveler Information

Traveler information applications use a variety of technologies, including Internet websites, telephone hotlines, as well as television and radio, to allow

users to make more informed decisions regarding trip departures, routes, and mode of travel.

Information Management

ITS information management supports the archiving and retrieval of data generated by other ITS applications and enables ITS applications that use archived information. Decision support systems, predictive information, and performance monitoring are some ITS applications enabled by ITS information management. In addition, ITS information management systems can assist in transportation planning, research, and safety management activities.

Crash Prevention and Safety

Crash prevention and safety systems detect unsafe conditions and provide warnings to travelers to take action to avoid crashes. These systems provide alerts for traffic approaching at dangerous curves, off ramps, restricted overpasses, highway-rail crossings, high-volume intersections, and also provide warnings of the presence of pedestrians, and bicyclists, and even animals on the roadway.

Roadway Operations and Maintenance

ITS applications in operations and maintenance focus on integrated management of maintenance fleets, specialized service vehicles, hazardous road conditions remediation, and work zone mobility and safety. These applications monitor, analyze, and disseminate roadway and infrastructure data for operational, maintenance, and managerial uses. ITS can help secure the safety of workers and travelers in a work zone while facilitating traffic flow through and around the construction area.

Road Weather Management

Road weather management activities include road weather information systems (RWIS), winter maintenance technologies, and coordination of operations within and between state DOTs. ITS applications assist with the monitoring and forecasting of roadway and atmospheric conditions, dissemination of weather-related information to travelers, weather-related traffic control measures such as variable speed limits, and both fixed and mobile winter maintenance activities.

Commercial Vehicle Operations

ITS applications for commercial vehicle operations are designed to enhance communication between motor carriers and regulatory agencies. Examples

include electronic registration and permitting programs, electronic exchange of inspection data between regulating agencies for better inspection targeting, electronic screening systems, and several applications to assist operators with fleet operations and security.

Intermodal Freight

Intermodal Freight ITS can facilitate the safe, efficient, secure, and seamless movement of freight. Applications being deployed provide for tracking of freight and carrier assets such as containers and chassis, and improve the efficiency of freight terminal processes, drayage operations, and international border crossings.

Collision Avoidance Systems

To improve the ability of drivers to avoid accidents, vehicle-mounted collision warning systems (CWS) continue to be tested and deployed. These applications use a variety of sensors to monitor the vehicle's surroundings and alert the driver of conditions that could lead to a collision. Examples include forward collision warning, obstacle detection systems, and road departure warning systems.

Driver Assistance Systems

Numerous intelligent vehicle technologies exist to assist the driver in operating the vehicle safely. Systems are available to aid with navigation, while others, such as vision enhancement and speed control systems, are intended to facilitate safe driving during adverse conditions. Other systems assist with difficult driving tasks such as transit and commercial vehicle docking.

Collision Notification Systems

Collision notification systems have been designed to detect and report the location and severity of incidents to agencies and services responsible for coordinating appropriate emergency response actions. These systems can be activated



Source: its.dot.gov

manually (Mayday), or automatically with automatic collision notification (ACN), and advanced systems may transmit information on the type of crash, number of passengers, and the likelihood of injuries.

Advancements in Technology

Technology is rapidly altering how transportation officials and transit service providers improve operation efficiency and safety in real-time. New and innovative technologies are integrated into both personal vehicles and devices, improving the overall traveler experience. Some of the new technologies are listed below:

Transit ITS

❖ Computer Aided Dispatch

Computer Aided Dispatch (CAD) systems are a way in which dispatch can communicate efficiently, in real time, with their entire fleet. "It allows dispatchers to quickly look up driver schedules, send text messages to drivers, and track the roadworthy status of every vehicle" (trapezegroup.com).

❖ Automatic Vehicle Location

The Automatic Vehicle Location (AVL) systems enable transit agencies to easily monitor and collect data on their fleet's location and performance. This data is translated into real-time bus arrival information for passengers, and an improved perception of transit reliability. The system is practical, time-saving, and increases schedule adherence. If the system was linked to other systems, potential uses may include tracking where traffic delays are occurring on highways since multiple transit vehicles are using the network.

❖ Automatic Passenger Counter

The Automatic Passenger Counter (APC) technology supplies precise ridership data directly from the vehicle to the dispatch center's database. APCs use wireless, infrared sensor technology to collect the necessary counts, reducing time and money spent. This is an important tool from a planning standpoint because population distribution can be revealed through the ridership data collected.

Highway ITS

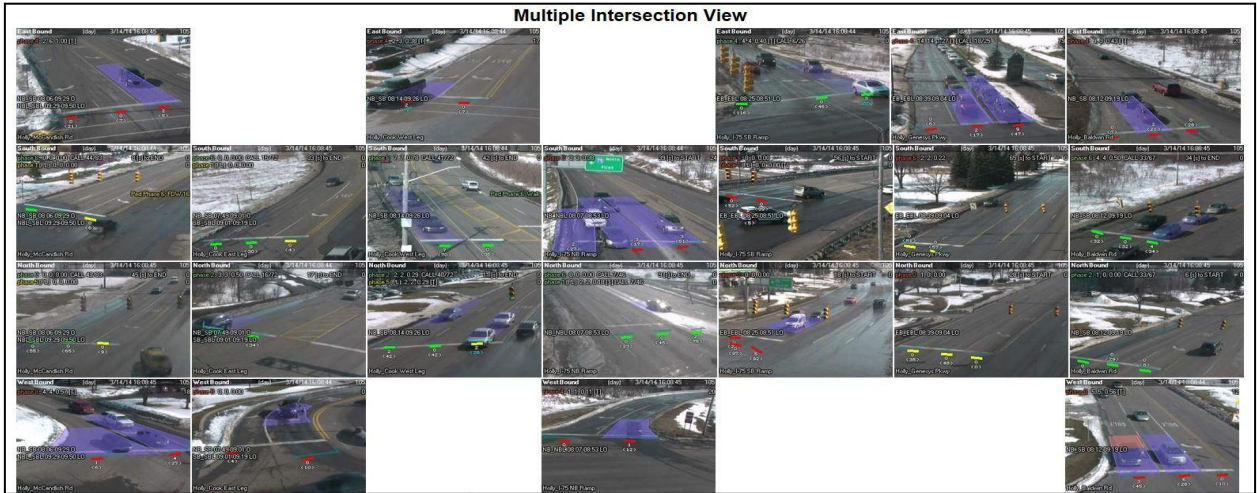
❖ Dynamic Message Signs

Dynamic Message Signs (DMS) allow ITS operators to share information collected from associated freeway management technologies. DMS

helps alert travelers of traffic congestion, accidents, travel time, construction, speed limits, and much more.

❖ Adaptive Signal Control Technologies

The Adaptive Signal Control Technologies (ASCT) accommodates current traffic patterns to promote smooth flow and ease traffic congestion. Other benefits include reduction in fuel consumption and travel time reliability. The Genesee County Road Commission (GCRC) has installed the InSync Adaptive Traffic Signal Control System into 7 intersections along Holly Road in Genesee County. As seen below, this system detects and collects vehicle data by processing video images and automatically optimizing the changing of traffic signals to instantly adapt to real time traffic demand.



Courtesy of the Genesee County Road Commission

❖ Public Information

In the past decade there has been a significant increase in public access to ITS. Drivers have access to current conditions (weather, road, emergency) through the use of innovative wireless applications. Traveler information programs may use in-vehicle devices to display traveler information or a variety of roadside technologies, such as dynamic message signs and highway advisory radio.

Consumer Technologies

In recent years, advancements in technology have improved traveler safety, awareness and the way in which consumers can access real-time information. Access to the internet has opened up choices and opportunities for interested consumers. Along with ease



Source: its.dot.gov

of access, many ITS technologies can be purchased and used by consumers without control by governmental agencies. More common technology seen on the roads today include vehicles with safety-related ITS components. A reduction in vehicle accidents can be accounted for by such technologies as vehicle-to-vehicle communication. The Intelligent Transportation Systems Joint Program Office states that "vehicle-to-vehicle (V2V) communication exchanges anonymous, vehicle-based data regarding position, speed, and location to sense threats and hazard". Overall, this technology will change the way individuals receive and use real-time information.

Intelligent Transportation System Plans

There are currently two ITS plans that serve Genesee County: The Michigan Department of Transportation (MDOT) Bay Region ITS Plan and the Flint Mass Transportation Authority (MTA) ITS Implementation Plan.

MDOT Bay Region ITS Architecture and Deployment Plan

The Bay Regional ITS Architecture and Deployment plan provides a guide for development in the Michigan Department of Transportation (MDOT) Bay Region and ensures compatibility of the regional system. The Bay Region includes Tuscola, Sanilac, Saginaw, Midland, Lapeer, Isabella, Huron, Gratiot, Gladwin, Genesee, Clare, Bay and Arenac Counties. The regional focus of this plan allows it to improve traffic operations through the region as a whole rather than focusing on details in each county. The MDOT Regional Plan is the overarching document for ITS Architecture in any given region. Project conformance to the regional ITS architecture is a requirement for any agency in the region to be eligible for federal funding of an ITS project.

Genesee County Metropolitan Planning Commission (GCMPC) staff was involved in the previous development of the Bay Region ITS plan to ensure regionally significant projects in Genesee County were included in the plan and that the regional system would be compatible with the plans in Genesee County. Most recently, MDOT has begun an administrative update to the Bay Regional Architecture and Deployment Plan and has asked for GCMPC staff to participate and contribute where possible. The updated version is expected to be complete in the fall of 2014.

Flint Mass Transportation Authority ITS Implementation

The Flint Mass Transportation Authority (MTA) has worked diligently to identify and adopt appropriate Intelligent Transportation System solutions to improve the effectiveness and efficiency of transit service in and around Genesee County. The 2005 *Intelligent Transportation System Architecture and Deployment Plan* is a

major initiative by the MTA to plan short and long-term approaches to deploying Intelligent Transportation Systems technologies.

In recent years, MTA has made significant progress with the installation of transit management techniques including computer aided dispatch (CAD) equipment and automatic vehicle location (AVL) components. Additionally, all MTA vehicles both paratransit and fixed route are equipped with Mobile Data Terminals (MDTs). Currently paratransit vehicles are using this technology, while fixed route setup and testing will occur through 2014. The MTA's wireless internet, phone, and radio systems operate on 3 frequencies (450, 800, & 900 MHz) provided by their communications tower. This utility serves point-to-point contact connections to all service centers owned by MTA in Genesee County. The MTA's most recent ITS projects also utilize the tower's services and other local municipalities and agencies have the option to improve ITS communications by leasing space on the tower.

At the end of 2013, an Enterprise Asset Management (EAM) system was introduced and will soon be fully integrated for the purchasing and finance departments. EAM software allows agencies to service their fleet by electronically keeping track of parts, services, and labor to have a more efficient and effective maintenance department. In fiscal year 2014, both an Interactive Voice Response (IVR) system and a Network Video Recording (NVR) system will be installed on transit vehicles. These ITS upgrades will help improve overall data collection, transit scheduling, and passenger security. In the summer of 2014, the MTA will begin a technology assessment plan to determine the future course of MTA technology based on current need and future demand in service.

Historic ITS Projects in Genesee County (prior to 2010)

Agency	Project
City of Flint	Downtown Signal Replacement & Interconnect
GCRC	Miller Rd - Dye to Ballenger (Signal Modernization)
MDOT	I-75 off ramp @ Bristol Rd (Signal Modernization)
MDOT	M-15 @ Flint Street (Signal Modernization)
MDOT	M-57 (M-54 to Nichols - Signal Interconnect)
GCRC	Genesee & Linden Rd Locations (Signal Modernization)
GCRC	Bray/Stanley (Signal Modernization)
GCRC	Carpenter Rd @ Selby & Detroit St (Signal Modernization)
MDOT	M-15 (Hegel to Main St. - Signal Optimization)
City of Flint	Saginaw St. (Saginaw St. Signal Interconnect)
City of Flint	Ballenger Hwy. (Signal Optimization from Miller Rd. to Welch)
MDOT	M-57 (Signal Modernization & Interconnect, M-54 to Nichols Rd.)
City of Grand Blanc	Saginaw Street Corridor - Signal Modernization, Interconnect and Optimization
GCRC	Pierson Rd. – Signals - Elms Rd. to Clio Rd. - Signal Modernization, Interconnect and Optimization
GCRC	Hill Road – Signals - Torrey Rd to Saginaw Rd - Signal Modernization, Interconnect and Optimization
MDOT	M-54 Signals – Saginaw to Mt. Morris Rd. – Signal Modernization, Interconnect and Optimization
MDOT	M-21 – Signals - Morrish Rd. to Ballenger Hwy. - Signal Modernization, Interconnect and Optimization
MTA	Acquire Support equipment – ITS Deployment

Recently Completed ITS Projects in Genesee County

Agency	Project
City of Fenton	Signal Timing (Owen Rd.)
City of Mt. Morris	Signal Interconnect (Saginaw St./Mt. Morris Rd)
MDOT	M-21: Signal Optimization (M-13 to I-475)
MDOT	M-54: Signal Optimization (Grand Blanc Rd. to Clio Rd.)
GCRC	Hill Rd: Sensys detection equipment (I-75 to Dort Hwy.)
GCRC	Bristol Rd: 900 MHz Radio equipment, & Sensys detection equipment, upgraded to box span layouts & 12" signal heads – 13 intersections (Torrey Rd. to Dort Hwy.)

Recently Completed ITS Projects in Genesee County (continued)	
Agency	Project
City of Flint	Pierson Rd: Signal Modernization (Clio Rd. to MLK Jr. Ave.)
GCRC	Holly Rd: Wireless Interconnect (Baldwin Rd. to Grand Blanc City limits)
GCRC	Upgraded to box span layouts & 12" signal heads (Clio/Mt. Morris, Jennings/Pasadena, Pasadena/Lavelle, Beecher/Calkins, Flushing/Lavelle, Hill/Saginaw) – 6 intersections
GCRC	Holly Rd: Insync Traffic Adaptive equipment, upgraded box span layouts (Baldwin Rd. to McClandlish Rd.) – 7 intersections
GCRC	Genesee Rd: Wireless Radio Interconnect & upgrade to box spans (Richfield to Mt. Morris Rd.)- 6 intersections
MDOT	I-69: closed circuit TV (CCTV), Dynamic Message Signs (DMS), and Environmental Sensor Stations (ESS) (GC ITS System)
MTA	Automatic Vehicle Location & Passenger Counters
MTA	Computer Aided Dispatch Equipment
MTA	Dispatch Dual Monitors (location and performance)
MTA	Equipment and Asset Management System

Proposed ITS Projects

Agency	Project
MDOT	3 Dynamic Message Signs (DMS) at various locations along I-475 and I-69
MDOT	6 closed circuit TV (CCTV) cameras along I-75 and I-69
MDOT	Signal Modernization (I-69 @ M-54, I-69 @ Center Rd.)
MDOT	M-54: Signal Modernization (Court St. to Leith St.)
MTA	Interactive Voice Response and Network Video Recording
GCRC	Automatic data collection for permanent Traffic Count Stations (Bristol Rd, Hill Rd, Holly Rd, and Genesee Rd.)
MDOT	Genesee County: additional closed circuit TV (CCTV) cameras

Genesee County ITS Objective

The Genesee County ITS objective is to continue to collaborate with regional and statewide partners including the Michigan Department of Transportation, Flint Mass Transportation Authority, Genesee County Road Commission and other agencies to avoid duplication of efforts and to ensure integration of ITS systems. It is also the objective to encourage ITS components in the Transportation Improvement Program Call for Projects, Safety Call for Projects and Congestion Mitigation Air Quality Call for Projects.

Moving Ahead for Progress in the 21st Century Act (MAP-21)

ITS architectures satisfy the conformity requirements first established in the Transportation Equity Act for the 21st Century (TEA-21) highway bill and continued in the Moving Ahead for Progress in the 21st Century Act (MAP-21) bill passed in 2012.

Next Steps

As the integration of intelligent transportation systems increase in transportation infrastructure and vehicles, the Genesee County Metropolitan Planning Commission (GCMPC) staff will continue to be directly involved with any updates to ITS Architecture plans that serve Genesee County. This will ensure goals, objectives, and projects of the County stay current and consistent within the entire Bay Region.