TRB 2016 International Conference & Workshop on Winter Maintenance and Surface Transportation Weather

Connected Vehicle Winter Weather Maintenance Advanced Technologies/Management for Motorist Advisories and Warnings

Michigan Department of Transportation

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Learning Outcomes

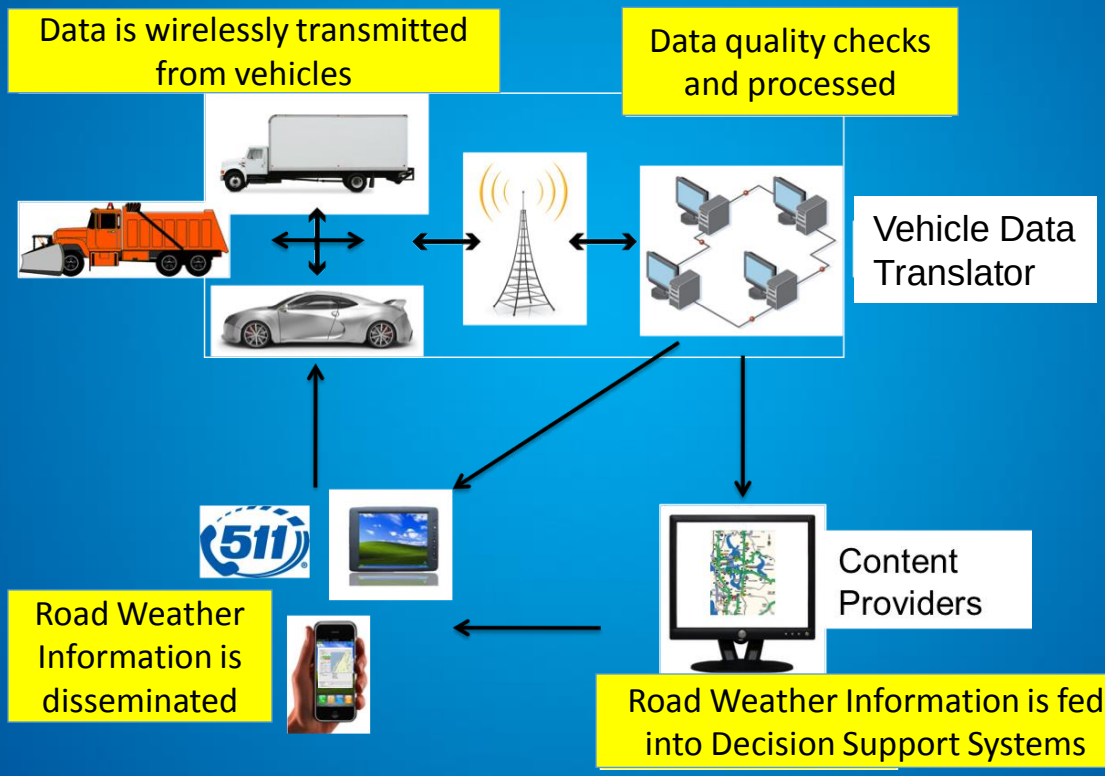
- Traveling Public Benefits
- Operations Users Benefits
- Maintenance Users Benefits

Federal Highway Administration (FHWA) Integrated Mobile Observations (IMO) Objectives

FHWA established several IMO objectives:

- Better understand how to capture, communicate, and process data from the vehicle's internal and external road weather sensors
- Identify uses for and incorporation of the data in new and existing applications
- Assess the impact and results of utilizing the data in applications
- Establish a sustainable infrastructure that can be an integrated with operational assets that will support an agencies data collection needs

FHWA Roadway Weather Management Project Description



FHWA IMO Project Partner DOTs

Goal: Exploring the feasibility of using vehicle-based data to improve transportation safety & mobility

Vehicles Used:

DOT Snow Plows

DOT Supervisor Trucks

DOT Safety Trucks

DOT seasonal high mileage vehicles

Minnesota DOT

- ~550 Vehicles
- Data
  - GPS
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Wiper Status
  - Brake Status
- DSRC & Cellular

Nevada DOT

- ~30 Vehicles
- Data
  - GPS
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Wiper Status
  - Maintenance Status
- DSRC, Radio & Cellular

Michigan DOT

- 15 - Vehicles
- Data
  - GPS
  - Air Temperature
  - Relative Humidity
  - Surface Temperature
  - Wiper Status
  - Camera image
  - Differential wheel speed
- DSRC, Cellular & WiFi

Winter Maintenance Operations

- Transportation Operations Centers (TOCs) & Messaging for Weather Information
- Traditional weather information (NWS, ASOS, AWOS, etc.)
- Roadway Weather Information System (RWIS)
- AVL/Maintenance Decision Support System
- IMO & WxTINFO Connected Vehicle for Weather Data
- Data Usage, Mapping and Messaging

MDOT/FHWA Integrated Mobile Observations (IMO) Project

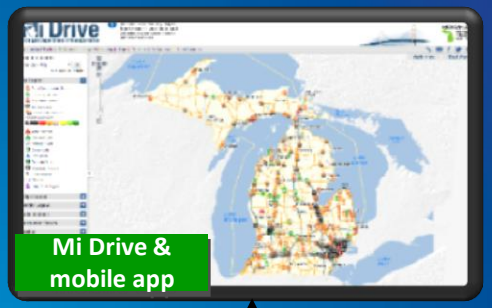
15 - IMO MDOT Vehicles

DSRC, cell, WiFi

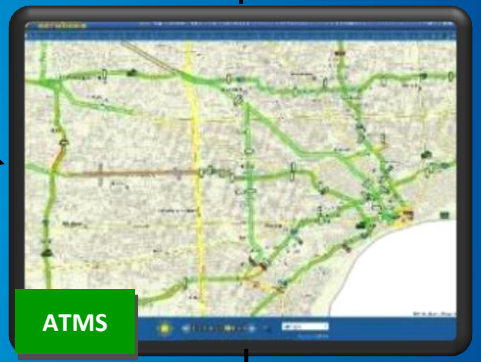
RSU

Communication Line

DUAP



Mi Drive & mobile app



ATMS

DMS

IMO 3 Vehicle Files Forwarded

IMO 3 DSRC Files Forwarded

RWIS

Other Weather

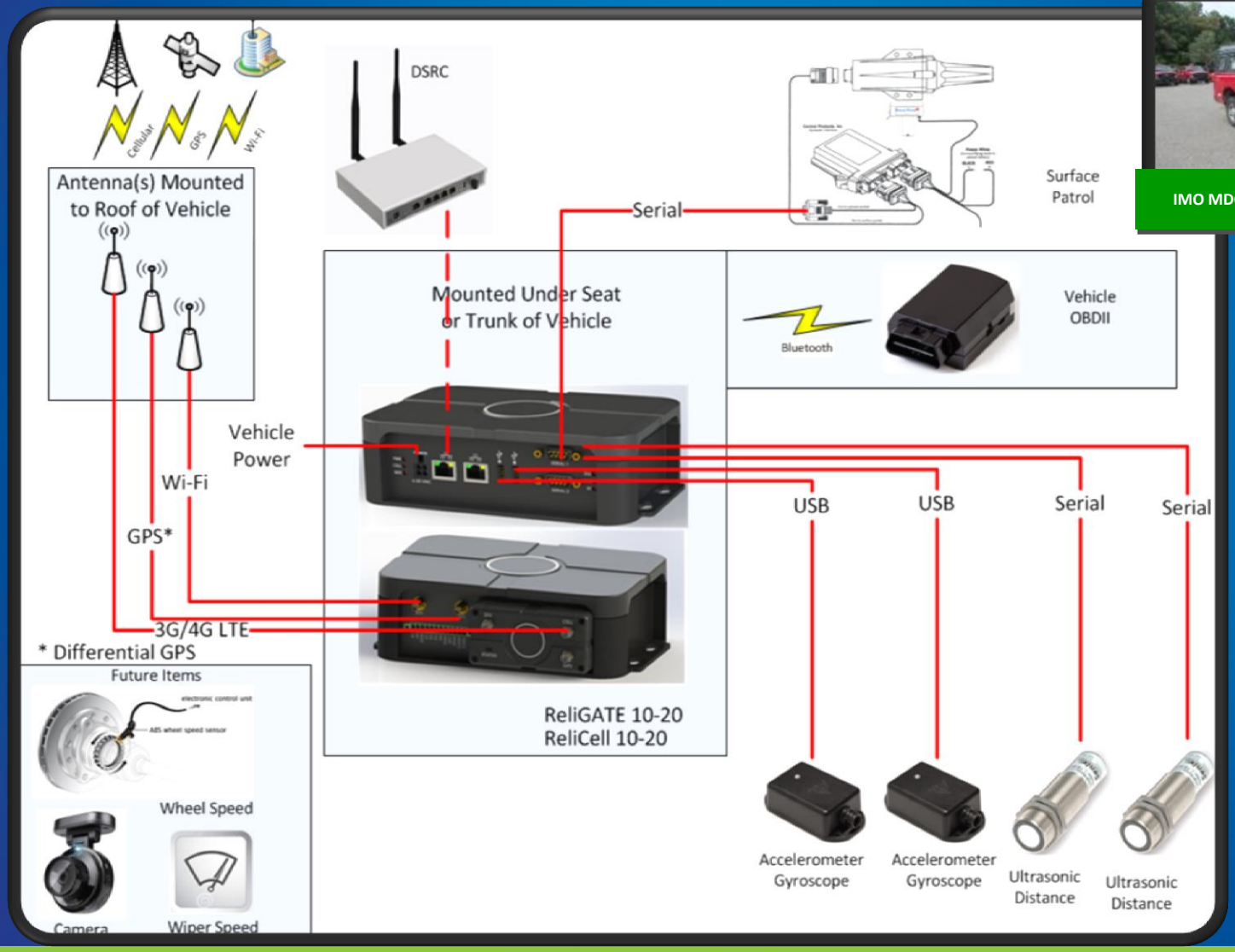
USDOT Data Warehouse

NCAR/VDT Server

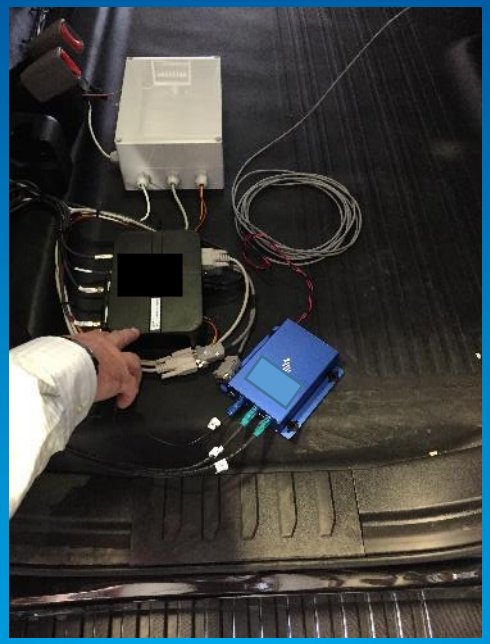
MDOT/FHWA Integrated Mobile Observations (IMO) Project - Data Collection

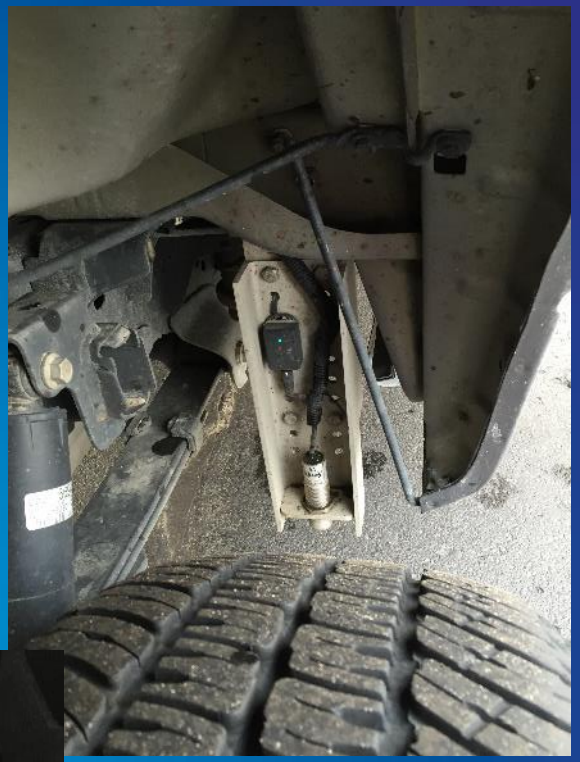
- 15- MDOT vehicles (Ford F150) equipped with a mobile data acquisition platform
- Data collected
  - Accelerometer readings
  - Latitude
  - Longitude
  - Altitude
  - GPS Speed
  - Surface temperature
  - Ambient temperature
  - Humidity
  - Dew point
  - Images
  - Wheel speed (x4)
  - CANBus

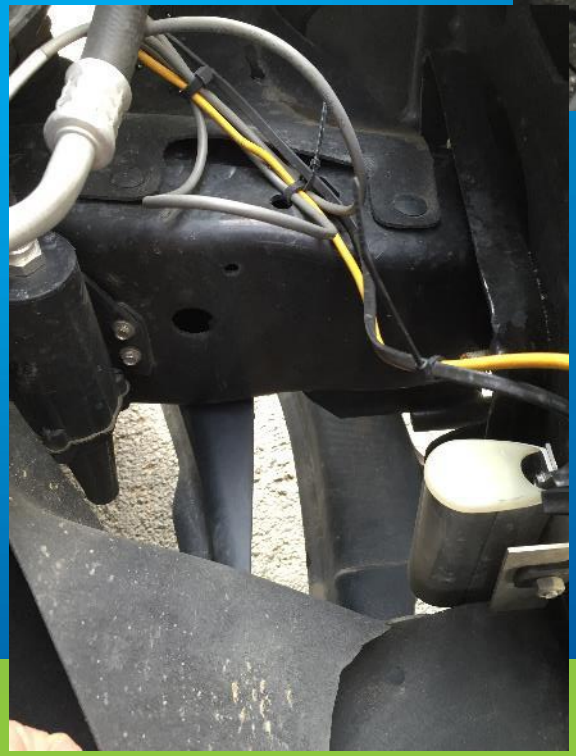
MDOT Vehicle Data Collection Description



IMO MDOT Vehicles



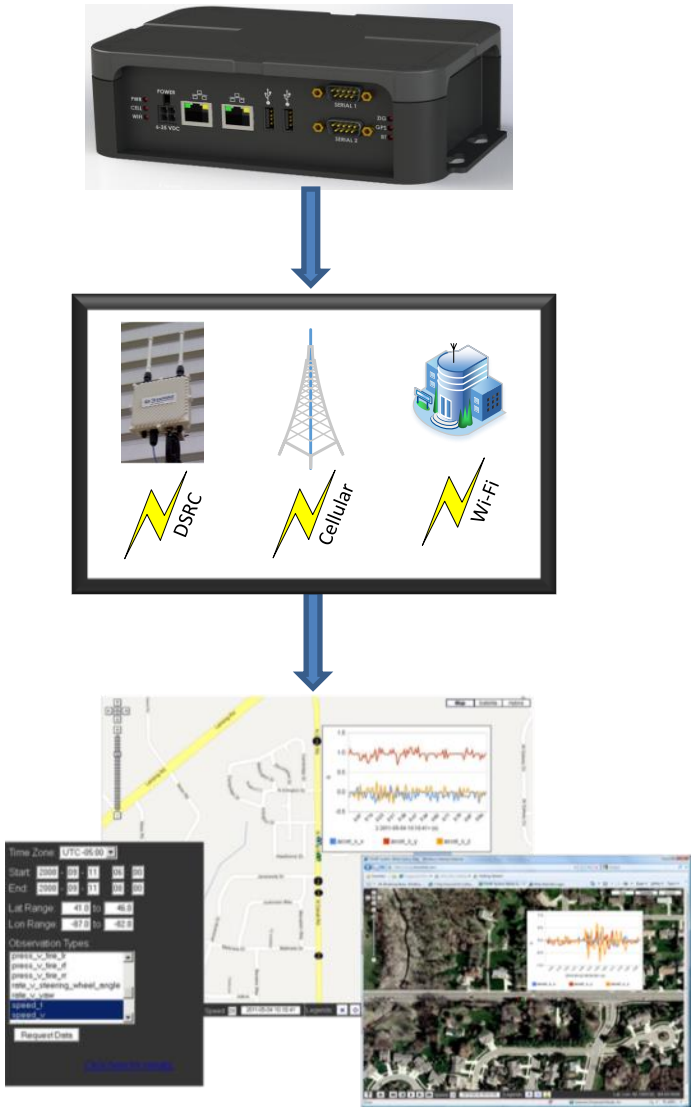


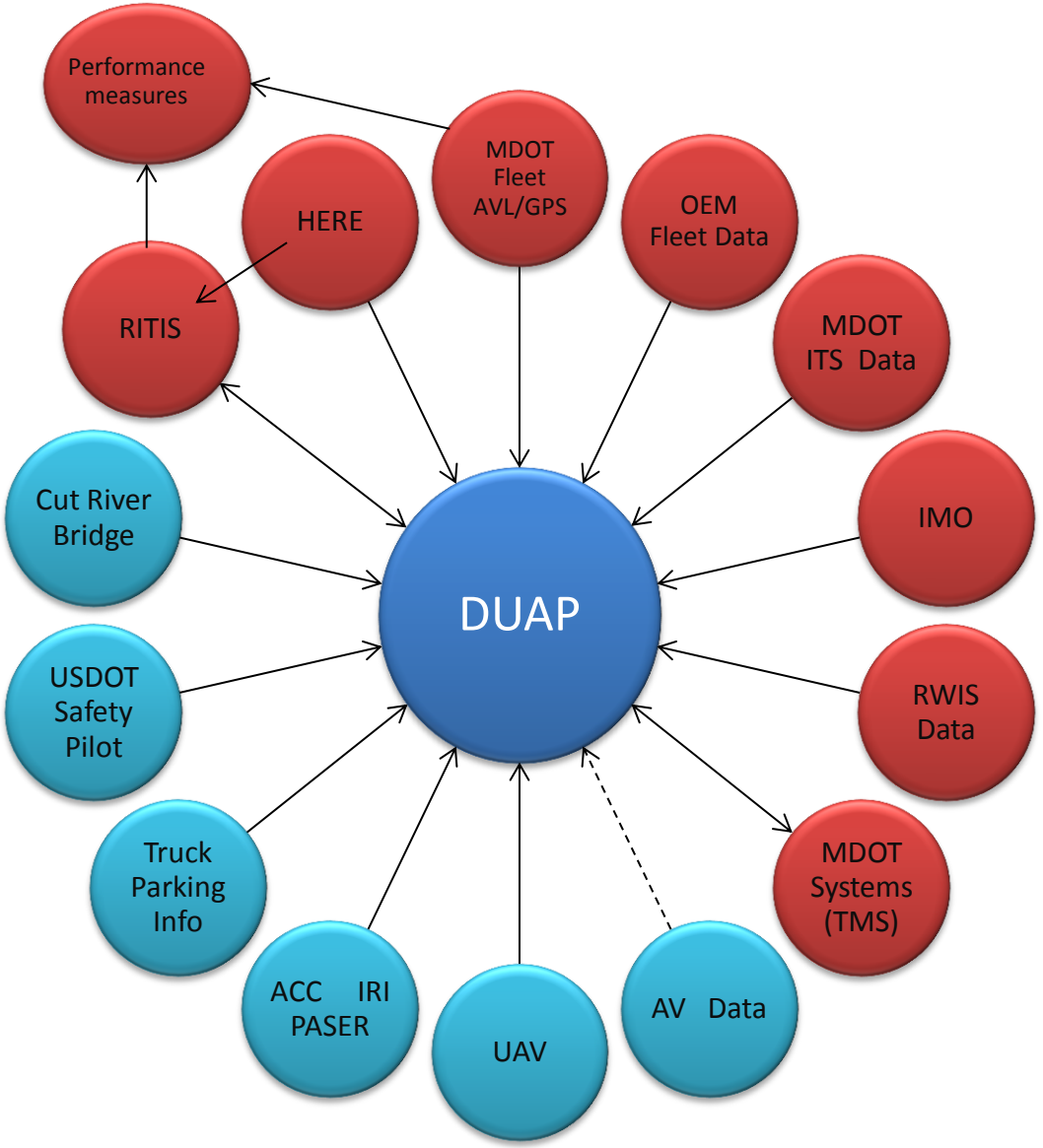


FHWA/MDOT Weather Response Traveler Information System (Wx-TINFO) Project Objectives

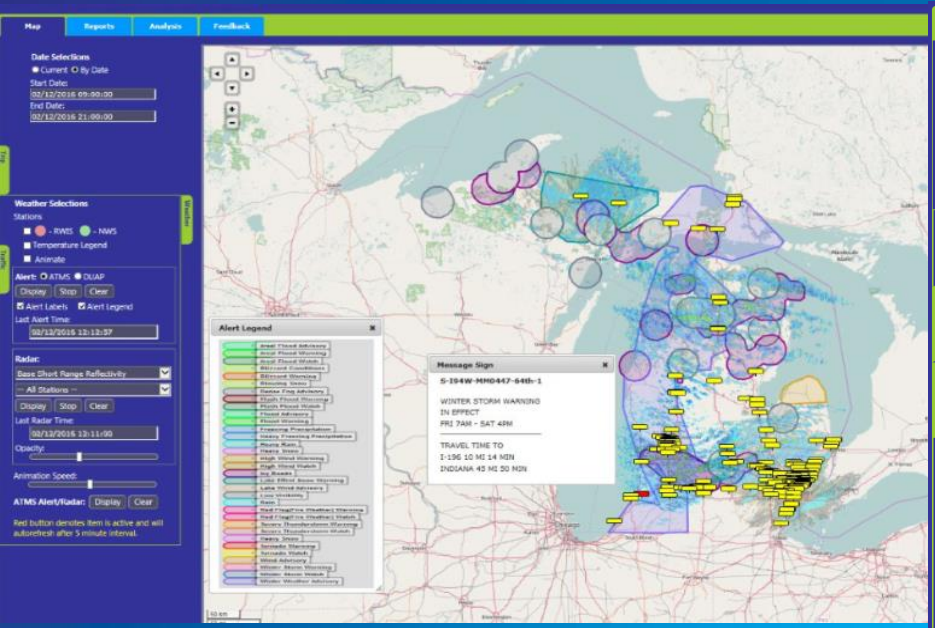
- Wx-TINFO project designs a system that brings together near-real time environmental/weather related data collected from both fixed and mobile data sources and develops motorist advisories and warnings
- The information is made available to the traveling public via roadside dynamic message signs (DMS) and a traveler information website

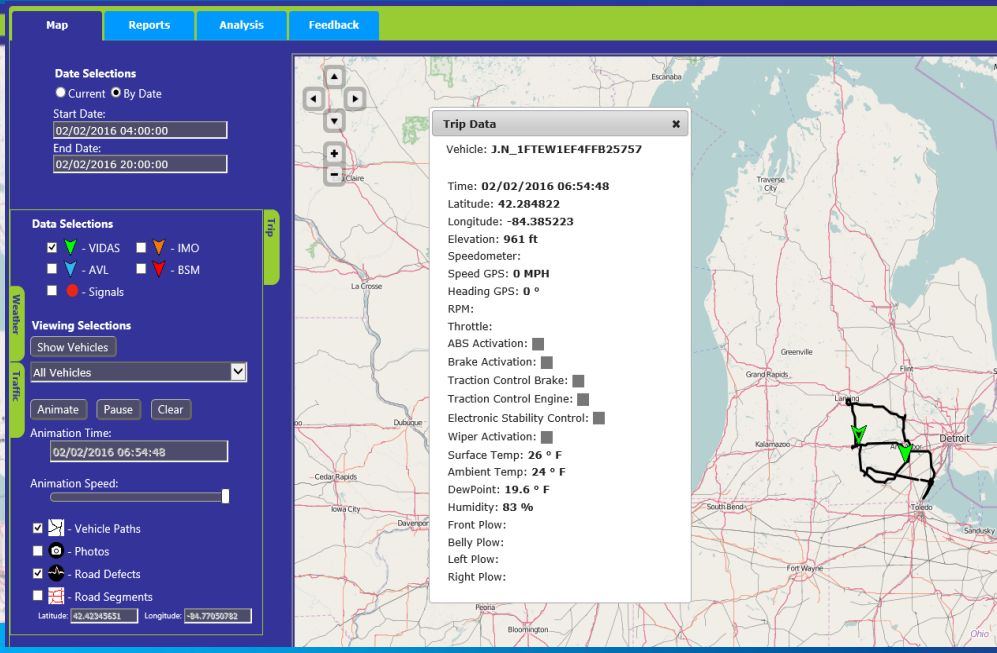
MDOT Data, Use, Analysis & Processing (DUAP) Project

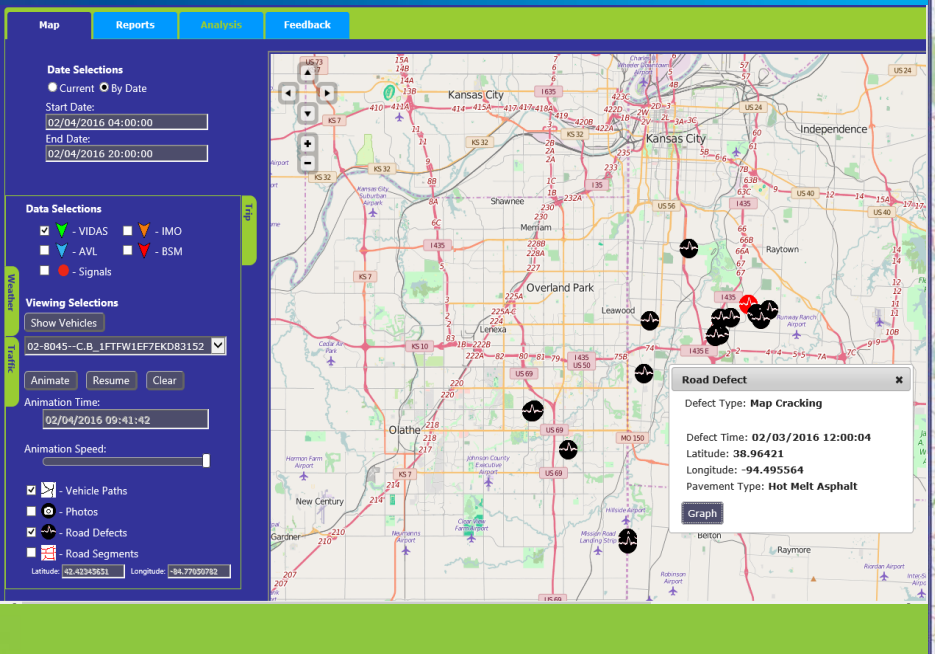


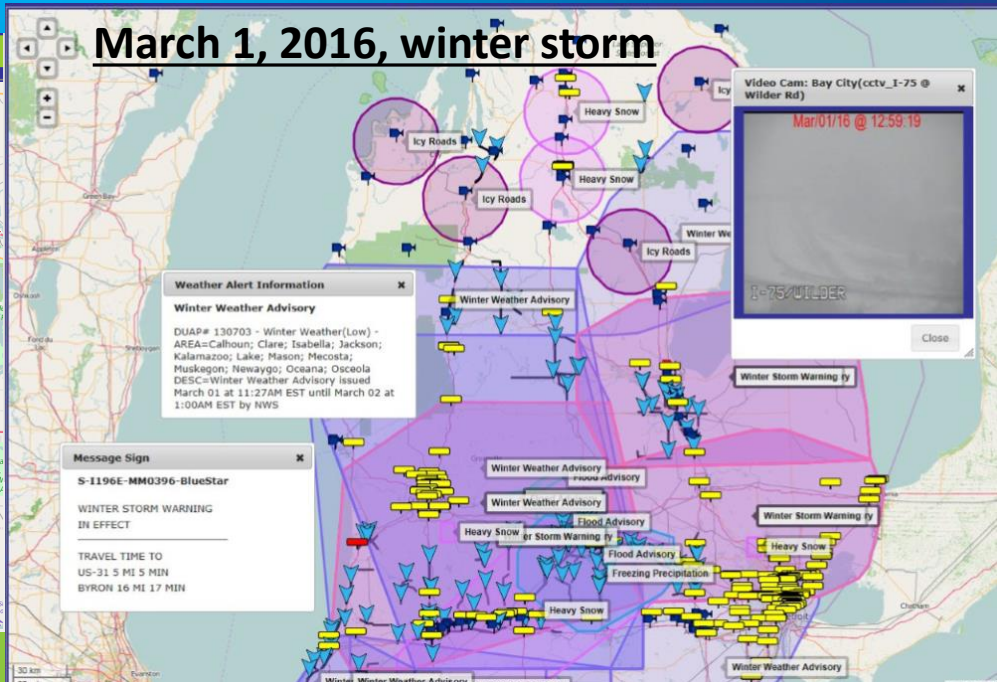


MDOT DUAP/ATMS Weather Map

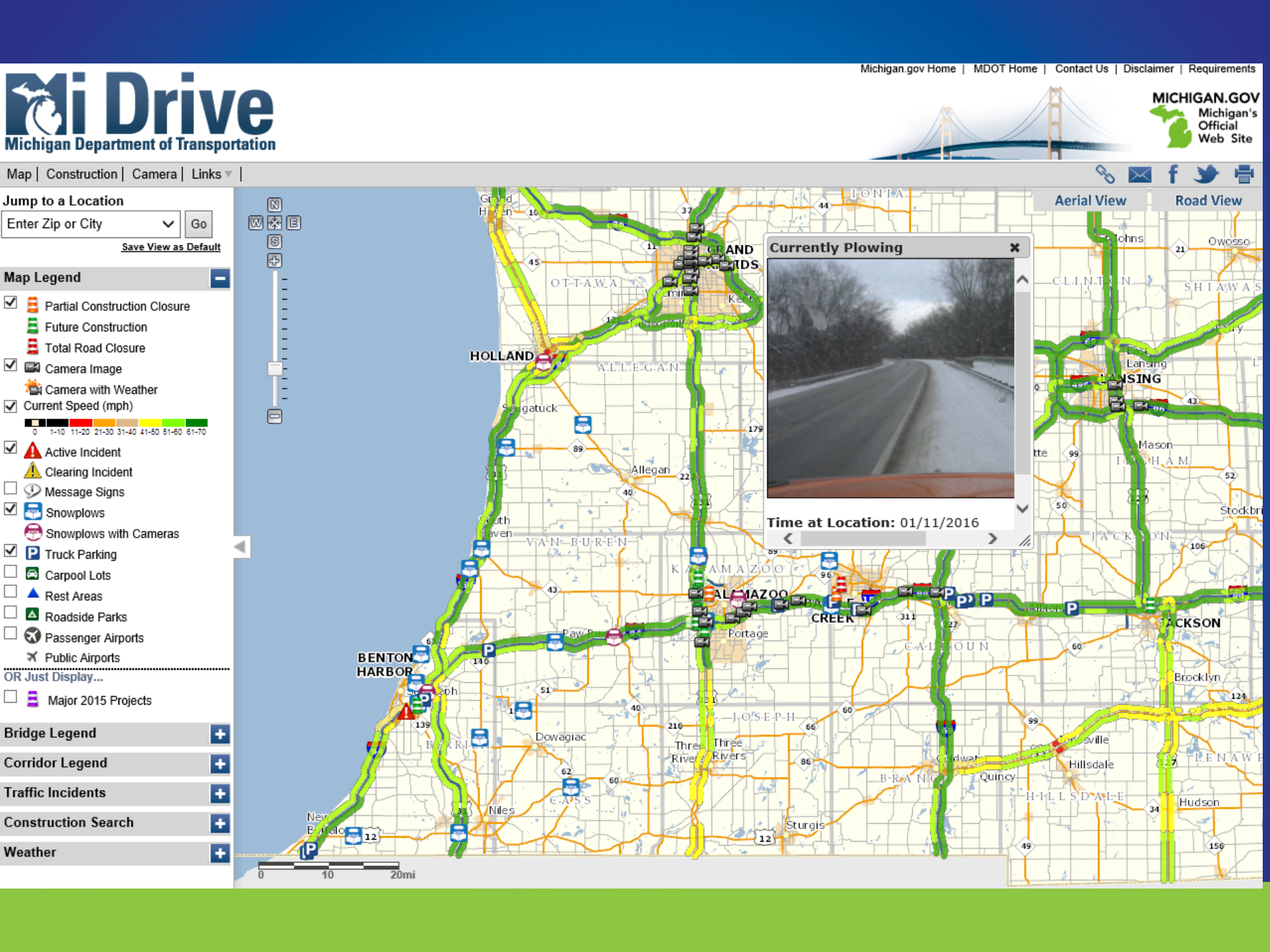









Mi Drive
WB M14
US23
N OF BARTON
M14
W OF US12
I94
CONSTRUCTION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MICHIGAN.GOV
Michigan's Official Web Site
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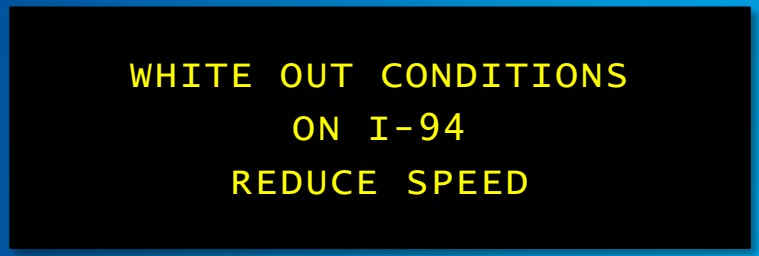
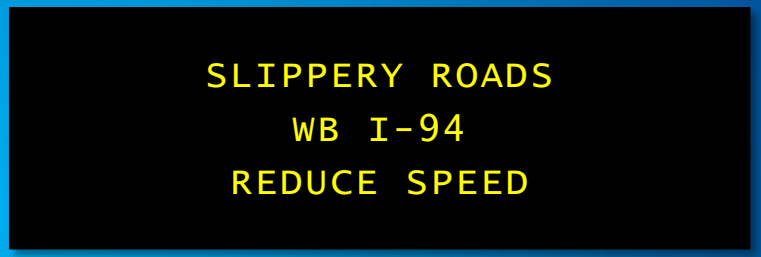
Jump to a Location
Enter Zip or City
Go
Save View as Default
Map Legend
Partial Construction Closure
Future Construction
Total Road Closure
Camera Image
Camera with Weather
Current Speed (mph)
0 1-10 11-20 21-30 31-40 41-50 51-60 61-70
Active Incident
Clearing Incident
Message Signs
Snowplows
Snowplows with Cameras
Truck Parking
Carpool Lots
Rest Areas
Roadside Parks
Passenger Airports
Public Airports
OR Just Display...
Major 2015 Projects
Bridge Legend
Corridor Legend
Traffic Incidents
Construction Search
Weather
Aerial View
Road View
Currently Plowing
Time at Location: 01/11/2016
HOLLAND
Allegan
Dowagiac
Niles
Sturgis
Three Rivers
Portage
BENTON HARBOR
Hillsdale
Quincy
Brooklyn
Owosso
Mason
Lansing
Stockbridge
Hudson
0 10 20mi

DMS Motorist Advisory/Warning Messages

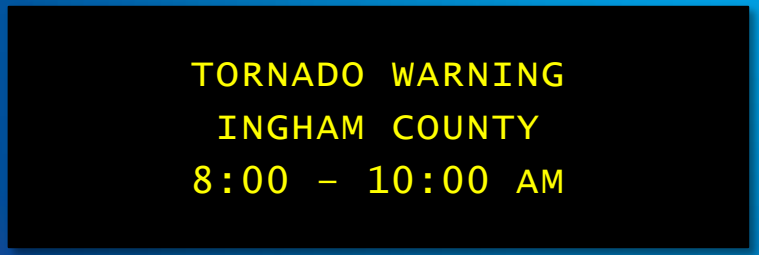
- White Out Conditions



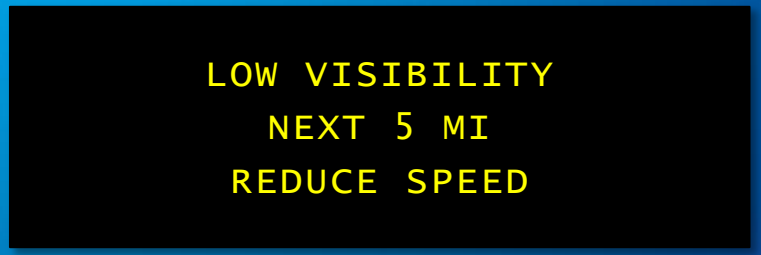
- Icy Roads



- Tornado Warning



- Low Visibility



Examples of Motorist Advisory and Warnings

Variable Speed Limit Sign

Severe Weather Warning Sign

Dynamic Message Sign

Smart Truck Parking

Learning Outcomes

- Traveling Public Benefits: demonstrated how providing motorists with more timely/valuable information allows them to make safer decisions both pre-trip and en-route in relation to traveling the road network in inclement weather conditions.
- Operations Users Benefits: DOT operations are critical in providing motorists with valuable information during winter weather events. TOC/TMCs can become overwhelmed with incidents that occur during winter weather events. Having the ability to utilize an alert system to advise TOCs of necessary weather related advisory or specific alert locations increases near real-time knowledge of roadway conditions, thereby increasing the motorist decision and safety.
- Maintenance Users Benefits: DOT maintenance activities are critical in providing motorists with safe driving conditions during winter weather events. DOT maintenance staff manages multiple maintenance activities (plowing, salting, etc.) during winter weather events. Having the ability to utilize an alert system to advise maintenance staff of necessary winter maintenance locations, including near real-time unsafe pavement/roadway conditions, enhances response times and improves the use of maintenance resources.

THANK YOU

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