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

Steven J. Cook, P.E.
Engineer of Operations and Maintenance
Learning Outcomes

• Traveling Public Benefits
• Operations Users Benefits
• Maintenance Users Benefits
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
FHWARoadway Weather Management Project Description

Data is wirelessly transmitted from vehicles

Data quality checks and processed

Vehicle Data Translator

Road Weather Information is disseminated

Content Providers

Road Weather Information is fed into Decision Support Systems
FHWA IMO Project Partner DOTs

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

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

Vehicles Used:
- DOT Snow Plows
- DOT Supervisor Trucks
- DOT Safety Trucks
- DOT seasonal high mileage vehicles
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

IMO 3 Vehicle Files Forwarded

IMO 3 DSRC Files Forwarded

USDOT Data Warehouse

NCAR/VDT Server

Mi Drive & mobile app

ATMS

TRAVEL TIME TO
M-8 5 M I 6 MIN
I-696 10 M I 13 MIN

DMS

Other Weather

RWIS

USDOT Data Warehouse
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
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
March 1, 2016, winter storm
DMS Motorist Advisory/Warning Messages

- White Out Conditions
  
  **WHITE OUT CONDITIONS ON I-94**
  **REDUCE SPEED**

- Icy Roads
  
  **SLIPPERY ROADS**
  **WB I-94**
  **REDUCE SPEED**

- Tornado Warning
  
  **TORNADO WARNING**
  **INGHAM COUNTY**
  **8:00 – 10:00 AM**

- Low Visibility
  
  **LOW VISIBILITY**
  **NEXT 5 MI**
  **REDUCE SPEED**
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

Steven J. Cook, P.E.
Engineer of Operations & Maintenance
517-636-4094
cooks9@michigna.gov