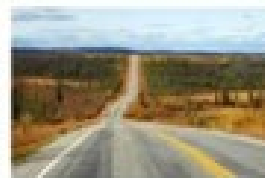


Mobile Weather Technology

(Integrating Mobile Observations (IMO))

Rose Parisi
Vaisala Inc.
Road/Airport Application Manager, North America



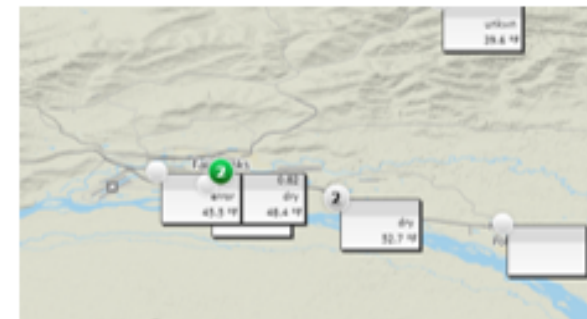
Why Mobile Sensing?

Challenges facing supervisors today

- Safety: Are the roads still slippery between stations?
- Environment: Are we using too much chemical there?
- Budget: Are we spending too much on treatment?
- Resources: Are the trucks where they should be?
- → Where to send the trucks out next?

Challenges facing plow drivers today

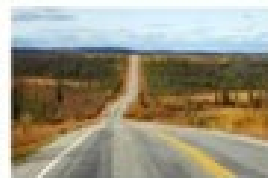
- Is there black ice on this section of road?
- Is that glare > water or ice?
- Is the road a little moist or just darker?
- Is road colder than ambient air?
- → How to treat this road?



Currently no data available between RWIS stations → 'Virtual'



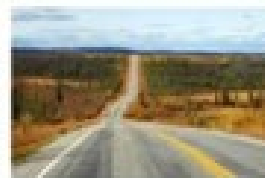
Detailed road conditions are difficult to detect by eye → Need to guess



Legacy Observation Mobile Parameters (limited)

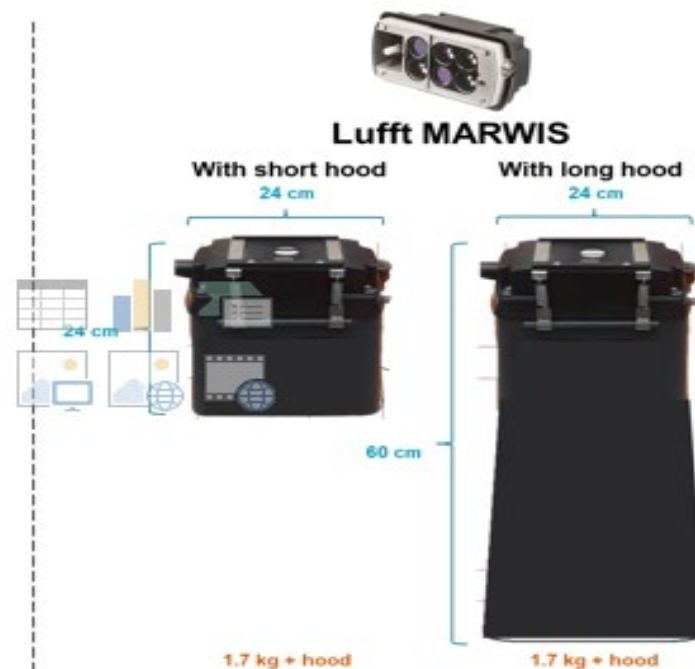
- Air Temperature
- Pavement Temperature
 - Some had R/H & Dew Point

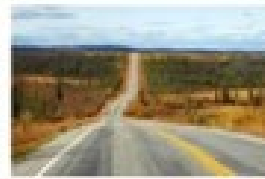




New Mobile Sensors – (Expanded Observations)

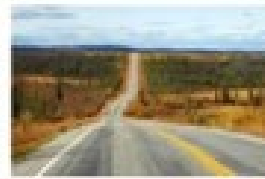
- Air Temperature/Relative Humidity
- Pavement Temperature
- Road Condition
- Water/Snow Layer
- FRICTION





What is Friction?

- What is friction ?
 - Friction is a force that opposes the motion between two objects in contact with each other
- Why are we interested in measuring friction ?
 - Friction is the only well defined quantity that uniquely describes how slippery the road surface is:
 - For a dry road friction varies around 0.80 ± 0.10 for typical tires and pavement surfaces
 - If there is hard ice on the surface, every car will experience a dramatic drop of friction despite the quality of the tires -> friction will drop down to about 0.10 – 0.20 with a thick layer of hard ice



Friction and ITS?

- Friction gives us that quantitative number to be able to make automated decisions.
- 0.06 and above = Grip good
- .04 to 0.59 = Grip poor
- 0.39 and below = Very poor grip
- This value can greatly improve the algorithms needed to make decisions, and provide and easier decision process.



There are Road Cameras and there is Mobile Friction Sensors



Fixed Camera

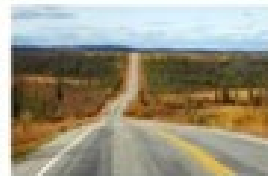


Fixed stations Grip & Condition Sensor



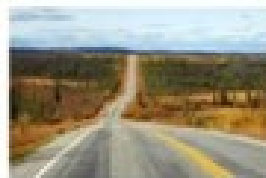
Mobile Sensor (provides all key parameters, including grip)

- Road Cameras provide excellent information to the operational decision maker.
- However friction mobile sensors offer a whole new level of road information
- Perhaps a picture only paints 500 words and the other 500 are provided by friction mobile pavement sensor and additional pavement information



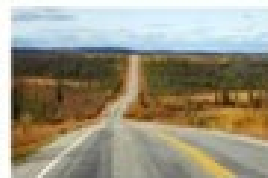
Guess The Driving Conditions?





Did You Guess Them Right? The Mobile Sensor Did!





Applications

Snow plows & Spreaders

Maintenance operations
during weather events



“How should I treat this road,
what is correct salt amount?”

Road patrol cars

Road quality control
before & after events



“Is the road so slippery that
we should send our plows
out?”

Airport patrol cars

Runway quality control before
& after events



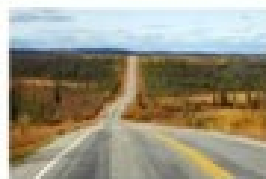
“Which runway condition code
should be reported?”

Other fleet

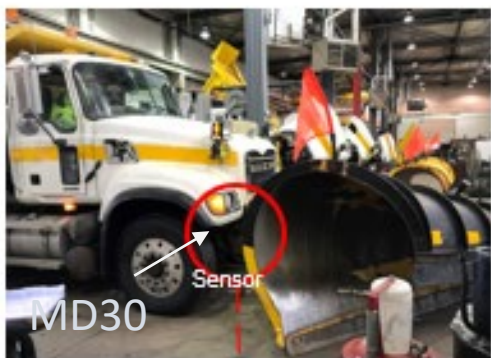
New 24/7 applications: post
car / taxi / bus, traffic mgmt.



“Can we use our 24/7 moving
cars to gather live data for
you?”



Sensor Data + Video Images + Color-coded map = Powerful Combination



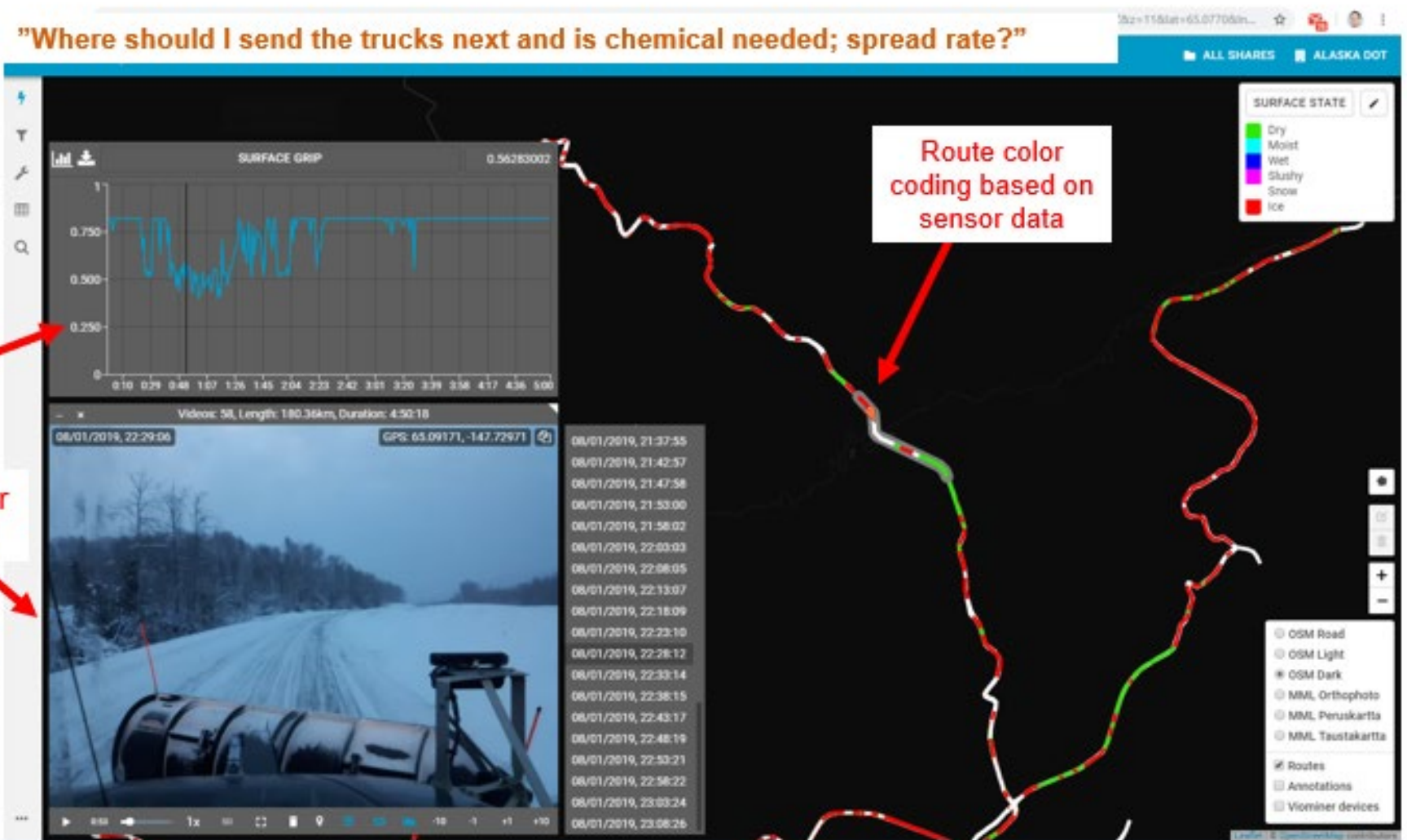
Bluetooth

Sensor data

Phone app for driver

"How much salt to put?"

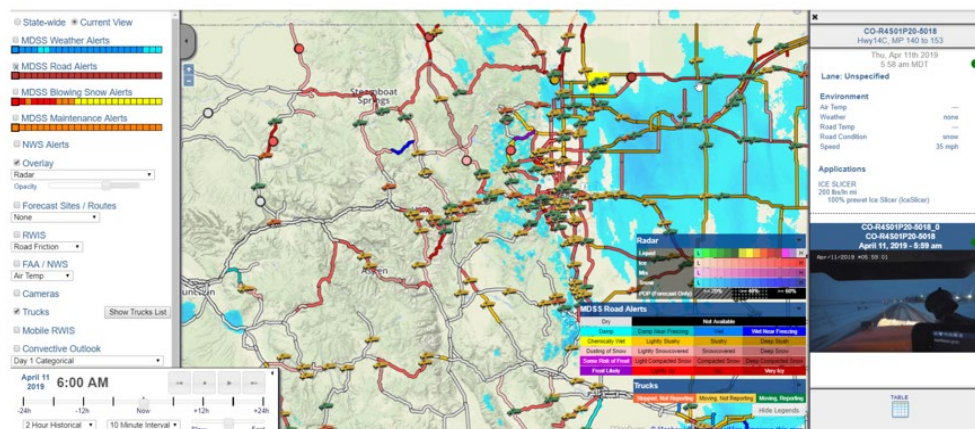
Video or photos

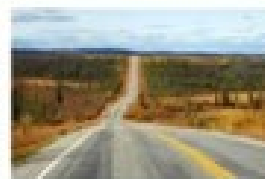




Web Visualization and Mobile Sensors

- Ability to display mobile RWIS data, in real-time
- Breadcrumb capabilities for all variables available
- Detailed historical data
- Ability to display camera imagery





Technologies and Data Used in West Des Moines

Road Weather Sensors

- Stationary
- Mobile

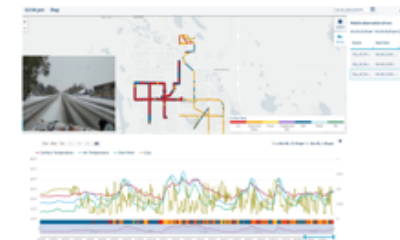
Cameras

Data Collected:

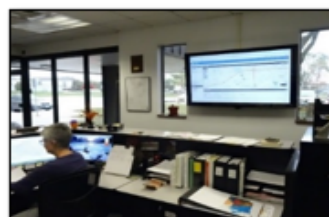
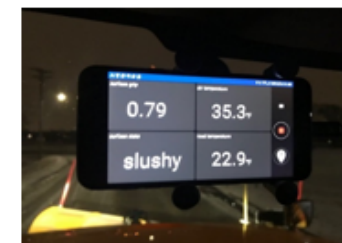
- Road friction
- Pavement/sub-surface temperatures
- Relative humidity
- Dew point
- Air temperature
- Snow/Ice depth
- Wind speed
- Pictorial history of road conditions



Infrared Stationary
RWIS

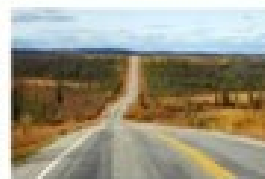


Live/Recorded Road Data



Real-Time Information





Technologies and Data Used Alaska DOT

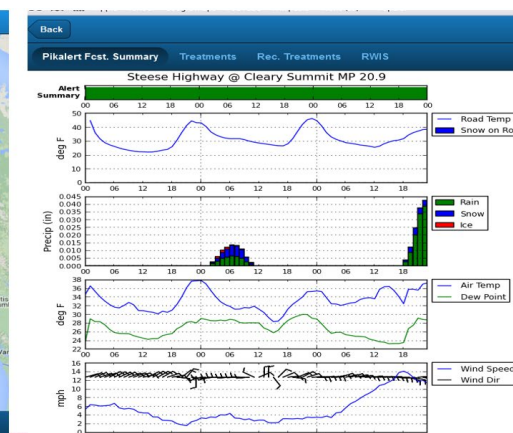
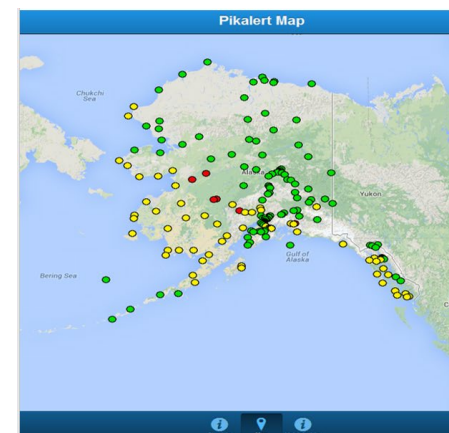
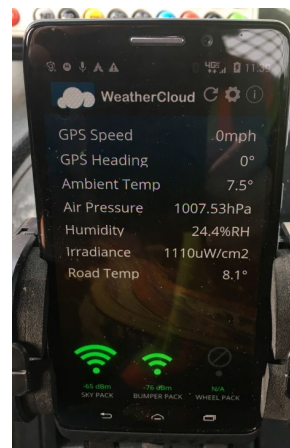
• Road Weather Sensors

- Stationary RWIS Stations
- Some Mobile

• Cameras

• Data Collects

- Road friction
- Pavement/sub-surface temperatures
- Relative humidity
- Dew point
- Air temperature
- Snow/Ice depth
- Wind speed
- Pictorial history of road conditions

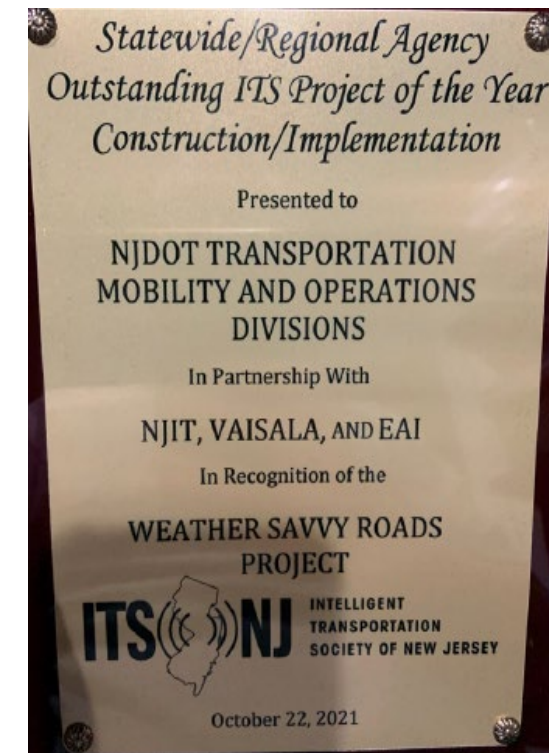


NJDOT Weather Savvy Roads

2021 Outstanding Project/Program - Statewide/Regional Agencies Construction/Implementation:

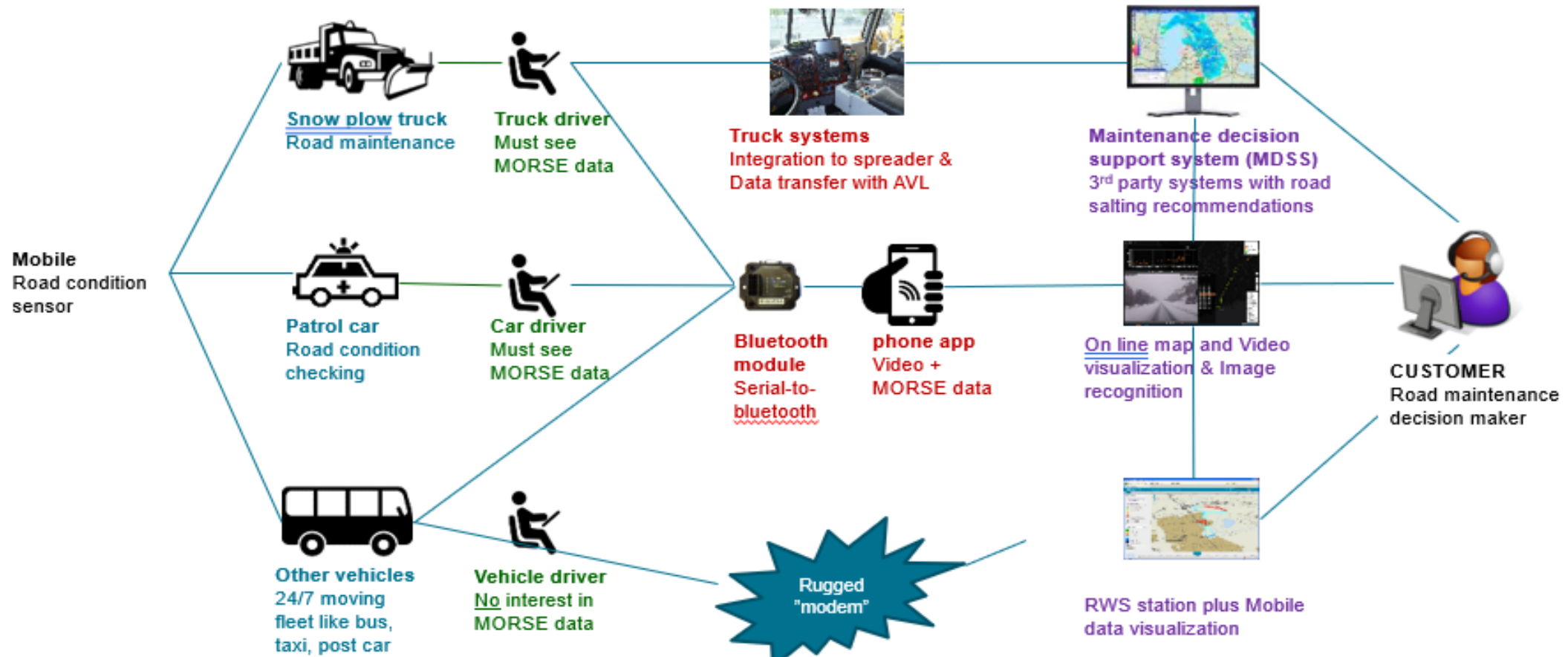
NJDOT's Weather Savvy Roads (WSR) Program

NJDOT's Weather Savvy Roads (WSR) program started with NJDOT's Mobility Division applying for and receiving NJ's first federal Accelerated Innovation Deployment (AID) grant in the amount of \$322,462. The concept was to procure and install mobile RWIS devices and dash cameras in 23 DOT snow-fighting vehicles statewide to view real time conditions and guide decisions for allocation of resources during a winter event. The team is comprised of staff from NJDOT Mobility, NJDOT Operations, the NJIT ITS Resource Center, and technical partners from Vaisala and EAI. A web-based platform was then created by NJIT where users could view a statewide map and both data from the RWIS devices and video from the CCTV could be viewed in real time. The WSR project was also designed to continue the Department's investigation into cellular strength along NJDOT's road network. This effort was first evaluated during NJDOT's STIC Incentive grant funded program using iCone devices on SSP trucks. Utilizing a cellular router carrying FIRSTNET cellular capability, the technical team at NJIT is evaluating the strength of this first responder-only focused cellular system to see the various levels of signal strength. The project has shown tremendous benefits after just one winter season with staff across multiple levels of the Department utilizing the web platform to make better informed decisions about staffing and contractor use.

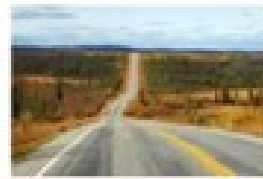




Several Options for Mobile Data Flow



Moving the time slider updates the map with the forecast information for that time.



IMO, Integrating Mobile Observations – FWA Initiative?

Weather and road condition data collection from fleet vehicles for a more comprehensive view of network conditions

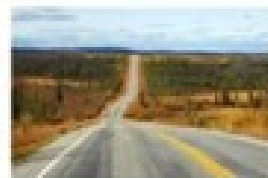
Advanced, vehicle-based technologies are deployed to **collect, transmit, and use** weather, road condition, and related vehicle data



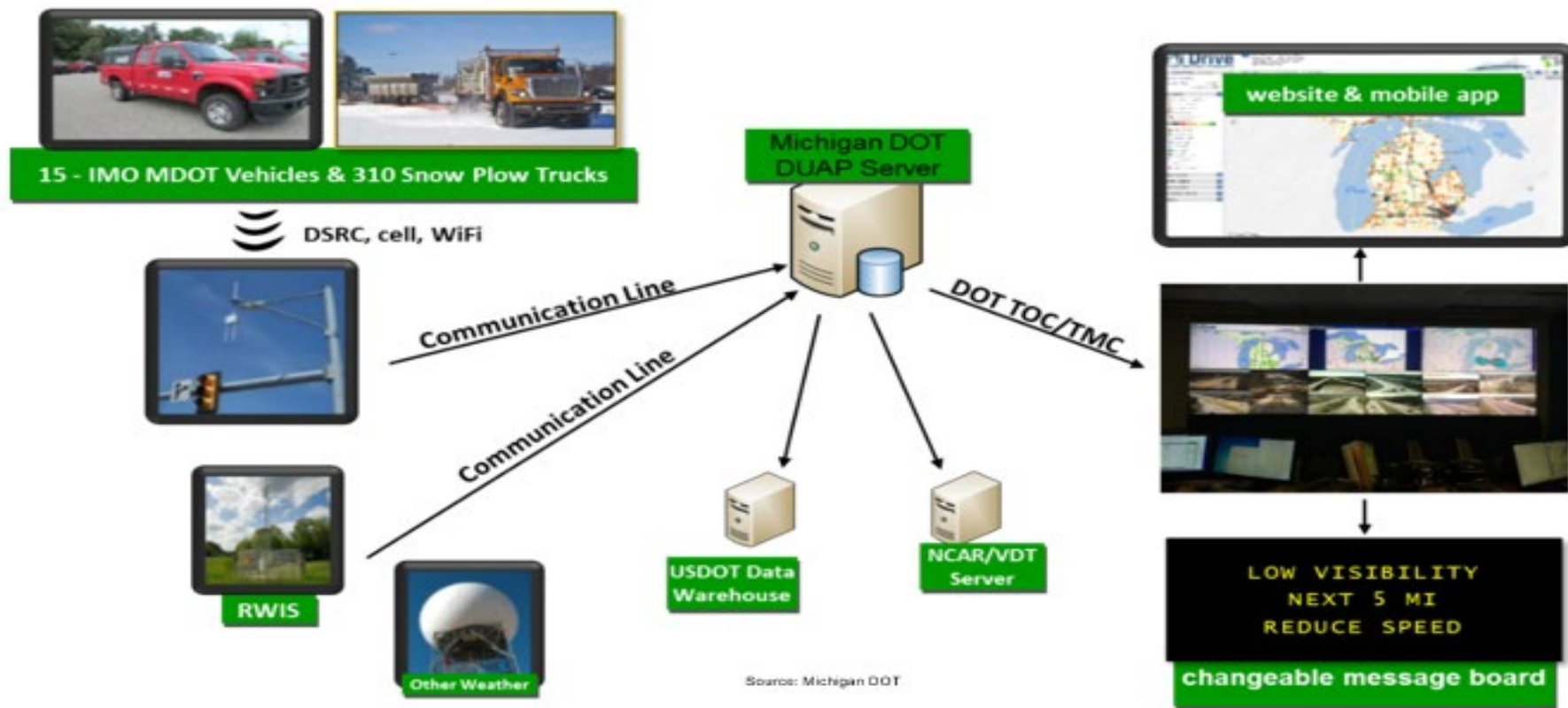
Source: Wyoming DOT

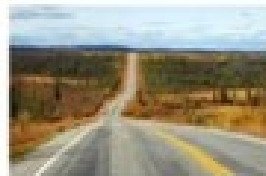
Intended Outcome –
Utilizing enhanced data for more informed system management

(maintenance, traffic, asset, performance)



IMO, System Framework





Alaska's Smart Vehicle System