

Weather Savvy Roads

UPDATE



NJDOT Weather Savvy Pilot

Updates and Lesson Learned Summary

NJ STIC 4th Quarterly Meeting
December 15, 2021



Agenda

1. Weather Savvy Roads – Pilot Project
2. Vehicle Instrumentation Status
3. Instrumentation Process
4. Web Portal Status
5. FirstNet Communication Coverage and Quality Experience
6. Initial Takeaways
7. Lesson Learned
8. Next Steps

Weather Savvy Roads – Pilot Project

What is the pilot?

An FHWA pilot program, valued at \$322,462, under the “Weather Savvy Roads Integrating Mobile Observations (IMO)” innovation.

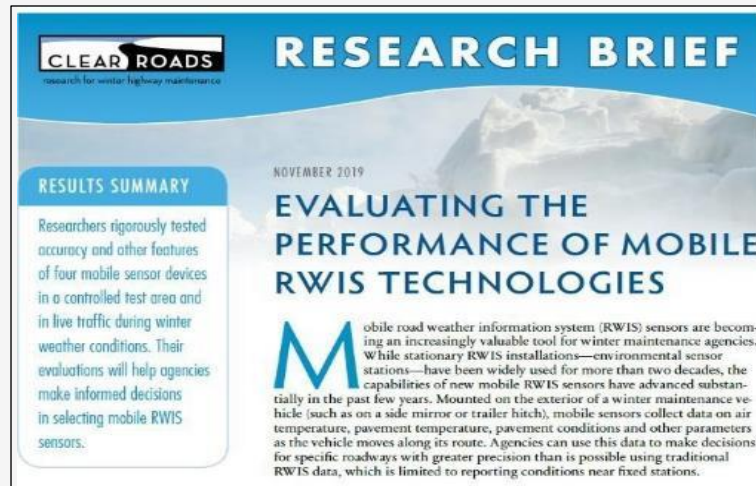


Weather Savvy Roads – Pilot Project

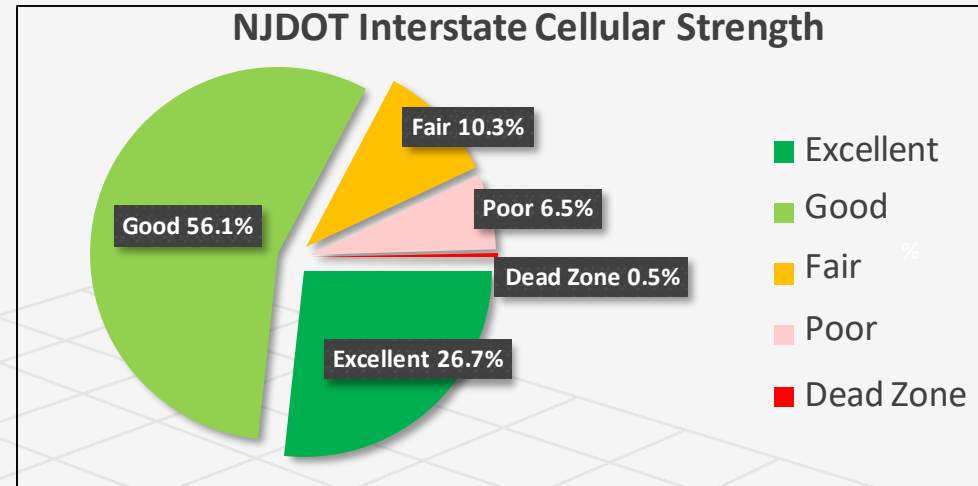
Why is NJDOT Doing This?

To do our own research ...

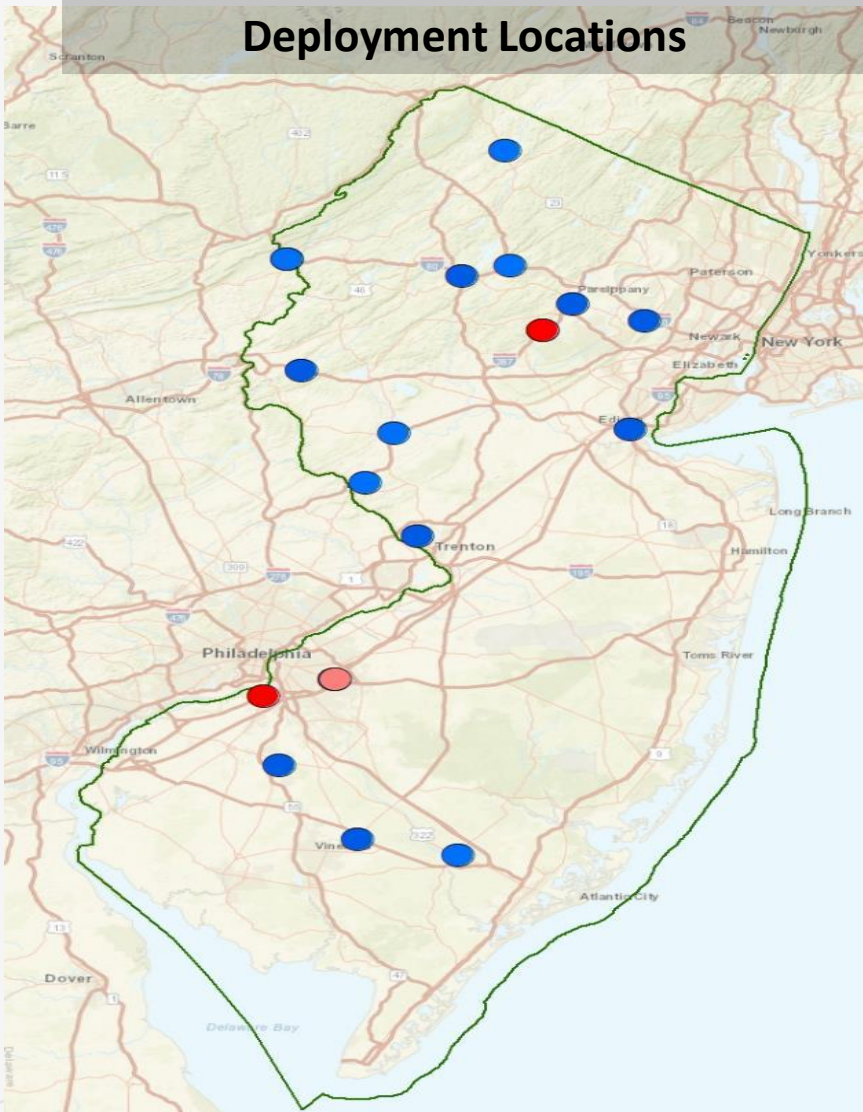
...to compare the value of mobile RWIS vs fixed RWIS



...to test FirstNet signal strength vs commercial cellular strength on NJDOT's road network



Weather Savvy Roads – Pilot Project



Vehicle Instrumentation Status

- Operational: 24 vehicles

Operations Region →	North	Central	South
Plow trucks	3	2	2
Supervisor pickup	4	3*	2
IMRT vehicle	1	-	1
SSP trucks	3	-	3

* Includes one SUV assigned to a Manager

Strategic instrumentation of vehicles:

- Cover the yards assigned to “incline packages”
- Cover the North/Central/South regions
- Cover SSP North/South routes

Weather Savvy Roads – Pilot Project

Instrumentation Process




Cab Setup – IMRT Truck

Weather Savvy Roads – Pilot Project

Instrumentation Process



Cab Setup –
IMRT Truck

- Cellular Router (with GPS) –

- Video Camera Transcoder and Power Unit
- Power distribution unit

Weather Savvy Roads – Pilot Project

Instrumentation Process



Road Weather Sensor
Installation –
SSP/IMRT Trucks

Weather Savvy Roads – Pilot Project

Instrumentation Process



Cab Setup –
Dump/Plow Trucks

Weather Savvy Roads – Pilot Project

Instrumentation Process



MRWIS Installed

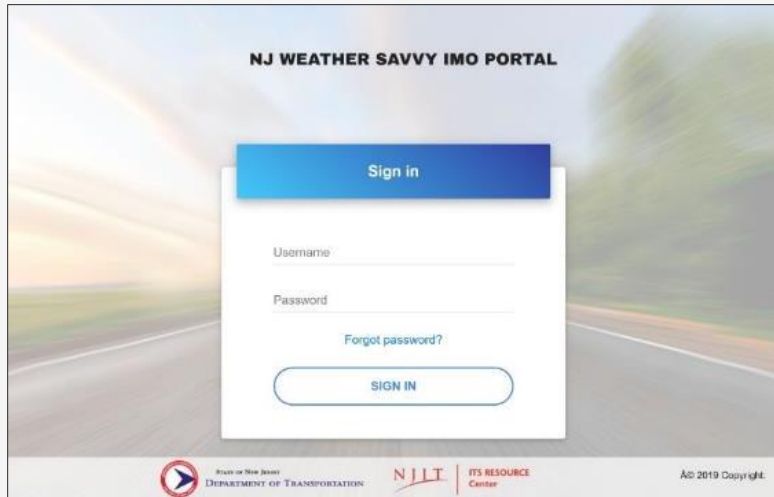


Ambient Weather Sensor Installed

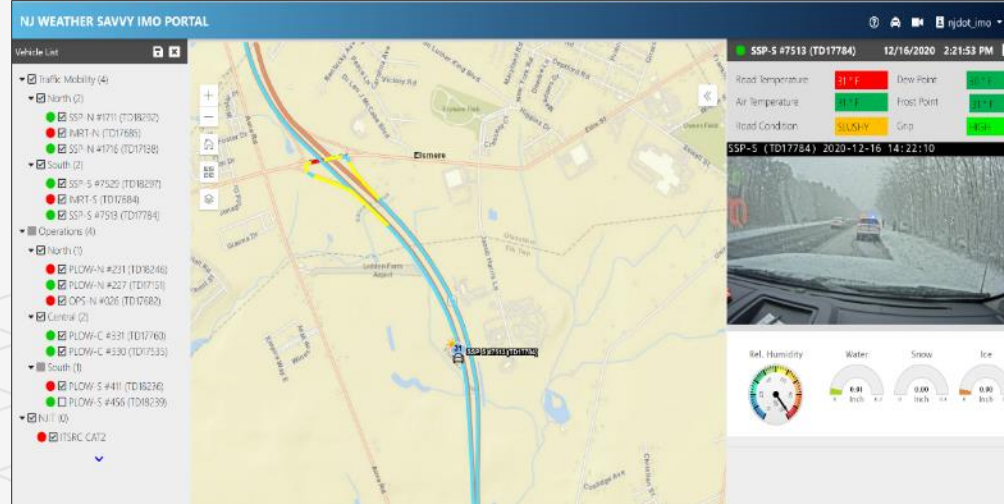
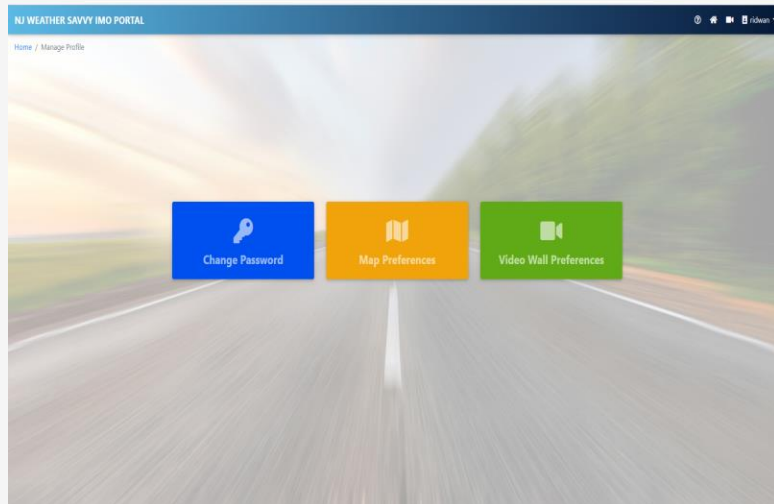
Sensors Installed-
Dump/Plow Trucks

Weather Savvy Roads – Pilot Project

Web Interface (GUI)



- 139 registered users
- More Secure website with user authentication
- Real-time data feed from deployed vehicles
- Map interface, virtual video wall
- External map data layers (e.g., RWIS stations, snow subregions, CCTV)
- Additional data analytics and visualizations being developed



Weather Savvy Roads – Pilot Project

Web Interface (GUI)

System Map

Virtual Video Wall

NJ WEATHER SAVVY IMO PORTAL

Vehicle List

- Traffic Operations (2)
- North (3)
 - SSP-N (TD18292)
 - IMRT-North
 - SSP-N (TD17138)
- South (1)
 - SSP-S (TD18297)
 - IMRT-South
 - SSP-S (TD17784)
- NIIT (1)
 - ITSRC CAT2
 - NIIT LAB

Map showing location: North of Exit 21 - CR 600 (Overpass) - South

Zoom to: 275 of County Route 666

SSP-S (TD18297) 9/1/2020 4:30:27 PM

Road Temperature	93 ° F	Dew Point	62 ° F
Air Temperature	84 ° F	Frost Point	N/A
Road Condition	Wet	Grip	High

SSP-S (TD18297) 2020-09-01 16:32:05

Rel. Humidity, Water, Snow, Ice gauges.



NJ WEATHER SAVVY IMO PORTAL

Home / Video Wall

Camera Group: Operators

Show sensor data

Grid of camera feeds and weather data for various locations including PLOW S #456, PLOW S #411, PLOW-N #231, PLOW-N #227, PLOW-C #331, and PLOW-C #338.

Vehicle Dashboard

OPS-N #026 (TD17682) 12/17/2020 1:09:29 AM

Road Temperature	28 ° F	Dew Point	26 ° F
Air Temperature	27 ° F	Frost Point	27 ° F
Road Condition	SNOW	Grip	LOW

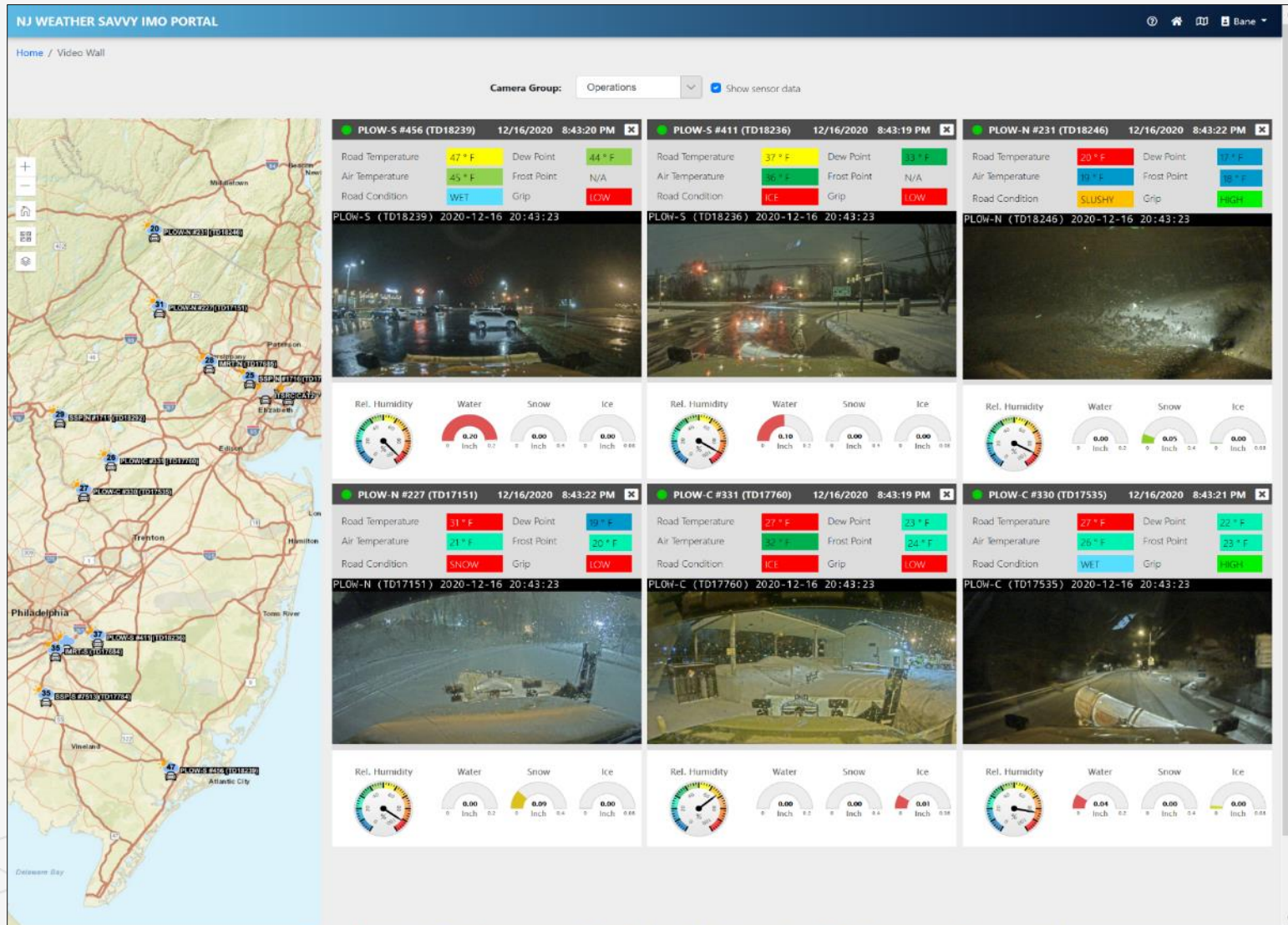
OPS-N (TD17682) 2020-12-17 01:09:50

Rel. Humidity, Water, Snow, Ice gauges.



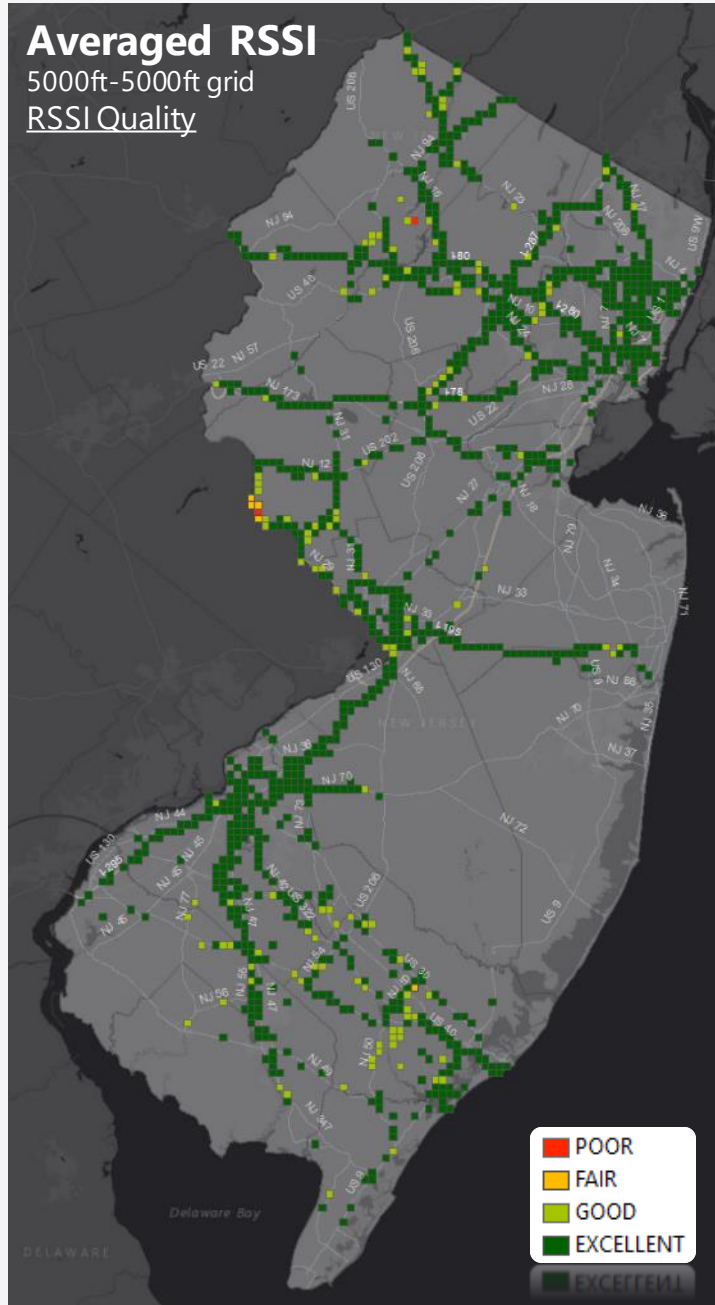
Weather Savvy Roads – Pilot Project

GUI: December 16-17, 2020, Winter Storm



Averaged RSSI

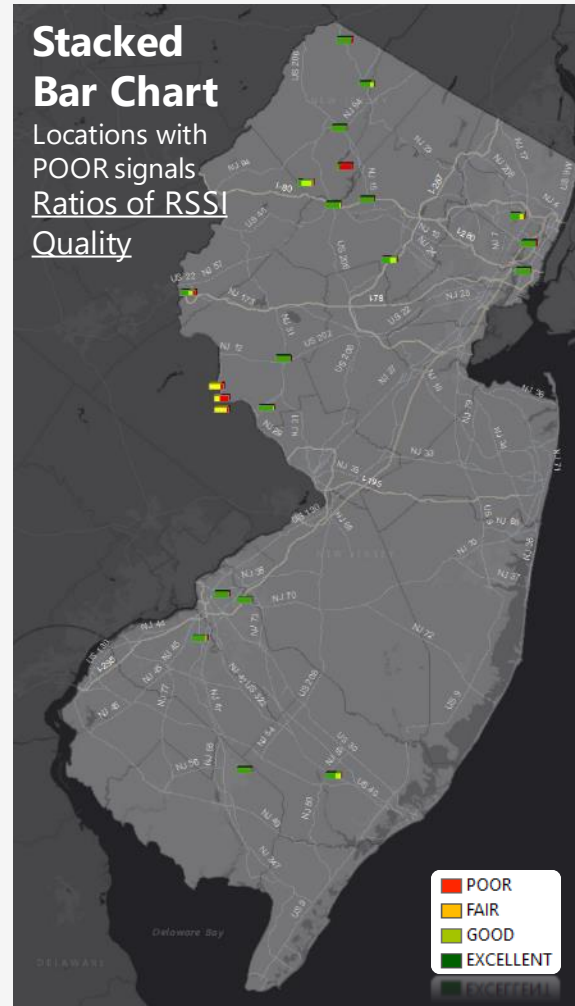
5000ft-5000ft grid
RSSI Quality



First Net Signal Quality

Stacked Bar Chart

Locations with POOR signals
Ratios of RSSI Quality



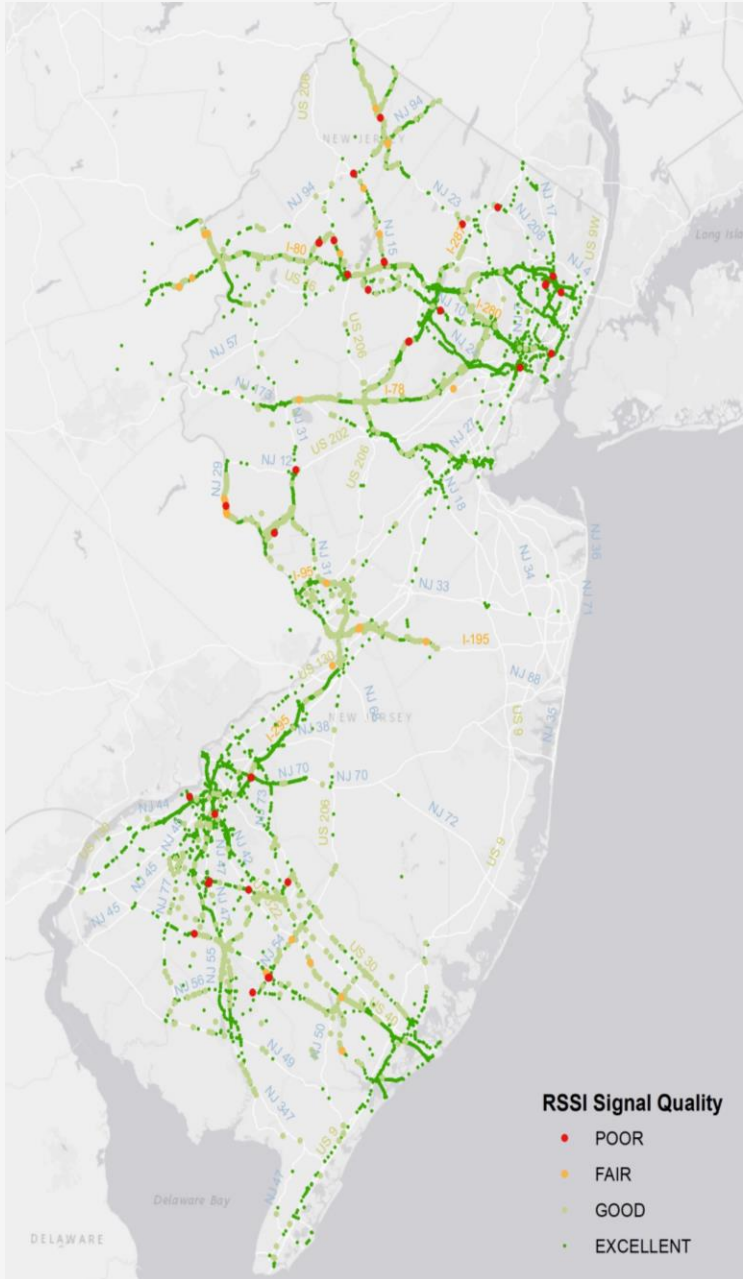
Data: December 2020 – February 2021

- Over 98% Excellent or Good Signal Quality.

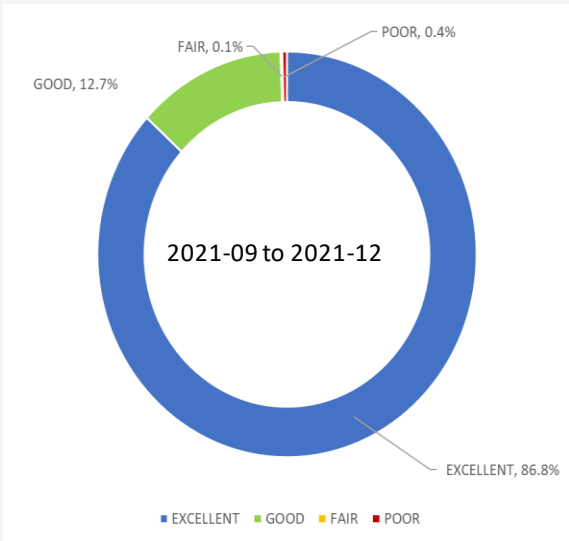
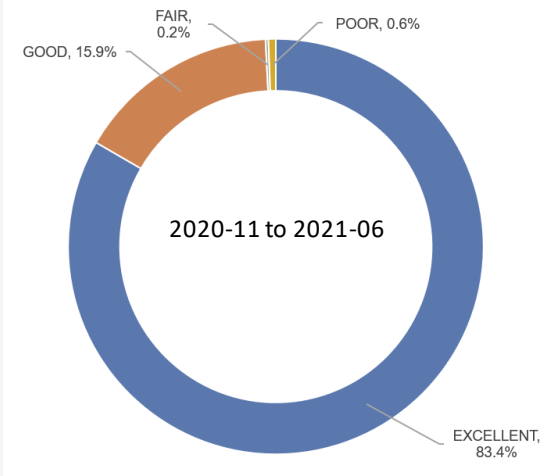
Ratios of RSSI Quality by Truck



First Net Signal Quality



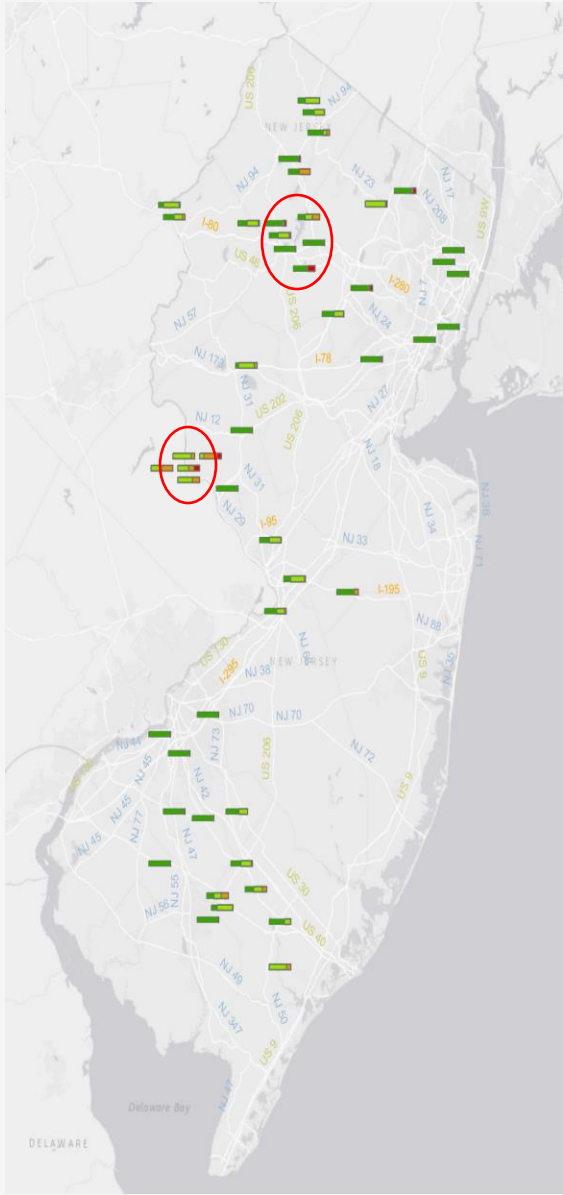
2021-09 to 2021-12



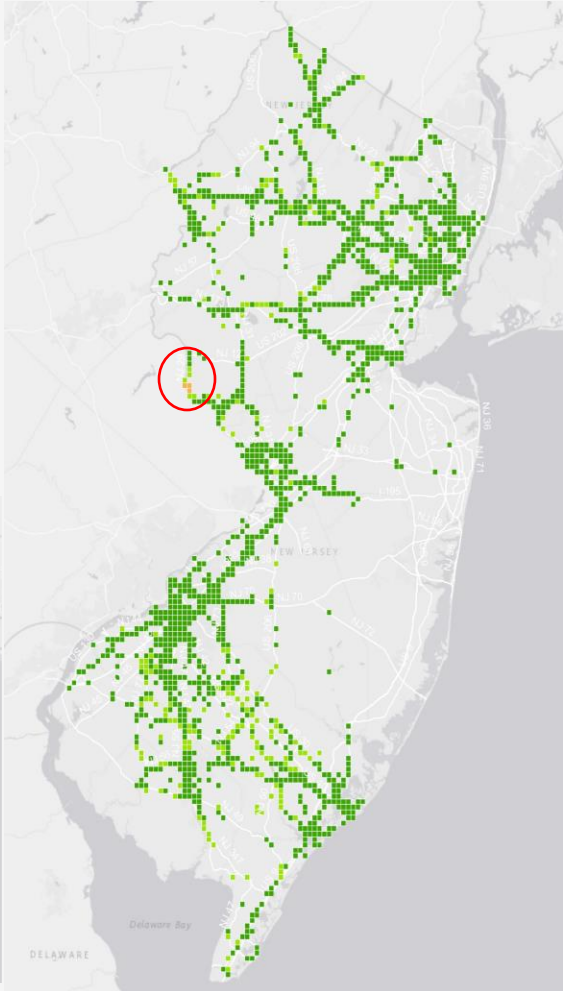
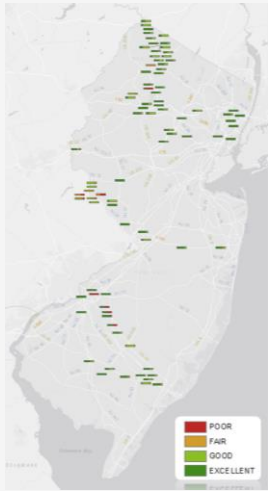
- Total records: 41,047
- POOR signal percentage: 0.4%
- FAIR signal percentage: 0.13%
- Slightly improved signal quality as compared to the previous analysis (53,771 records from 2020-11 to 2021-06)



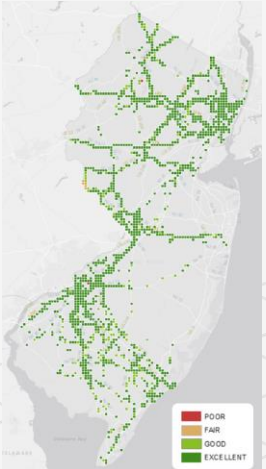
First Net Signal Quality



Percentages of RSSI signal quality for grids that have POOR or FAIR signals



Averaged RSSI per grid

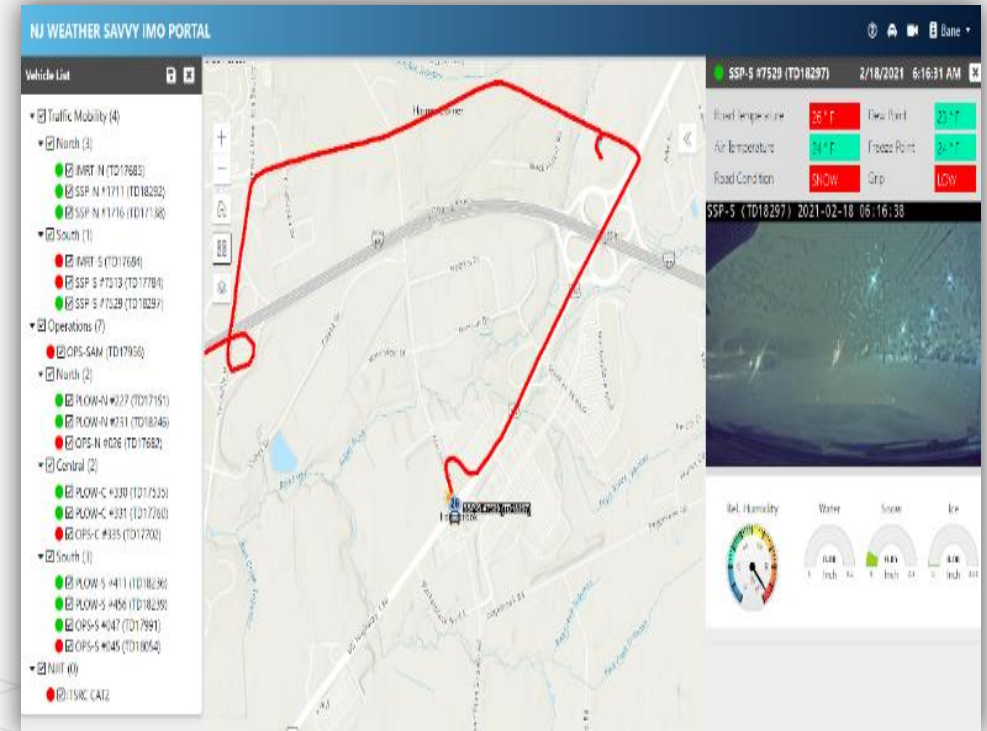


- Averaged RSSI per 5000ft-by-5000ft grid
- Problematic area along NJ-29 (*with much fewer poor signal records in the most recent record set*)
- On average, no poor signal quality per grid over the last three months



Weather Savvy Roads – Pilot Project Initial Takeaways

- Very useful tool for Maintenance and Mobility Operations Management.
- Improved situational awareness, served as a decision support tool.
- “Wish I had this on every DOT vehicle out there!”
- Consider expansion of the program and additional decision support and automation features to improve efficiency and effectiveness of road weather management and operations.



Weather Savvy Roads – Pilot Project

Lessons Learned

1. Weather Sensors

- Discovered a manufacturing issue in the sensor – all sensors will be replaced under warranty
- This finding helped vendor to fix the flaw.
- Some states and countries who use this sensor also benefited from design fix

2. Tablet PC Security

- One incident of theft – tablet retrieved (was exposed to dirt and elements, but fully functional due to rugged design).
- Solution: Purchased Absolute software for PC tracking and data security – to be installed on all tablet PC units.

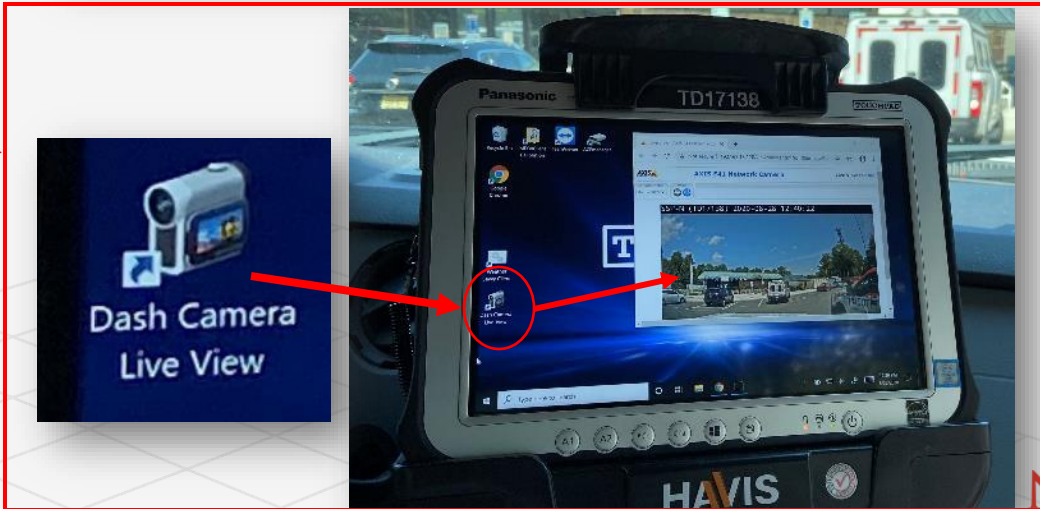
Weather Savvy Roads – Pilot Project Lessons Learned

3. Dashboard Camera

Bullet-camera type often out-of-place.

Drivers can view the dashboard video on the tablet and adjust the camera position before the trip.

More permanent solution: forward-facing dome camera affixed to the headliner (next page)



Weather Savvy Roads – Pilot Project

Lessons Learned

3. Dashboard Camera (continued) – dome camera solution for future instrumentations.



Weather Savvy Roads – Pilot Project

Next Steps

1. Additional vehicle instrumentations

- a) Cost per vehicle ~\$15,000 /vehicle (including 1-yr FirstNet service).
- b) Work with the vendor EAI to prevent installation scheduling delays.
- c) Will require additional funding

2. Improve System's Capability

- a) Allocate dedicated Server to handle additional vehicles and user.
- b) Video Management System: Example Genetec.
- c) Maintain the servers and databases

3. Hardware Maintenance

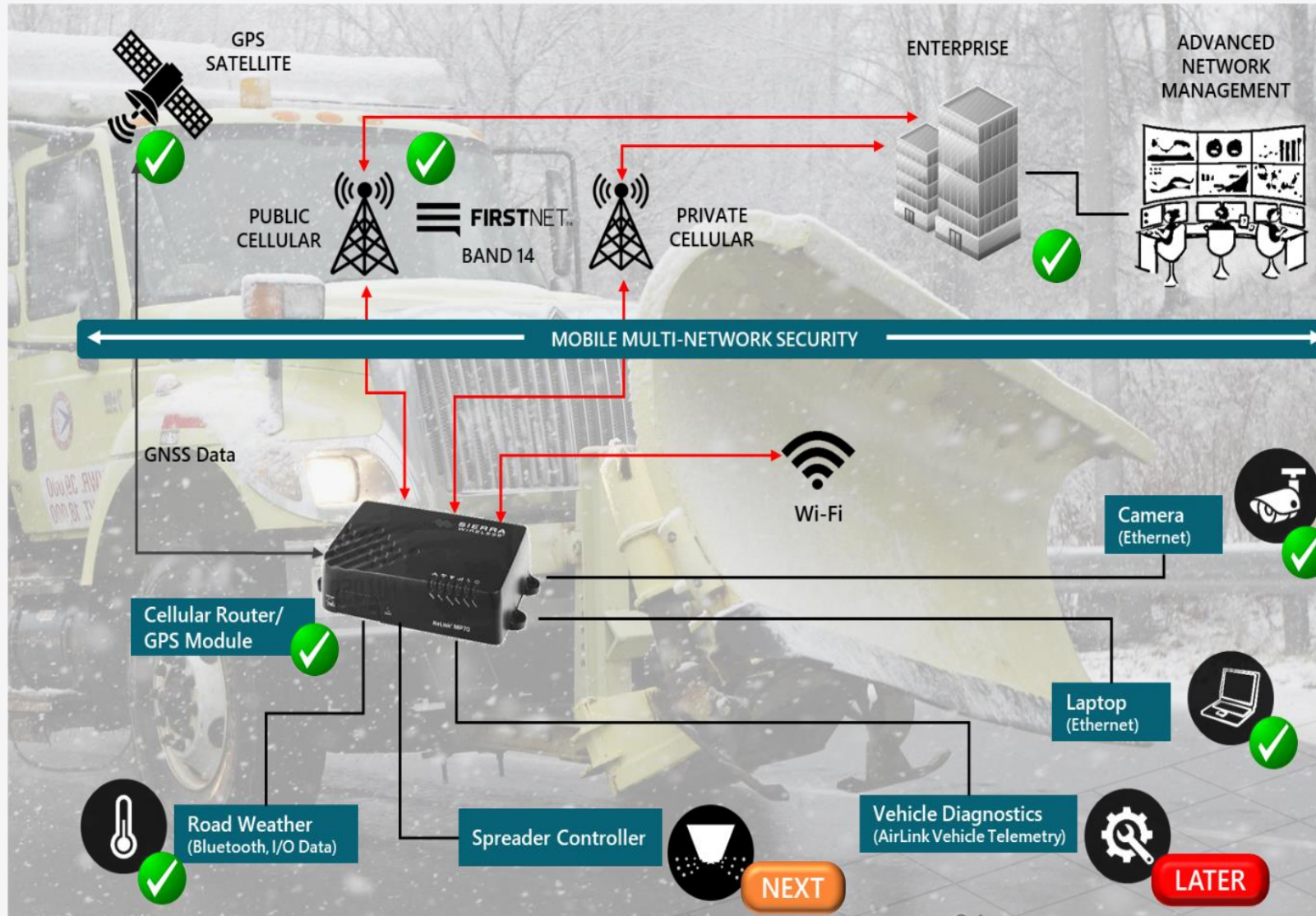
- a) Document protocols, especially for MRWIS sensor
- b) Camera maintenance – pertains mainly to proper positioning of bullet-cameras
- c) Cellular router/communication monitoring and maintenance – NJIT

4. Driver Awareness

- a) Educate driver about Weather Savvy Roads.
- b) Train how to troubleshoot if needed.

Weather Savvy Roads – Pilot Project

Next Steps (cont.)

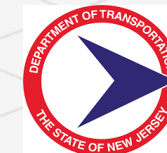


6. New (Advanced) Technologies

- Integration with the spreader controller - pilot demonstration
- CV/CV2X Road Weather Information Pilot Demonstrations
- Weather Responsive Variable Advisory Speed
- Weather-Responsive Signalized Intersection

5G

CV2X



NJIT
New Jersey Institute
of Technology

ITSRC
Intelligent Transportation Systems
Resource Center