



# Plow Camera and Location Sharing Practices

National Rural ITS Conference

October 23, 2018



# Outline

- NWP Program Overview
- Project Background
  - Purpose
  - What we did
- State Summaries
  - ID, MT, ND, MN, IA, PA
- Project Summary



# North/West Passage Overview

- North/West Passage has been a Transportation Pooled Fund since 2003
- Members
  - 7 States from Washington to Minnesota along I-90 and I-94





# North/West Passage Overview

- States share common challenges
  - Commercial and recreational travel corridor
  - Extreme weather conditions
  - Road closures and transportation management
- North/West Passage vision is to develop effective **methods for sharing, coordinating, and integrating** traveler information and operational activities across borders



# Project Background

- **Purpose:** To document current plow camera and location sharing practices for the NWP members that are considering deployment or enhancing current systems.
- **DOT Practices:**
  - Some states are providing plow location using AVL systems, and
  - Some states use plow cameras to provide traveler information and support winter maintenance operations



# Project Activities

- Phone interviews gathered information from 6 states (ID, MT, ND, MN, IA, PA) in early 2018 to summarize current practices for traveler information and winter maintenance operations
- A peer exchange webinar was held on August 26 to share interview findings and facilitate states discussing specific points of interest including camera placement and display, camera mounts, image resolution, communication providers, and lessons learned
- Interview findings and webinar notes were compiled in a project summary report



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# **Interview Highlights**

ID, MT, ND, MN, IA, PA

- In early 2018 ITD kicked off a pilot project with Idaho National Laboratory (INL)
- The project equipped 4 vehicles with cameras and AVL to collect location information to:
  - Get a more complete understanding of roadway conditions
  - Help INL determine trouble spots for a safer commute



- System was not fully functional until May/June 2018 so ITD was unable to test the system with winter weather data
- ITD plans to evaluate and summarize findings from the pilot project this winter season.  
Anticipated data collection:
  - Collect camera images every 10 minutes and transmit with AVL data by cell to the 511 contractor
  - Display a map of AVL data and camera images that ITD staff could access through bread crumb images on ITD's internal pilot project web page



# Idaho

- May consider pulling INL information onto the 511 web page for traveler information
- Working on an open bid for a camera and data provider for a fully functioning rollout

## Lessons Learned:

- Working with different 511, camera, and data service providers posed a significant challenge
  - Advice: If a contractor does not have experience providing this type of service, don't assume it will happen quickly

US 30: Snow Plow Camera Today at 9:51 AM CST

Map Satellite

St Anthony Clemons Allison Marsh Hilltown State Center Lamoni Van Cleve Haverhill Fergusac

Map data ©2018 Google 2 km Terms of Use Report a map error

Today at 9:46 AM CST, IA 330

Today at 9:51 AM CST, IA 330

Today at 9:29 AM CST, IA 330

Today at 9:16 AM CST, IA 330

- DOT: ■ Seasonal ■ Partially Covered ■ Completely Covered ■ Travel Not Advised ■ Impassable
- ⊘ Closure or Blockage 📷 Plow Cameras ⬆ No active material ⬆ Applying liquid material  
⬆ Applying solid material ⬆ Applying liquid and solid material ● Newest ● Oldest ● Historic plow location/image

- During the winter of 2015-16 Montana installed cameras on 10 of their 550 snow plows statewide and provided public access to the images
  - Plow cameras are mounted on tow plows
  - MDT hopes to add 2 additional plow cameras soon
- The winter of 2017-2018 was the second winter MDT has provided snow plow camera images to the public

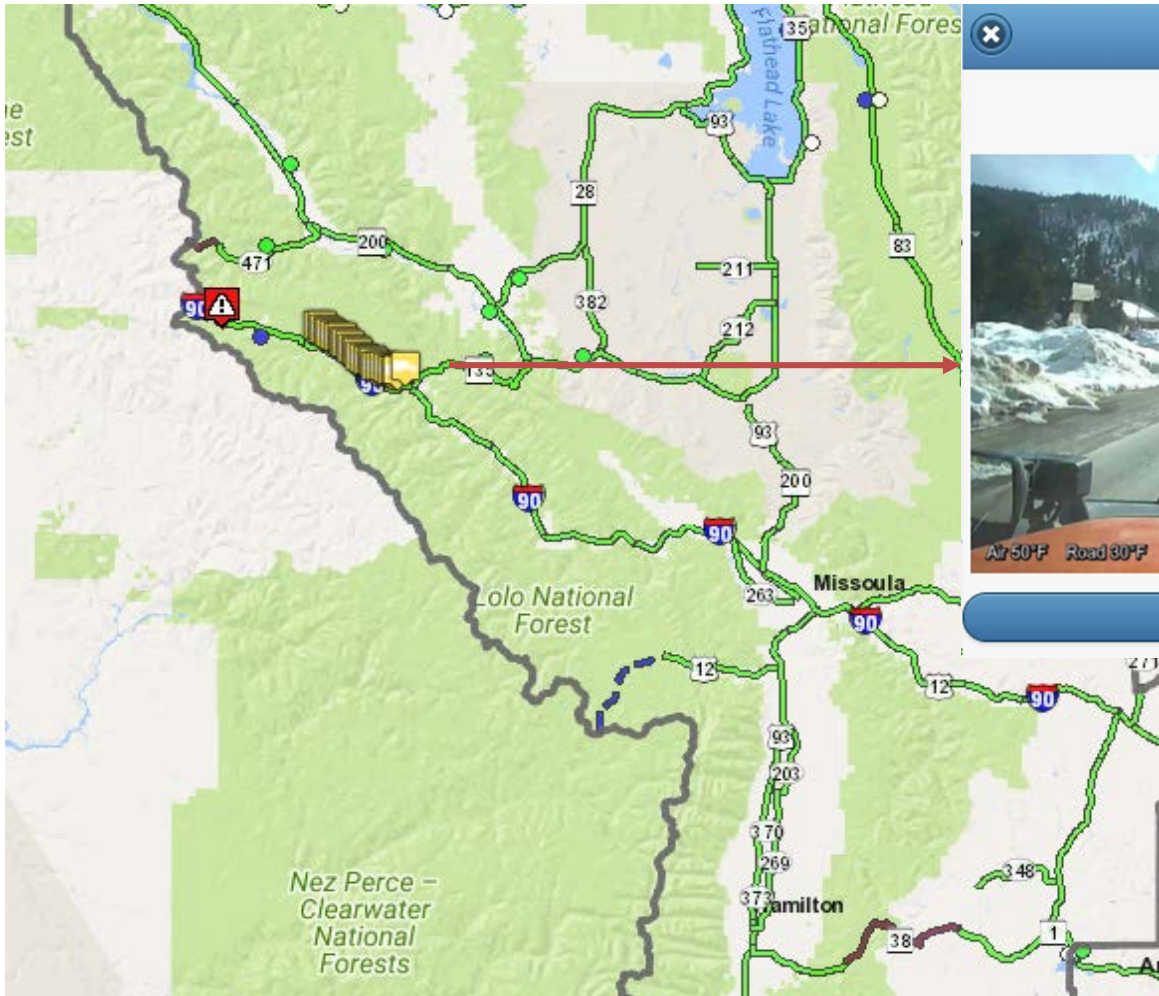


# Montana

- Cameras and modems are activated when the truck ignition is turned on
- Cameras take a photo every ½ mile
- Camera images are available on MDT's website for 30 min
- Plow cameras are cell-based so images are uploaded to the vendor and pushed to MDT

- MDT provides forward facing camera images to the public
  - Positive response from the public
- Some drivers have used camera images prior to their shift to determine which area to focus on
- MDT's snow plow cameras also take video
  - MDT logs into the vendor website to view videos
  - No video is provided to the public

# MDT Travel Info Map



**MDT Snow Plow Camera**

Date: 03-13-2018 12:08:09

A first-person view from the driver's perspective of a snow plow. The road is covered in snow with visible tire tracks. The plow's blade is visible in the foreground. The background shows a snowy landscape with evergreen trees and hills under a clear sky.

Air 50°F Road 30°F

Close



## Lesson Learned

- Not all MDT hardware is the same which makes expansion more difficult
- Though all plow trucks are equipped with AVL, for their purposes it worked better to track truck locations using GPS
- Trucks also have rear facing cameras but MDT has had difficulty keeping rear cameras clear
- Advice: after granting others access to camera images be ready to expand both for the public and internally for maintenance management



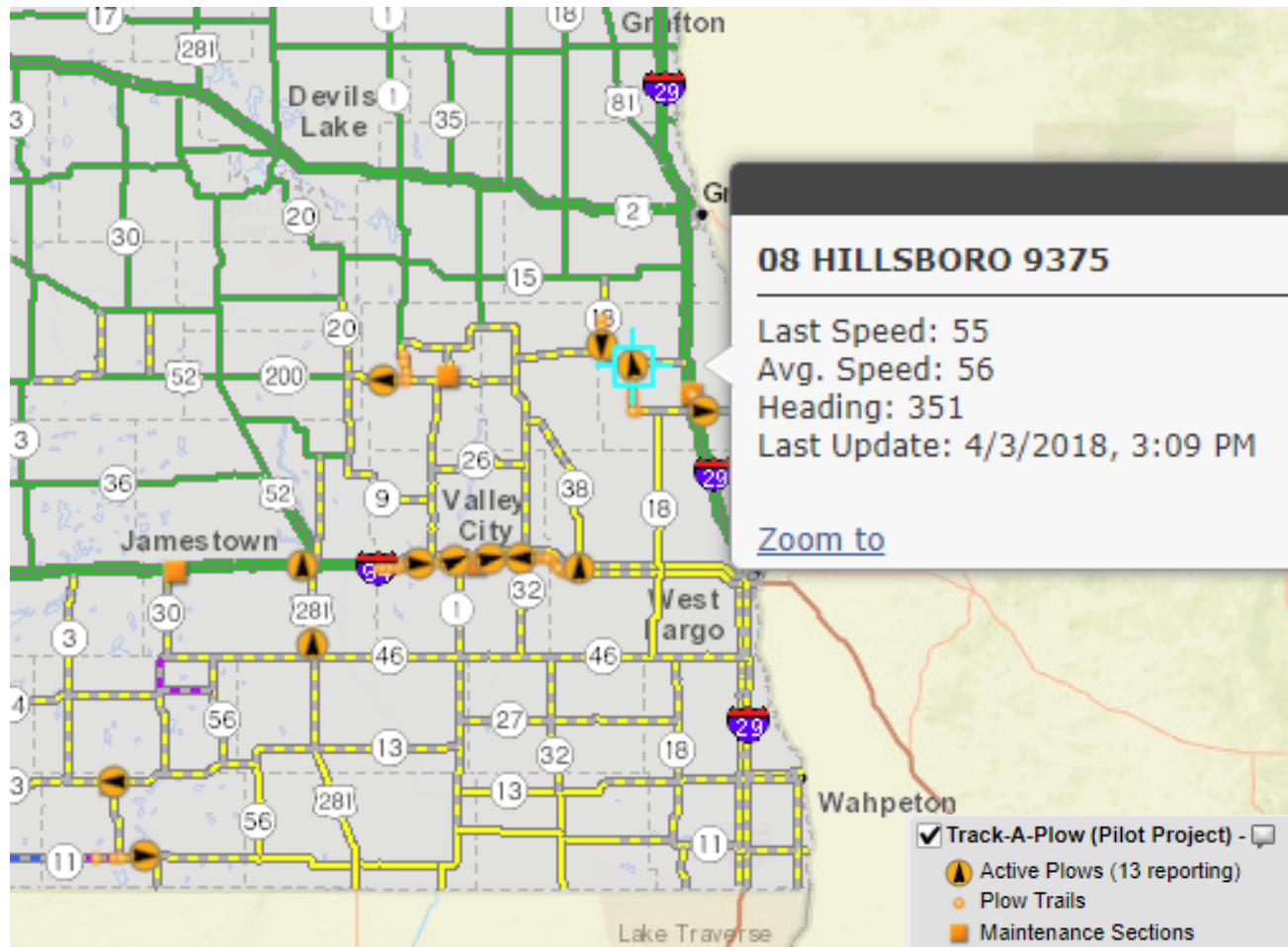
# North Dakota

- North Dakota launched a Track-A-Plow pilot program mid-January 2018
- The pilot was implemented using a GPS tracker on 47 of the state's 350 plows to assure legislators and the public that the DOT was continuing to plow the roads and maintain the same level of service after closing 8 garages
- Plows use cellular service to report to North Dakota's 511 map

# North Dakota

- The GPS tracker uses the North Dakota traveler information map to show plow speed, time, and direction and provide bread crumbs to identify the plow location for the last 15-20 minutes
- Data is pulled every 2 minutes, but if the plow is turned off or moving less than 3 mph, it is not shown on the map

# NDDOT Track-A-Plow



## Lessons Learned

- NDDOT wishes they had installed cameras in plows right away as the GPS tracker does not provide the public with much information
  - NDDOT plans to continue with the GPS tracker until an AVL system with cameras is feasible



# Minnesota

- 240 of MnDOT's 837 plows have cameras and 650 are equipped with AVL
  - All new trucks are purchased with AVL
  - By 2019 MnDOT hopes to have AVL in all plows
- Photos are taken every 5 minutes when the truck is traveling more than 10 mph and is close to the center line and provide information to the 511 website



# Minnesota


- Camera images interface with the 511 map, and MDSS website
- Camera images are displayed on Minnesota 511 website with bread crumbs to show where the plow has been

- MnDOT can take video but videos must be manually initiated, are not transmitted, and are only used to record general information, accidents, and work zones
- Feedback
  - Positive response to cameras from the public
  - Operators did not feel cameras posed a distraction and would like additional cameras to expand the network

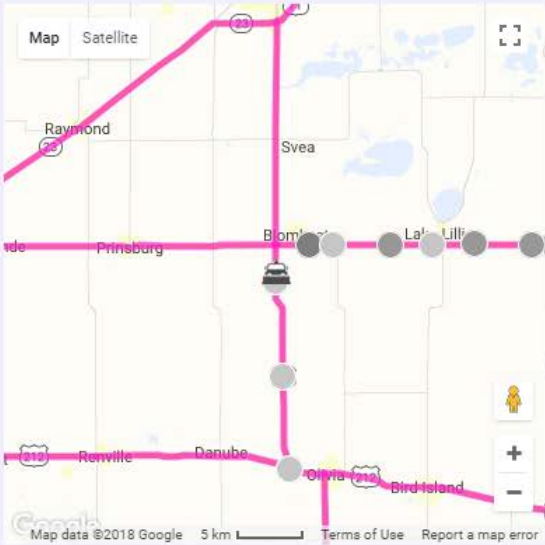


# 511 Minnesota

US 71: Snow Plow Camera Today at 12:12 PM CDT



April 3, 2018 12:12:43  
TH 71 Olivia to Jct 7



Map Satellite

Raymond Svea Prinsburg Blom La Lilli Renville Danube Olivia Bird Island

Map data ©2018 Google 5 km Terms of Use Report a map error

FLOW CAM

Today at 12:02 PM CDT, MN 7

Today at 11:52 AM CDT, MN 7

Today at 11:42 AM CDT, MN 7

Today at 11:32 AM CDT, MN 7

Today at 11:22 AM CDT, MN 7

Today at 11:12 AM CDT, MN 7

Today

## Lesson Learned

- MnDOT is moving from dash mounts to ceiling mounts
  - Ceiling mounts provide a better view of the road (Snow can block images from cameras with dash mounts)
  - Dash mounts are more intrusive to operators
- Concern that camera images might be too good and not adequately depict the severity of the weather and road conditions because the cameras filtered some blowing snow
  - MnDOT found cameras are good for showing road conditions
- Advice: States should get a camera system for future compatibility

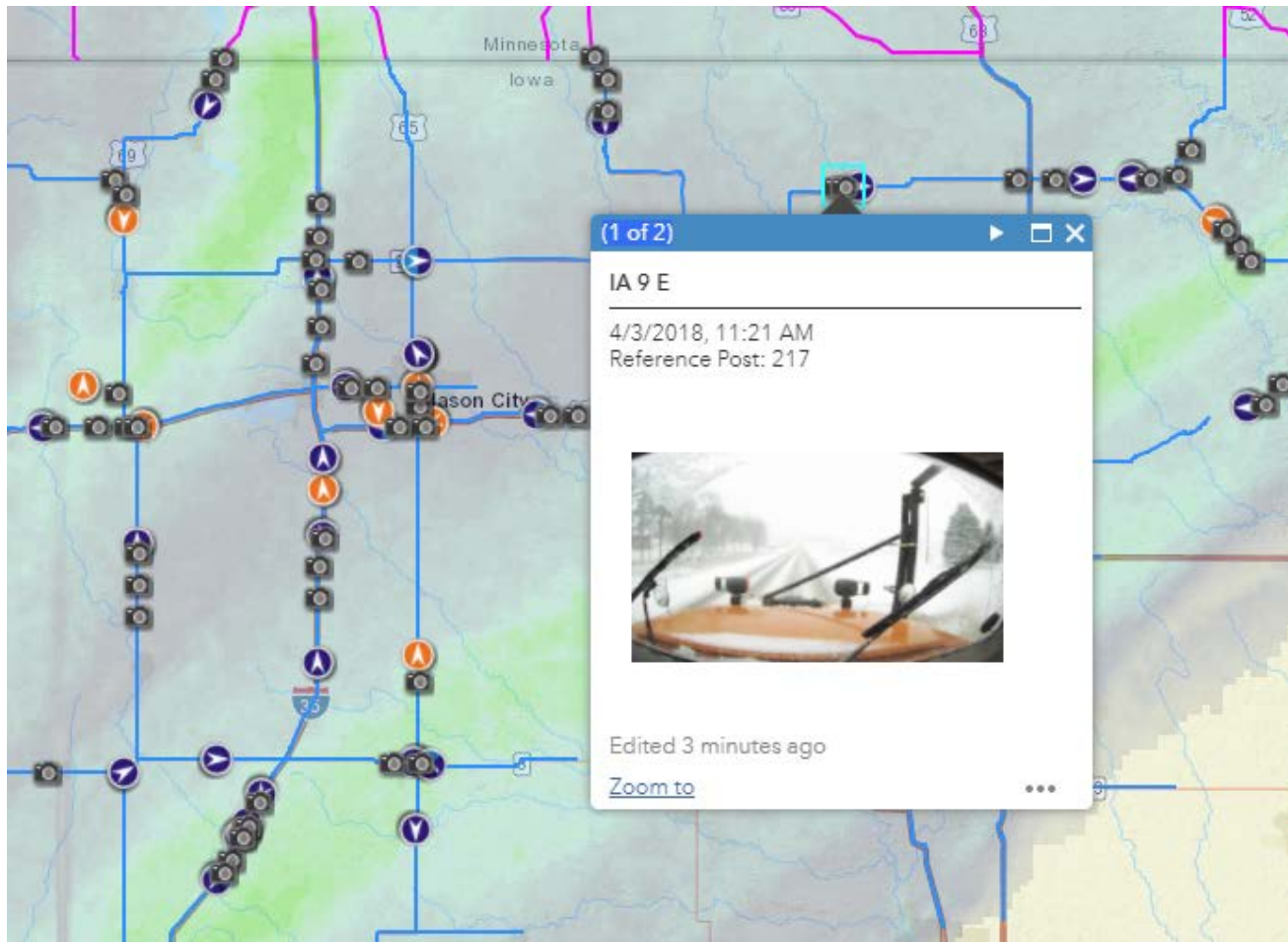
- Iowa's Track a Plow system rolled out in 2013
- In August 2013, the Iowa DOT director requested that plow photos be provided to the public
- An iPhone was mounted forward facing in the cab of 600 of Iowa's 902 plows and camera images for traveler information were added in February 2014

- Iowa DOT created an iPhone app that powered up and down at startup/shutdown
- Photos were taken every 5-10 minutes when plows moved at least 8 mph within 20 ft of the center line
- The iPhone system was low cost and worked well at first, but frequent iOS updates affected the app and suction cup mounts frequently fell off the window from constant vibration and extreme temperatures

- In 2015, Iowa DOT changed AVL providers to improve cell coverage but found that they still experienced some problems along their borders
- During the summer of 2017, Iowa DOT replaced snow plow iPhones with Access 1065L cameras
- The winter of 2017-18 is the first full winter Iowa DOT has used this system but they have experienced few issues

- With the new cameras, night photos default to black and white
- Iowa DOT has stored the photos from the beginning
  - There have been instances where Iowa DOT has needed to retrieve photos to address claims against the department
- Through social media Iowa has recorded outstanding public response to camera images
- Iowa maintains 2 feeds, one with filters for the website and one for internal use

# Iowa Track a Plow



## Lessons Learned

- In addition to traveler information, plow camera images can be used to assist garages in making staffing decisions
- Advice from an operational standpoint:
  - Manage the expectations of management
  - Select the cell provider with the best coverage





# Pennsylvania

- In 2014-15, PennDOT created a pilot project that equipped 700 plows with an AVL system that used in-truck technology to log and share data in real-time as part of the Governor's Office of Transformation, Innovation, Management and Efficiency (GO-TIME) initiative.
- After the first year, the program expanded to include all plows used by PennDOT, some owned by the state and some that were rented.



# Pennsylvania

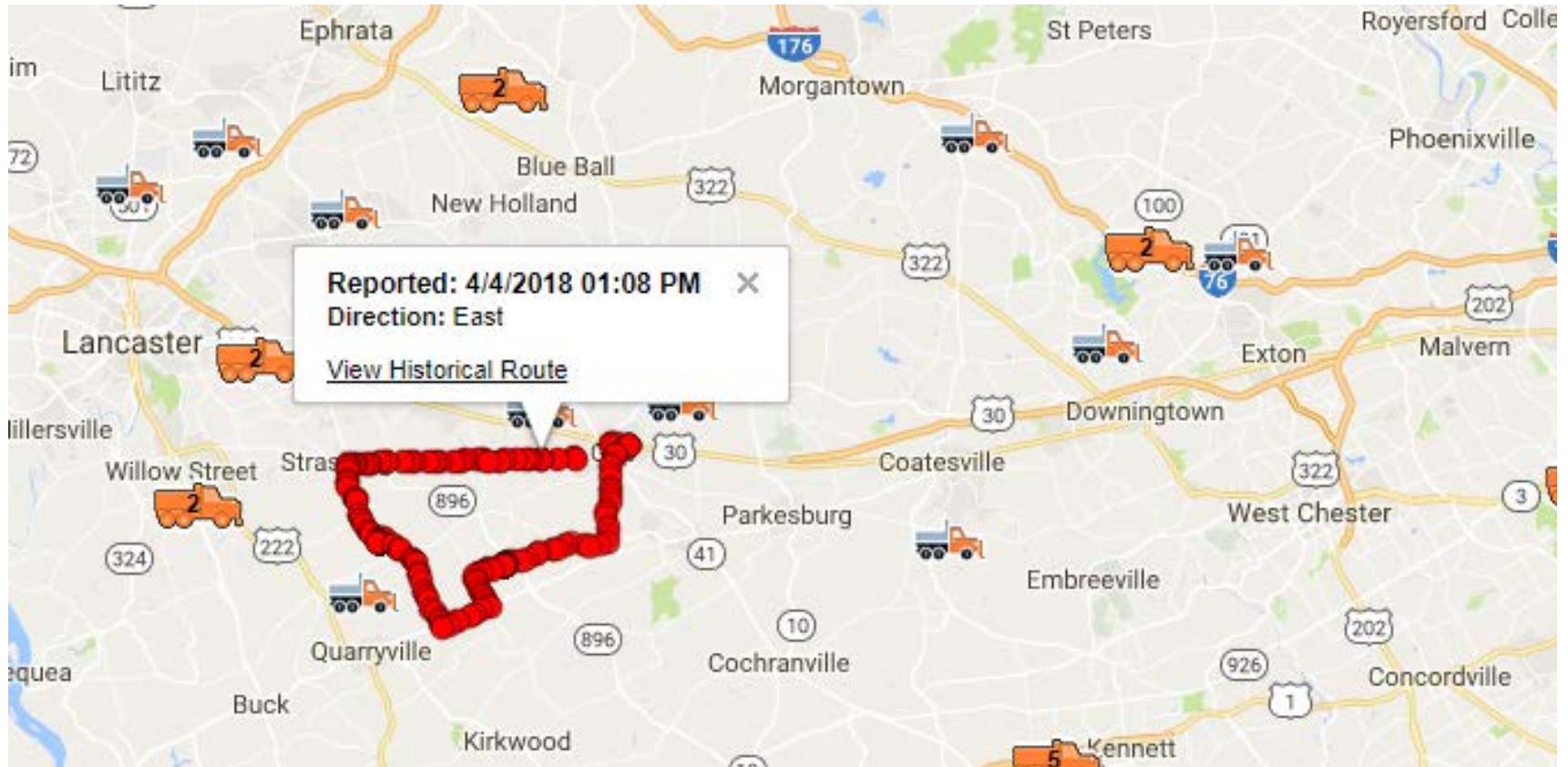
- Currently, PennDOT has installed AVL on all of its nearly 3,000 plows
- Each AVL unit sends a cellular signal every 30 seconds to show where a plow is located
- When the plow is on and moving, PennDOT's AVL system is on, but if a plow doesn't move for 30 minutes or is turned off, it will not appear on the 511 map



# Pennsylvania Background

- Prior to the project the 511 mobile app had been downloaded by 60,000 users after the pilot project it was downloaded by 220,000 users.
- 1 in 3 site visitors used the plow truck location feature.
- A local tv network successfully located three plows shown on the northern part of the state's 511 map

# Pennsylvania 511





# Pennsylvania

## Lesson Learned

- PennDOT has seen a lot of public response from the addition of the AVL technology, most of it positive
- PennDOT Maintenance recommends talking to drivers early to help answer questions and minimize driver resistance
- PennDOT worked with the plow drivers' union to reach an agreement prior to implementing the AVL system so most drivers responded either positively or neutrally
- A change in how the public uses their 511 website, from traditional day-to-day traveler information to information primarily for winter weather and emergencies, has changed how PennDOT views future enhancements to 511.



# Project Summary

- Iowa DOT, MnDOT, and MDT provide snow plow camera images to the public.
- NDDOT and PennDOT provide only snow plow location and breadcrumbs to the public.
- No state that was interviewed streams video or has plans to stream video.



# Project Summary

- ITD partnered with Idaho National Laboratory (INL) to place a camera on two INL vehicles in addition to two ITD plows during their pilot project.
- Montana uses images taken every half mile by cameras installed on tow plows to update their 511 website and displays photos on the website for 30 minutes.
- North Dakota DOT uses a GPS tracker with the traveler information map to show plow speed, time, and direction to the public and provide bread crumbs to identify the plow location for the last 15-20 minutes.



# Project Summary

- Images taken by MnDOT snow plows interface with Minnesota's 511 map, MDSS website, and the weather data exchange.
- Iowa DOT uses color intensity bread crumbs on their 511 website to identify where the plow has been and attaches this information to historic camera images from the last 24 hours.
- PennDOT installed AVL on all plows, provides plow location data to the public, and collects additional data including spreader rate, plow speed, and temperature for internal use.





# Contact Information

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