Iowa DOT's Mobile Truck Cameras and GPS Experience

Columbus, Ohio

June 29, 216

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Iowa DOT

IOWA DOT

SMARTER | SIMPLER | CUSTOMER DRIVEN

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IOWA DOT

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Agenda

- Iowa DOT Overview
- The Plow Data Story
  - Initial GPS/AVL Development
  - Dash Cameras
  - Involving the Public
  - Future direction
  - Lessons learned

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- Primary Roadway Responsibilities:
  - 24,122 lane miles of roadway
  - 3,687 lane miles of Interstate (ramps included)
  - 9,403 centerline miles of roadway
  - 3 different winter service levels

- Equipment
  - 892 Snowplows
  - 53 Motor graders
  - 133 Endloaders
  - 12 Heavy duty self-propelled snow blowers
  - 76 Snow blower attachments for loaders/tractors
  - 12 Tow Plows

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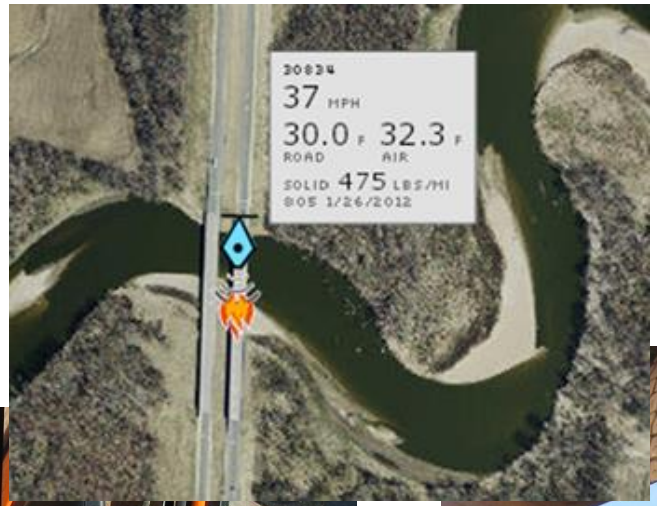
- Budget
  - $43 Million snow/ice budget
  - 5 year Avg Salt usage – 166,539 tons
  - Avg price per ton (2015 Contract) = $75.01
  - ~17.8 Million gallons brine/year
- 109 Maintenance facilities
- Staffing
  - 1,051 Permanent staff
  - 462 Seasonal staff
  - 5-year average winter hours = 409,090 hours

Our AVL/Plowcam Experience



Goals and Objectives:

- Purpose was to understand & visualize
  - Fleet Movement
  - Material Usage
- Provide
  - Tools for managers to direct fleet
  - Less paperwork for drivers
  - Public a better winter driving experience
- Turn plow data into information we could use to become more efficient
- Access to raw data for custom reporting
- Selected LTI as a vendor (https://www.loctech.com/)

Full Deployment -- 2012/13

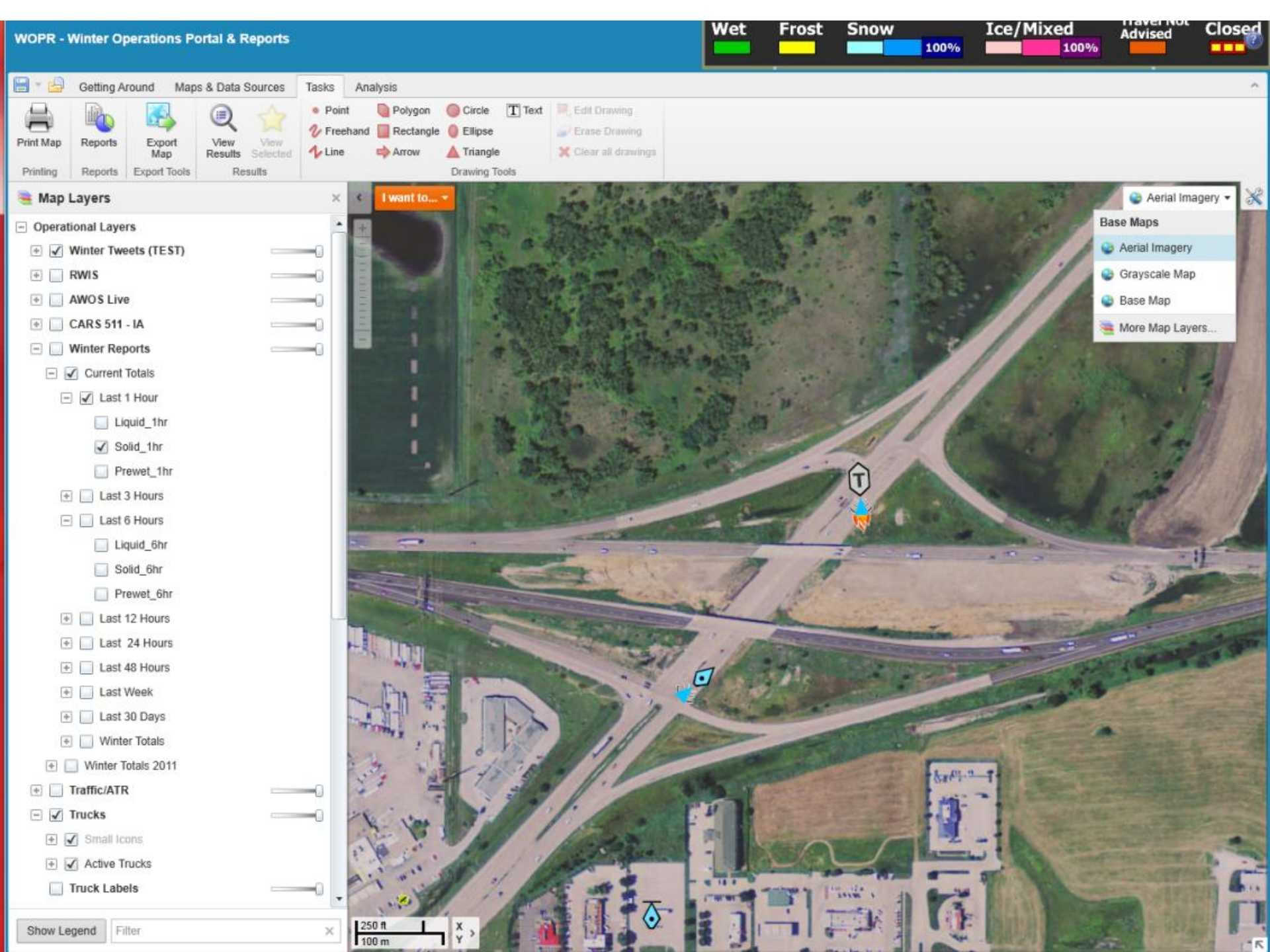
- Used the simpler modem (LT6 unit)
- Made the system invisible to the driver
- Standardized spreader controllers
- Install on all ~900 plows
- More robust database architecture
- Began integration with existing resource management systems

~$3,000 per truck for AVL equipment
$7 per month per truck for data plan
$43,000/year for data hosting

Data Collected

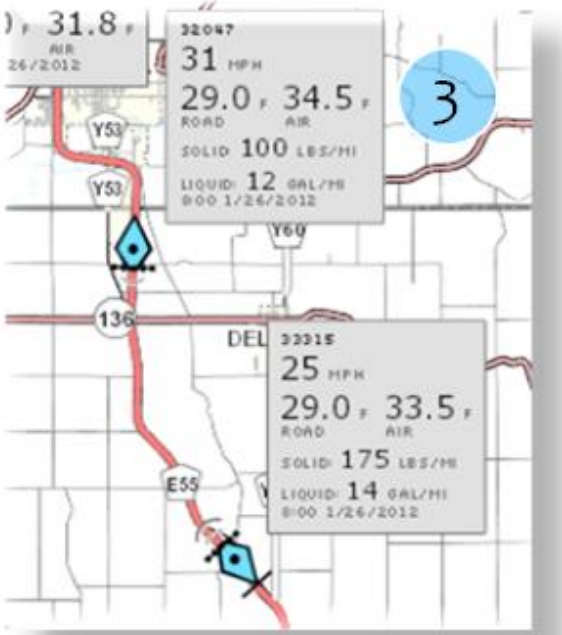
- Truck location
- Speed
- Heading
- Front and wing plow up/down
- Spreader data
  - Set rate
  - Instantaneous rate
  - Material type
  - Prewet/antiice rate
  - Cumulative ‘storm totals’ of applied materials
- Odometer (sometimes)
- Pavement and air temperature

Data flows ‘real time’ – when changes are made or at least every 2 min.


WOPR - Winter Operations Portal & Reports
Wet
Frost
Snow
100%
Ice/Mixed
100%
Travel Not Advised
Closed
Getting Around
Maps & Data Sources
Tasks
Analysis
Print Map
Reports
Export Map
View Results
View Selected
Printing
Reports
Export Tools
Results
Point
Freehand
Line
Polygon
Rectangle
Arrow
Circle
Ellipse
Triangle
Text
Edit Drawing
Erase Drawing
Clear all drawings
Drawing Tools
Map Layers
Operational Layers
Winter Tweets (TEST)
RWIS
AWOS Live
CARS 511 - IA
Winter Reports
Current Totals
Last 1 Hour
Liquid_1hr
Solid_1hr
Prewet_1hr
Last 3 Hours
Last 6 Hours
Liquid_6hr
Solid_6hr
Prewet_6hr
Last 12 Hours
Last 24 Hours
Last 48 Hours
Last Week
Last 30 Days
Winter Totals
Winter Totals 2011
Traffic/ATR
Trucks
Small Icons
Active Trucks
Truck Labels
Show Legend
Filter
I want to...
Aerial Imagery
Base Maps
Aerial Imagery
Grayscale Map
Base Map
More Map Layers...
250 ft
100 m
X
Y


1
32908
31 MPH
31.0 F ROAD
30.3 F AIR
LIQUID: 20 GAL/MI
6:48 1/26/2012


2
30147
31 MPH
36.0 F ROAD
34.8 F AIR
SOLID: 125 LBS/MI
8:00 1/26/2012
Z36
30
Z30
LOW MOOR

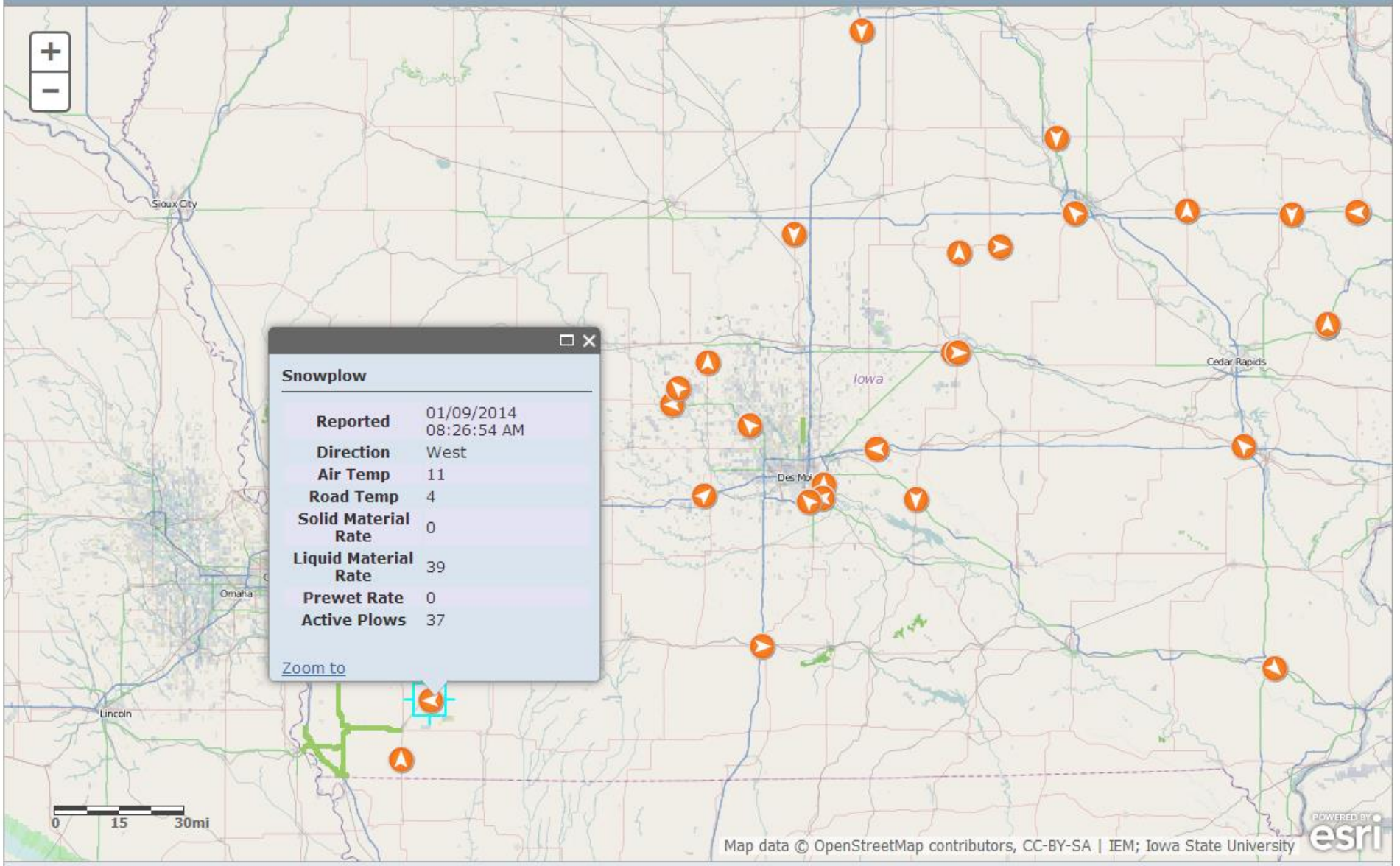

31.8 F
AIR
26/2012
32047
31 MPH
29.0 F ROAD
34.5 F AIR
SOLID: 100 LBS/MI
LIQUID: 12 GAL/MI
8:00 1/26/2012
3
Y53
Y53
Y60
136
DEL
33315
25 MPH
29.0 F ROAD
33.5 F AIR
SOLID: 175 LBS/MI
LIQUID: 14 GAL/MI
8:00 1/26/2012
E55


34TH AVE NW
4
65
6


30147
30 MPH
37.0 F ROAD
34.8 F AIR
SOLID: 125 LBS/MI
8:01 1/26/2012
32592
37 MPH
29.0 F ROAD
34.8 F AIR
SOLID: 250 LBS/MI
FREWET: 30 GAL/MI
8:00 1/26/2012
5

Iowa DOT Snowplows

Map shows Iowa Department of Transportation's snowplows.



Snowplow

Reported	01/09/2014 08:26:54 AM
Direction	West
Air Temp	11
Road Temp	4
Solid Material Rate	0
Liquid Material Rate	39
Prewet Rate	0
Active Plows	37

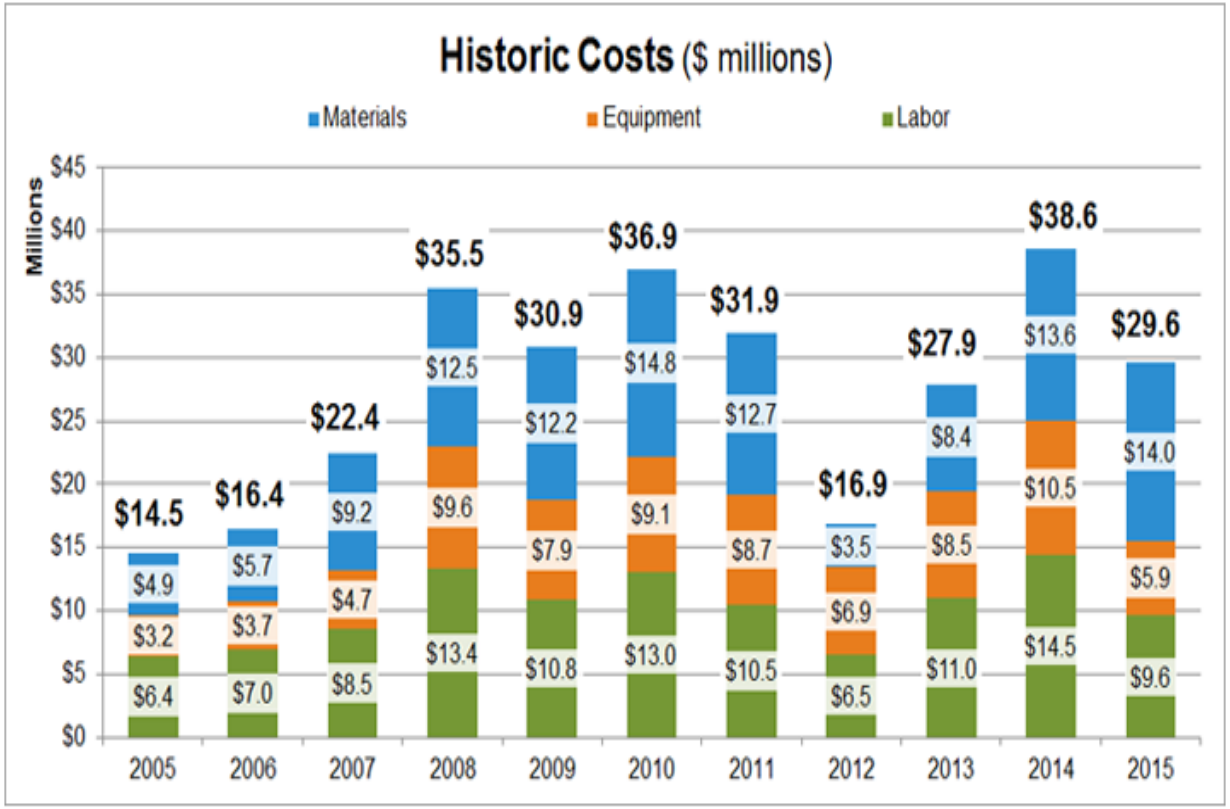
Zoom to

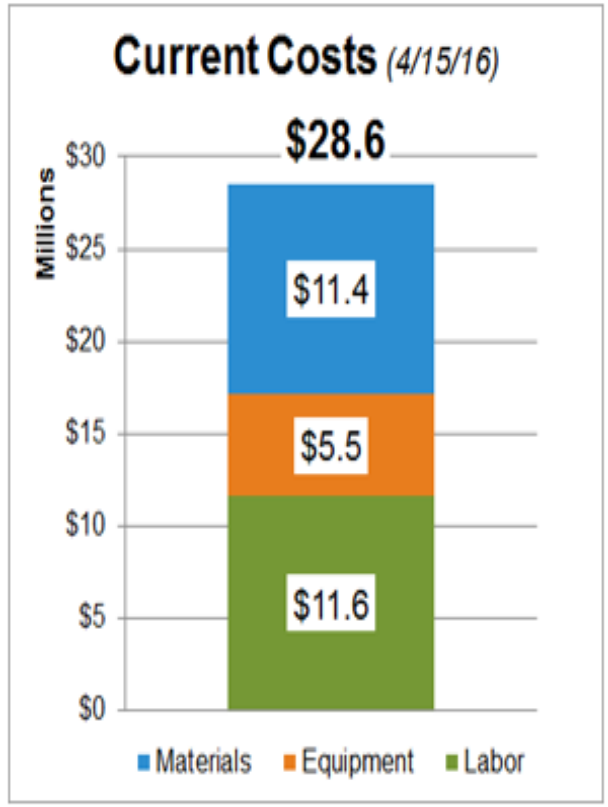
A map from: ejabrams

state is slightly under the expected salt use.

Salt target considers storm type and duration, concurrent pavement temperatures, and traffic volume of roads impacted by

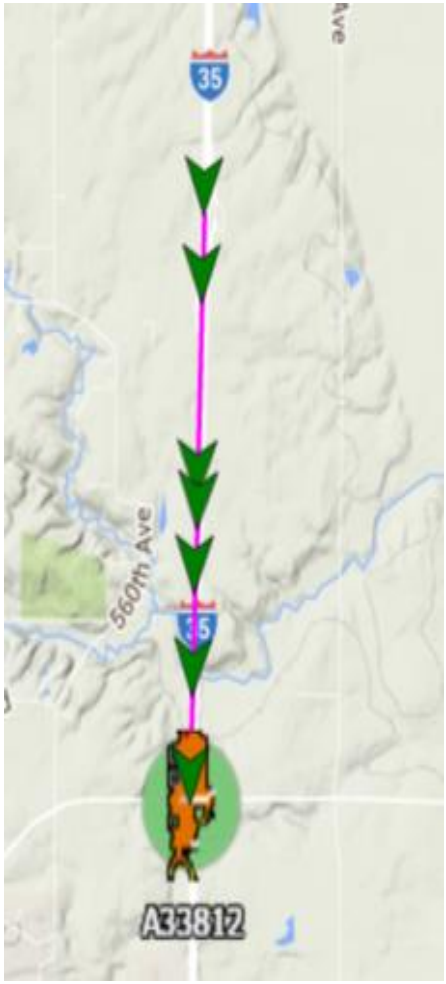
Winter Maintenance Season Expenditures





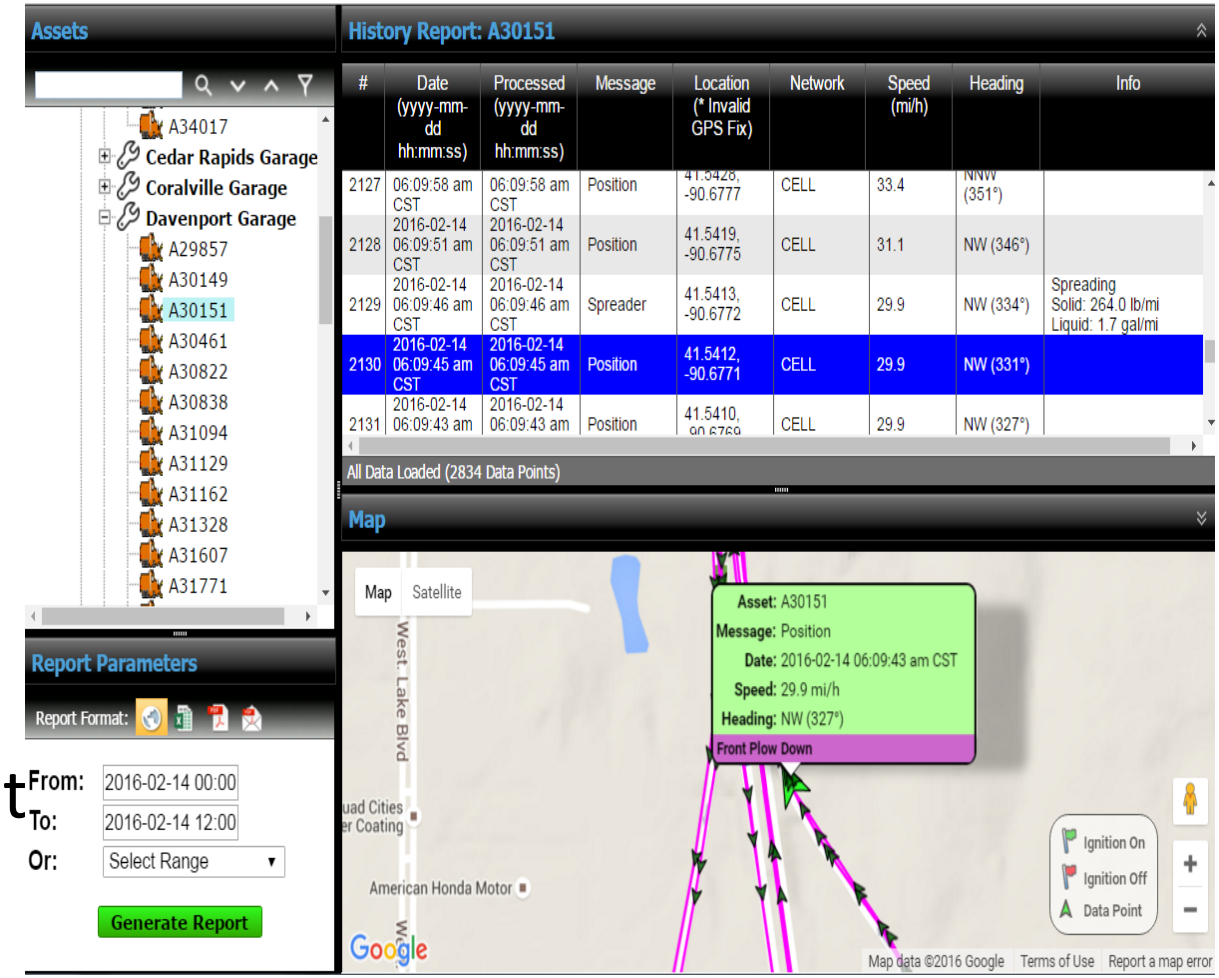
Plow GPS Update

- First GPS system install began in 2010
- Since 2012, all ~900 plows equipped with GPS
- New GPS system contract awarded in September to Skyhawk
- “Split” deployment to accommodate budgets and allow more install time
  - Installation started on ~ 540 plows through October-January
  - Districts 4, 1, 6, Waterloo, and new trucks
  - Remaining fleet to be equipped this spring, likely before July
  - Old contract ends June 30



New Features

- New hosted user-interface
- More engine diagnostics
- In-truck WiFi
- More spreader system information
- US Cellular instead of Sprint

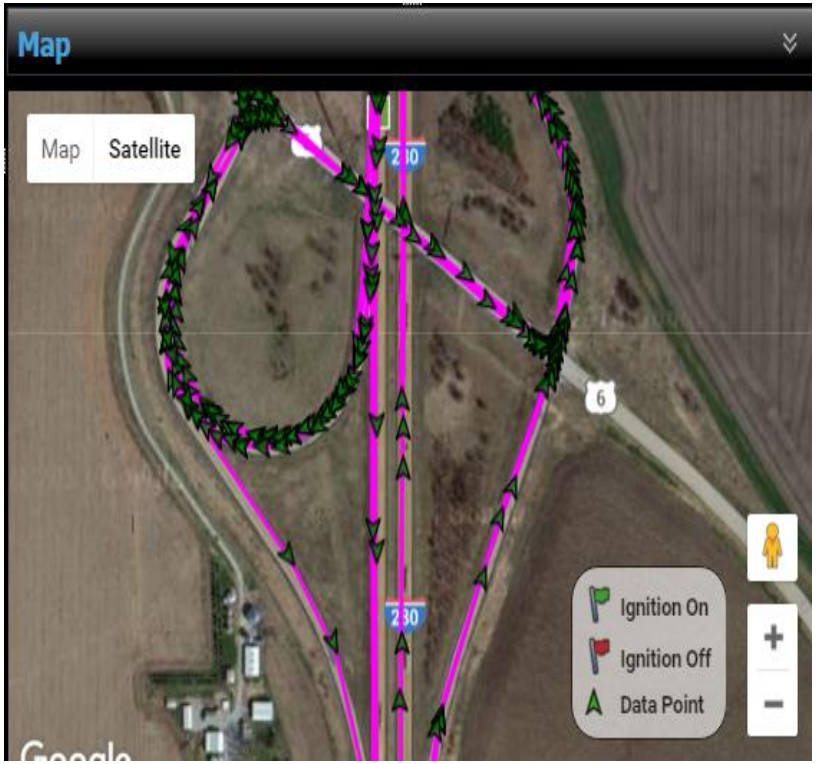


Reporting Features

- Storm replay
- MIL alerts to email
- Real-time and historical crumbtrail
- Custom geofence setup
- Winter operations material/hours summaries by
  - Trip
  - Time
  - Geofence
- Now used by Claims Dept. for managing complaints and damage claims

From: "no-reply@connectanywhere.co" <no-reply@connectanywhere.co>
Date: March 2, 2016 at 7:56:10 AM CST
To: "Wolf, Ronald [DOT]" <Ronald.Wolf@dot.iowa.gov>
Subject: MIL Alert: A32859

Trouble Code(s):
SPN: 8321 FMI: 7 CM: 0 OC: 0
Occurred: 2016-Mar-02 07:56:08 CST
http://goo.gl/lS1emg




…Also in 2013-14 – The Plow Cam!

iPhone Plow Cams

What

- iPhones with suction-cup windshield mounts
- Custom app snaps a photo of road every 10 minutes if truck is moving

Why

- A picture is worth a thousand words
- Road condition monitoring for managers and public

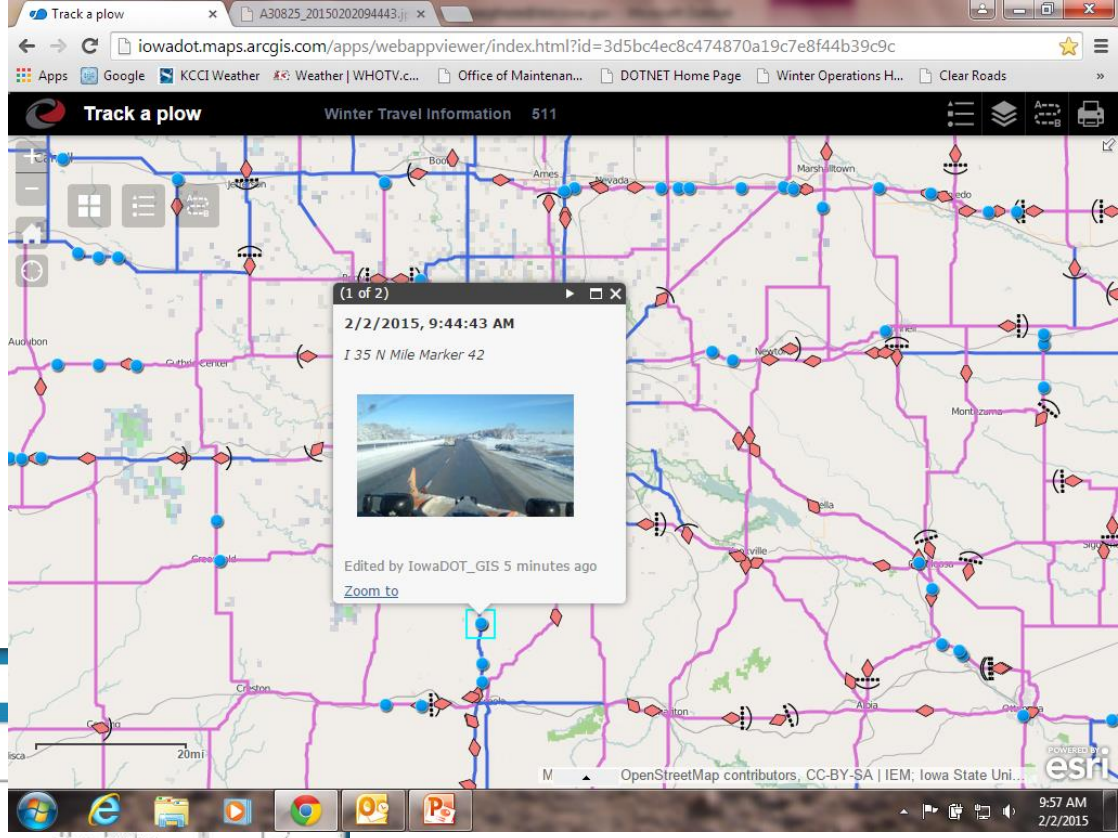
How

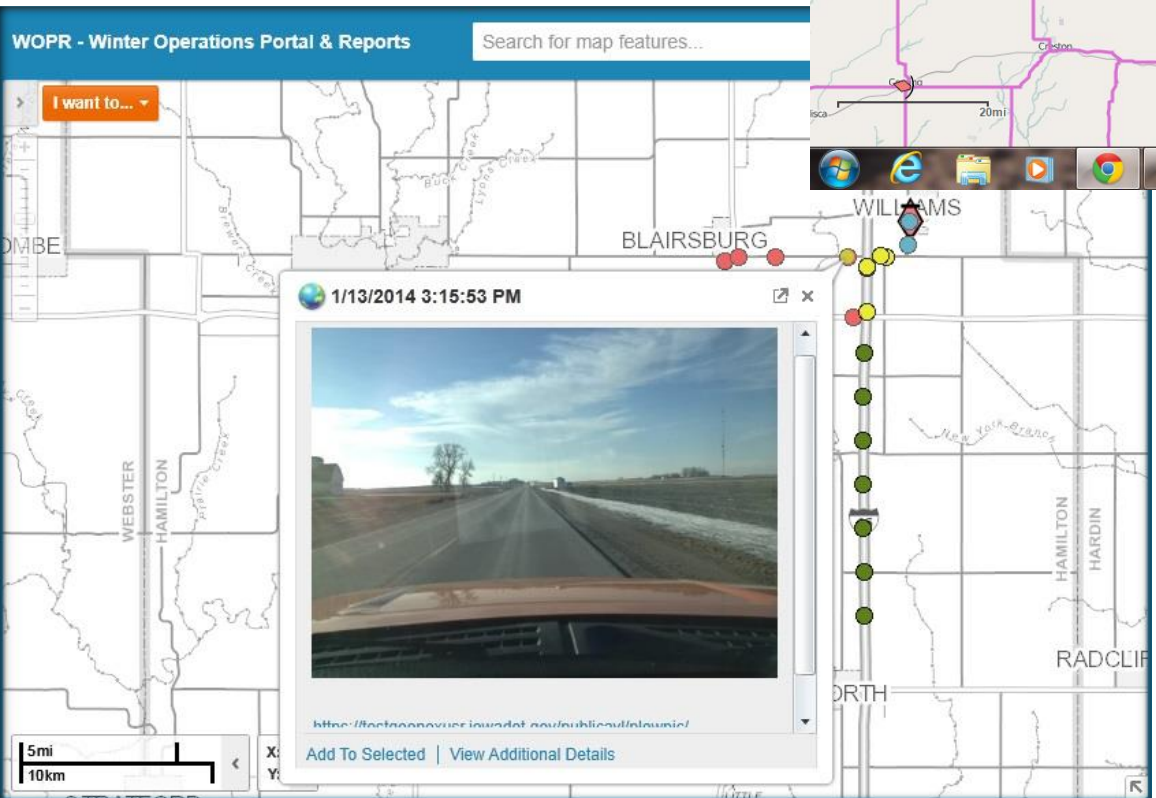
- Phone sends picture and GPS coordinates to server
- Photo posted on website map with location

Why iPhones?

- Could not just plug a regular camera into our current GPS/AVL system
- Has its own connectivity and data transfer
- Cheap (free with data plan ~$35/mo.)
- Nice photos
- Easily available
- Can design custom programming
- Multi-functional
- Simple

1-hour of photos available to Internal AVL website





½ hour available to public plow page

How Plow Cam Helps Maintenance

- Supervisors can check on many roads at once
- See if maintenance plan is having the intended effect
- Snoop on other regions' progress
- Watch the storm roll in and its impact before it arrives on location
- See if precipitation on radar is actually hitting the ground -- and vice versa

2014-2015 AVL/Plow Cam Timeline

- Public site (dubbed Track a Plow) renovated
- Expanded to ~420 plow cams
  - Currently don't believe all plows must be equipped
- IT fixed some bugs that were causing the app to crash
- PlowCam code and documentation now available to share with other agencies

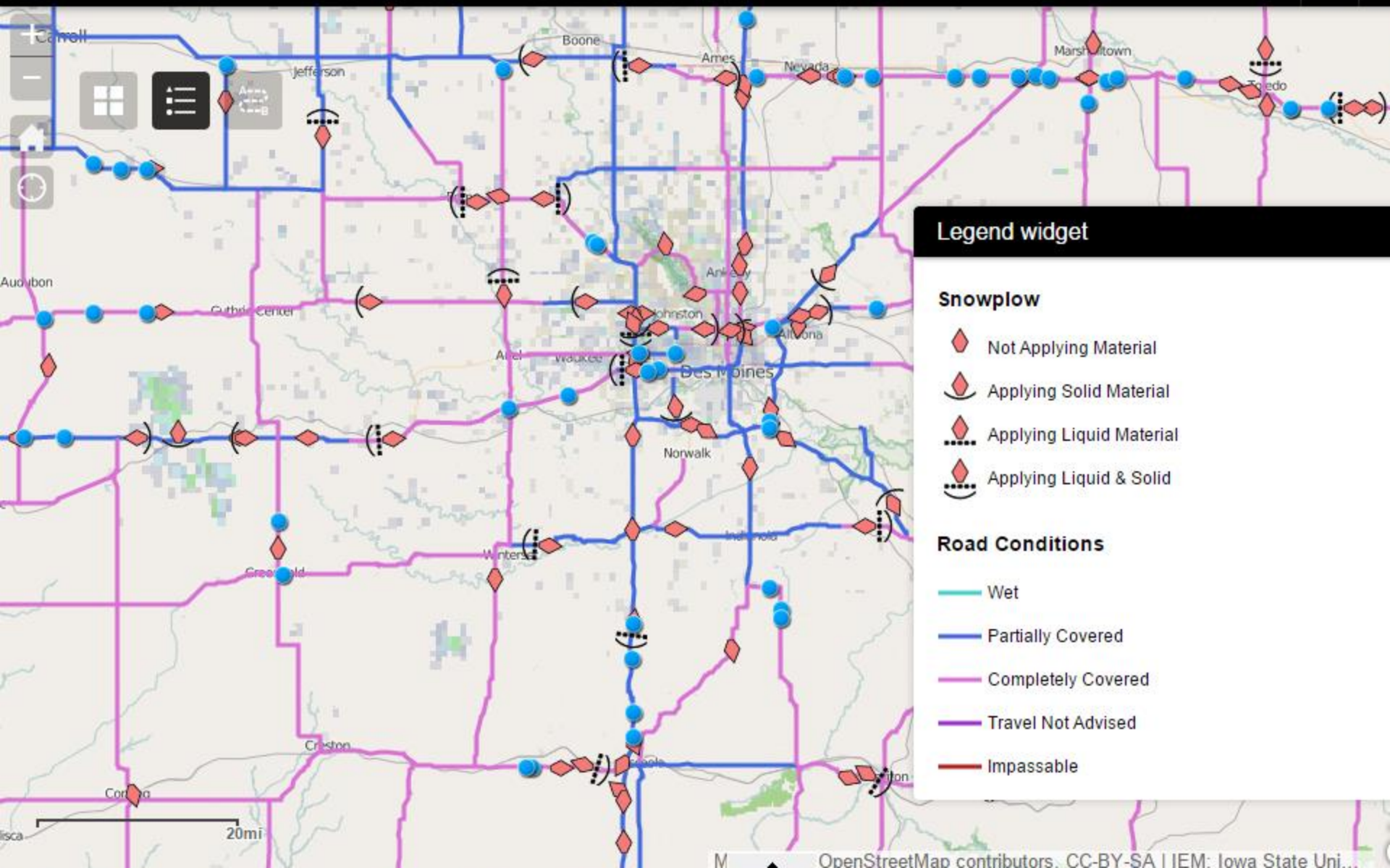
Track a plow

iowadot.maps.arcgis.com/apps/webappviewer/index.html?id=3d5bc4ec8c474870a19c7e8f44b39c9c

Apps | Google | KCCI Weather | Weather | WHOTV.c... | Office of Maintenan... | DOTNET Home Page | Winter Operations H... | Clear Roads

Track a plow

Winter Travel Information 511



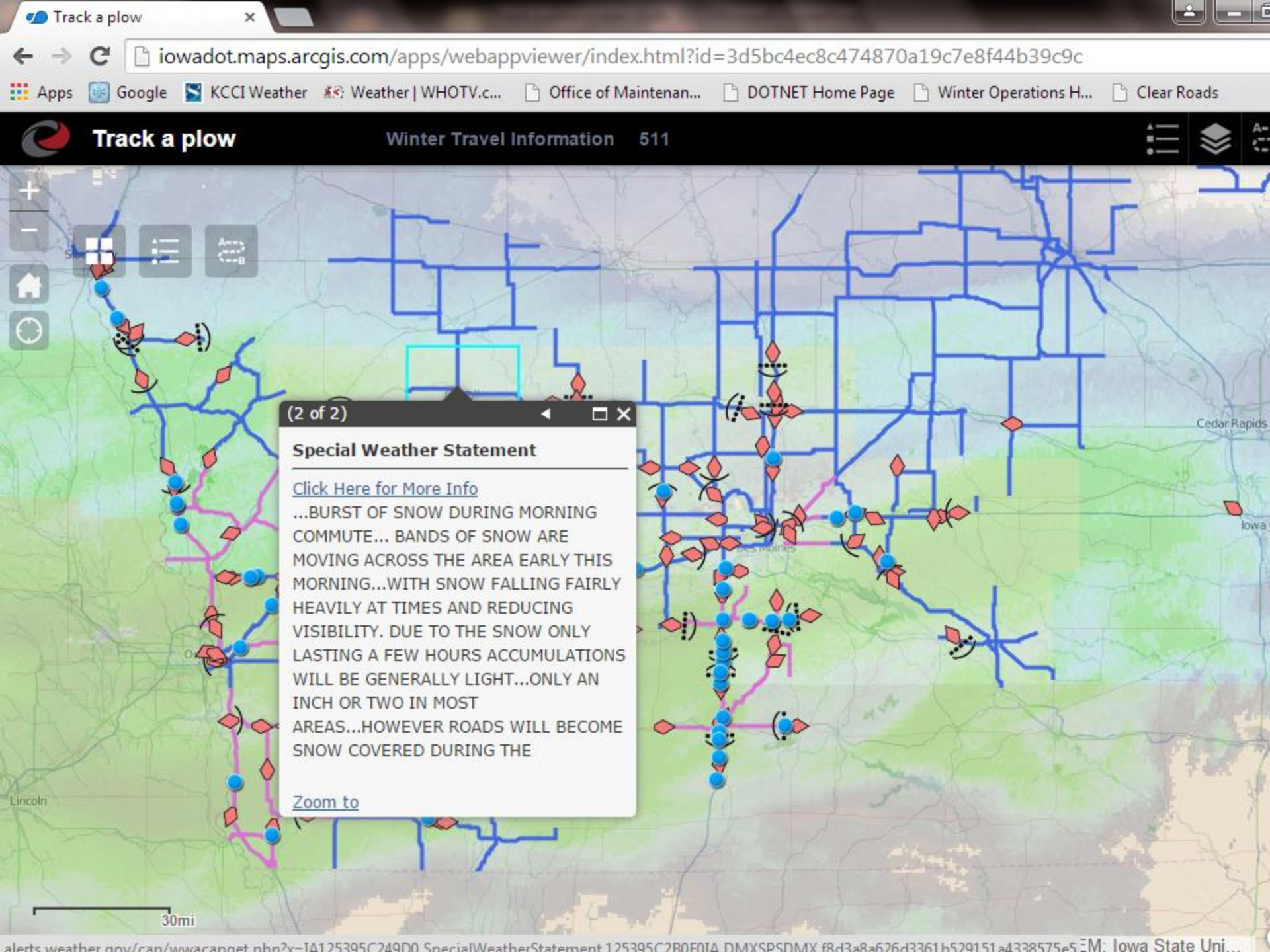
Legend widget

Snowplow

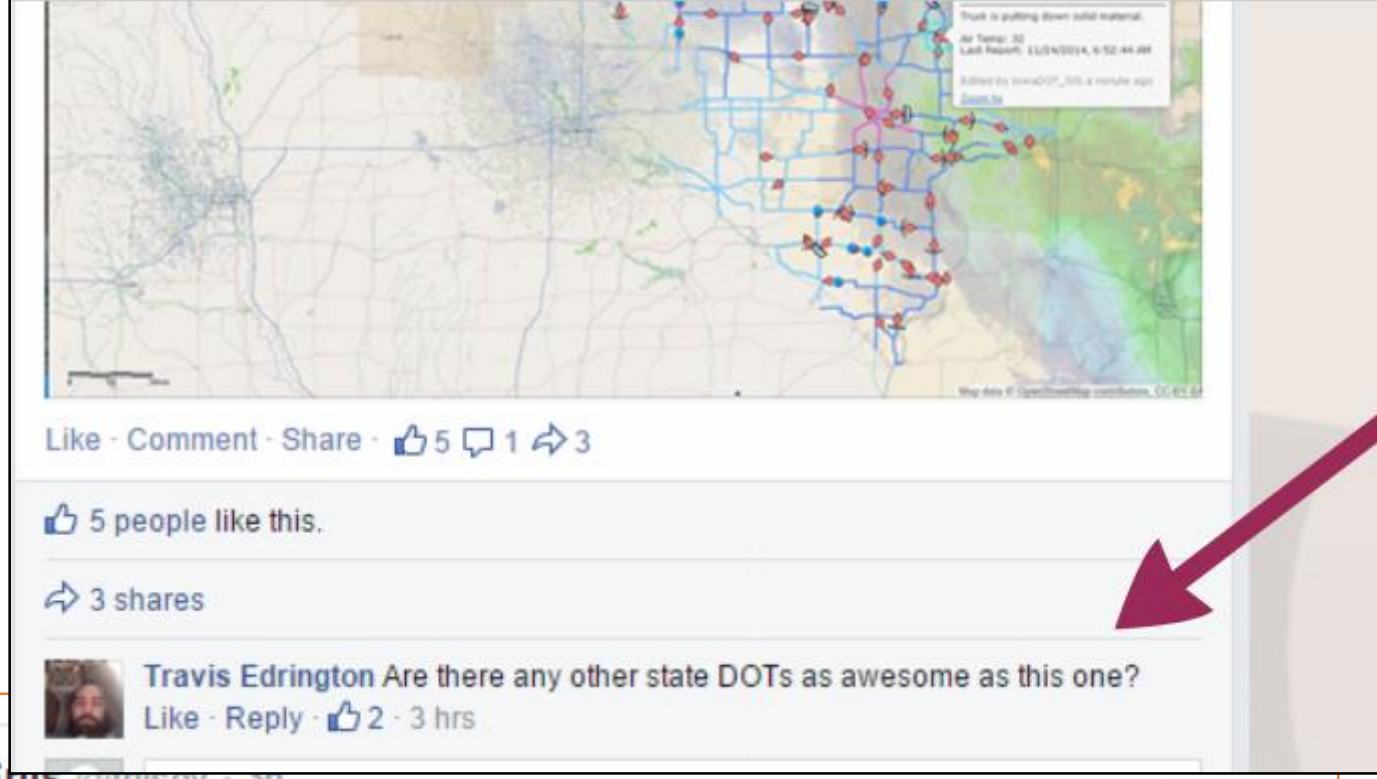
- Not Applying Material
- Applying Solid Material
- Applying Liquid Material
- Applying Liquid & Solid

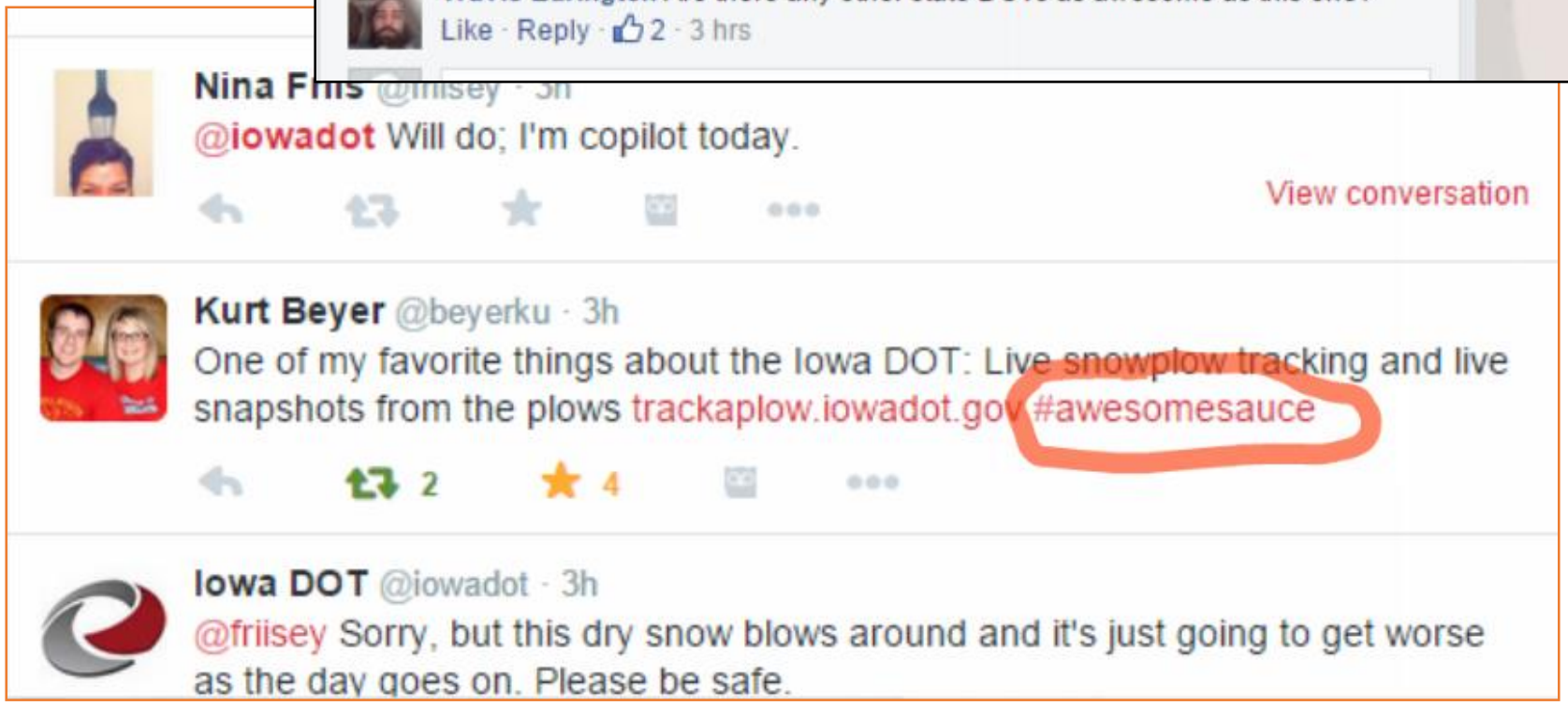
Road Conditions

- Wet
- Partially Covered
- Completely Covered
- Travel Not Advised
- Impassable


Track a plow
iowadot.maps.arcgis.com/apps/webappviewer/index.html?id=3d5bc4ec8c474870a19c7e8f44b39c9c
Apps
Google
KCCI Weather
Weather | WHOTV.c...
Office of Maintenan...
DOTNET Home Page
Winter Operations H...
Clear Roads
Track a plow
Winter Travel Information
511
(2 of 2)
Special Weather Statement
Click Here for More Info
...BURST OF SNOW DURING MORNING COMMUTE... BANDS OF SNOW ARE MOVING ACROSS THE AREA EARLY THIS MORNING...WITH SNOW FALLING FAIRLY HEAVILY AT TIMES AND REDUCING VISIBILITY. DUE TO THE SNOW ONLY LASTING A FEW HOURS ACCUMULATIONS WILL BE GENERALLY LIGHT...ONLY AN INCH OR TWO IN MOST AREAS...HOWEVER ROADS WILL BECOME SNOW COVERED DURING THE
Zoom to
Cedar Rapids
Lincoln
30mi

Public Response: Extremely positive!





Involving the Public

- Communications staff used images and plow counts extensively
  - Multiple posts per day
  - Before, during, and after storms
- Fewer calls from public and law enforcement "wondering if we were out"

Involving the Public

- ~500,000 photo/info requests per day in some large storms
- Used by TV stations for their news/weather segments

What We Have is a Good Start But…

- We need more engine data
- Cell coverage gaps/data drops are problematic
- Need different data at different frequency to support Resource Management System
- Seems silly having 2 cell systems (one for AVL, one for plow cam) in the truck
- Need easier/deeper automated reporting capabilities
- Our plow sensors are not accurate

Potential Solution?

- We need more engine data
- Cell coverage gaps/data drops are problematic
- Need different data at different frequency to support Resource Management System
- Seems silly having 2 cell systems (one for AVL, one for plow cam) in the truck
- Need easier/deeper automated reporting capabilities
- Our plow sensors are not accurate

Looking for alternate (maybe Bluetooth?) plow blade sensors

Looking into new AVL system

Looking to the Future

- Vendor-hosted analytics/website
  - Many automated reports and visualization tools for summarizing plow data
  - More historical play-backs
- Engine fault alerts and idle reports
- External feed to support public pages and DOT analysis
- Internet connectivity to support plow cam and other?
- More frequent spreader data
- Better cell coverage

Looking to the Future

- Started a trial of a new system on 10 trucks which had previously experienced data connectivity problems

SkyHawk Telematics
CONNECT ANYWHERE

cypress solutions

What We Learned

- It is much easier to collect data than it is to provide good information
  - Had to learn the hard way what data we *really* need – and for what purpose
  - Still working on good reporting systems
  - Must try to fill gaps or summaries won't be accurate
- Plow photos are much more useful than we thought at first
- Careful and proactive communication with public seems to really help
  - How much to communicate is always under debate!
- It is an iterative process

Thanks!
Any Questions?

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