

Reading the Signs at MnDOT

Generating Roadwork Reports Automatically from Smart Arrow Boards

Kristin Virshbo
Castle Rock Associates
2018 NRITS Conference
Fort McDowell, AZ
October 24, 2018



WHY SELF-DRIVING CARS *CAN'T EVEN* WITH CONSTRUCTION ZONES



“Self-driving car companies hoping to avoid active construction sites are screwed from the get-go, because the vast majority of states don't bother with databases detailing what work is happening where.”

MnDOT's CARS system

The screenshot displays the MnDOT's CARS system interface. At the top, there is a navigation bar with a menu icon, a yellow diamond icon, a green circle with the number '0', and the user name 'Kristin' next to a settings gear icon. Below this is a search bar with the text 'Future Info: 31' and a search button. The main area is a map of Minnesota showing various traffic reports. A sidebar menu on the left is titled 'Main Menu' and includes sections for 'Current Reports', 'DOT Equipment', 'Future Reports', 'Past Reports', and 'Visitor Info'. The 'Current Reports' section is expanded, showing a list of report types with checkboxes. The map shows several yellow diamond icons (roadwork/warning) and blue square icons (coming soon) scattered across the state. A tooltip over one of the yellow diamonds reads 'Reduced to two lanes'. The map also shows major highways, cities, and geographical features like reservations and forests.

Main Menu

- Current Reports
 - Closure
 - Restriction
 - Incident
 - Roadwork/Warning
 - Lane Closure
 - Weather Warning
 - Flooding
 - Info
- DOT Equipment**
 - Cameras
 - Weather Stations
 - Roundabout
- Future Reports**
 - Coming Soon
- Past Reports**
 - Past Reports
- Visitor Info**
 - Other States' Info

Future Info: 31 Enter a location Clear Search Select Map

Map Satellite

Reduced to two lanes

Help

It's not just self-driving cars that are puzzled sometimes.

US 169 in both directions: Construction work.

Between MN 19 (near Henderson) and Delaware Avenue (near Jordan). Look out for construction work. Expect changing traffic patterns. Until October 30, 2018 at about 4:00AM CDT.

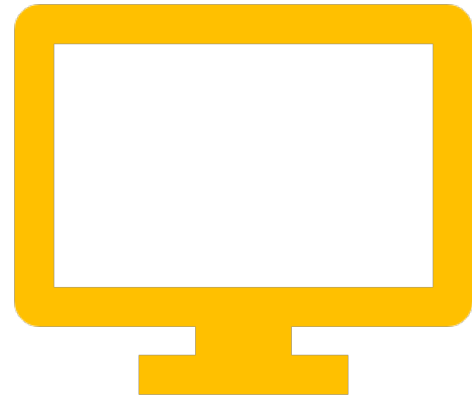
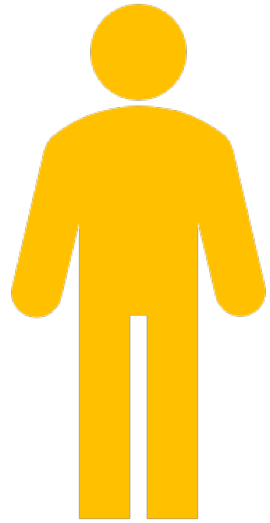
Comment: Head to head traffic from Jordan to TH 19, Henderson exit. For project information: [Click Here](#)

Last updated May 29 by MnDOT

I have something to say about this report

- 4 See what other travelers have said
- 2 travelers confirmed it
- 2 travelers said it wasn't there





How can we better create and share reliable **knowledge** about work zones...for humans and computers?

Arrow Boards

Automating
lane closure reports
from roadwork sites.



THE STREET SMART RENTAL
“BLACK BOX”

ONE WAY

How does it work?



LEFT ARROW
45.522054, -93.235279

THE MINNEAPOLIS / ST PAUL PILOT

- 20 arrow boards
- Highway trucks and pull-behind attenuators
- Goal to go statewide

Creating work zone knowledge: the data flow



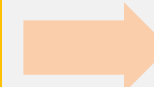
Smart AB

**A signal
from the field**



IRIS (ATMS)

**Adding
operational
intelligence**



CARS (ATIS)

**Spreading the
knowledge**

Step 1:

SmartAB

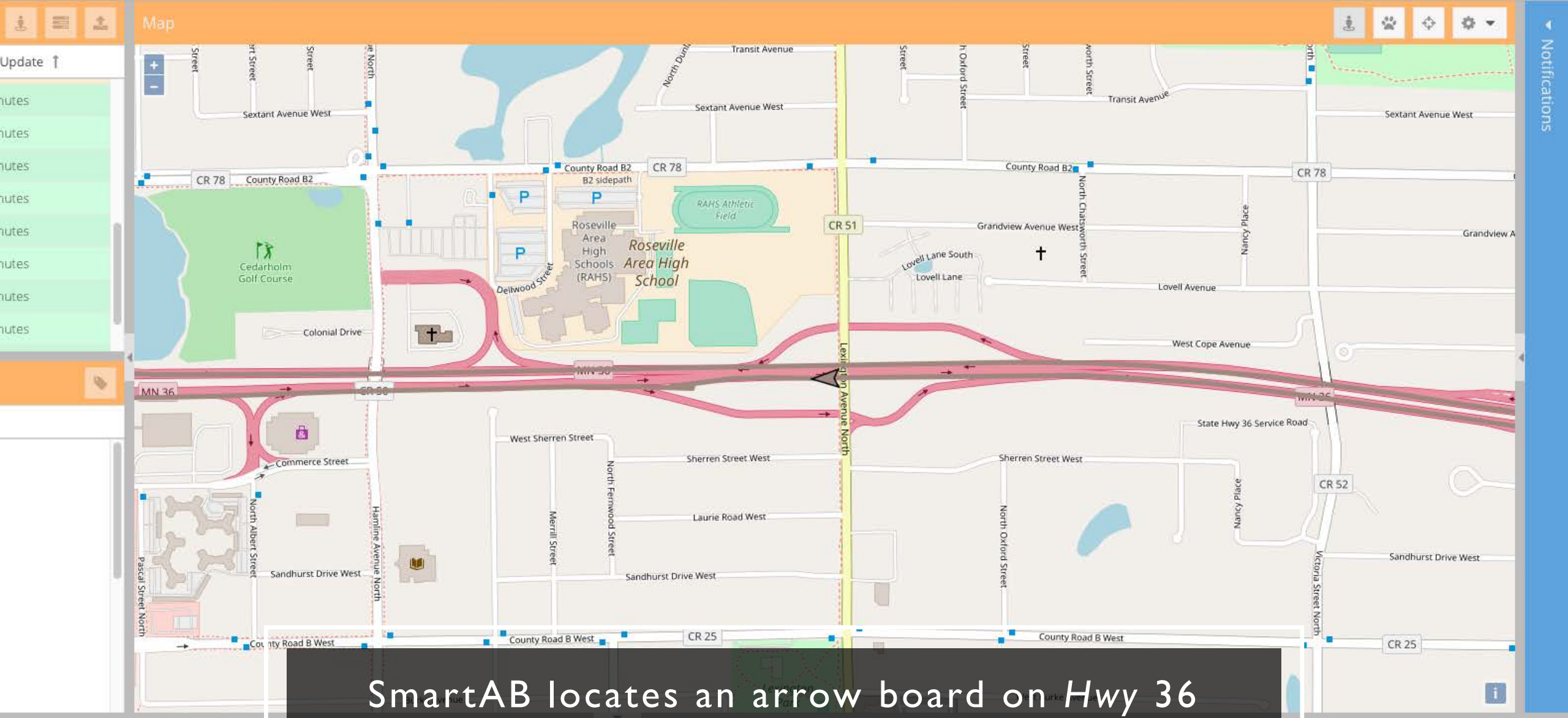
- Finds **active** arrow boards (power on, sign up)
- Creates new “incident” for IRIS with **lat/long** and **arrow type**.
- When sign is switched off, ends the “incident”

The screenshot displays a mobile application interface. On the left, there is a 'Devices' table with columns for Name, Status, and Last Update. Below it is a 'Status' section with a table of attributes and values. On the right, there is a 'Map' showing a geographic area around Minneapolis, Minnesota, with several location markers.

Name	Status	Last Update
SAB 1113	Offline	19 days
217456	Offline	9 days
SAB 1115	Online	0 minutes
SAB 1116	Offline	
2033000	Online	3 minutes

Attribute	Value
Longitude	-93.121750°
Altitude	0
Accuracy	0.00 mi
Distance	0.00 mi
Total Distance	71850702.16
Valid	Yes
IP	166.250.201.172

The map shows several location markers: a red circle with a white center labeled 'MN 610' near Elk River; a black circle with a white center labeled '217456' near Champlin; a black circle with a white center labeled '2033000' near Brooklyn Center; and a green circle with a white center and a black arrow pointing left, labeled 'SAB 1115' and 'SAB 1113' near East Bethel. The map also shows various city names like Minneapolis, Saint Paul, and Golden Valley.



SmartAB locates an arrow board on Hwy 36

Time	Latitude	Longitude	Speed	Address
2018-09-27 12:10:02	45.010360°	-93.148350°	0.0 mph	1134 MN 36, Roseville, Minnesota, US
2018-09-27 12:10:22	45.010360°	-93.148350°	0.0 mph	1134 MN 36, Roseville, Minnesota, US

Step 2:

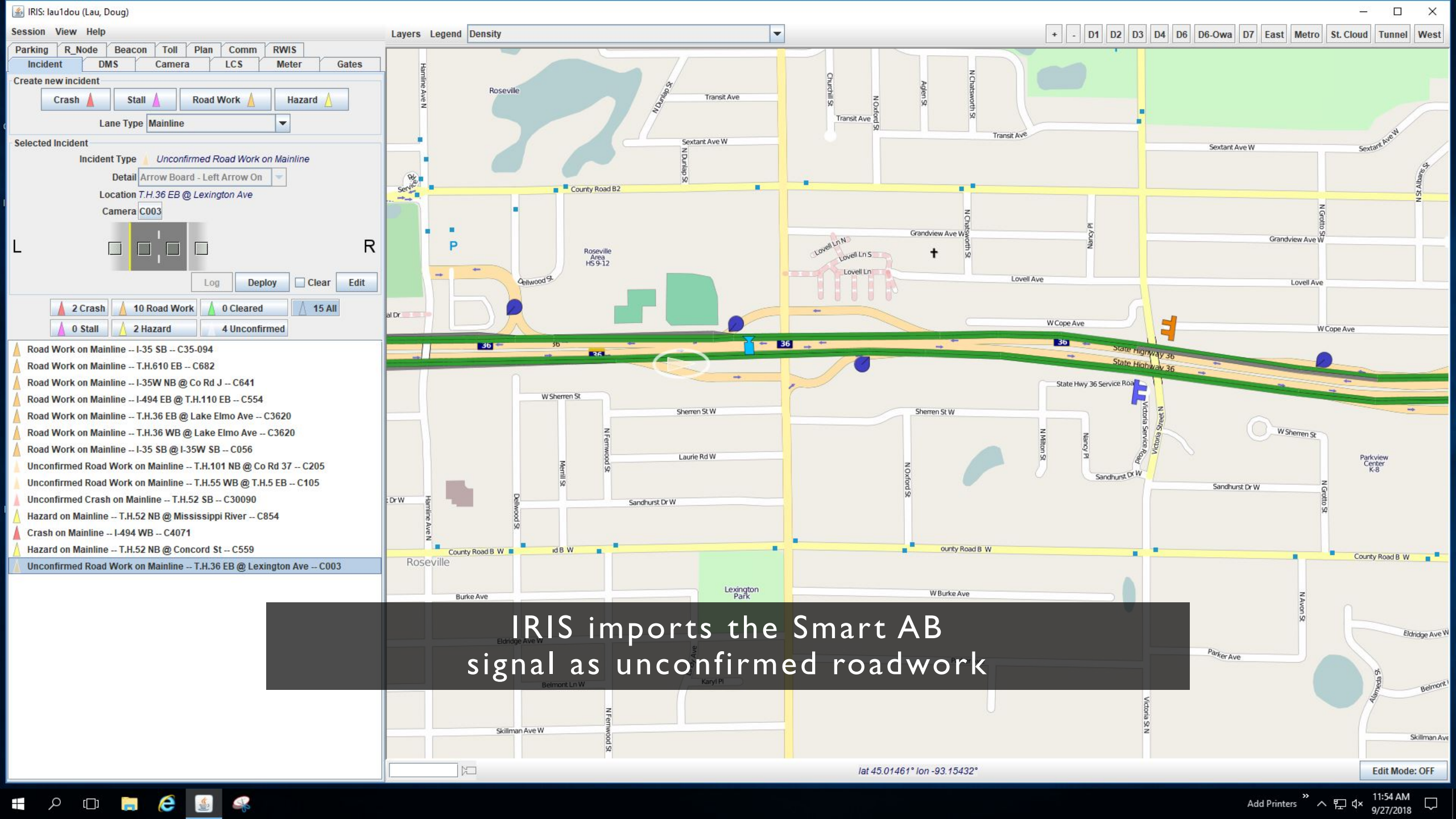
IRIS

- Monitors Smart AB & imports incidents
- Maps to highway trunk
- Identifies direction of travel
- Triggers DMS Plans
- Creates TMC situational awareness

The screenshot displays the IRIS software interface, which is used for monitoring and managing traffic incidents on highways. The interface is divided into several sections:

- Top Panel:** Includes a menu bar (Session, View, Help) and a toolbar with buttons for Incident, DMS, Camera, LCS, Meter, R_Node, Comm, and Plan. It also shows a Layers Legend and Density dropdown.
- Incident Details:** A panel on the left shows the selected incident details, including Name (V94E00), Location (I-94 EB @ 25th Ave), Status (None), and Operation (None). It also includes a Brightness control (69%) and a Camera ID (CB36).
- DMS Plan Configuration:** A central panel allows users to select a DMS plan (e.g., "FREeway TIME TO") and configure its duration. It includes a "Duration" dropdown and buttons for "Clear", "Send", and "Blank".
- DMS Status:** A section below the configuration panel shows the status of various DMS units, including counts for "User Deployed", "Available", "Scheduled", "Failed", "User Deployed", "Maintenance", and "All".
- Incident List:** A list of incidents is shown at the bottom left, with columns for ID, Name, and Status. The list includes incidents like V169N07, V52N02, V94W15, and I-94 WB @ Xerxes Ave.
- Map:** The right side of the interface features a large map of a highway network. The map shows various road segments, with some highlighted in green and others in yellow or red, indicating different traffic conditions. The map also shows various road signs and markers.

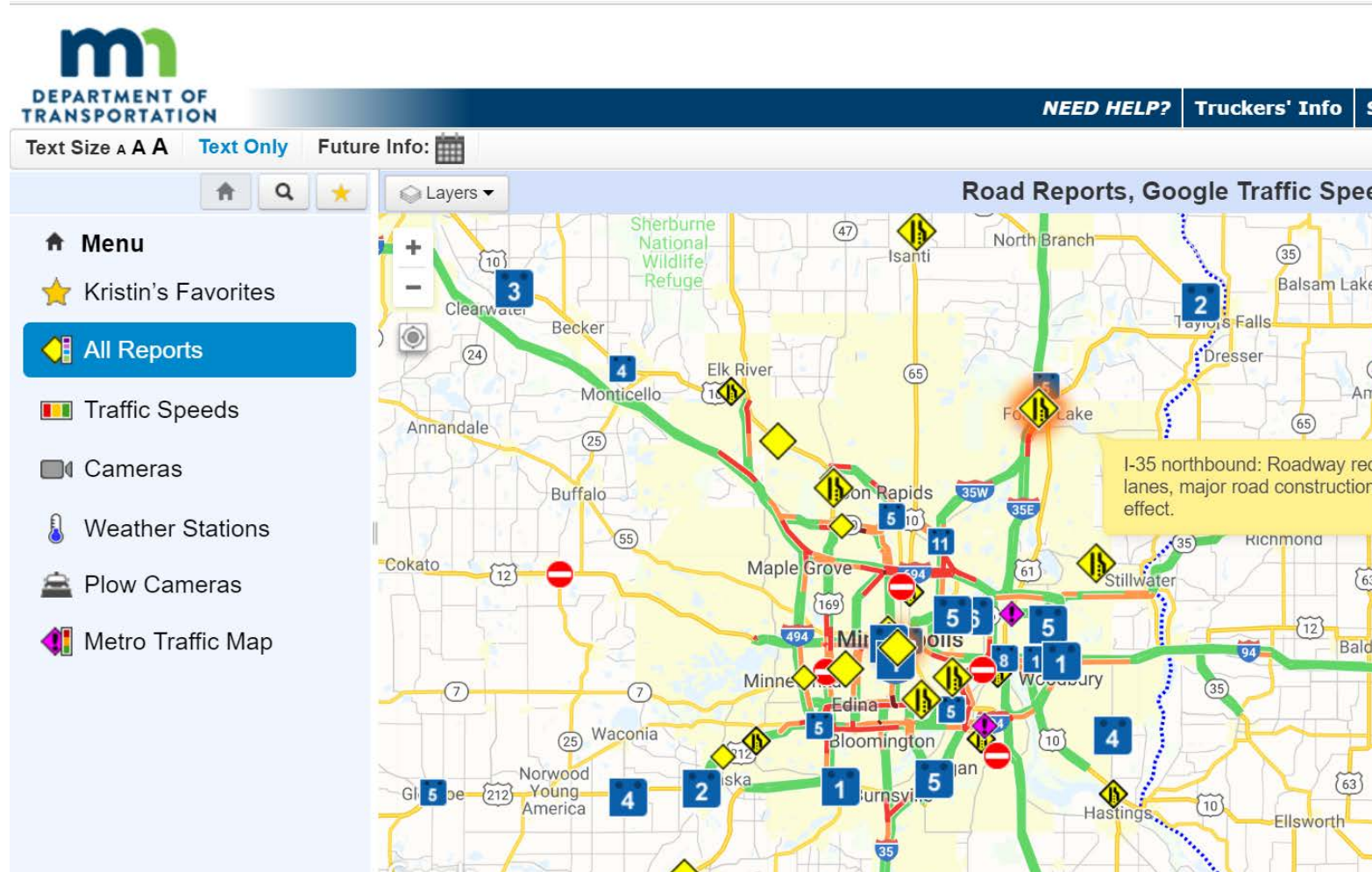
The bottom right corner of the map displays the coordinates: lat 44.96479° lon -93.44971°.



IRIS imports the Smart AB
signal as unconfirmed roadwork

Step 3: CARS & 511

- Monitors IRIS and imports arrow board roadwork reports
- Creates a **traffic story**
- Adds **delay impacts & cameras**
- Makes **mobile work site events**
- **Spreads the knowledge**



Future Info: 31

Enter a location

Clear

Search

Select Map



Map

Satellite

Left lane closed

MN 36 eastbound between Hamline Ave and Lexington Ave (Roseville).

The left lane is closed.

Last updated today at 12:11PM CDT by CARS-AB

Events List



A traffic story emerges in CARS and 511

Help

Google

Map data ©2018 Google 100 m

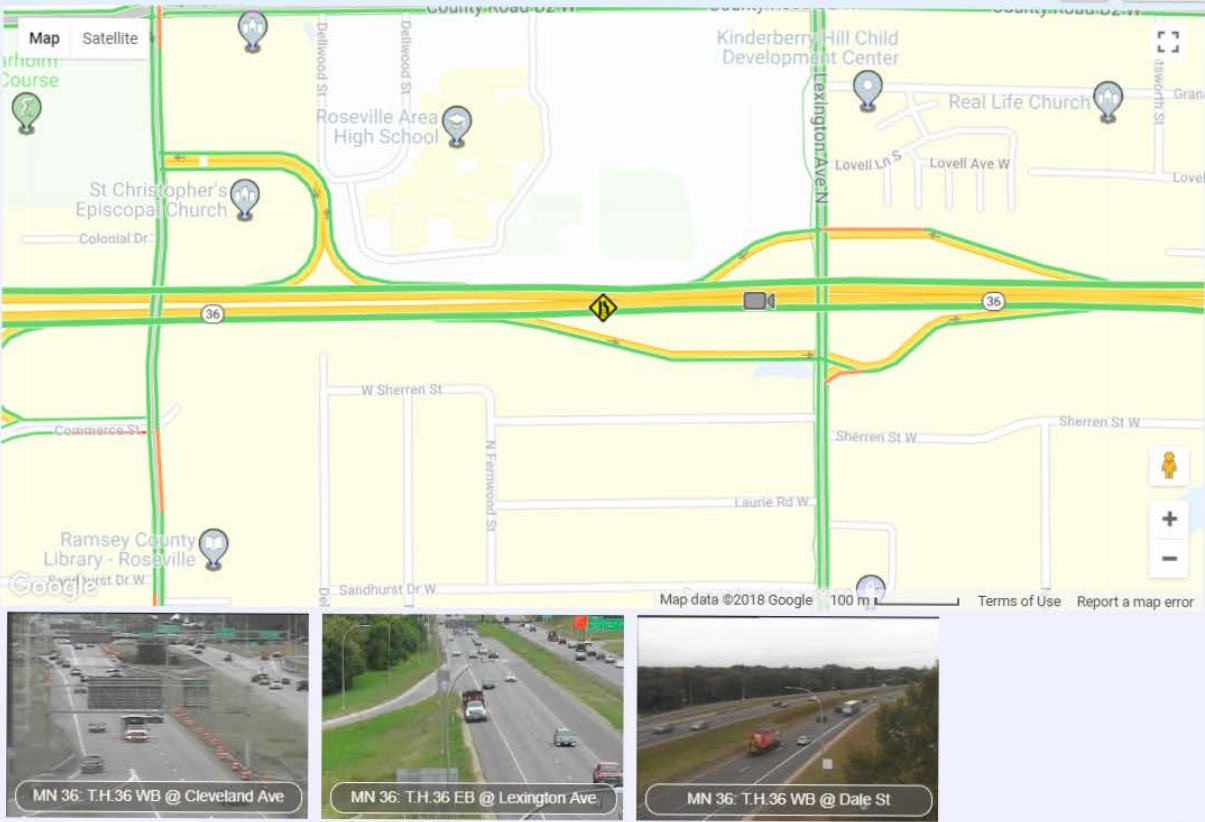
Terms of Use

Human-friendly reports, weaving in cameras and delays

MN 36 eastbound: Right lane closed.

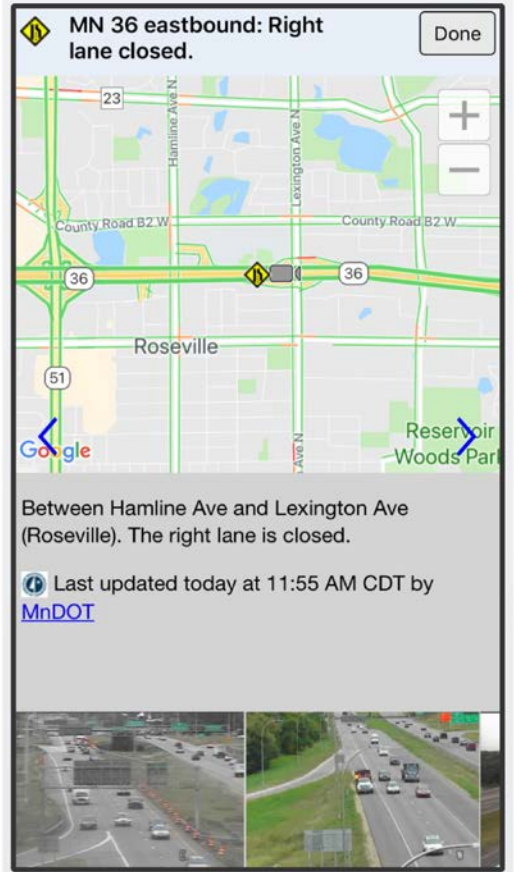
Between Hamline Ave and Lexington Ave (Roseville). The right lane is closed.

Last updated Today at 11:55 AM CDT by [MnDOT](#)



Map data ©2018 Google

MN 36 eastbound: Right lane closed. Done



Between Hamline Ave and Lexington Ave (Roseville). The right lane is closed.

Last updated today at 11:55 AM CDT by [MnDOT](#)

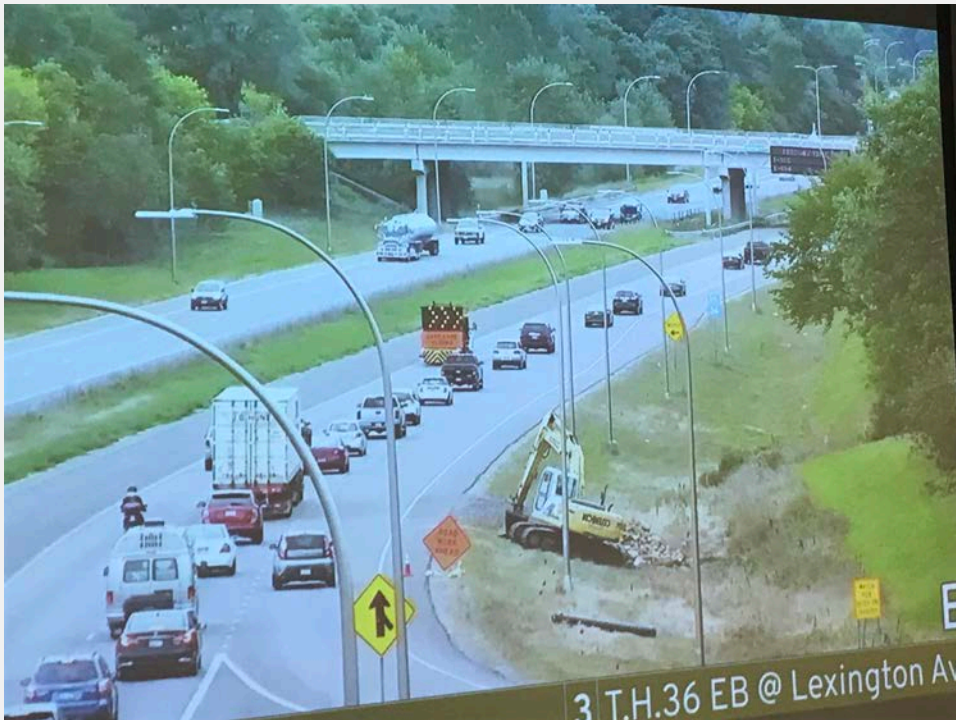


MN 36: T.H.36 EB @ Lexington Ave



Dave Tody!

CARS also creates mobile work site reports



Event location
updates
automatically about
every 1-2 minutes

And communicates the delay impacts

The screenshot displays the MnDOT website interface. At the top left is the MnDOT logo and the text "DEPARTMENT OF TRANSPORTATION". On the top right, there is a link for "Your 511 (sign in)". A navigation bar contains links for "NEED HELP?", "Truckers' Info", "Streamlined Version", "Links", and "Contact MnDOT". Below this, a banner reads "There are critical disruptions on MN 24, I-35, MN 119. There are closures or blockage". The main heading is "Road Reports, Google Traffic Speeds".

The central map shows a network of roads with color-coded traffic speeds. A prominent yellow diamond is located at the intersection of MN 35 and MN 36, indicating a critical disruption. Other roads shown include MN 24, MN 119, and various county roads. The map also shows geographical features like Acorn Park, Harriet Alexander Nature Center, and Gervais Lake.

On the left side, there is a "Menu" with options: "Personalize your 511", "All Reports" (highlighted in blue), "Traffic Speeds", "Cameras", "Weather Stations", "Rest Areas", and "Metro Traffic Map".

At the bottom right, there is a "Legend" button and a scale bar indicating 500 meters. The map data is attributed to Google, 2018.

The story gets tweeted

The screenshot shows the Twitter profile for MN Stage (@mnstage). The profile header features the Minnesota Department of Transportation logo and statistics: 131 tweets, 11 followers, 0 lists, and 0 moments. The profile bio includes a warning that this is a test service for MnDOT traffic incidents. The tweet feed shows three recent tweets, each reporting a traffic incident with a link to mnlb.carsstage.org.

Home Moments Notifications Messages Search Tw



Tweets **131** Followers 11 Lists 0 Moments 0

MN Stage 
@mnstage

WARNING THIS IS A TEST SERVICE:
Official MnDOT Twitter feed for
Minneapolis/St. Paul traffic incidents.
Reports will be removed when they are
no longer active.

 Minnesota

 mnlb.carsstage.org

 Joined July 2009

Tweets **Tweets & replies**

 **MN Stage**  @mnstage · 1m
MN 36 EB: Left lane closed from Hamline Ave to Lexington Ave (Roseville).
mnlb.carsstage.org/forwarding/vie...

 **MN Stage**  @mnstage · 8m
I-94 WB: Crash from Zane Avenue to Exit 33 - Brooklyn Boulevard (Brooklyn
Center). mnlb.carsstage.org/forwarding/vie...

 **MN Stage**  @mnstage · 33m
US 52 NB: Debris on roadway from Butler Avenue to MN 156; Concord Street
(West Saint Paul). mnlb.carsstage.org/forwarding/vie...

And shared through an API
(for Google, Waze, and other systems)

```
"lon": -93.397
},
{
  "name": "L034_869594",
  "event_date": "2018-09-27T08:22:02-05:00",
  "description": "Incident ROADWORK",
  "road": "I-494",
  "direction": "EB",
  "lane_type": "Mainline",
  "impact": ".....",
  "cleared": false,
  "confirmed": false,
  "camera": "C1535",
  "detail": "ab_right",
  "replaces": null,
  "lat": 45.00438,
  "lon": -93.46344
},
```

From data to knowledge, for humans & computers

Arrow Board

- » Lat, Long
- » What arrow?
- » Sign on/off

IRIS

- » Highway / lane mapping
- » Direction of travel
- » DMS messaging
- » TMC situational awareness

CARS + 511

- » Human-friendly explanations
- » Traffic stories
- » Integrates cameras
- » Measure & report delay impacts

Lessons learned (so far)

1. Be mindful of **DATA TRANSLATIONS** as they pass from system to system
2. Schedule intensive **TESTING** with system specialists and field operators.
3. Plan for ongoing hardware **MAINTENANCE** checks.
4. **CREATE** knowledge for both **HUMANS** and **COMPUTERS**.

The project
partners



Thank you!

Questions?

Kristin Virshbo
Castle Rock Associates

kristin.virshbo@crc-corp.com

+1.503.734.6493

