Reading the Signs at MnDOT

Generating Roadwork Reports Automatically from Smart Arrow Boards

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DEPARTMENT OF TRANSPORTATION

Street Smart Rental

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Athey Creek CONSULTANTS

AARIAN MARSHALL TRANSPORTATION 02.10.17 01:01 PM

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.**"

Wired, Feb 10, 2018, https://www.wired.com/2017/02/self-driving-cars-cant-even-construction-zones

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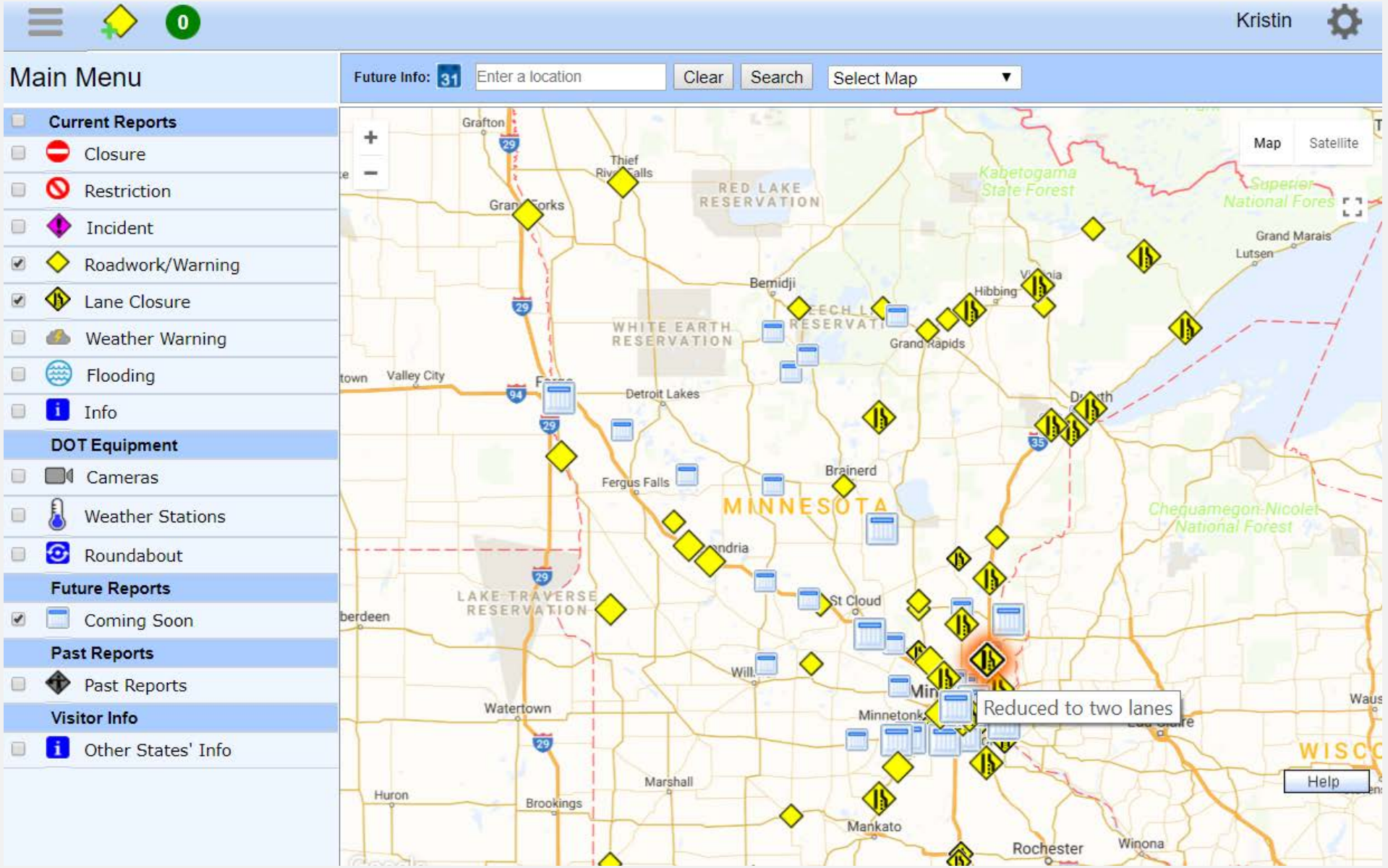
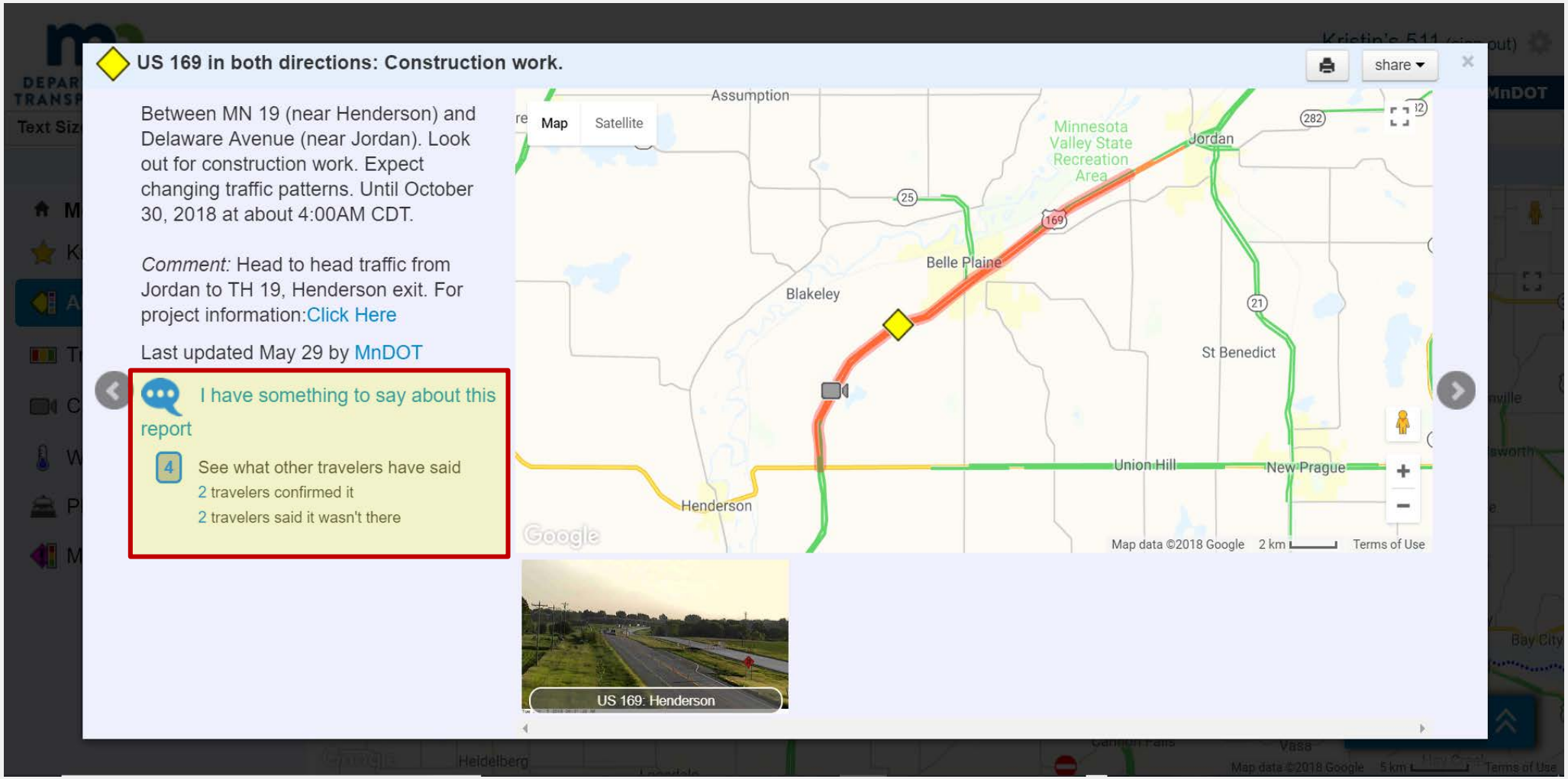
MnDOT's CARS system



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



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

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Arrow Boards

Automating
lane closure reports
from roadwork sites.

THE STREET SMART RENTAL "BLACK BOX"

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

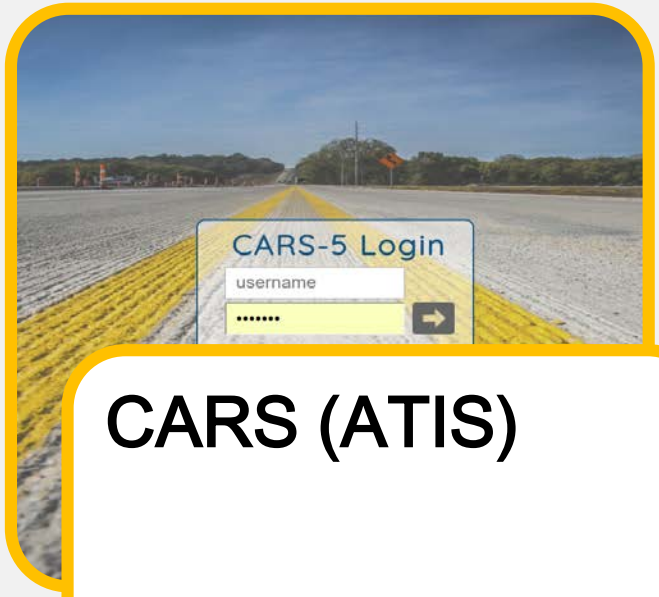
Smart AB

A signal from the field

IRIS Software

IRIS (ATMS)

Adding operational intelligence



CARS (ATIS)

Spreading the knowledge

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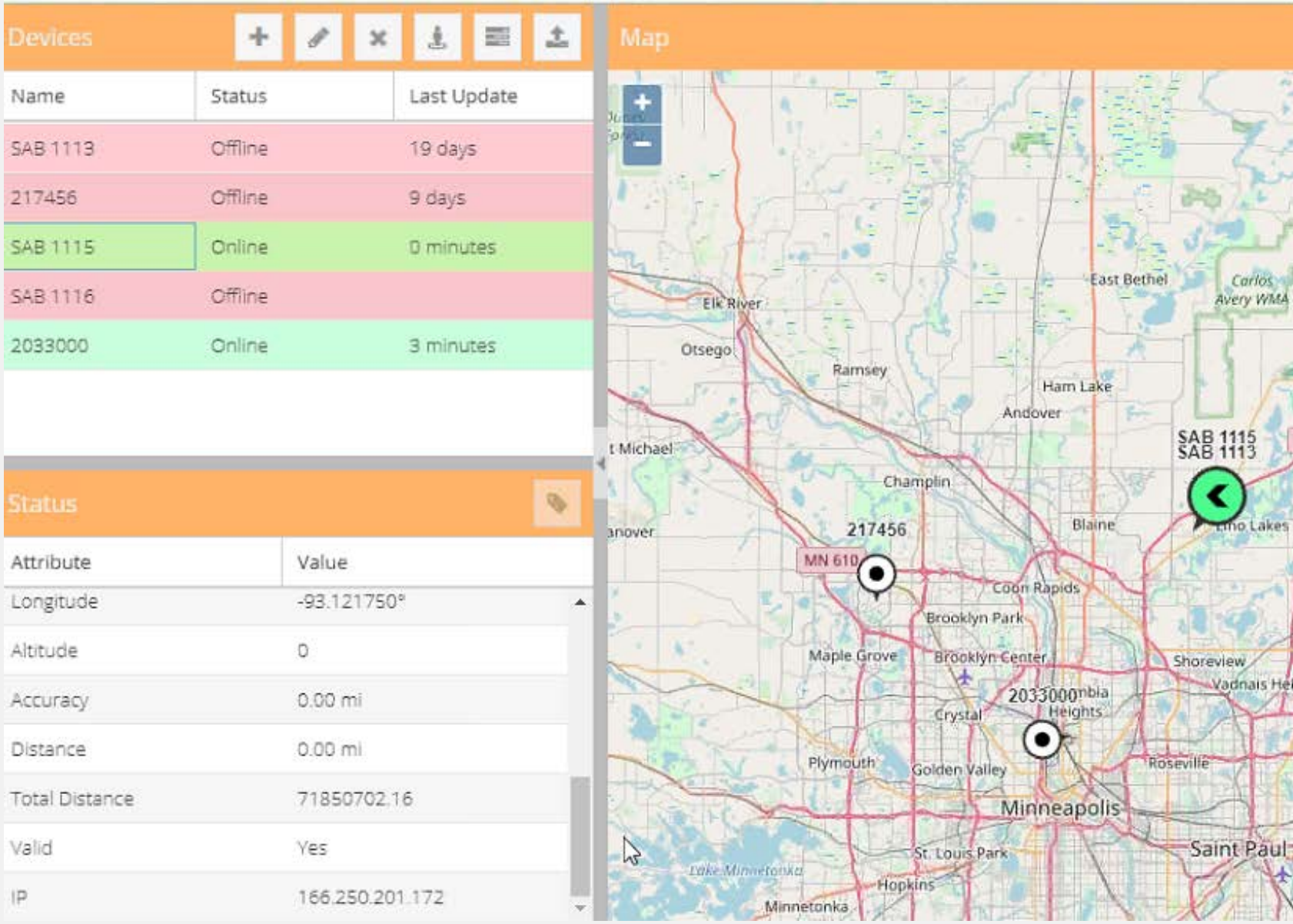
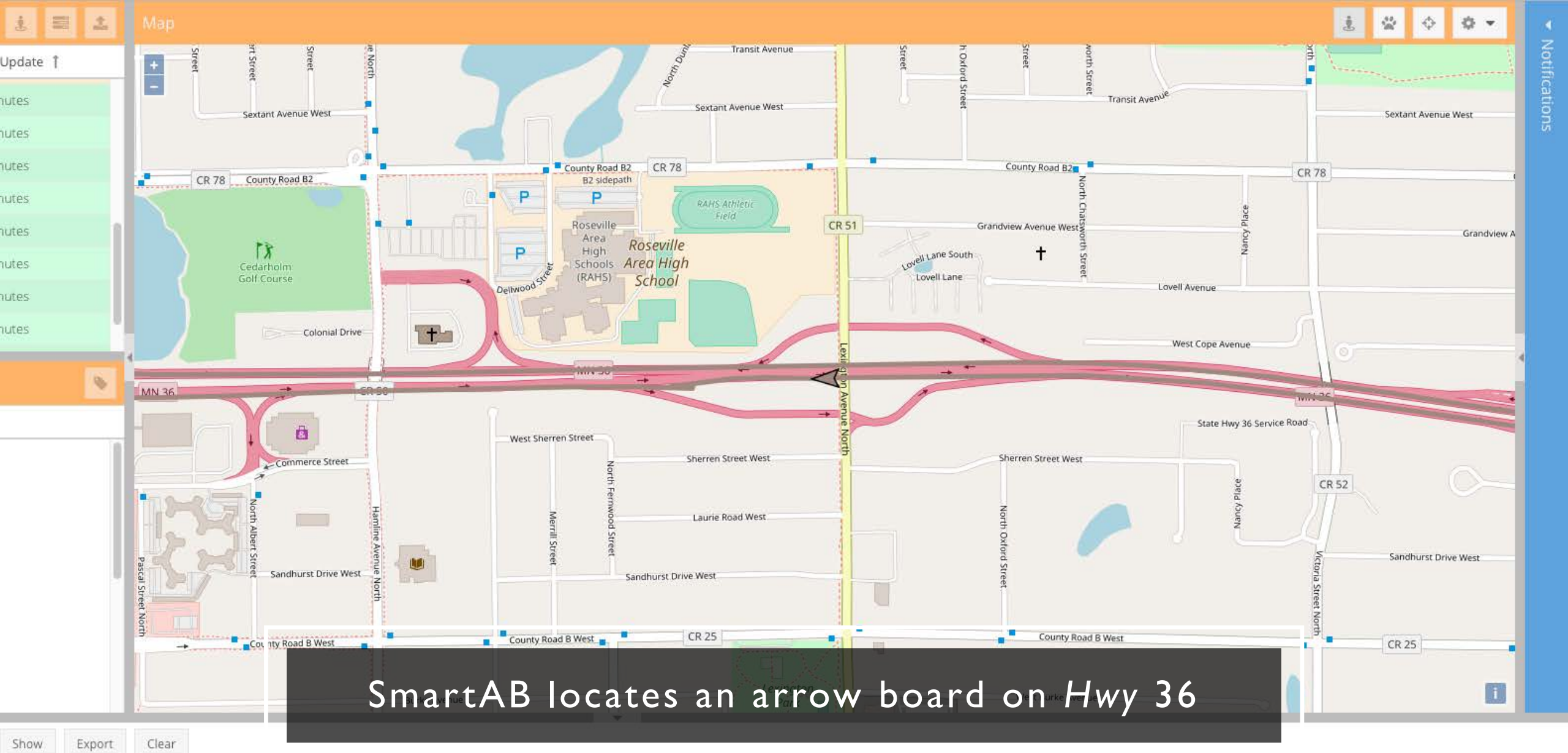
Step 1:

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"



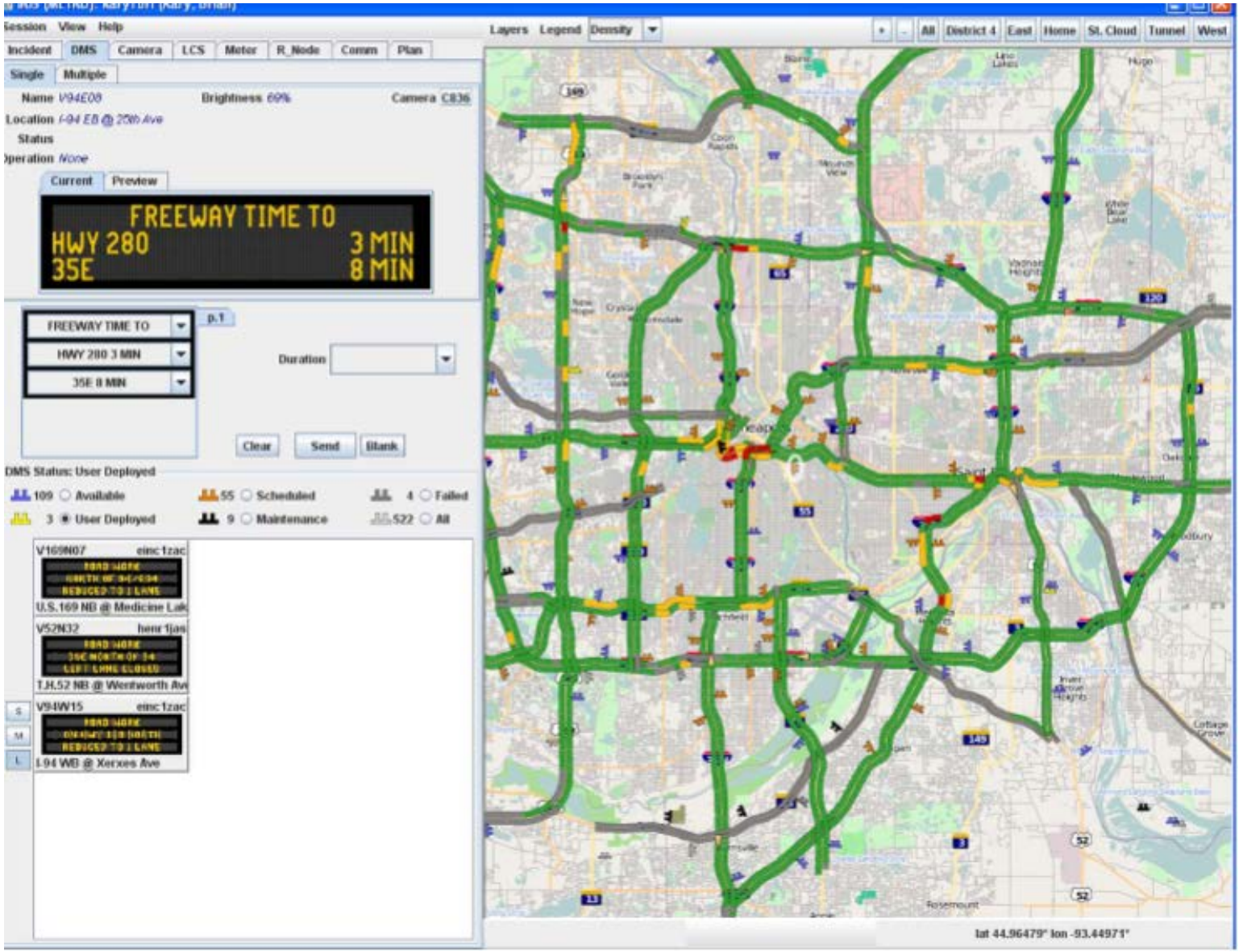


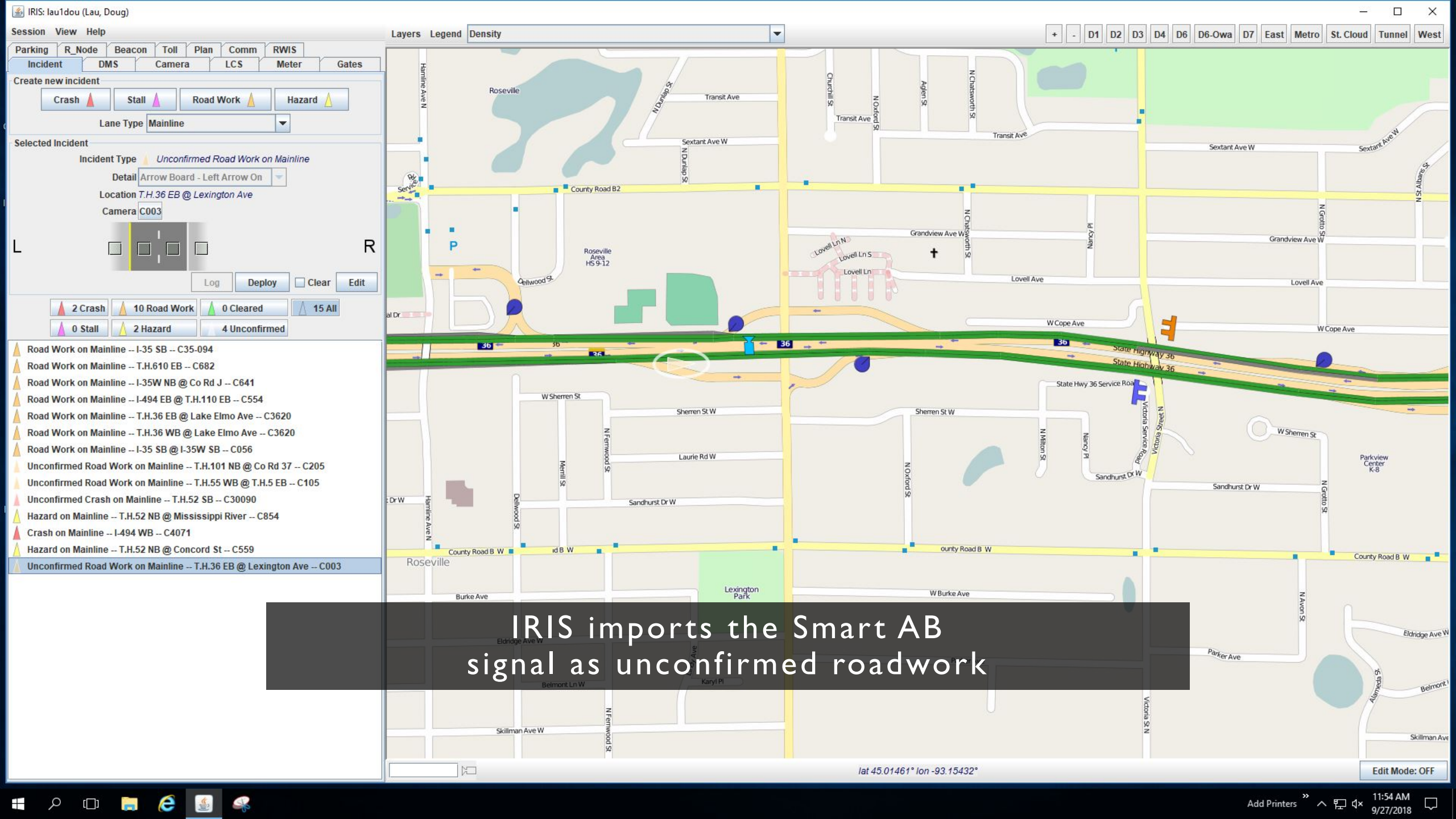
SmartAB locates an arrow board on *Hwy* 36

Step 2:

IRIS

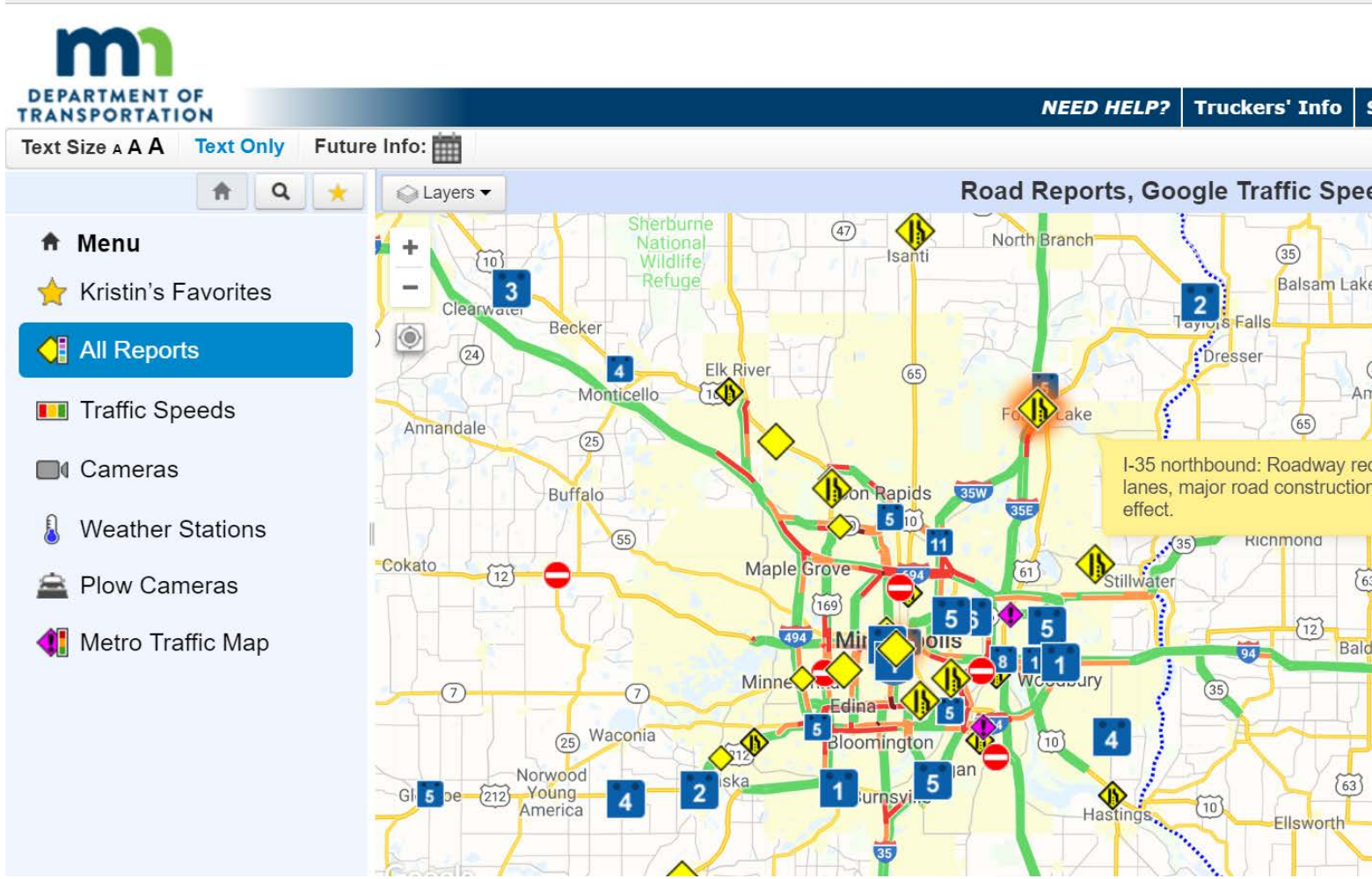
- Monitors Smart AB & imports incidents
- Maps to highway trunk
- Identifies direction of travel
- Triggers DMS Plans
- Creates TMC situational awareness




IRIS: lau1dou (Lau, Doug)
Session View Help
Parking R_Node Beacon Toll Plan Comm RWIS
Incident DMS Camera LCS Meter Gates
Create new incident
Crash Stall Road Work Hazard
Lane Type Mainline
Selected Incident
Incident Type Unconfirmed Road Work on Mainline
Detail Arrow Board - Left Arrow On
Location T.H.36 EB @ Lexington Ave
Camera C003
L R
Log Deploy Clear Edit
2 Crash 10 Road Work 0 Cleared 15 All
0 Stall 2 Hazard 4 Unconfirmed
Road Work on Mainline -- I-35 SB -- C35-094
Road Work on Mainline -- T.H.610 EB -- C682
Road Work on Mainline -- I-35W NB @ Co Rd J -- C641
Road Work on Mainline -- I-494 EB @ T.H.110 EB -- C554
Road Work on Mainline -- T.H.36 EB @ Lake Elmo Ave -- C3620
Road Work on Mainline -- T.H.36 WB @ Lake Elmo Ave -- C3620
Road Work on Mainline -- I-35 SB @ I-35W SB -- C056
Unconfirmed Road Work on Mainline -- T.H.101 NB @ Co Rd 37 -- C205
Unconfirmed Road Work on Mainline -- T.H.55 WB @ T.H.5 EB -- C105
Unconfirmed Crash on Mainline -- T.H.52 SB -- C30090
Hazard on Mainline -- T.H.52 NB @ Mississippi River -- C854
Crash on Mainline -- I-494 WB -- C4071
Hazard on Mainline -- T.H.52 NB @ Concord St -- C559
Unconfirmed Road Work on Mainline -- T.H.36 EB @ Lexington Ave -- C003
Layers Legend Density
+ - D1 D2 D3 D4 D6 D6-Owa D7 East Metro St. Cloud Tunnel West
Roseville
County Road B2
Transit Ave
Sextant Ave W
Grandview Ave W
Lovell Ave
W Cope Ave
State Highway 36
W Sherren St
Sherren St W
Laurie Rd W
Sandhurst Dr W
County Road B W
W Burke Ave
Lexington Park
Parkview Center K-8
Parker Ave
Eldridge Ave W
Belmont Ln W
Skillman Ave W
lat 45.01461° lon -93.15432°
Edit Mode: OFF
IRIS imports the Smart AB
signal as unconfirmed roadwork
Add Printers
11:54 AM
9/27/2018

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**



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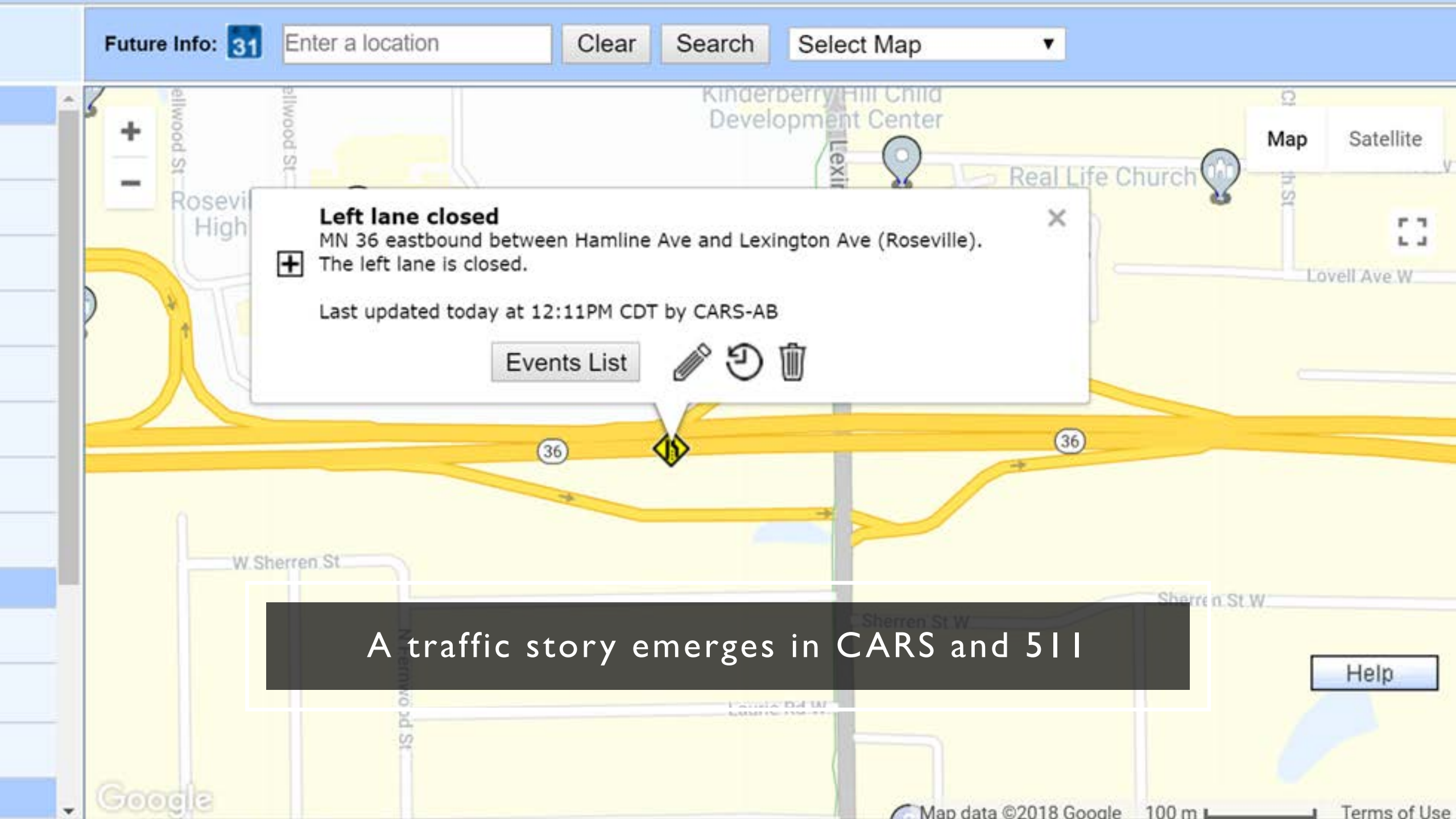
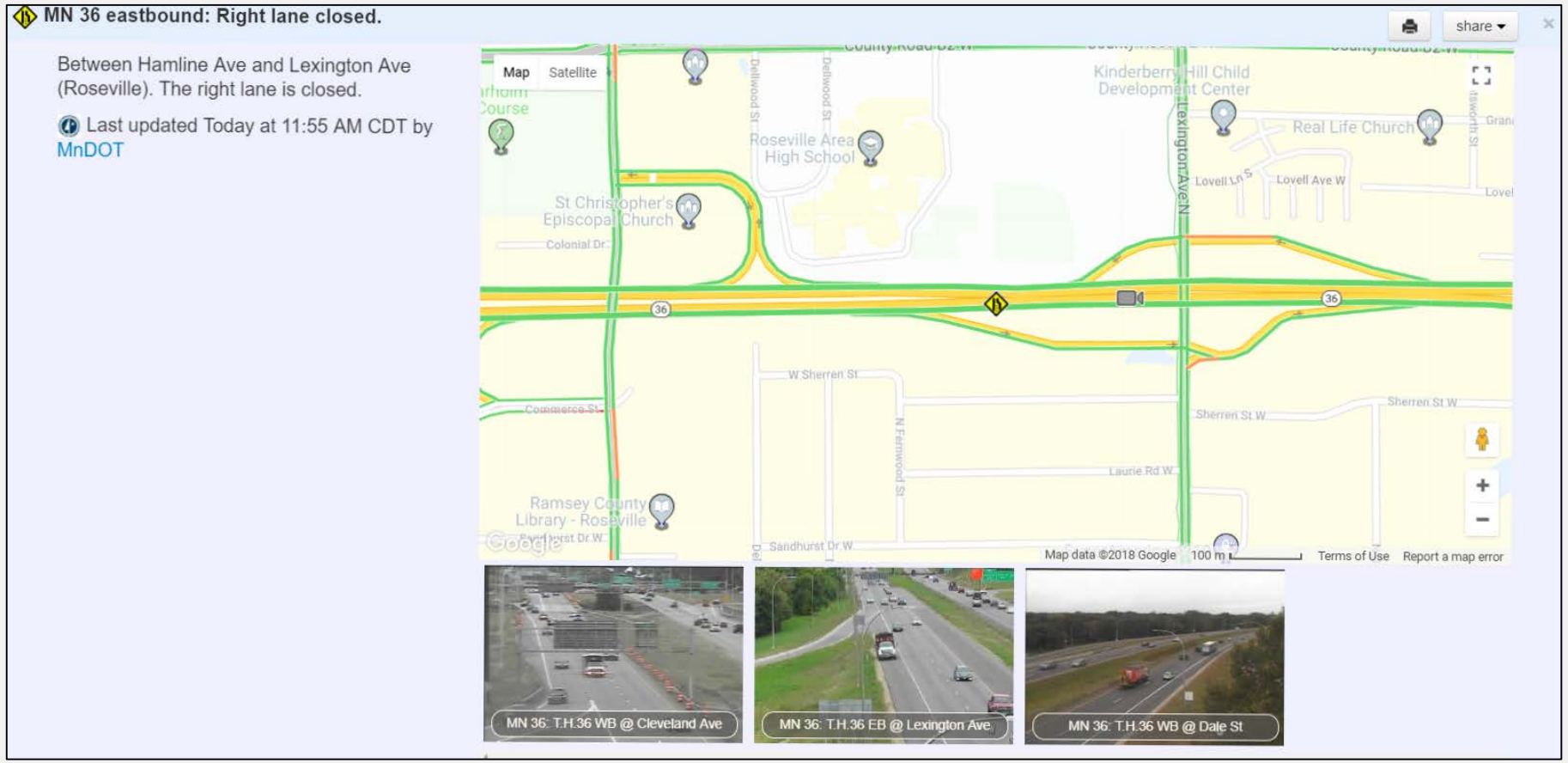
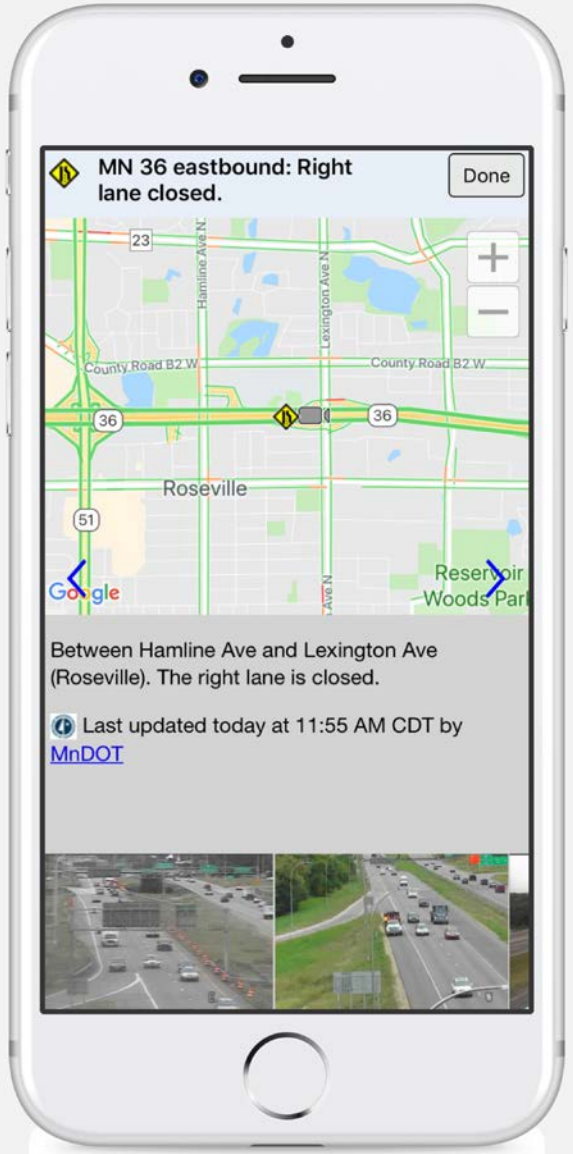


A traffic story emerges in CARS and 511

Human-friendly reports, weaving in cameras and delays





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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

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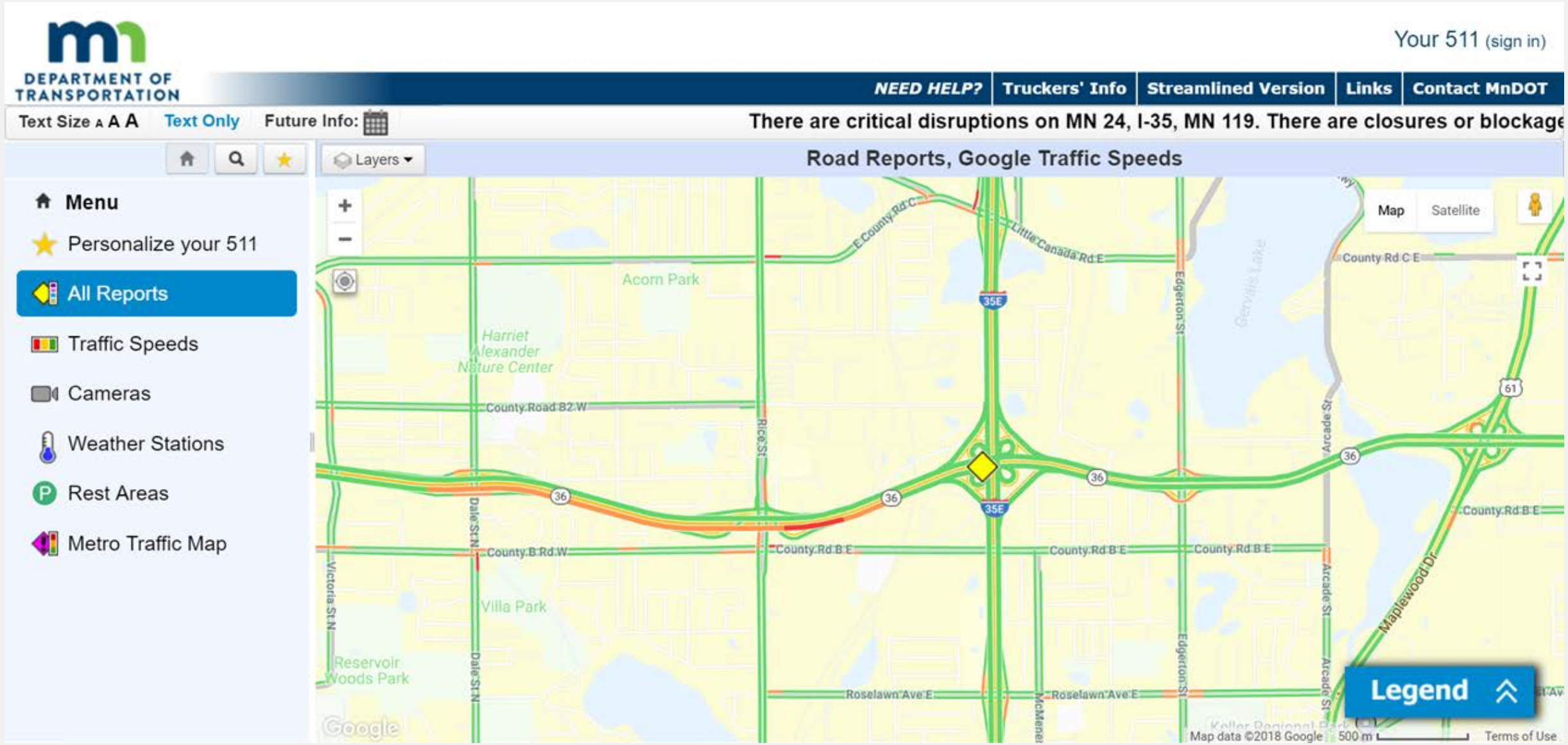
And communicates the delay impacts



The story gets tweeted

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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
  },
```


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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

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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.

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The project partners

Thank you!

Questions?

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