Talking Transportation Technology (T3) Webinars

INTELLIGENT TRANSPORTATION SYSTEMS
PROFESSIONAL CAPACITY BUILDING

Tuesday, August 15, 2023 – 1:00PM

Road Weather Management and Arterial Management

Part 4 of 5 in the Crowdsourcing for Operations Course via Webinar

Course developed by the Federal Highway Administration (FHWA) Every Day Counts (EDC) Crowdsourcing for Operations

U.S. Department of Transportation

INTELLIGENT TRANSPORTATION SYSTEMS
PROFESSIONAL CAPACITY BUILDING

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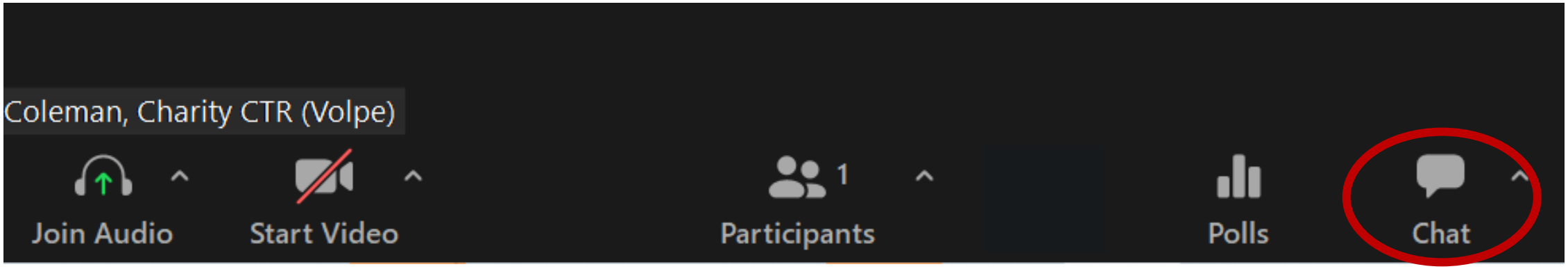
INTELLIGENT TRANSPORTATION SYSTEMS
PROFESSIONAL CAPACITY BUILDING

Use the Chat Pod

- Click on Chat icon on your screen
- Submit your question or comments in the Chat window



Questions/comments will be addressed after the last presentation, as time permits

Intelligent Transportation Systems Joint Program Office (ITS JPO)
Professional Capacity Building (PCB) Program Presents

Road Weather Management and Arterial Management

Part 4 of 5 in the Crowdsourcing for Operations Course via Webinar

August 15, 2023

Course developed by the Federal Highway Administration (FHWA) Every Day Counts (EDC) Crowdsourcing for Operations Innovation and delivered by the FHWA Office of Operations

U.S. Department of Transportation
Federal Highway Administration

Every Day Counts
Innovation for a Nation on the Move

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Today's Host and Presenters

Source: FHWA.

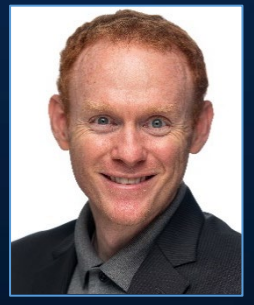
James Colyar, Host
EDC Crowdsourcing Colead
FHWA Office of Operations

Source: MAG.

Dr. Wang Zhang
Transportation Data Program Manager, Maricopa Association of Governments (MAG)

Source: Ohio DOT.

Stephanie Marik
Transportation Systems Performance Engineer, Ohio Department of Transportation (DOT)



Source: Jeremy Dilmore.

Jeremy Dilmore
Transportation Systems Management and Operation Engineer, Florida DOT

Webinar Agenda

1:05 p.m. FHWA EDC-6 Crowdsourcing Innovation and Course Background

1:15 p.m. Road Weather Management

1:35 p.m. Arterial Management

2:10 p.m. Question and Answer

2:30 p.m. Webinar Close

*EDT Time Zone

Source: Unsplash.

Every Day Counts
Innovation for a Nation on the Move

U.S. Department of Transportation
Federal Highway Administration

What Is Every Day Counts?

State-based innovation deployment model

Proven but underutilized innovations

2-year cycles

http://www.fhwa.dot.gov/innovation/everydaycounts/

EDC-6: Deepen Crowdsourcing Roots for a Bountiful Suite of Benefits

Adding data sources and applications

Improving data management

Source: FHWA.

Improving archived data usage

Sharing and integrating data

Crowdsourcing Course-in-a-Box

Course Goals:

- Broaden understanding and knowledge about how crowdsourced data can improve transportation systems management and operations (TSMO)
- Help participants consider whether specific applications of crowdsourcing may meet their organizations' needs

Course Tools:

- Editable instructor templates
- Instructor materials
- Course slide decks
- Student materials

Source: Pixabay.

Whom Is the Course Targeting?

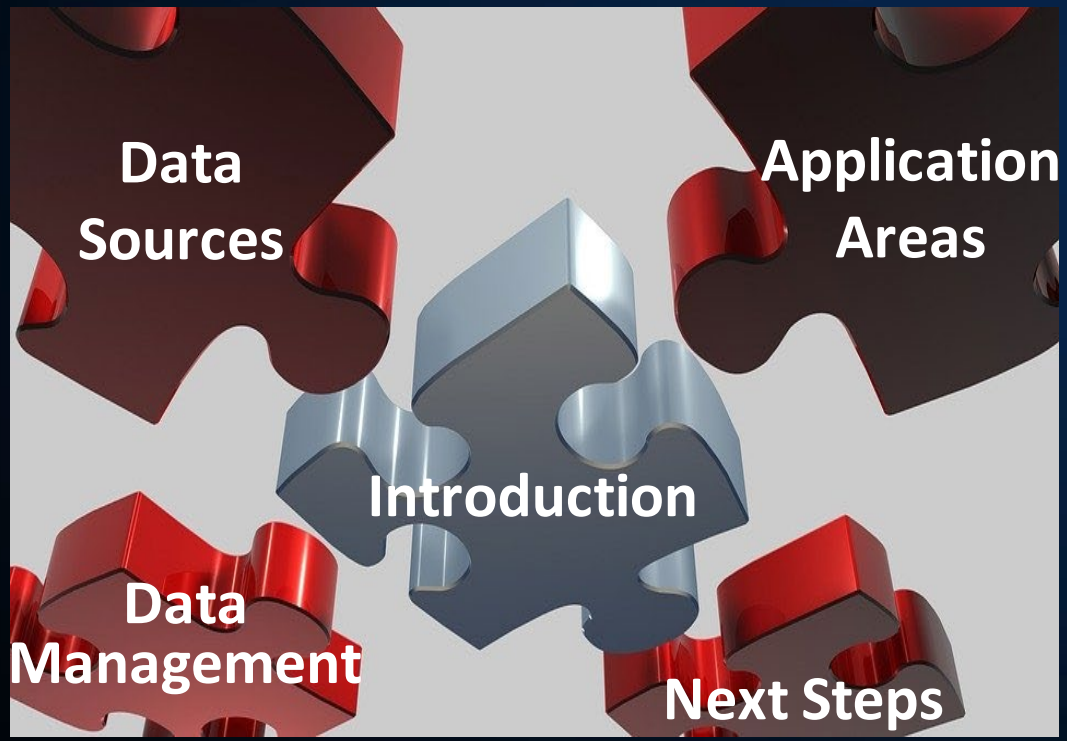
Transportation Groups

- Traffic management centers (TMCs)
- Traffic signal systems administrators
- Operations
- Maintenance
- Public works departments
- Emergency planning
- Work zone managers
- Safety and planning

Consider nontraditional invitees such as policymakers, locally elected officials, administrators, or other leaders.

Course Is Modular by Design

Five Lessons:



Source: Adapted from Pixabay.

Six Application Modules:

- Traffic Incident Management
- Traveler Information
- Arterial Management
- Work Zone Management
- Road Weather Management
- Emergency Management

Crowdsourcing Course Delivery by Webinar

Webinar	Date	Course Lessons and Modules
1	May 16	Crowdsourcing Introduction and Applications Lessons
2	June 20	Data Sources and Management Lessons
3	July 18	Traveler Information and Traffic Incident Management Modules (recording coming soon)
4	**August 15**	**Road Weather and Arterial Management Modules**
5	September 19	Emergency and Work Zone Management Modules and Next Steps Lesson

Summary of Webinar 3 Modules

Traveler Information

- Crowdsourced data can deliver quantitative predictive travel times and offer greater details on issues affecting roadways.
- Crowdsourced data can improve traveler information timeliness.

Traffic Incident Management

- Crowdsourced data help detect incidents and queues quickly, reduce operator workload, and support after-action reviews.
- Crowdsource data improve responder and traveler safety.

- For traveler information, traffic incident management, and other TSMO strategies, **crowdsourced data can expand geographic coverage and resolution.**

Introductions

Please enter your name, agency, and job title in the chat window.

Source: FHWA.

LESSON: Road Weather Management
INSTRUCTOR: Stephanie Marik, Ohio DOT

Source: Pixabay.

Lesson Objective

Describe how crowdsourcing data can improve key aspects of road weather management

Source: Unsplash

Road Weather Management Challenges

- Timely and accurate road-specific weather data
- Understanding the safety and mobility impacts of weather
- Weather-responsive decisions and outcomes

"More timely, accurate and relevant information about weather-related impacts to the roads enables transportation managers and travelers to make more effective decisions."

FHWA Office of Operations, Road Weather Management Program

Crowdsourcing Applications for Road Weather Management

Source: Colorado DOT

- Expand weather-reporting geography and timeliness
- Reduce operator workload
- Facilitate real-time weather responsive strategies
- Facilitate post-weather response studies

Road Weather Management Crowdsourcing Examples

Agency	How Data is Used	Crowdsourced Data
Utah DOT	Situational awareness and traveler information	Citizen Reporter app
City of Frisco, Texas	Situational awareness and real-time weather responsive strategies	Waze®
Maine DOT	Operator workload, situational awareness and traveler information	Field mobile app

https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/docs/crowdsourcing_applications.pdf

Example: Utah DOT Citizen Reporter Program

- Provided a consistent way for the public and DOT workers to report road weather
- Short training program promotes consistent reporting
- Reports improve web, 511, and UDOT Traffic app traveler information

Source: Utah DOT

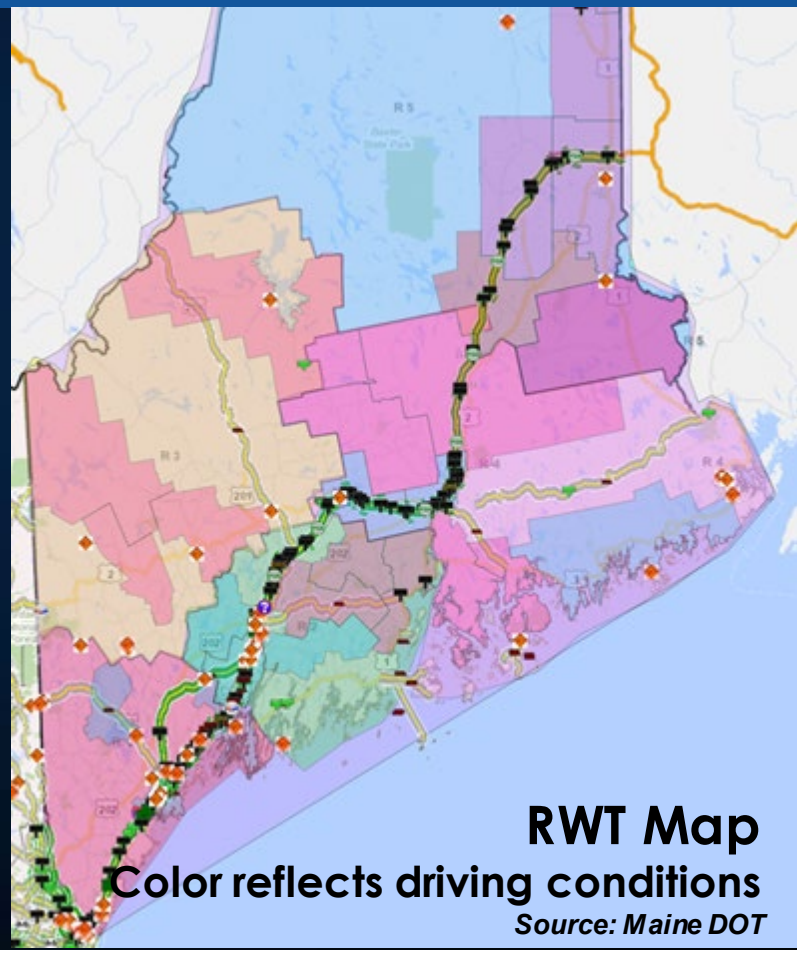
Example: City of Frisco, Texas Crowdsources Road Weather Detection

- Developed a Waze® interface
- Use public reports to respond to road weather events
- Post Waze® events on Public Safety Computer Aided Dispatch Maps

Source: City of Frisco, Texas

Example: Maine DOT Crowdsources Road Weather Detection within Workforce

- App for road crews to report pavement, weather, and temperature (PWT) conditions
- Data automated into the State's Traffic Management Center (TMC) software
- Saved TMC and Road Crew time, while standardizing reports and improving location accuracy



RWT Map
Color reflects driving conditions
Source: Maine DOT

TSMO

TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

Making Our System Work Better

Ohio DOT
Road Weather Reporting

Crowdsourcing for Operations Course, August 15, 2023

odot

Stephanie Marik, P.E.
Transportation Systems Performance Engineer
stephanie.marik@dot.ohio.gov

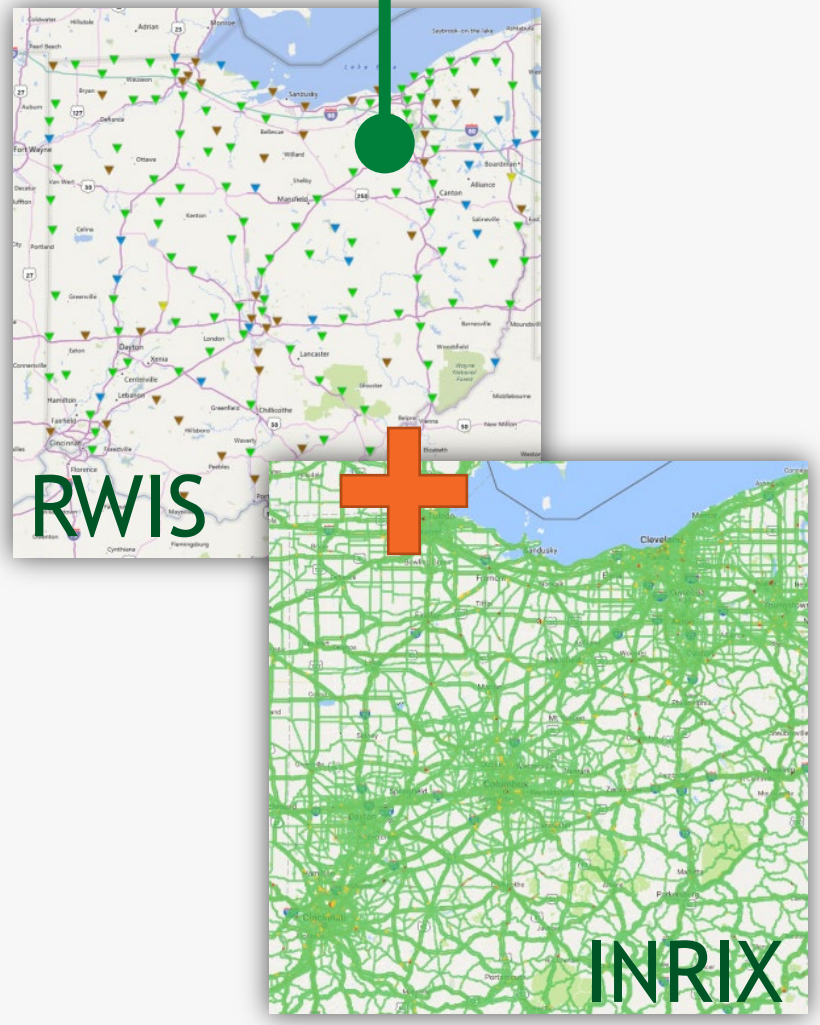
Snow & Ice – Performance Evaluator (SNIPE)

1997-98

2013-14

SNOW AND ICE SPOTTERS PROGRAM

During the 1997-98 snow season, ODOT began the use of the Snow and Ice Spotters program. Residents living in each of the counties throughout Ohio have been recruited as observers, with the task of noting how well ODOT snow crews clear the roads after a snow event. After a snowfall and removal, the county managers or other county



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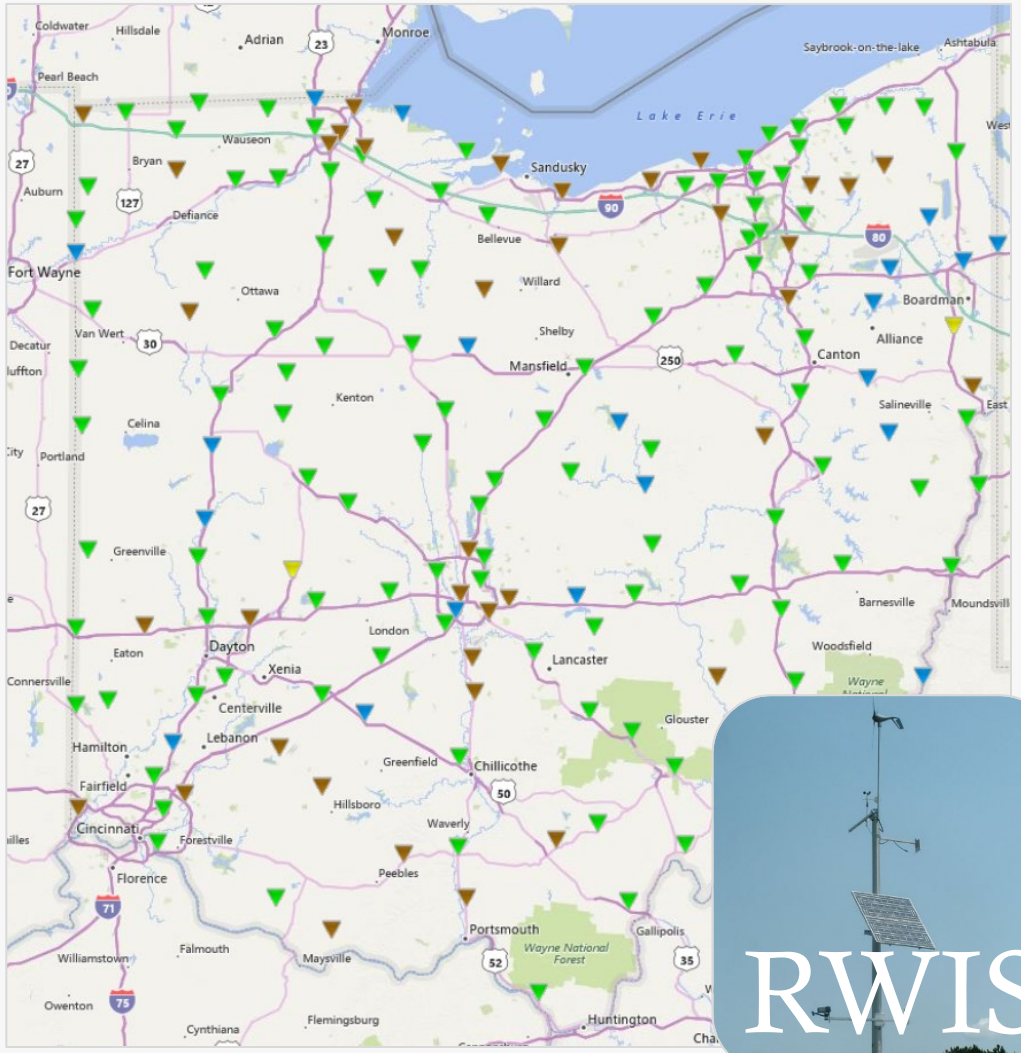
Snow & Ice – Performance Evaluator (SNIPE)



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1 – Event Begins

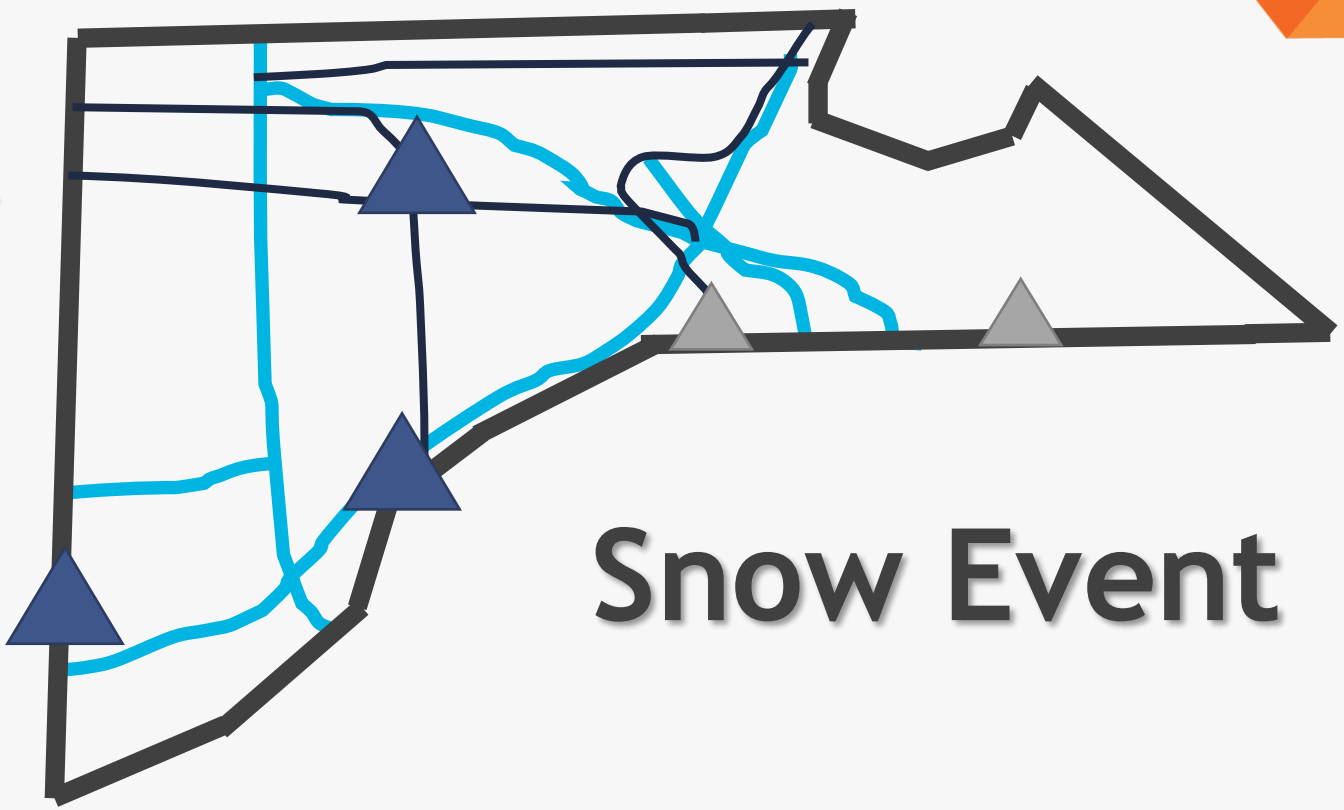
≥40% RWIS

Detect Winter Precipitation*

+

≥25% INRIX

Routes with avg. speeds at least 10 mph below expected speeds



Snow Event

1 – Event Begins

2

3

2 – Event Ends

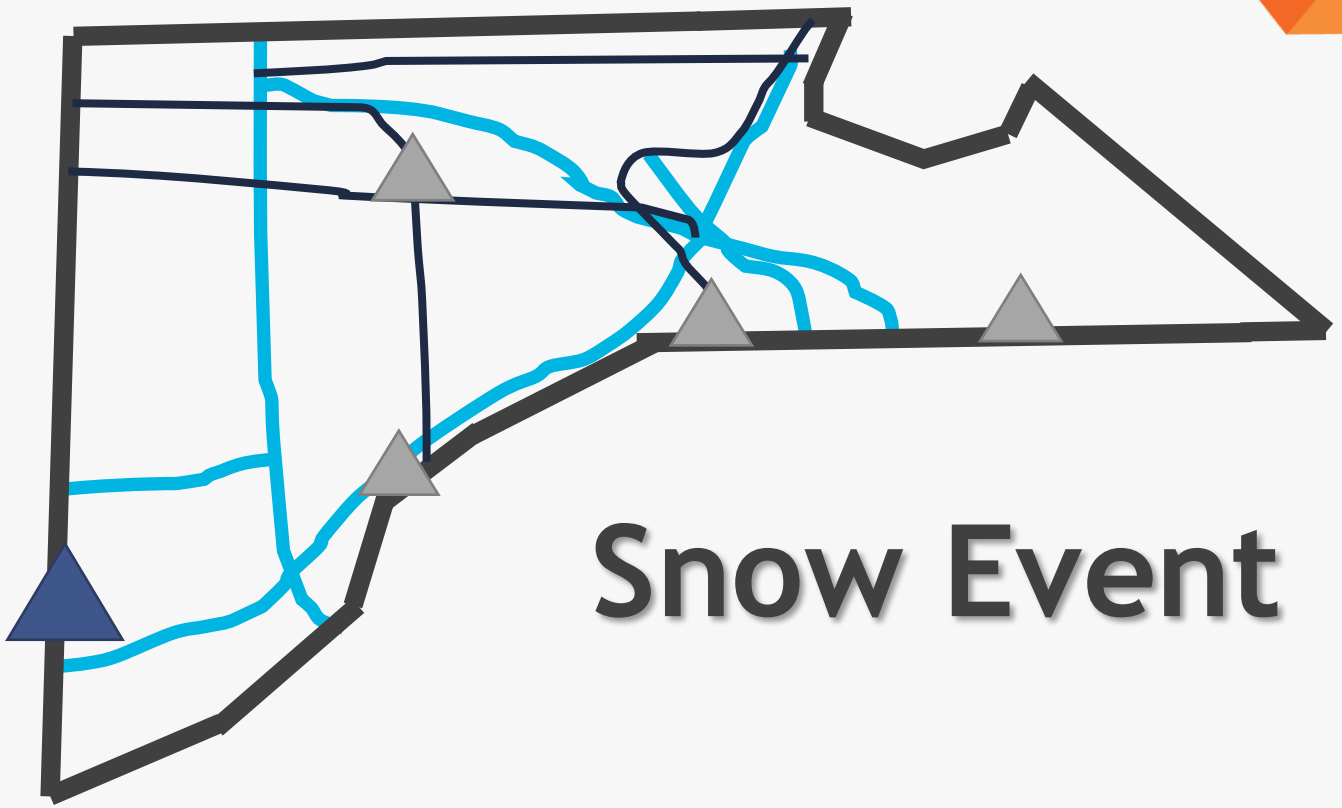
>60% RWIS

- Stops snowing/freezing
- Winds below matrix**

+

No New Event

begins within 2 hours



Snow Event

1 — 2 — 3

Event Ends

Weather Matrices

*Winter Precipitation by Temp

Precip Type	Air Temperature
Snow or Freezing	≤ 37
Unknown Precipitation	≤ 34
Rain	≤ 32

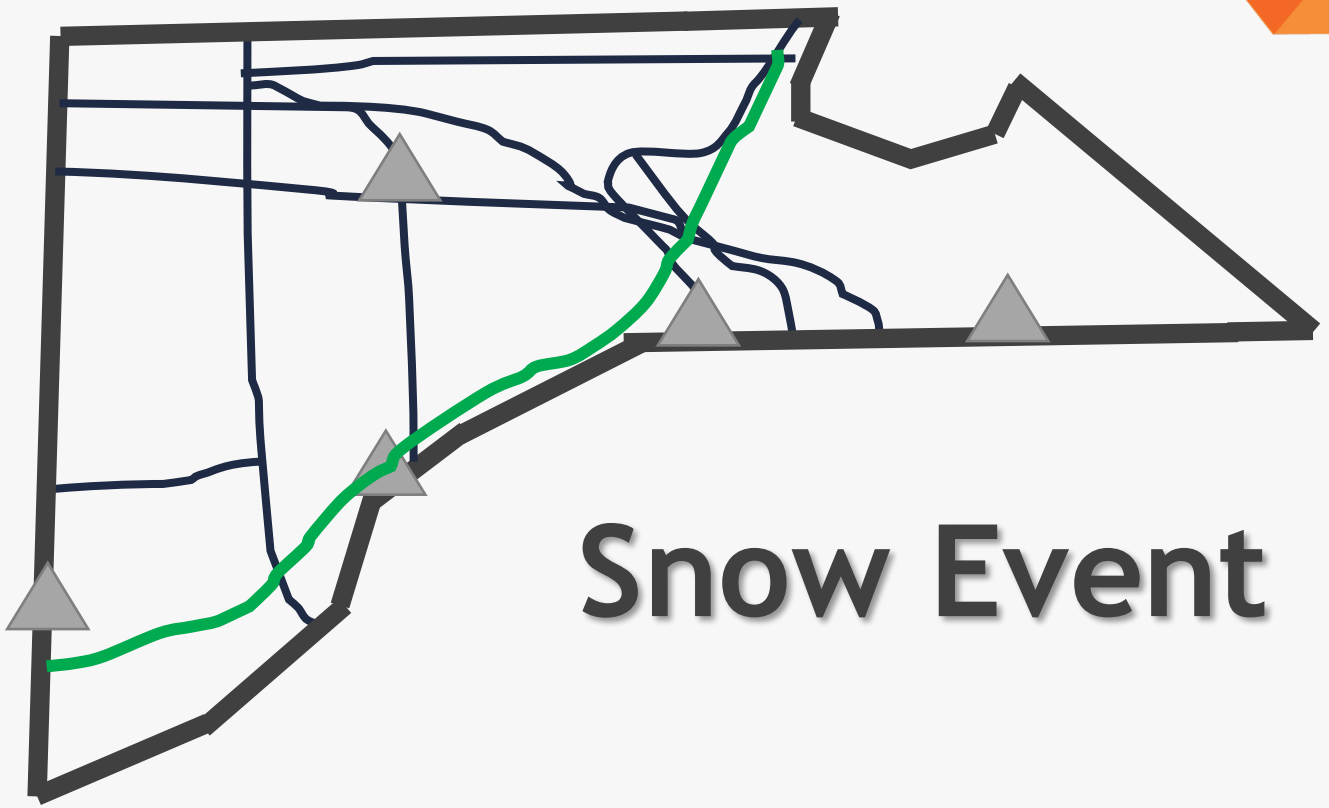
** Wind Matrix for Drifting Snow

Wind Type	Speed (mph)	Air Temperature
Avg Sustained	≥ 12	≤ 20
Gusts	≥ 17	≤ 20
Avg Sustained	≥ 15	20 < T ≤ 34
Gusts	≥ 22	20 < T ≤ 34

3 – Route Recovery

Average difference between expected and real-time speeds

≤ 10 mph



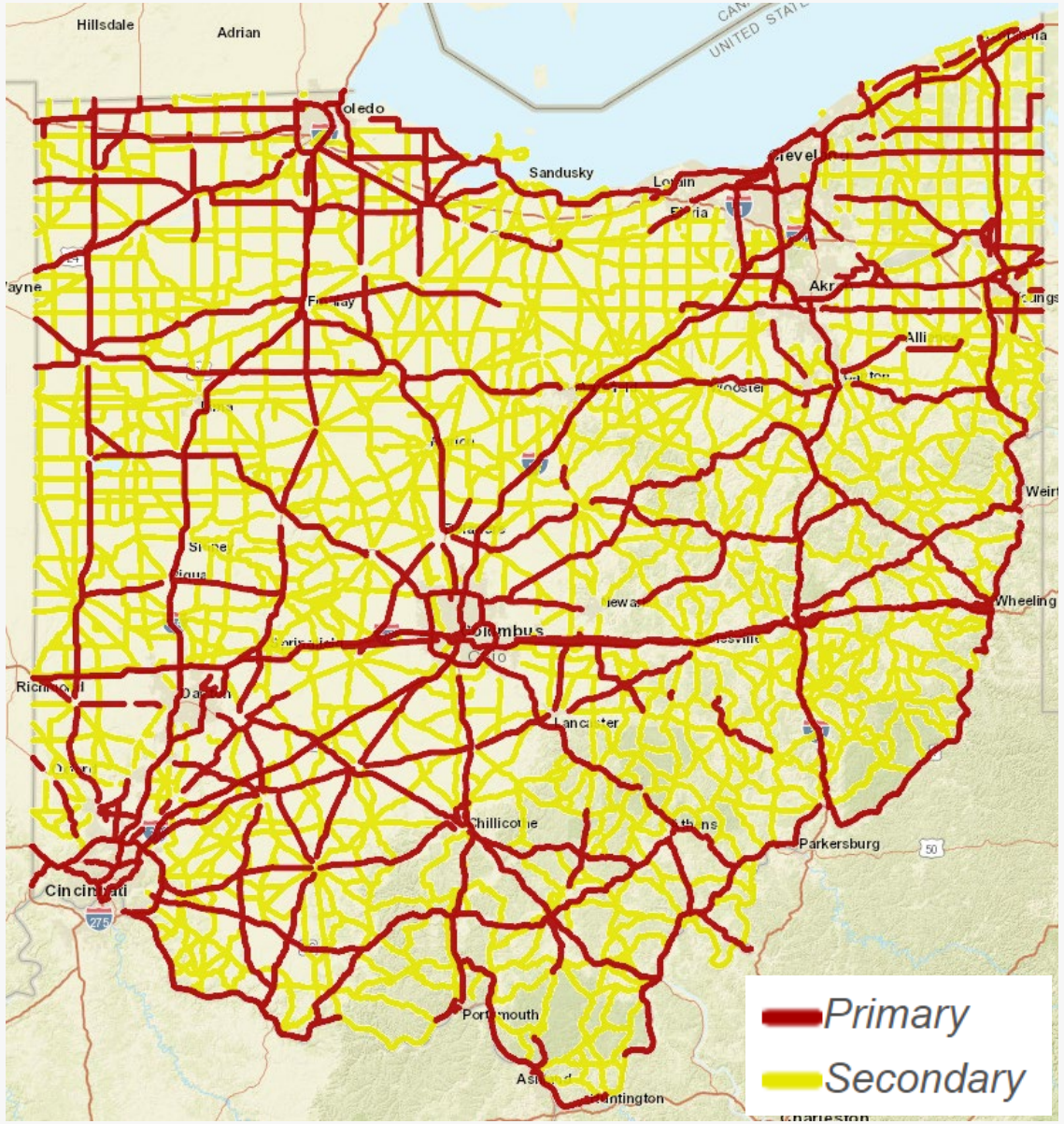
1 — 2 — 3

Route Recovered

Route Level of Service

Recovery Goals

- Primary = 2 hours
- Secondary = 4 hours*



*Reduced service 11p-5a

Snow & Ice - Reporting

Recovery Overview for SCLESR00028**C-2	
Event Start	Dec 26, 2022, 10:50:00 AM
Event End	Dec 26, 2022, 12:50:00 PM
Recovery Goal	Dec 26, 2022, 4:50:00 PM
Recovery Time	Dec 26, 2022, 7:45:00 PM

Open Route Map

Legend

Time Down (in minutes*)

Not down | 5 - 60 | 61 - 120 | 121 - 180 | 181 - 240 | 241 - 300 | 301 - 360 | 361 - 420 | 421 +

*** minutes are not necessarily consecutive.**

Real-Time Snow and Ice

EDC-6

How do we communicate snow event data in real-time to better help maintenance managers?

Problems:

- SNIPE looks backwards AND forwards in time
- Mapping segments in real-time is not performant

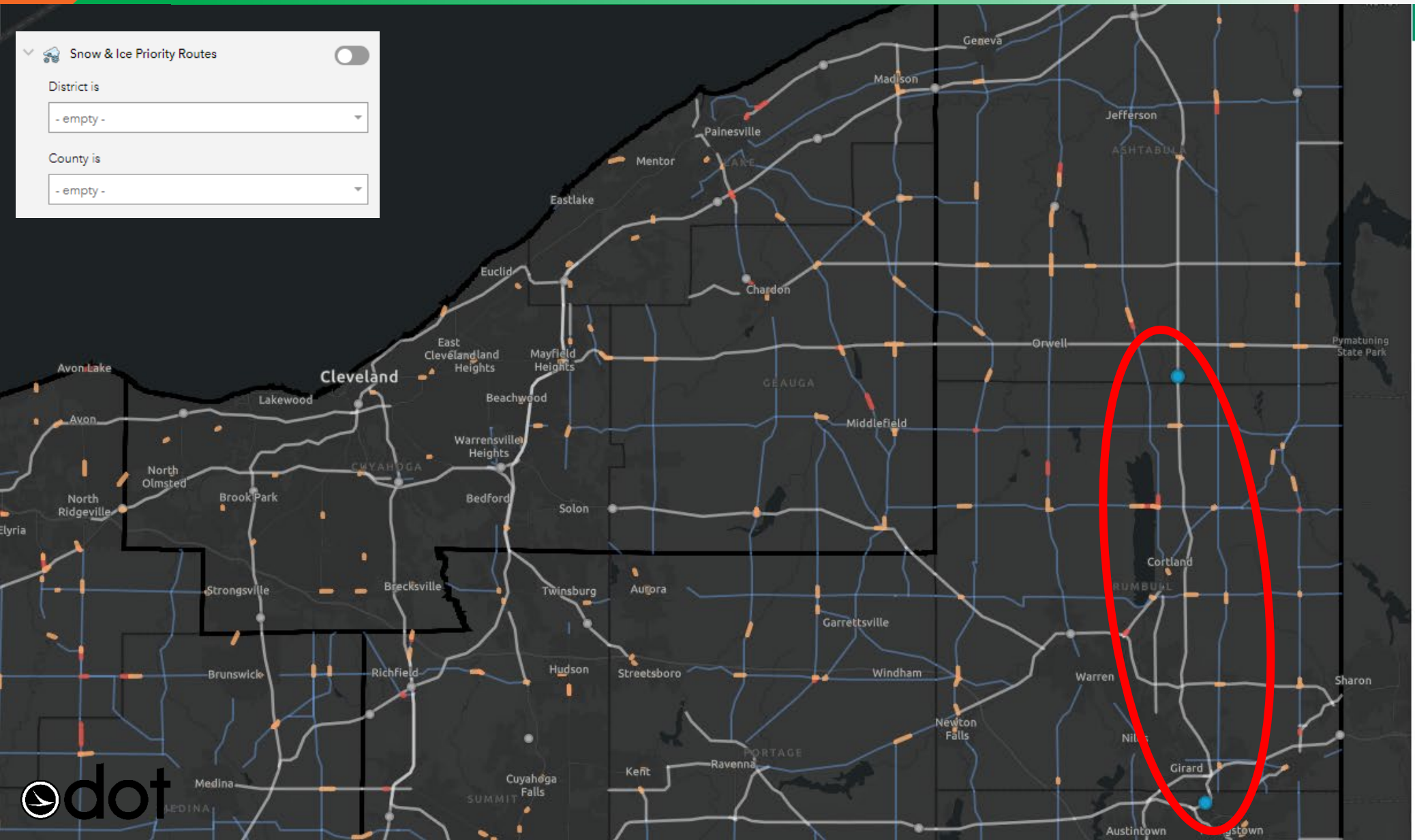
Solution:

- Show simplified versions of input data on a map using TSMO API & GeoEvent Server

dot

Real-Time Snow and Ice

EDC-6



Legend

Routes 10 to 14.9 mph down

10 - 14.8

Routes at least 15 mph down

15 - 60

RWIS Stations

Snow and Ice Condition

- No snow and ice event detected.
- Snow/freezing rain conditions.
- Windy with snow drift conditions.

Snow & Ice Priority Routes

- Primary
- Secondary

Districts

Counties

Making the Business Case

Benefits of purchasing crowdsourced data

Use Case	Benefit	Details
Snow & Ice Performance Report	Time Savings	Through automation (APIs & Python Scripts) reduced report processing time and resources from 2-3 people for 3-4 days to a background process that runs for ~2 hours.
Real Time Snow & Ice	Resource Allocation	Allows managers to see in real time which routes are experiencing slowdowns according to the Snow & Ice Performance metric to adjust resources where needed.

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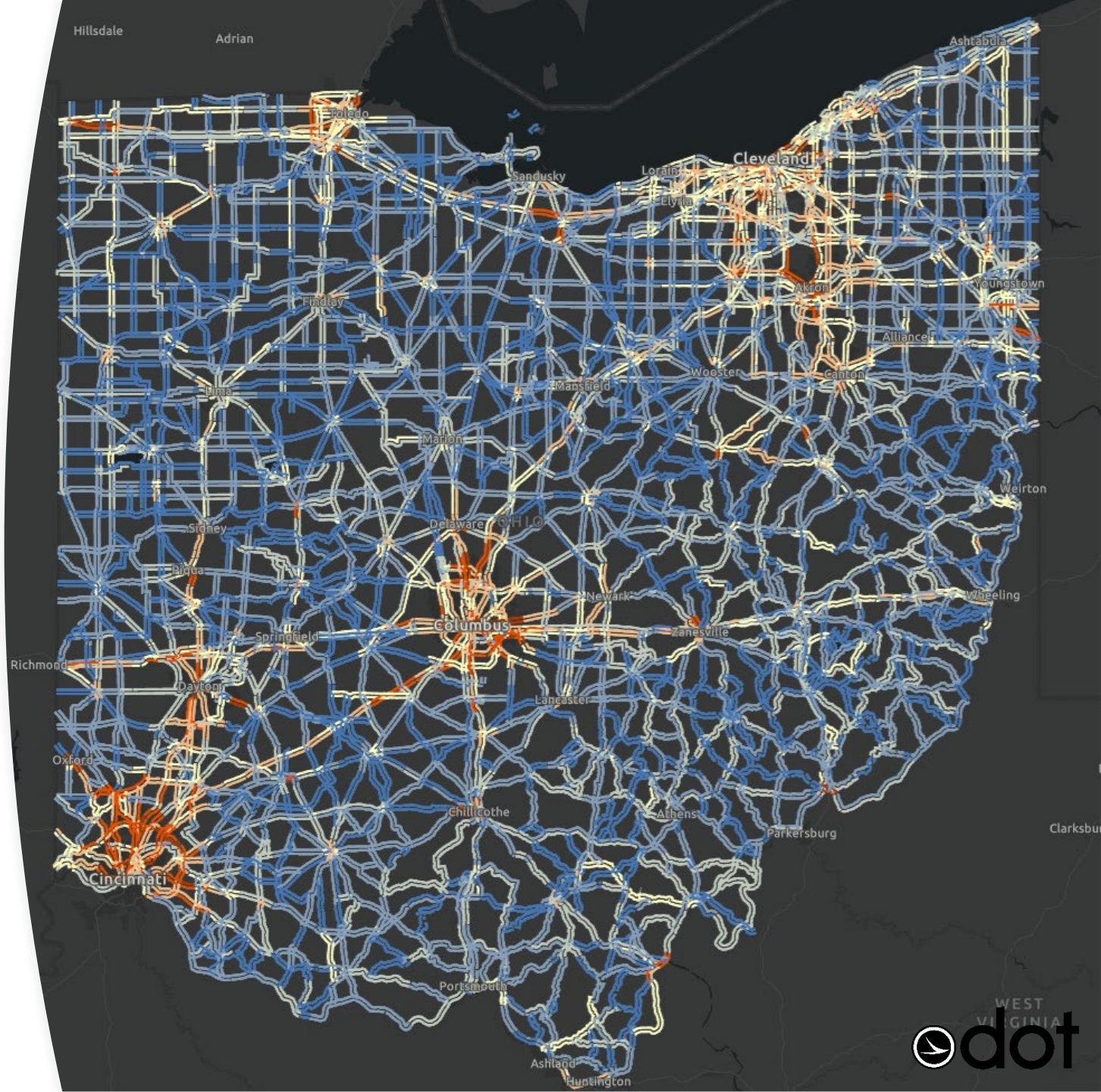
TOAST

Traffic Operations Assessment Systems Tool

- Bottlenecks
- Travel Time
- TSMO Safety
- Traffic Incident Management
- Traffic Volume Data



Knowledge Check

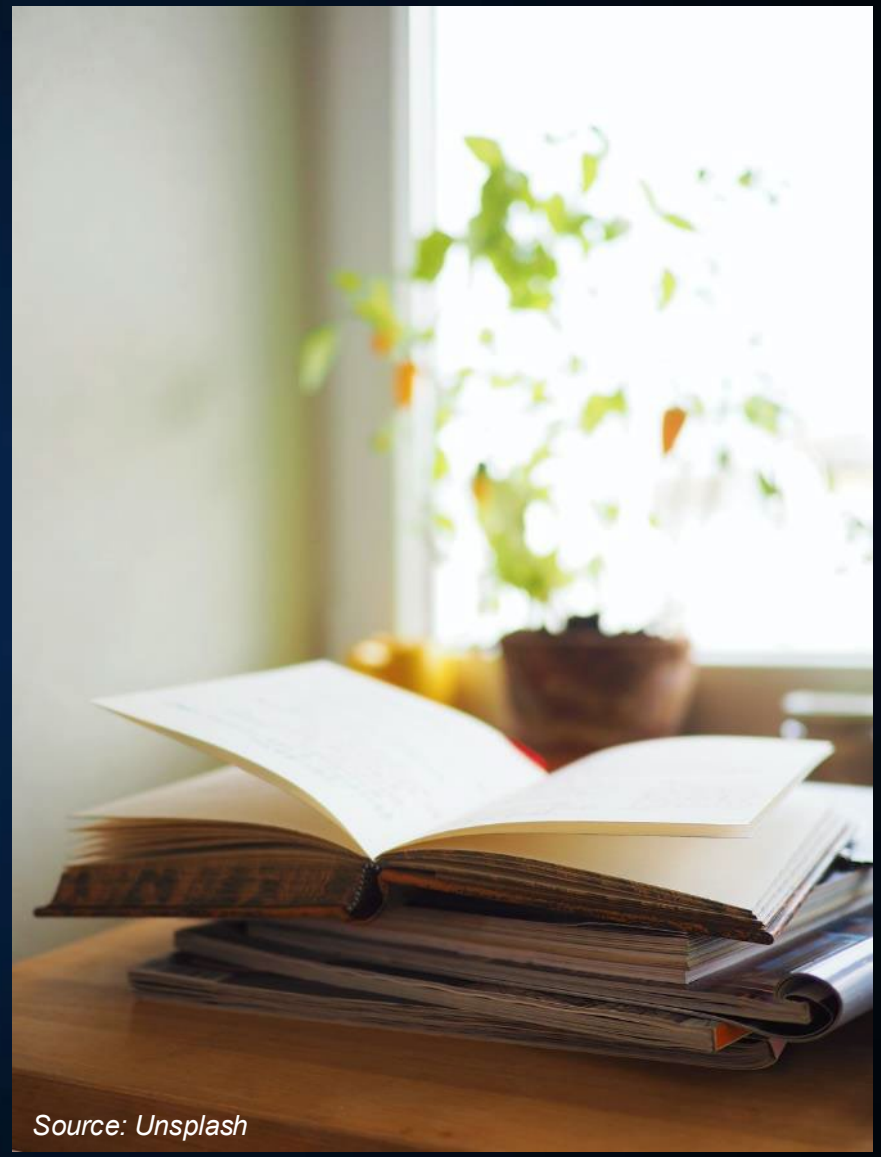
How does crowdsourcing data improve key aspects of road weather management?

A. Expand weather-reporting geography and timeliness

B. Facilitate real-time weather responsive strategies

C. Facilitate post-weather response studies

D. All of the above



Source: Unsplash

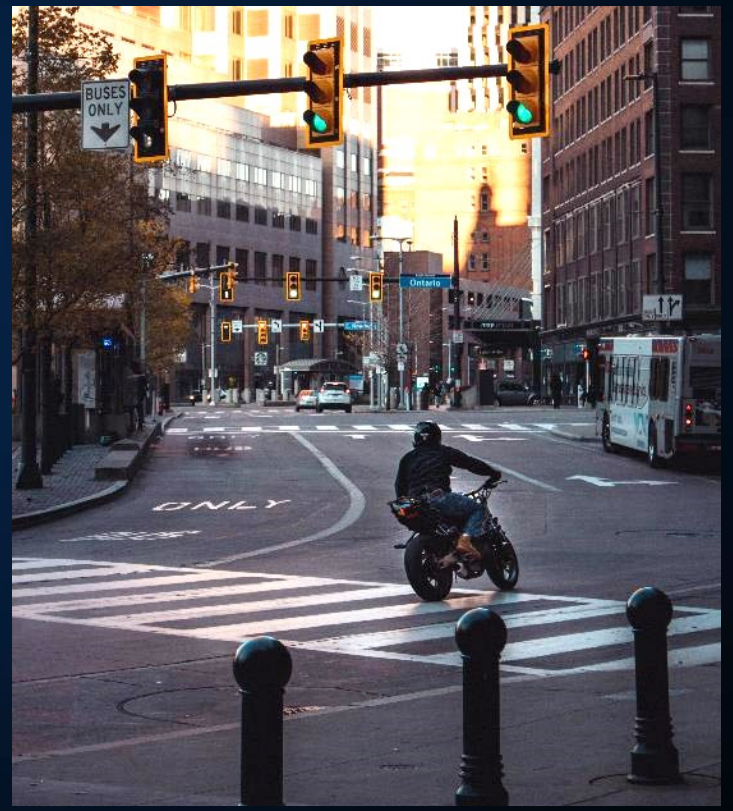
LESSON: Arterial Management

INSTRUCTOR: Dr. Wang Zhang, MAG and Jeremy Dilmore, Florida DOT

Source: Pixabay.

Lesson Objective

Describe how crowdsourcing data can improve key aspects of arterial management.



Source: Unsplash.

Arterial Management Challenges

- Knowing when traffic signal timing plans require updating
- Measuring impacts from traffic signal maintenance or new arterial infrastructure
- Adapting signal control to real-time traffic needs

"Advance the use of objectives and performance-based approaches to traffic signal management, to improve design, operations and maintenance practices, resulting in increased safety, mobility and efficiency for all users."

Federal Highway Administration Office of Operations, Arterial Management Program

Crowdsourcing Applications for Arterial Management

Source: Unsplash

- Performance-based rather than fixed calendar-based retiming.
- Continuous monitoring rather than sampling for performance.
- Measuring improvement effects.
- Proactive signal response.

Crowdsourced Data Uses for Arterial Management

Dr. Wang Zhang
Transportation Data Program Manager, Maricopa Association of Governments (MAG)

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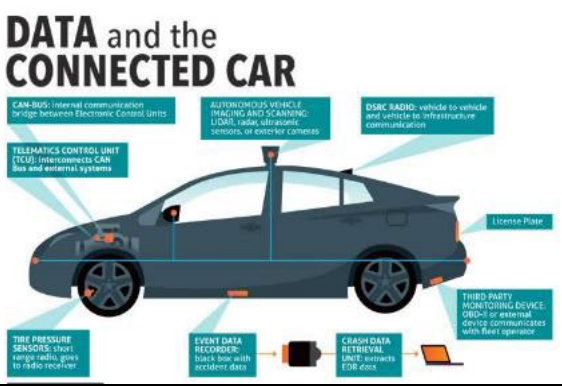
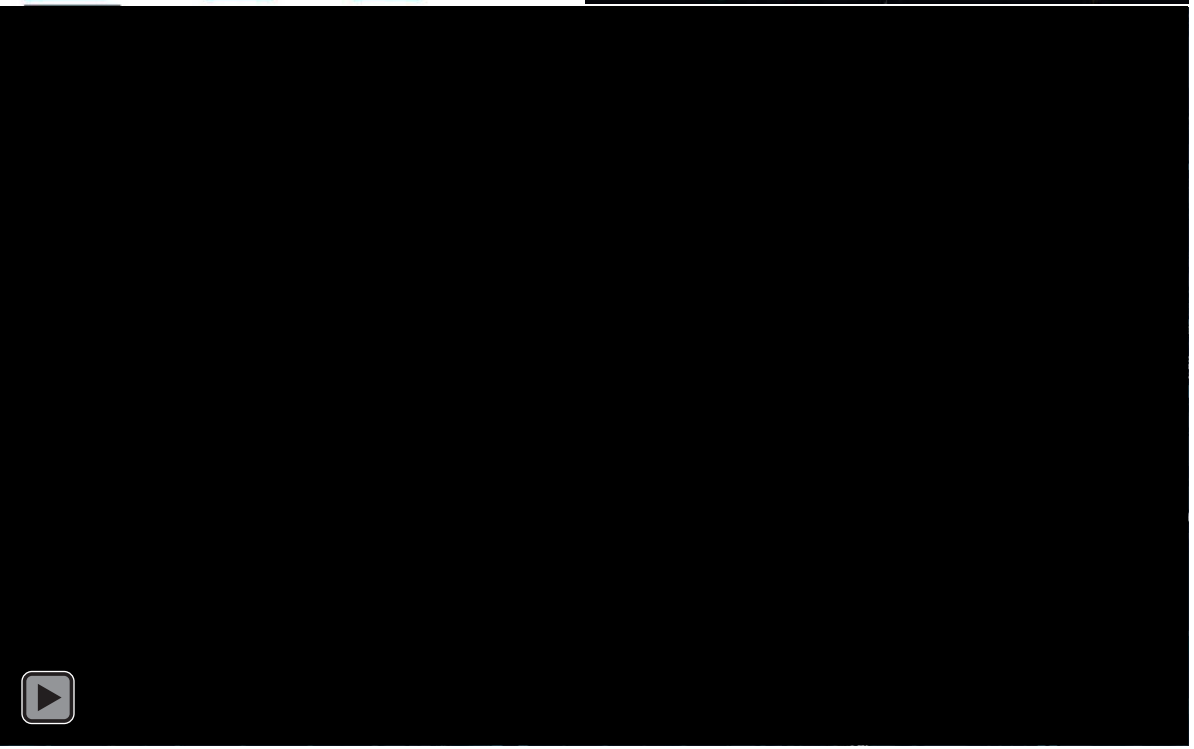
New Mobility Data – Connected Vehicle (CV) Data





- **From connected vehicle sensors**
- **Vehicle trajectory updated every 3-sec with high precision:**
  - Reporting: GPS position, speed, heading direction
  - Derivatives:
    - Origin-Destination
    - Path choice
    - Acceleration/deceleration
    - Intersection measures such as control delay, arrival on green, and split failure
- **Passenger cars only (Sedans, SUVs, Pickups), newer cars (2015 and later), from certain OEM**
- **Penetration rate varies by region**
- **Short-term future unclear**

How MAG Uses Connected Vehicle (CV) Data in Arterial Management

- 60% of VMT in the region travels on arterial network
- Compared CV data application with floating car method in measuring arterial congestion
- Identified values in CV data to help monitor arterial traffic at intersection and corridor level
- Piloting INRIX signal analytics with MAG member agencies, monitoring intersection delay and optimizing traffic signal operation

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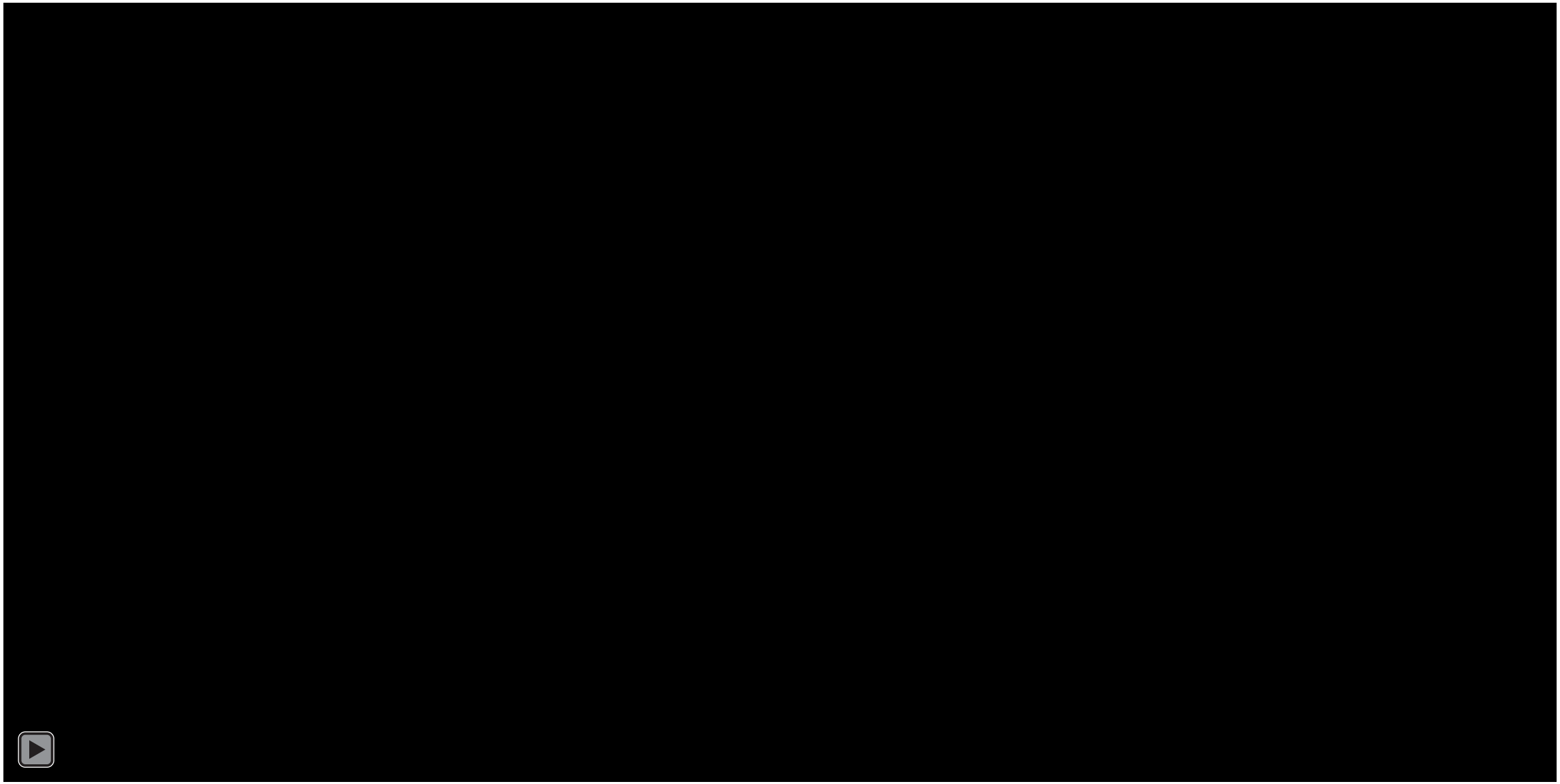
Floating Car vs. Connected Vehicle Data



Intersection Analysis

Vehicle Movement Data

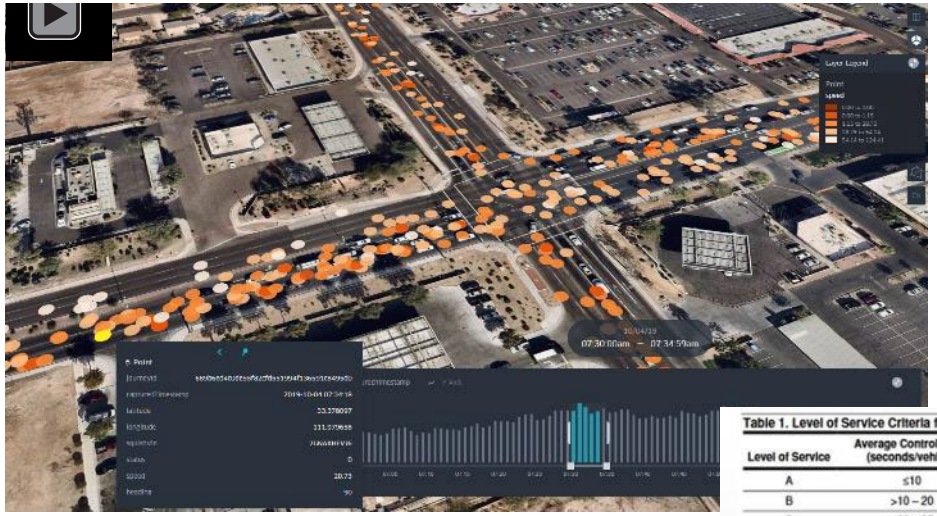
- 3-sec resolution, 24/7 coverage in the region
- High-resolution vehicle trajectory: speed, location, travel direction
- Sample rate: 4-6% of total traffic

Converting Data to Intersection Measurement

- Turning movement count (TMC) ratio
- Travel delay (control delay and stop delay) by turning movement
- Level of Service (LOS)
- Queue length, percent arrivals on green (POG)
- Intersection congestion profile by time of day and by date

Technical Advantage

- High consistency to data collected by traditional methods
- Broader spatial-temporal coverage
- Continuous monitoring
- Lower cost



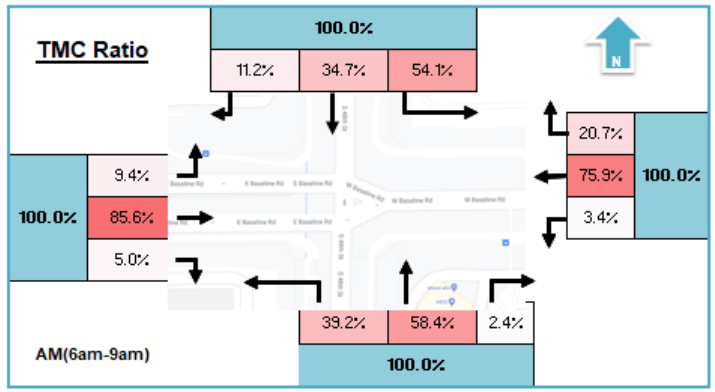
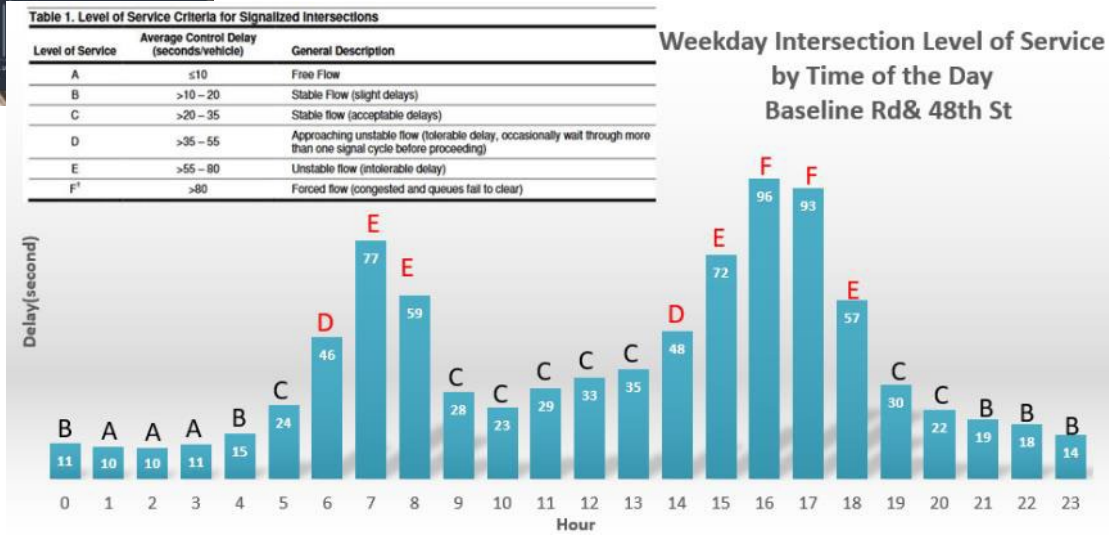
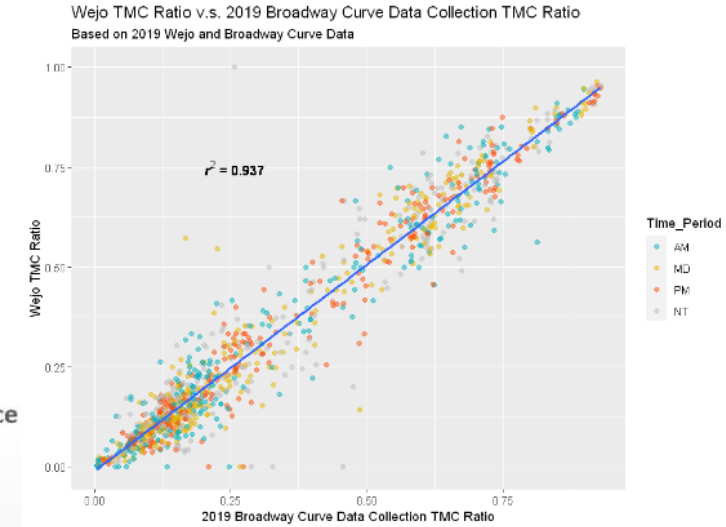
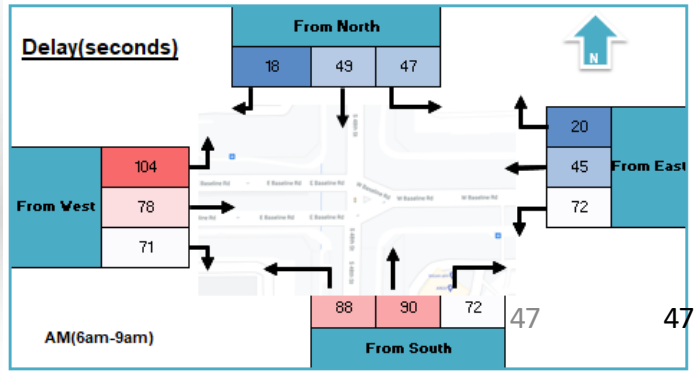


Table 1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	General Description
A	≤10	Free Flow
B	>10 – 20	Stable Flow (slight delays)
C	>20 – 35	Stable flow (acceptable delays)
D	>35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 – 80	Unstable flow (intolerable delay)
F[1]	>80	Forced flow (congested and queues fail to clear)







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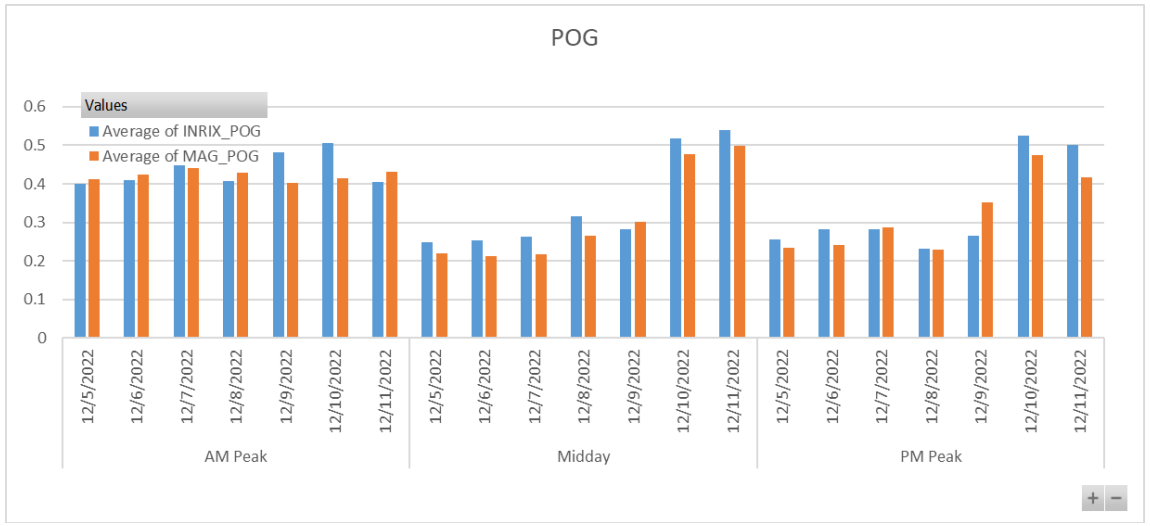
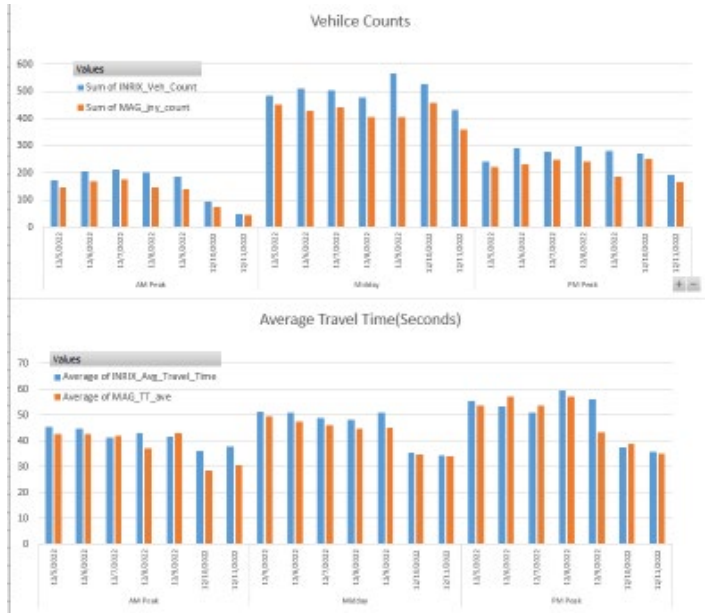
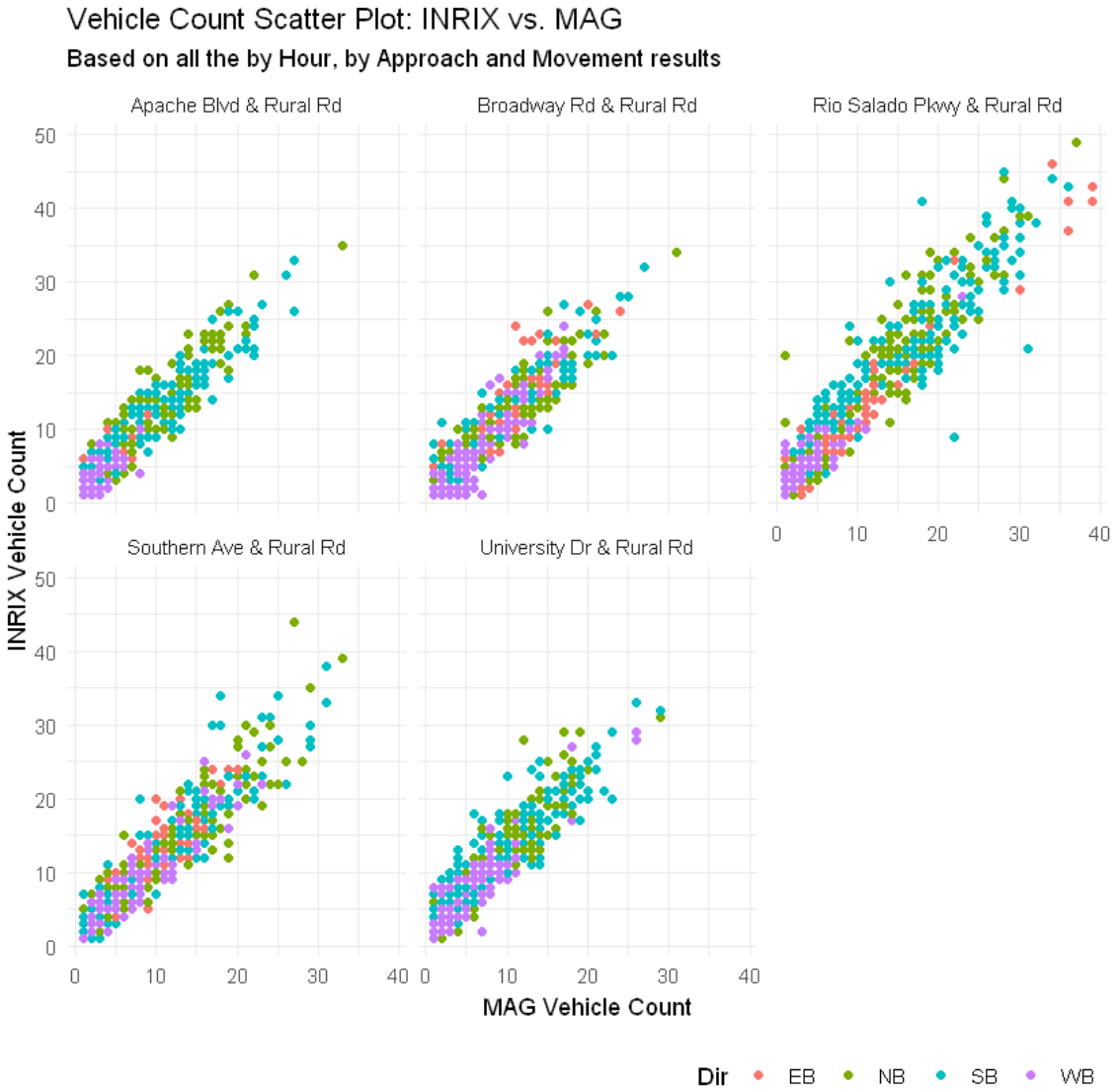
INRIX Signal Analytics Pilot

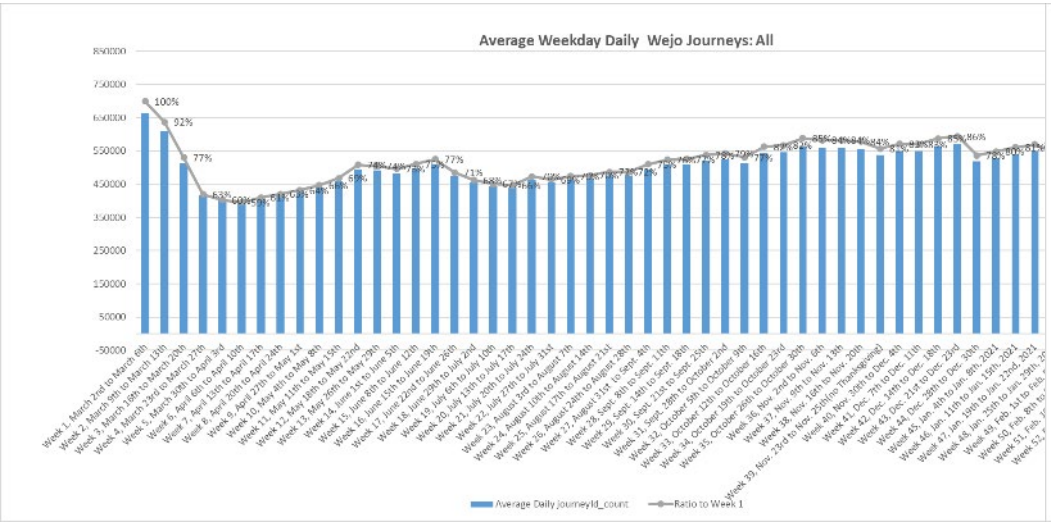


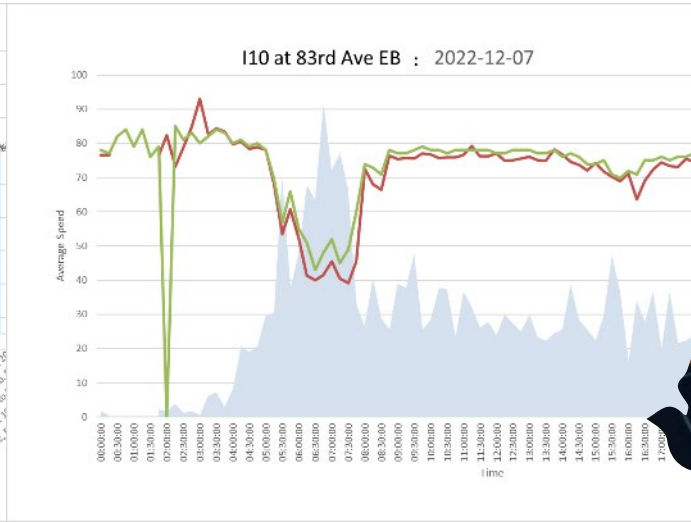




How MAG Uses Connected Vehicle (CV) Data on other Applications

- Bottleneck study - queue, select link analysis
- Trend analysis
- Benchmark other mobility datasets
- Model calibration –Macroscopic/Microscopic
- Event data





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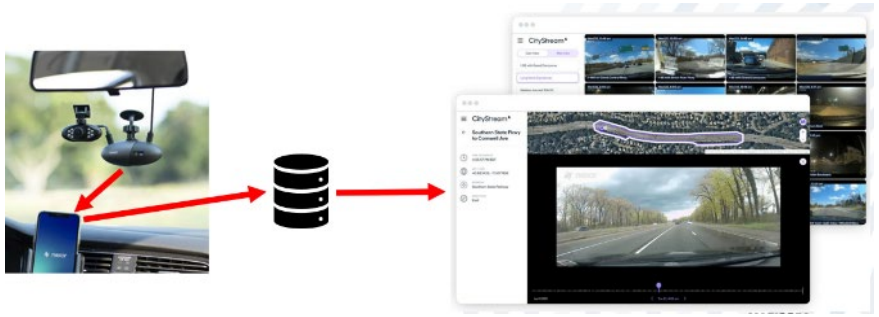
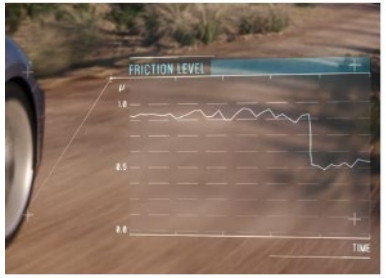
MAG Embraces Connected Vehicle Data and Other Crowdsourcing Technologies

- Explore CV Data from other sources
- Improve data processing efficiency
- Truck GPS data/analytics from multiple sources
- Other pilot efforts under MAG emerging tech program
  - Virtual camera for inspection, pavement conditions
  - Lidar for roadway inventory
  - Tire pressure sensor on pavement conditions





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Integrating Crowdsourced and Sensor-Based Data for Arterial Operations

Crowdsourcing for Operations Course, August 15, 2023

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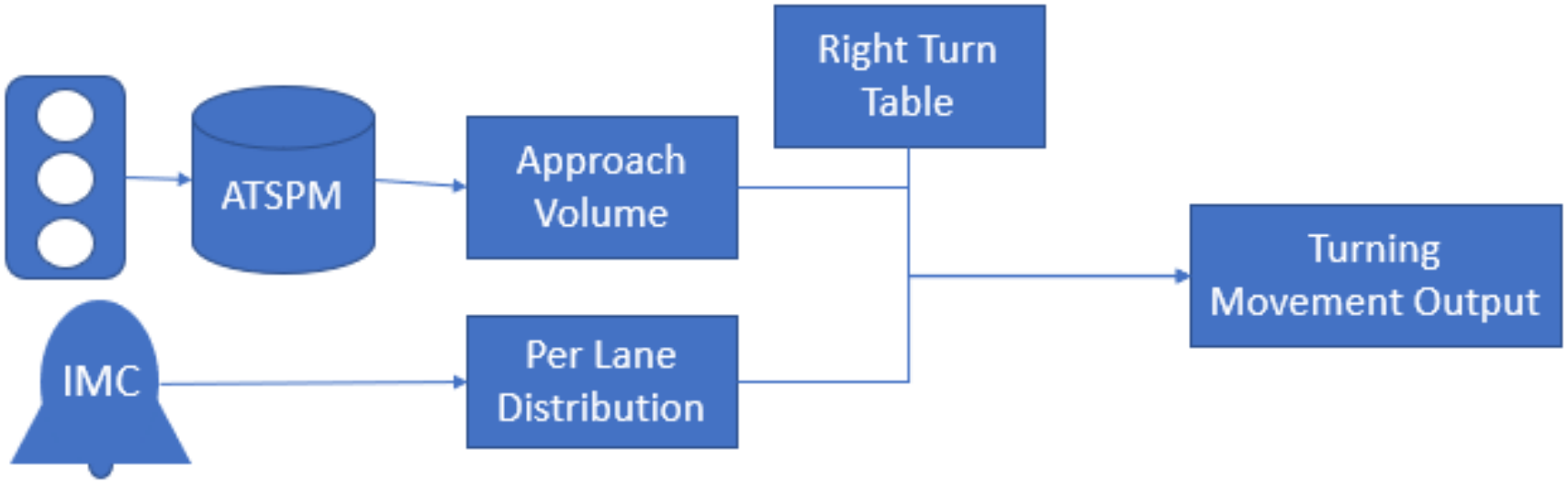
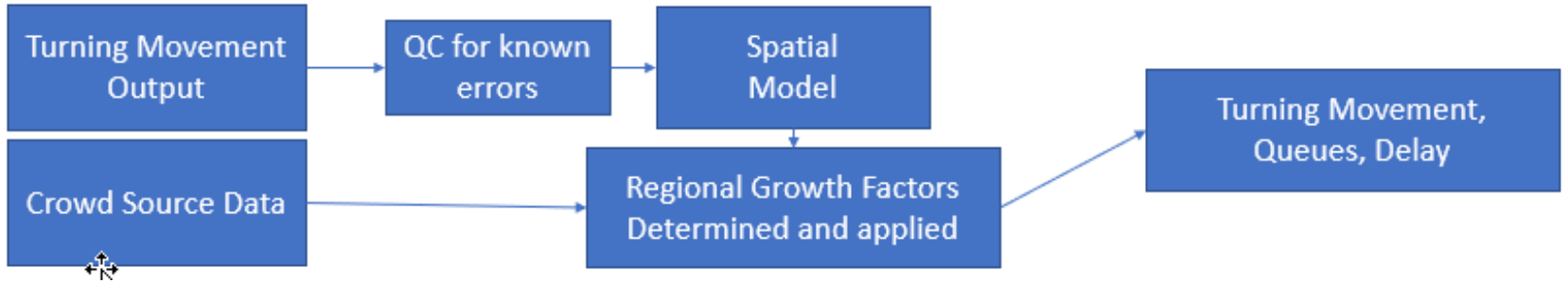
Arterial Data Sources

- Florida District 5 arterial roadways have 1600 signalized intersections
  - 900+ reporting ATSPM (2-minute frequency)
  - 200+ have CCTV reporting turning movement counts
- Crowd sourced data
  - GPS based subset of instrumented and reporting

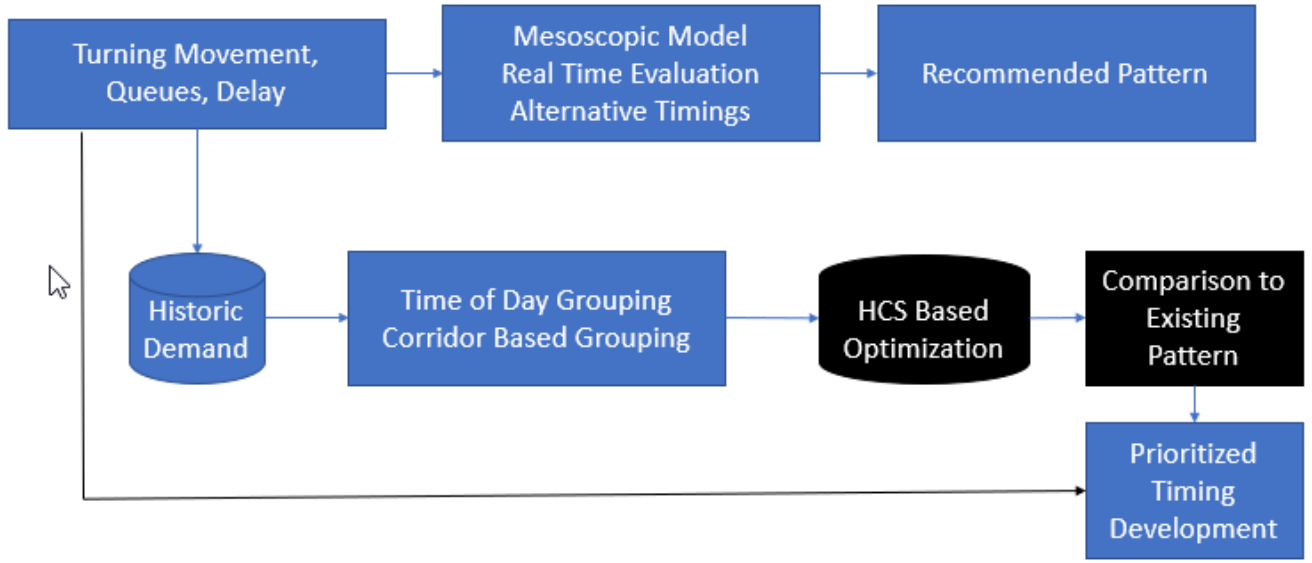


Improving Arterial Awareness

- **Fusing data provides coverage unobtainable with only instrumentation**



- **Fused data then used manage whole system**
  - Crashes, event driven demand
  - Retiming based on need



R-ICMS
FLORIDA'S REGIONAL INTEGRATED CORRIDOR MANAGEMENT SYSTEM

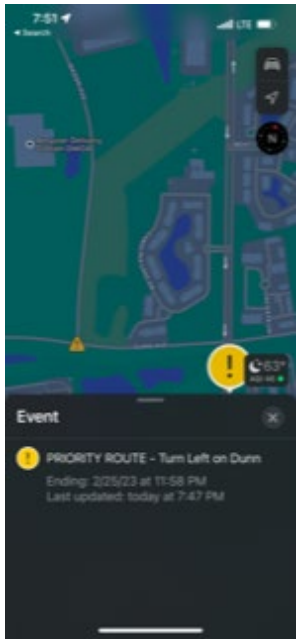
Improving Arterial Operations

Two Way Communication - Using applications to inform drivers during events such as rocket launches, Orlando venues, hurricanes, etc.

Wildfire

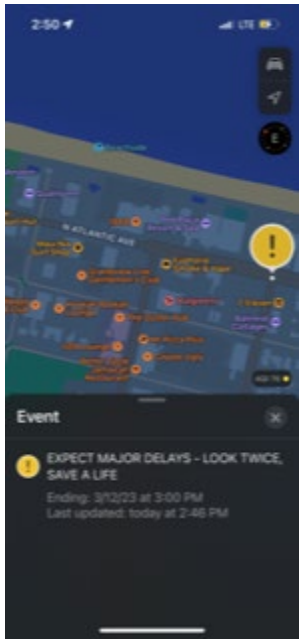
WILDFIRE IN AREA– USE CAUTION

Event Routing



PRIORITY ROUTE – TURN LEFT ON DUNN

Safety Campaign During Event



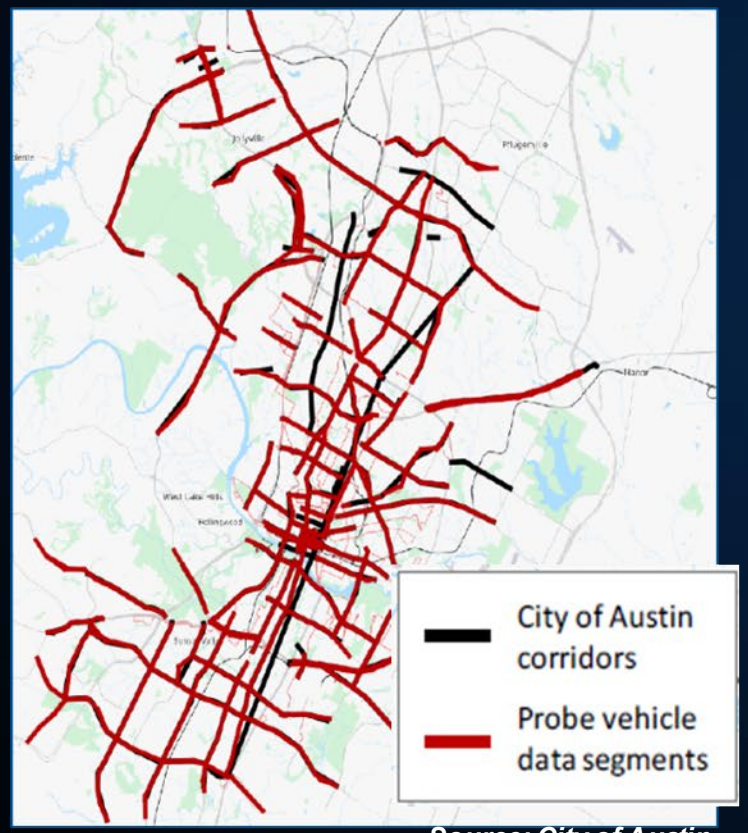
EXPECT MAJOR DELAYS– LOOK TWICE, SAVE A LIFE

Arterial Management Crowdsourcing Examples

Agency	How Data is Used	Data Source
Austin, TX	Performance-based retiming	INRIX®
Louisville, KY	Performance-based retiming Measuring improvement effects	Waze®
Lake County, IL	Continuous monitoring Proactive response Performance-based retiming	Waze® and ATSPM
Washington, DC	Performance-based retiming	INRIX®, Waze®, and ITS sensor data

https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/docs/crowdsourcing_applications.pdf

Example: City of Austin Shifts to Performance-Based Corridor Retiming



Source: City of Austin

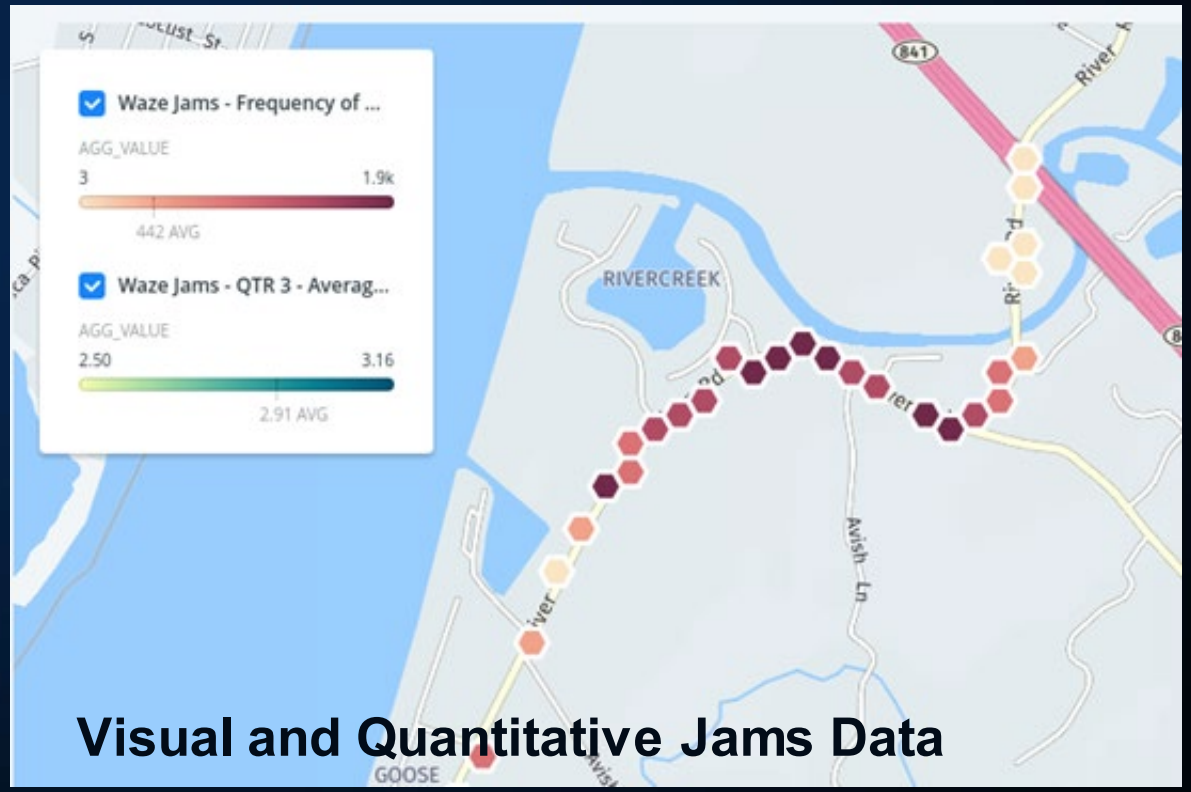
- Previously retiming on rotating three-year schedule among ninety corridors.
- Historic vehicle probe data used to prioritize annual retiming of approximately 30 percent of city signals.
- Benefits of retiming shared with public.

Travel Time Reduced	Travel Time Reduced	Travel Time Reduced	Travel Time Reduced	Travel Time Reduced
12.1%	7.7%	2.1%	3.4%	5.0%
FY2016 Goal: 5.0%	FY2017 Goal: 5.0%	FY2018 Goal: 5.0%	FY2019 Goal: 5.0%	FY2020 Goal: 5.0%

Source: Port Authority of New York and New Jersey

Example: Louisville Metro, Kentucky Crowdsources Signal Retiming Impacts

- Archive and analyze Waze® jams data using PowerBI®.
- Compares data before and after retiming rather than through a paid study.
- Also use data for hot-spot analysis and detecting faulty intersection equipment.



Visual and Quantitative Jams Data

Source: Louisville Metro, Kentucky

Example: Lake County Integrates Navigation Application Data for Signal Responsiveness

- From manual, infrequent to automated, continuous data collection
- Proactively implements alternate signal timing for crashes or adverse weather
- Significant savings on signal coordination and timing studies

Travel Time, Delay, and Speed Data from Waze, Stops from Automated Traffic Signal Performance Measures

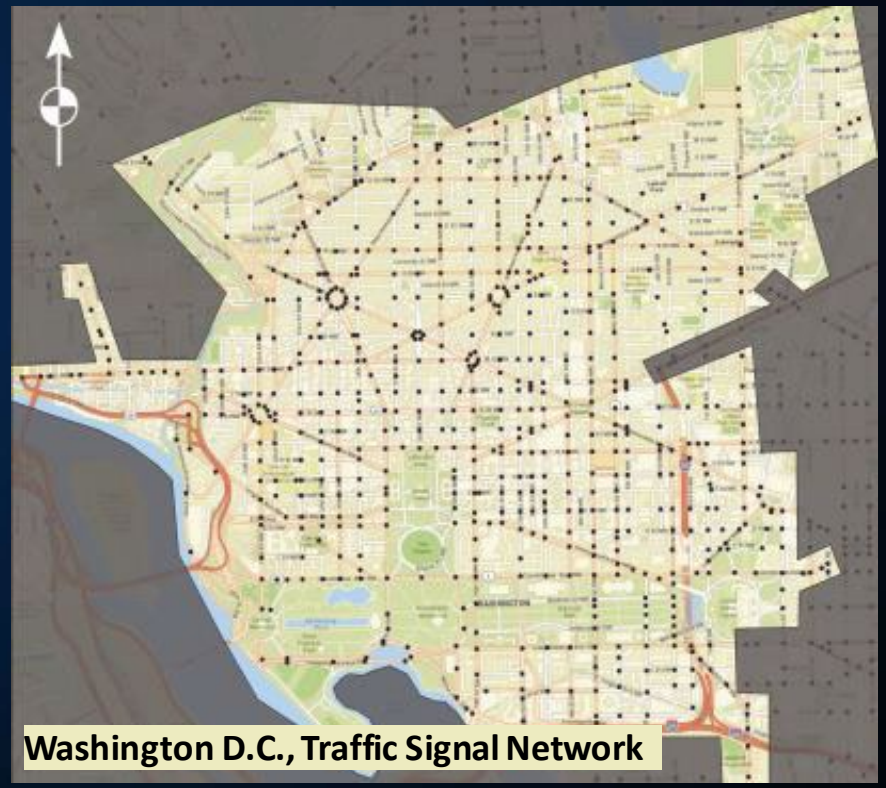
SPEED/DELAY SUMMARY
Butterfield Rd. - (Allanson Rd. To IL 137)

		Condition	Travel Time	Delay	Stops	Average Speed
AM PEAK	N/B	Pre-imp.*	380	44.7	1.3	35.1
		Post-imp.**	374	43.3	1.7	35.7
	S/B	Pre-imp.	620.3	287	5.7	21.5
		Post-imp.	356.7	28.7	1.0	37.4

Source: Lake County DOT

Example: Washington D.C. Uses Multiple Data for Corridor Retiming

- 600+ signal grid network with auto, bus, pedestrian, and bicycle considerations.
- Used vehicle probe data through RITIS, Google® Traffic®, Waze®, floating car/GPS, bicycle travel time, and other data with a Synchro® simulation model to retime network.
- Resulted in annual $2.4M mainline traffic delay savings, and annual $5.8M savings considering all traffic approaches.



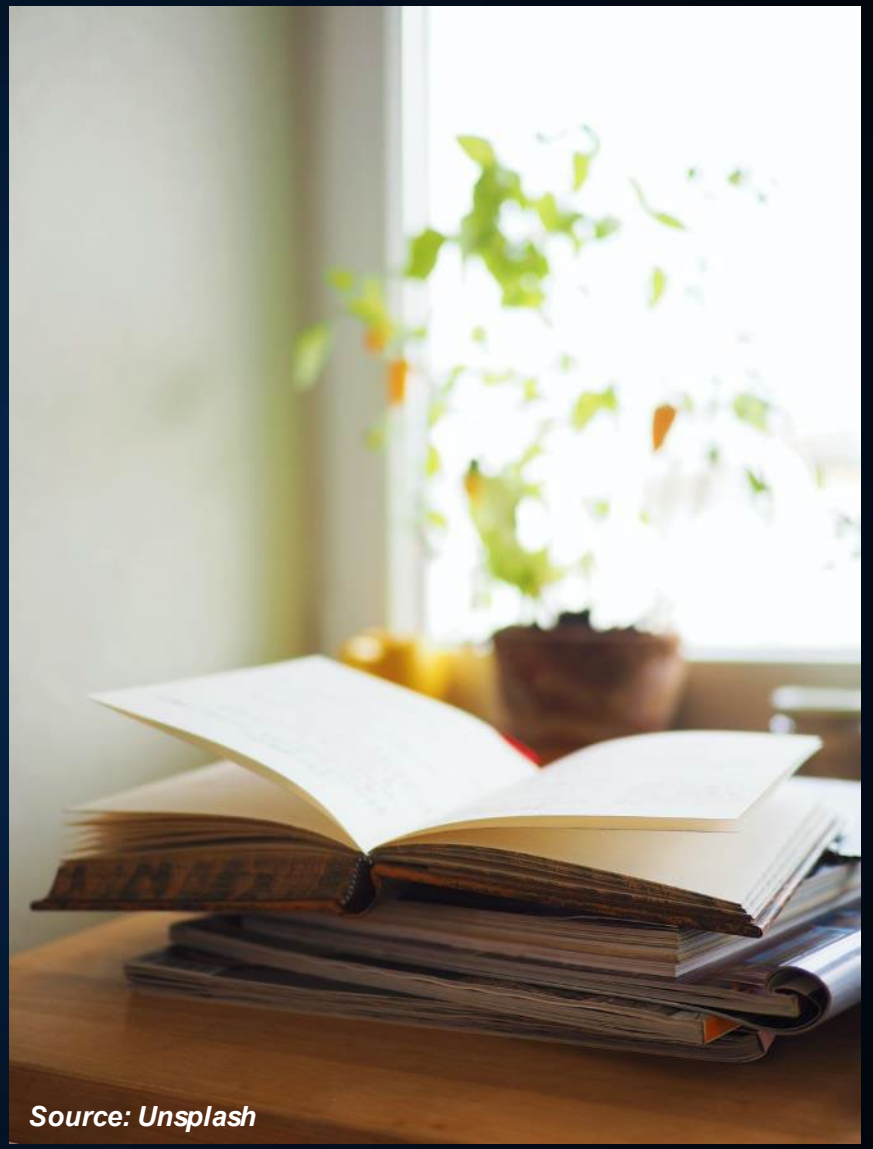
Washington D.C., Traffic Signal Network

Source: District Department of Transportation

Knowledge Check

How does crowdsourced data improve arterial management?

A. Detection of faulty traffic signals
B. Performance-based corridor retiming
C. Assess impact of signal retiming
D. All of the above



Source: Unsplash

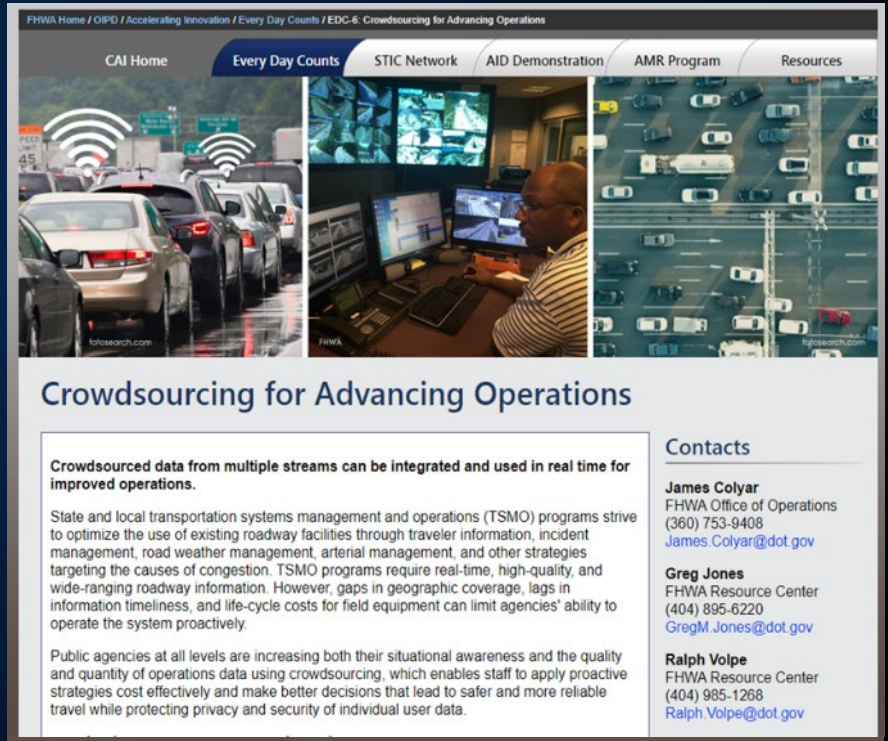
Source: Pixabay.

Question, Answer, and Discussion

Road Weather Crowdsourcing Resources

Adventures in Crowdsourcing webinars with road weather content:

- Social Media for Improved Operations
- Engaging Navigation Providers
- Using Crowdsourced Data for Traveler Information
- Business Case for Crowdsourced Data



FHWA EDC-6 Crowdsourcing for Advancing Operation Resource Site (bit.ly/CS4Ops)

Arterial Crowdsourcing Resources

Adventures in Crowdsourcing webinars with arterial management content:

- Traffic Signal Applications
- Validating Crowdsourced Data

Eastern Transportation Coalition webinar:

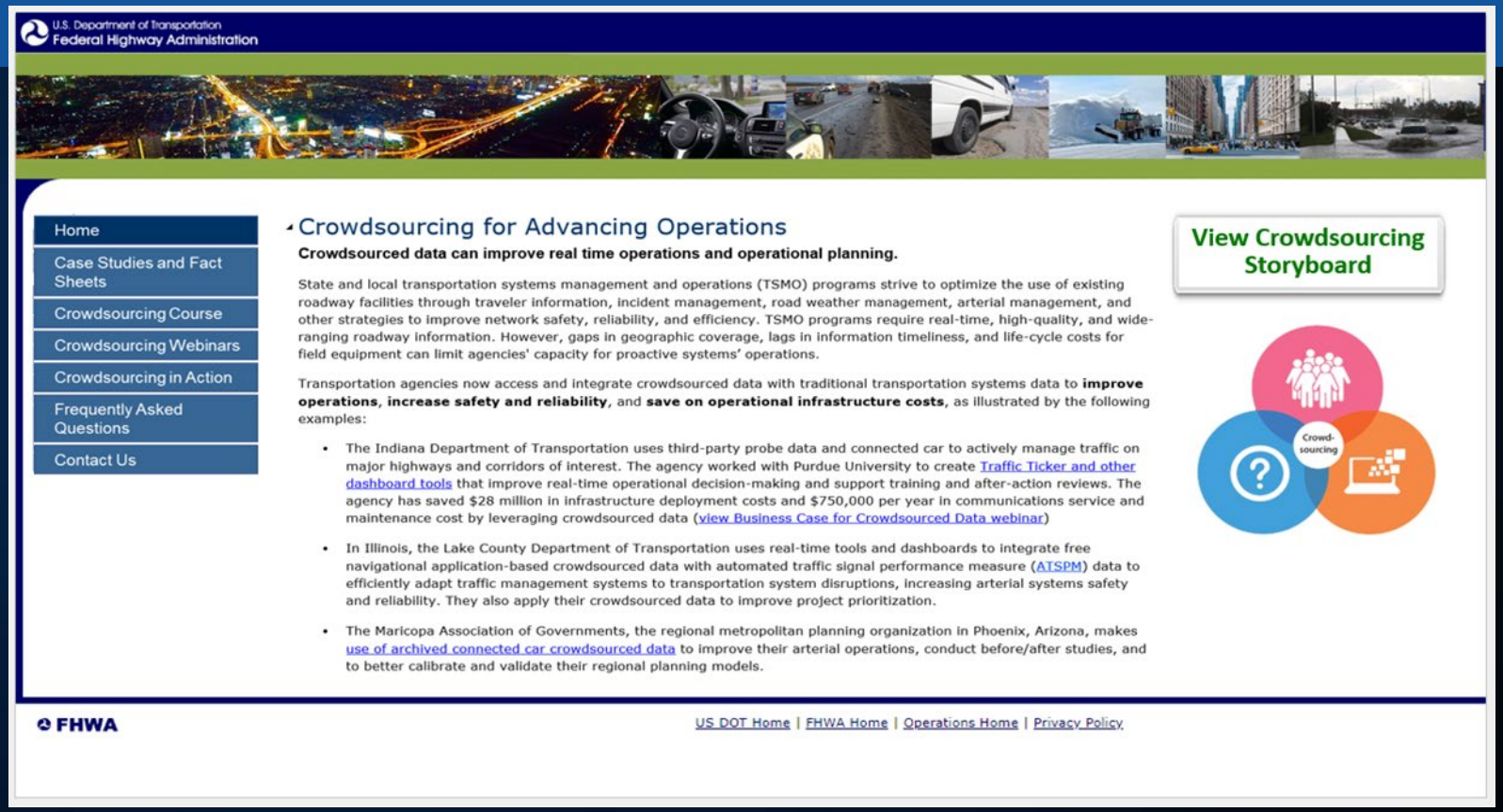
- Using RITIS for Arterial Performance Measures (Briefing)

FHWA Arterial Management Program

FHWA EDC-6 Crowdsourcing for Advancing Operation Resource Site (bit.ly/CS4Ops)

Crowdsourcing Beyond Every Day Counts Round Six

- New website presence
- Continue course delivery
- Continue technical support
- Continue free access to the EDC-6 Adventures in Crowdsourcing webinar series hosted by the National Operations Center of Excellence



Concept website in development and intended for FHWA Office of Operations.

Source: FHWA.

Thank you.

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U.S. Department of Transportation
Federal Highway Administration

Every Day Counts
Innovation for a Nation on the Move

Upcoming T3 Webinars

Webinar	Date	Time
Crowdsourcing for Advancing Operations: Emergency and Work Zone Management and Next Steps	Tuesday, September 19, 2023	1:00 P.M. - 2:30 P.M. ET

Register: https://www.pcb.its.dot.gov/t3_webinars.aspx

To access the recording and past T3 webinars, visit:
https://www.pcb.its.dot.gov/t3_archives.aspx

Feedback

- A link to a feedback questionnaire is provided in the chat pod. Please take a few minutes to fill it out – we value your input

- To receive notifications of upcoming events, send an email to T3@dot.gov with "Add to mailing list" in the subject line

Thank you!

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