

# *TSMO for Transportation Resilience: Bridging the way with innovation*

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U.S. Department of Transportation  
**Federal Highway Administration**



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# Session Goals

- **Why TSMO and what do we mean by resiliency for operations?**
- **Share how institutional and organizational processes support resilient operations.**
- **Promote the use of innovative data sources, like crowdsourcing, and how it can be leveraged for resilient operations.**



Photo Source: Pixabay

# Session Highlights



FHWA [Every Day Counts \(EDC\) Program](#)  
and the Crowdsourcing Innovation



Overview of TSMO and Resiliency



Examples from TSMO foundations and  
support innovations



Moving Forward




Source: Pixabay

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A lightbulb icon inside a square frame, which is centered within a larger rounded square on a dark blue background.

# FHWA EDC Program and Crowdsourcing

# What is Every Day Counts?



FHWA EDC Program  
and Crowdsourcing

State- and local-based model that identifies and rapidly deploys proven, yet underutilized innovations to:



**Shorten Project Delivery**



**Enhance Roadway Safety**



**Reduce Traffic Congestion**



**Integrate Automation**



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# EDC Innovation Rounds

- Two-year cycle each round
- 5-10 innovations each round
- State Departments of Transportation (DOTs) self-report progress by capability maturity advances



***Crowdsourcing was an EDC Round 5 and Round 6 Innovation.***



FHWA EDC Program  
and Crowdsourcing



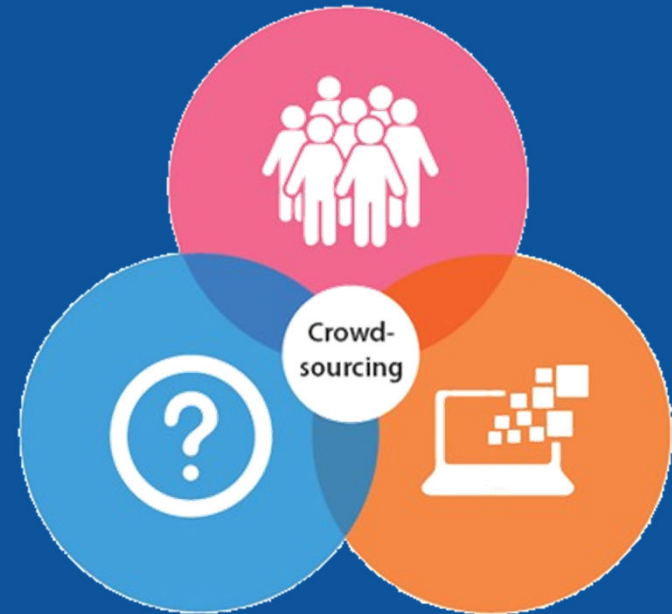
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# What is Crowdsourcing



FHWA EDC Program  
and Crowdsourcing

The practice of addressing a need or problem by enlisting the services of a large number of people via technologies.





# Crowd-sourcing Innovation



FHWA EDC Program  
and Crowdsourcing

***Mission:*** Advance transportation systems management and operations (TSMO) through broader, active use of crowdsourced data for better operations, safety, reliability, and cost.

## ***Innovation Goals:***

1. Foster understanding of crowdsourcing and data management
2. Promote crowdsourcing successes to prompt replication and adoption
3. Accelerate crowdsourcing use maturity by helping remove agency-specific barriers



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*Icons sourced from Microsoft PowerPoint Icons*

# Overview of TSMO and Resiliency

# Why TSMO (Transportation Systems Management & Operations)?

- TSMO focuses on actively managing the multimodal transportation network to deliver improved safety and mobility outcomes.
- TSMO is an integrated set of strategies to optimize the performance of infrastructure through the implementation of multimodal and multi-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system.

*- Moving Ahead for Progress in the 21st Century (MAP-21)*

# How is TSMO described?

- Proactive and Reactive
- Recurring and Non-recurring
- Entire Transportation System (Multi-modal, Multi-jurisdiction)
- Integrated Strategies
- Offers near-term, lower cost solutions
- Works as an alternative or complement to adding capacity
- Supported by ITS
- Moving People and Goods, not just Cars and Trucks

# Why resiliency?

“For a transportation system, resilience is the capability to recover from a disruption to an operational level similar to prior to the disruption in a timely manner. The longer and deeper the impact of the disruption on operations, the less resilient a transport system is.”

Inherent effects of Disruptions:

- Natural
- Anthropogenic

- Source: Rodrique, Jean-Paul (2020), *The Geography of Transport Systems*

# Natural Disruptions

- Weather events
  - Regular (storms and blizzards)
  - Extreme (floods, hurricanes, tornados, and droughts)
- Geophysical (earthquakes, tsunamis, and volcanic ash clouds)
- Geomagnetic storms (solar activity)
- Biological (pandemic)

# Anthropogenic Disruptions

- Accidents
  - Mobile (Modal crashes)
  - Stationary (Industrial)
- Infrastructure failure
- Conflicts
  - Wars
  - Civil unrest
  - Terrorism
- Economic risks
- Cyberattacks
  - Intentional
  - Unintentional
- Sanitary

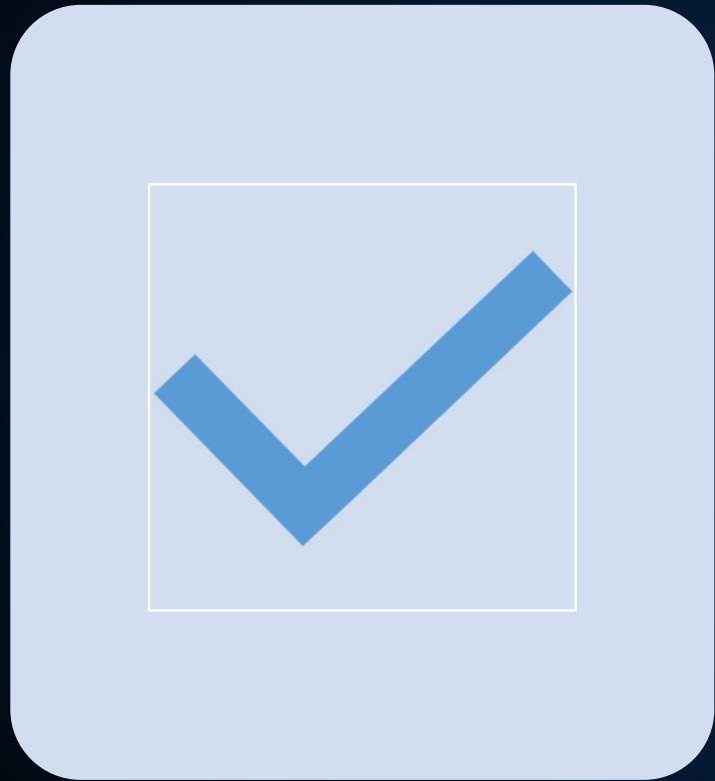
# Risk Management – Proactive Preparation

- Risk assessment
- Preparedness
- Mitigation
- Response
- Recovery
  
- Collaboration

***Resiliency is Bouncing Back!***







*Icons sourced from Microsoft PowerPoint Icons*

# Examples from TSMO and Support Innovations

# Bridging Resiliency to:

- Institutional and Organizational Foundations for TSMO
- Emerging TSMO Data Sources and Analytics
  - Crowdsourced Data

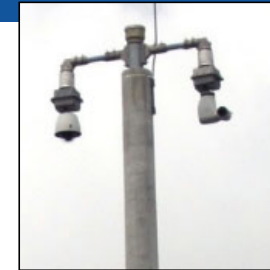
# Linking Resiliency to TSMO

- Dimensions of TSMO Capability
  - Business Processes
  - Systems and Technology
  - Data and Performance Management
  - Culture
  - Organization and Staffing
  - Collaboration

# Real-Time Monitoring: A Weakness in the Foundation of Operations

There are 4 primary limitations in our typical approach to real-time monitoring:

1. Big gaps in geographic coverage.
2. Lags in timeliness of information.
3. Cost to build-out and maintain field equipment.
4. Jurisdictional stovepipes.

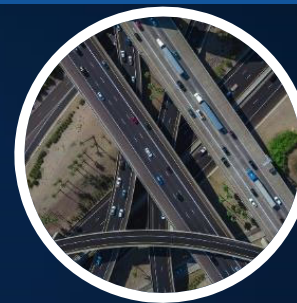


Source: FHWA

**These limitations reduce the ability to efficiently and (cost) effectively operate the system.**

# Bridging Resiliency to Emerging Data Innovations

- Crowdsourced data
- Differences between crowdsourced and traditional Intelligent Transportation Systems (ITS) data



*All Photos Source: Unsplash*

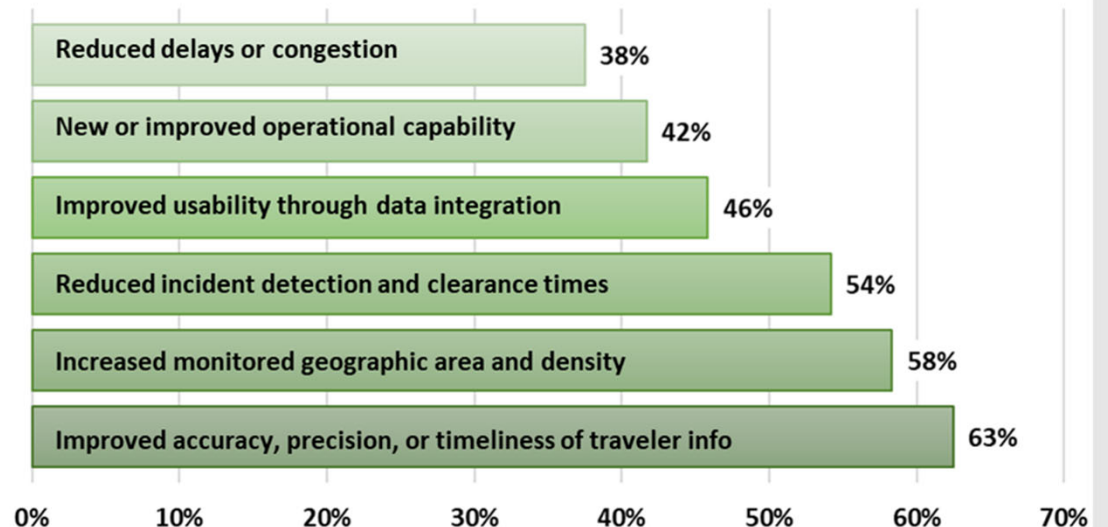
# States Benefitted from Crowdsourcing during EDC-5 Jan 2019 – Dec 2020



FHWA EDC Program and Crowdsourcing



Percentage of States Benefitting from Crowdsourced Data over the FHWA EDC-5 Period (Jan 2019 - Dec 2020)



\*Based on feedback from 24 State Departments of Transportation participating in the EDC-5 Crowdsourcing for Operations Innovation.

*Note: States focused on different applications of crowdsourced data; thus, States find benefits from a subset of the six areas.*



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# Why Crowdsourcing for Operations?

✓ Improve Operations



Source: FHWA

✓ Increase Safety and Reliability



Source: FHWA

✓ Save Cost



Source: Pixabay

# Crowdsourced Data Characteristics

- Greater volume, velocity, and variety than traditional ITS Infrastructure
- Does not require roadside ITS infrastructure such as loop detectors
- Actively or passively generated
- Real-time or archived



Source: Unsplash



# Sources of Crowdsourced Data for Transportation Operations

1. Vehicle probe
2. Navigation app
3. Social media
4. Connected vehicle
5. 311 and 511 apps
6. Multimodal probe data



Source: Pixabay

### Traffic Incident Management



Source: FHWA

### Work Zone Management



Source: Unsplash

### Road Weather Management



Source: Pixabay

### Traveler Information



Source: Pixabay

### Emergency Management



Source: FHWA

### Arterial Management



Source: Unsplash

### Freeway Management



Source: FHWA

### Traffic Studies



Source: Pixabay

### Road/ITS Maintenance



Source: Pixabay

### Project Prioritization



Source: Unsplash

### Performance Management



Source: Pixabay

### Other Applications?



Source: Pixabay

# Crowdsourcing Applications for Emergency Management

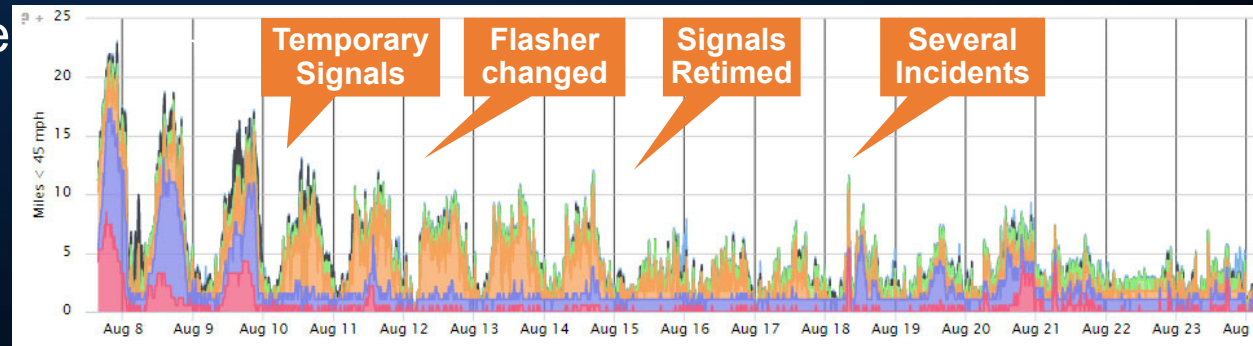


Source: Acuweather.com

- Situational awareness
- Detour management
- Queue monitoring
- Improve safety

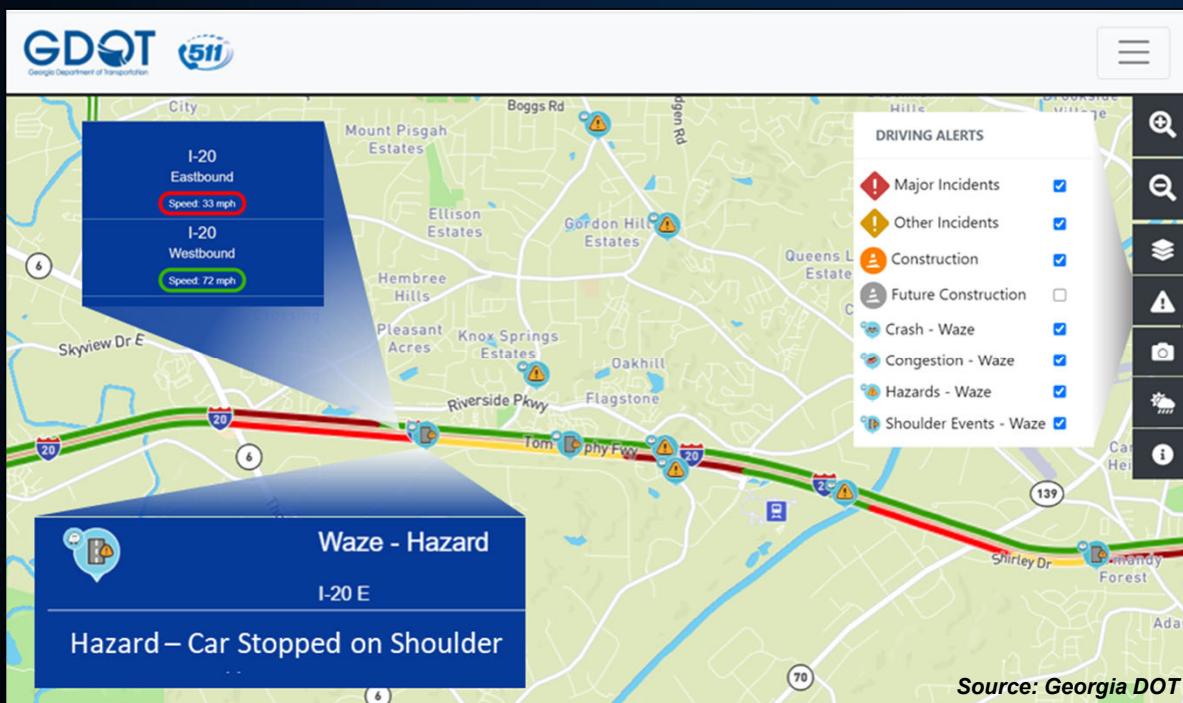
# Unplanned Bridge Closure I-65 NB, Indiana DOT

- Day 1: a 4-hour detour with negative press.
- Used vehicle probe data to visualize corridor performance.
- Implemented multiple operational changes.
- Day 5: Detour navigable further negative press.



All images Source: Indiana DOT

# Georgia DOT Manages Back of Queue Using Crowdsourced Data



Georgia DOT Safety Service Patrol uses Waze® and color-coded speed maps from their public-facing 511 site to position mobile message signs and warn approaching drivers of slow downs.

# 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

# 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



# Detour Management North Carolina Roadway Flooding

- Hurricanes Michael and Florence created unusual flooding.
- North Carolina DOT developed new information sharing procedures, working with navigation providers.
- Significant road users benefits.



Source: North Carolina Department of Transportation

# Queue Management for Hurricane Evacuation in Alabama

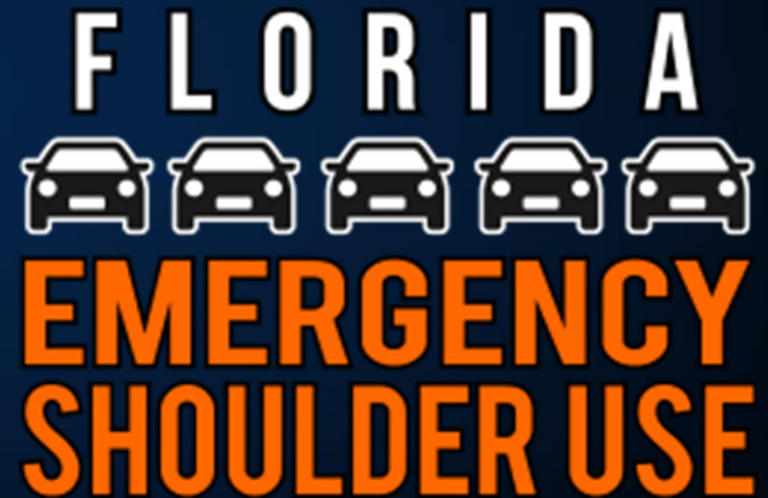
- Coastal areas and neighboring states contribute to network problems.
- Alabama DOT used a crowdsourced tool to identify choke points.
- Choke points prompted planning for alternate routes.
- Tracking of effectiveness possible.



Source: Pixabay

# Situational Awareness and Safety Florida Emergency Shoulder Use (ESU)

- Shared ESU with mapping providers, mass media, and social media.
- Florida DOT also uses road telemetry and crowdsourced data for monitoring emergency events.

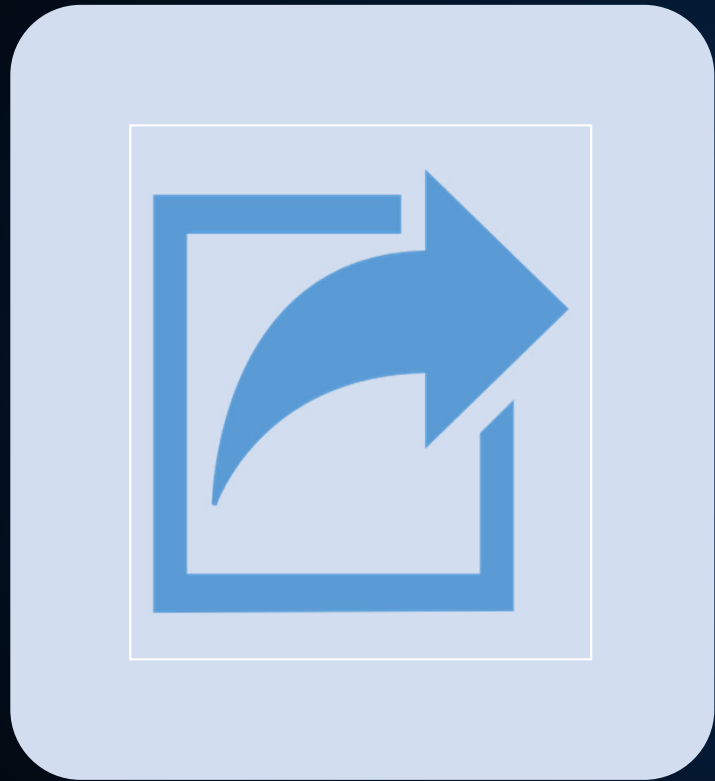


Source: Florida Department of Transportation

# Traffic Diversion Planning Tennessee DOT



- I-40 bridge required emergency repairs, requiring a detour for a 2-month duration.
- Multiple crowdsourced data complemented intelligent transportation systems (ITS) to actively manage detour strategies.
- Resulted in better traveler information, multiagency collaboration, and operational enhancements.



*Icons sourced from Microsoft PowerPoint Icons*

# Moving Forward

# TSMO Resources



FHWA - Operations Team

- **Organizing / Planning for Operations**
  - Capability Maturity Model (CMM) Self-Assessment
  - Strategic / Program Planning for TSMO
  - Planning for TSMO (Web-based / Web-conference)
  - Traffic Analysis Tools
- **ITS Technology Deployments**
  - ITS Architecture
  - Systems Engineering Analysis
  - Cybersecurity
- **TSMO Tactical Areas** (Work Zones, Road Weather, Traffic Management, etc.)
- **TSMO Approaches** (ATDM, Shared Mobility, ICM, CAV, Complete Streets)
- **Peer Exchanges**

# Crowdsourcing Resources

- Workshops and peer exchanges
  - *Crowdsourcing 101* course
- Technical assistance
- Crowdsourcing cohorts
- [Adventures in Crowdsourcing](#) webinar series
- [Website](#) – Factsheet, FAQs
- Reach out to EDC-6 Co-leads:

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# Thank you

Questions / Comments Please?



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# Grant Programs

- **Advanced Transportation Technologies and Innovative Mobility Development (ATTIMD)/Advanced Transportation Technology and Innovation (ATTAIN)**
  - Improve emergency evacuation and responses
  - \$60 million per year to FY 2026
- **Surface Transportation System Funding Alternatives (STSFA) Program**
- **Accelerated Innovation Demonstration (AID)**



# Grant Programs

- **Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT)**
  - More resilient to natural hazards, including flooding, extreme weather events, and other natural disasters
  - Up to \$300 million per year to FY 2026 as planning, resilience improvement, community resilience & evacuation route, and at-risk coastal infrastructure grants
- **Rebuilding American Infrastructure with Sustainability and Equity (RAISE)**
- **Rural Surface Transportation Grant Program**

