Use of Crowdsourcing to Advance Operations
How often is the “ask the audience” life line correct in the game show “Who Wants to be a Millionaire”? 

A:  95% of the time 
B:  50% of the time 
C:  30% of the time 
D:  75% of the time 

Source: Idea SV, El Salvador Milonario
Today’s Webinar Topics & Presenters

**EDC-5, Operations & Crowdsourcing: An Overview**
James Colyar, Transportation Specialist
FHWA Office of Operations

**Crowdsourcing for Operations: Opportunities & Considerations**
Greg Jones, Transportation Specialist
FHWA Office of Operations & Resource Center

**UDOT Citizen Reporter Program**
Lisa Miller, Traveler Information Manager
Utah Department of Transportation

**Managing Traffic with Probe Data**
Edward Cox, Engineering Director of Traffic Management
Indiana Department of Transportation

**Incident Detection and After-Action Reviews**
Chris Lambert, Systems Consultant for ITS
Kentucky Transportation Cabinet
EDC-5, Operations & Crowdsourcing
An Overview
What is “Every Day Counts” (EDC)?

State-based model to identify and rapidly deploy proven but underutilized innovations to:

- shorten the project delivery process
- enhance roadway safety
- reduce congestion
- improve environmental sustainability

- EDC Rounds: two year cycles
- Initiating 5th Round (2019-2020) - 10 innovations
- To date: 4 Rounds, over 40 innovations

For more information: [https://www.fhwa.dot.gov/innovation/](https://www.fhwa.dot.gov/innovation/)

FAST Act, Sec.1444
Transportation Systems Management and Operations (TSMO)

- Optimizing use of existing facilities.
- Maximizing performance of the system.
- Buying the most mobility for the least cost.
- Treating capacity as an asset to manage.
- Getting you there – people and goods.
- Targeted solutions to congestion causes.
- Complement to capacity projects.
- Approaches to match demand to supply.

Effective operations is built on a foundation of monitoring current conditions.
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.

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

Source: FHWA
What’s New for Operations?

Cheaper, accessible, monitoring, processing, and use of real-time data.

Source: Adapted from FHWA
Crowdsourcing: A Potential Solution

When integrated with an agency’s existing efforts, crowdsourcing helps agencies:

- Expand geographic coverage and resolution.
- Reduce information time lags for improved real-time situational awareness.
- Reduce dependence on and cost associated with roadside sensors and systems.
- Overcome jurisdictional stovepipes.
- Implement proactive operations strategies.

Crowdsourcing is a proven lower-cost solution to improving safety and operations.
What Exactly is Crowdsourcing?

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

- Addresses a need or problem outside of an organization’s resources or means by distributing the workload across a large group of people.
- Leverages the collective wisdom and unique insights of a crowd.
- Uses technology and new forms of communication and interaction to document, share, and reflect on the world.
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Source: Idea SV, El Salvador Milonario
Crowdsourcing Examples

1906: UK Weight Judging Competition

- British scientist held competition @ Fat Stock & Poultry Exhibition.
- 787 took part in steer weight-guessing contest.
- Average 2 lbs. off; best guess 10 lbs. off.

1995: Amazon Reviews

- Customers offer reviews & comment/vote on others’ reviews.
- Rating, based on machine learning, and affect product visibility.
- Reports of review tampering surfaced in 2004.
Crowdsourcing Examples

2000: Folding@home, Stanford University

- Volunteers allow use of their computers’ idle processing power to simulate protein folding and drug design.
- 2M sign-ups = 5th most powerful computer in the world.
- Enables research into Alzheimer’s, Cancer, & more.

Source: Bruce Blaus

2008: Lego Ideas

- Users post their ideas for potential Lego products.
- If an idea generates 10,000 views within a year, it qualifies for review by Lego.
- A user with a successful idea launch is entitled to 1% of the product’s revenues.

Source: Unsplash
Crowdsourcing is Everywhere

- Airbnb
- Best Buy
- Citizenscience.gov (GSA)
- Department of Defense
- Eucrowd (EU)
- Facebook
- Federal Bureau of Investigation
- General Electric
- Google
- Harley Davidson
- Kraft Foods

- Lego
- Mattel
- McDonalds
- Microsoft
- NASA
- Netflix
- New York City Simplicity
- Paypal
- Procter & Gamble
- Sony
- Starbucks
- Wikipedia
Crowdsourcing for Operations
Poll the Audience

Is your region or state currently leveraging crowdsourcing for transportation operations?

If yes, please share a few words about the application in the chat pod and a point of contact so that we may learn more from you.
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**Question & Answer from Chat Box**
Existing and Potential Crowdsourcing Applications in Transportation

Other possible applications include freight management, work zone management, and performance assessment and reporting.
Sources of Crowdsourced Data

• Data extracted from social media platforms.
• Data acquired from third-party crowdsourced data.
• Data collected from specially-developed mobile apps.
Crowdsourcing - Opportunities for Advancing Operations

Crowdsourcing benefits Transportation Operations:

- Expands & improves real-time monitoring
- Enables more targeted and timely response
- Enables strategic / programmatic operational improvements

Benefits beyond Transportation Systems…

- Promotes legitimization & acceptance of public decisions.
- Improves transparency & efficiency of public expenditures.
- Promotes a sense of community & greater citizen satisfaction.
Crowdsourcing Considerations

- Understanding your current operational gaps or needs.
- Understand nature of data - it may be different in focus, quality, processing, and management.
- Address policy, legal, or data ownership hurdles.
- Funding / procurement for non-traditional tools and services.
- Grow technical skills and architecture approaches.

Source: Adapted from Unsplash
Crowdsourcing for Operations Case Studies
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**Question & Answer from Chat Box**
UDOT Citizen Reporter Program

Lisa Miller
Traveler Information Manager
- Launched winter 2012-2013
- Provided a consistent way for the public to report
- Short training program
- Special thanks to Wyoming DOT! (ECAR)
**Logic:**

- **TI Mets** (Reports valid for 6 hours have an exponential decrease to 0% and report expires. TI Met reports are never more valuable than a TATS report if they are reported at the same time.)

- **TATS** (Reports valid for 1 hour then an exponential decrease to 6 hours when the report expires. TATS report have priority for 1 hour after reporting and are not overwritten by any other type of reporter)

- **Citizen Reporters** (Reports valid for 3 hours and have an exponential decrease to 0% and report expires.)

Color that appears “on top” is the report that is used for the RYG (not including priority TATS report for 1 hour)
Results

@UDOTTRAFFIC launching new app that allows citizens to report changing road conditions. A look @fox13now 5pm
10/30/13, 4:54 PM

Want to be part of @UDOTTRAFFIC new Citizen Reporter Program for road conditions? Starts Nov. 1st. Here is the info.

Meeting of wx/traffic minds talking winter wx and roads @UDOTTRAFFIC #utwx
10/30/13, 1:16 PM
Results

Number of Citizen Reports through 01/01/2018

Legend
- 0 reports
- 1 - 50 reports
- 51 - 100 reports
- 101 - 200 reports
- 201 - 500 reports
- 501 - 1000 reports
- >1000 reports

Dedicated Citizen Reporters by Segment, 01/01/2018

Legend
- 1 - 10 reporters
- 11 - 25 reporters
- 26 - 50 reporters
- 51 - 75 reporters
- 76 - 100 reporters
- 101 - 150 reporters
- 151 - 200 reporters
- 201 - 250 reporters
- >250 reporters

Reports received by day

![Graph showing reports received by day from 11/1/2013 to 3/1/2014.](image)
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**Question & Answer from Chat Box**
Managing Traffic with Probe Data

Edward D Cox, INDOT
September 2018
Crowdsourced Probe Data

- INDOT purchases real-time probe data
- Interstates partitioned into 2000+ segments
- Download speed data every 60 seconds
- “Traffic Ticker” developed by INDOT & Purdue University to process, visualize and use data
The Problem: **Unplanned I-65 NB Bridge Closure**
Interstate Diversion

I-65 Bridge closed on Aug 6
35,000 AADT and 5000 Trucks

NB I-65 closed from MM 141 to 178
(37 mile length)
Diversion route - capacity constrained
First Look – Perceptions of Detour

- On Day 1, a reporter drove the official detour route
- It took her 4 hours to drive 60 miles
- Press offered:

  “Moral of the story is that the INDOT detour route is essentially ineffective.”

So...

How do we mine the data to change operations & improve customer experience?
Traffic Summary along Detour Route

Stacked Segment Miles with Speed Below 45mph

- We can effectively manage by segment and for the entire corridor -
Traffic Ticker Dashboard

We can see how each operations change affects system performance

Temporary Signals

I-65 N Detour Route

231/18 Flasher changed

231 Signals retimed

Several Incidents

Day 1: 10 - 15 mile stretch with speed below 15 mph

Key operational measures implemented
Live Traffic Ticker

Tool ingests real-time data to offer visual profile by segment, direction, district and other factors.
Traffic Ticker’s Real-Time Delta Speed Function
Tool helps with training and after action reviews

Public Safety Workshop
At Purdue University
Using Metrics to Change Operations and Customer Experience

- Detour improvement from 4 hours to 64 minutes
- Stabilized traffic in 5 days
- No further ‘negative’ press
- Many positive reports from commuters and our staff noting zero delay stops!
- Media helped advocate use of the detour.
Thank You

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Question & Answer from Chat Box
Incident Detection
Real-Time Data Verification and Filtering of Noise
Incident Detection: Email Alerts

Automated email to TMC when HERE and Waze suggest incident

Summary Section

Counts of crowdsourced reports by type

District: 6 -- Campbell -- I-471
I-471 -- Northbound -- Near: I-275/Exit 1
HERE -- Speed Capped: 41.9 Speed Uncapped: 41.9 Free Flow: 54.25
WAZE -- Speed: None Delay: None min
  None : 1
  Heavy Traffic : 8
  Moderate Traffic : 2
  Stand Still Traffic : 3
  Minor Accident : 3
  Car Stopped on Road : 1
WEATHER -- Nearest Air Temp: 67.70 Nearest Pavement Temp: 71.89
Incident Detection: Email Alerts

Automated email to TMC – detailed report section

```
WAZE -- Speed: None Delay: None min
"Heavy Traffic" @ MP: 0.647 -- Reliability: 5 -- Comment: null
"Minor Accident" @ MP: 2.071 -- Reliability: 5 -- Comment: null
"Stand Still Traffic" @ MP: 4.933 -- Reliability: 5 -- Comment: null
"Moderate Traffic" @ MP: 1.998 -- Reliability: 5 -- Comment: null
"Car Stopped on Road" @ MP: 2.221 -- Reliability: 7 -- Comment: null
"Minor Accident" @ MP: 2.036 -- Reliability: 7 -- Comment: null
"Heavy Traffic" @ MP: 0.444 -- Reliability: 5 -- Comment: null
"Heavy Traffic" @ MP: 3.234 -- Reliability: 5 -- Comment: null
"Stand Still Traffic" @ MP: 0.7 -- Reliability: 5 -- Comment: null
"None" @ MP: 0.252 -- Reliability: 9 -- Comment: null
```
Incident Detection: User Perception

WAZE – Speed: None  Delay: None
“Major Accident” @ MP 2.76 - Reliability 7
“Heavy Traffic” @ MP 4.156 - Reliability 9
“None” @ MP 2.204 - Reliability 7
“None” @ MP 2.709 - Reliability 5
“Major Accident” @ MP 2.983 - Reliability 10
After-Action Review

Understanding the Order of Events using Crowdsourcing Data
After Action Review: Probe + Reports

WAZE Report Timeline

Hazard on Shoulder - Car Stopped
Hazard on Road - Object
Jam - Heavy Traffic
Jam - Moderate Traffic
Accident - Major
Hazard on Road - Car Stopped
Jam - Stand Still Traffic

One Incident, multiple WAZE Reports:
Car on Shoulder > Hazard on Road > Jam > Accident > Hazard > Jam!
After Action Review: Probe + Reports

HERE Average Speed

WAZE Report Timeline

TOC Crash Report
Thank You

Chris Lambert, Systems Consultant for ITS
Kentucky Transportation Cabinet
POLL THE AUDIENCE

What are the three most significant challenges or barriers for your agency’s adoption of crowdsourcing for operations?

- A. Cultural change
- B. Cost of tools/data
- C. External dependence
- D. Data quality/trust
- E. Staff resources/knowledge
- F. Unclear benefits
- G. Legal/policy concerns
- H. Other, enter in the chat pod
EDC-5
Crowdsourcing
Innovation
Upcoming Initiative Resources

• Workshops.
• Peer exchanges.
• On-site technical assistance.
• Training materials/training.
• Case studies.
• Fact sheets.
• Marketing materials.
• Webinars.
EDC-5 Funding Opportunities

- **State Transportation Innovation Council (STIC) Incentive**
  - Up to $100,000 per STIC per year to standardize an innovation
  - [https://www.fhwa.dot.gov/innovation/stic/](https://www.fhwa.dot.gov/innovation/stic/)

- **Accelerated Innovation Deployment (AID) Demonstration**
  - Up to $1 million available per year to deploy an innovation not routinely used
  - [https://www.fhwa.dot.gov/innovation/grants/](https://www.fhwa.dot.gov/innovation/grants/)
Innovation Deployment News

Weekly newsletter

Bi-monthly magazine

To Subscribe:
Email: https://www.fhwa.dot.gov/innovation/

Text: Send “FHWA Innovation” to 468311
Parting crowdsourced request…

Send us a creative tagline for EDC-5, Crowdsourcing for Operations. If we use your idea, you will have “bragging rights” at the upcoming EDC-5 Summits! (Send via chat box or an email to James Colyar).
The U.S. Government does not endorse products or manufacturers. Trademarks or manufacturers’ names appear in this report only because they are considered essential to the objective of the document.
Question & Answer