



Q. **What is crowdsourcing?**

A. Crowdsourcing is the practice of enlisting the services of a large number of diverse people to solve a problem or address a need that would otherwise be outside an organization's resources or means to tackle. Crowdsourcing leverages the collective wisdom and unique insights of a crowd by distributing the workload across a large group, incentivizing participants, and using technology and new forms of communication and interaction to document, share, and reflect on the world. Crowdsourcing is ubiquitous; it is used by public and private organizations around the world.

Q. **How does crowdsourcing benefit transportation systems management and operations?**

- A.** Using crowdsourced data allows transportation agencies to increase their monitoring capabilities, or situational awareness, of real-time traffic conditions. The crowdsourced data provides a new, real-time data source, outside of the boundaries of fixed sensors and cameras, to actively manage traffic and provide traveler information. Simply speaking, crowdsourced data helps agencies:
- ▶ **Expand geographic coverage.** Crowdsourced data enables agency staff to increase their geographic coverage area and overcome jurisdictional stovepipes because data is generated wherever the individual travels.
 - ▶ **Improve quality and timeliness of information.** Crowdsourced data enables agency staff to identify problems more quickly and more confidently, leading to faster and more accurate responses to traffic incidents and other congestion-causing events.
 - ▶ **Improve operations.** Crowdsourced data enables more proactive and effective operations strategies that can lead to improved traveler information, reduced traffic congestion, and improved reliability.
 - ▶ **Save costs.** Crowdsourced data is cost effective and could reduce the need for additional roadside sensors and systems that require installation and maintenance. In addition, some agencies are considering retiring portions of their sensor infrastructure and supplanting it with crowdsourced data. Crowdsourced data allows agencies to streamline their existing Intelligent Transportation Systems (ITS) infrastructure.

These improvements enable agency staff to make decisions with low latency, improved accuracy, and larger geographic coverage, leading to improved responses to traffic incidents and other congestion-causing events along with optimization of traffic flow through the system. Beyond, transportation systems management and operations (TSMO), crowdsourcing can support planning, maintenance, asset management, public involvement, and a host of other efforts under a transportation agency's purview.

Q. What TSMO strategies are enhanced by crowdsourcing?

- A. A wide range of TSMO strategies and applications can be enabled or enhanced with crowdsourcing. Below are a few examples:
- ▶ **Traveler information.** More timely and accurate messaging, shift towards in-vehicle signage for more personalized recommendations, and reduced need for infrastructure investments.
 - ▶ **Incident and event management.** Higher fidelity location information, more timely and accurate confirmation of incident types, quicker and improved incident response, on-site monitoring and management, and more timely warnings.
 - ▶ **Arterial management.** Better operations in oversaturated conditions, more timely updates to fixed-cycle signal timings, broad-based adaptive controls, reduced reliance on physical sensor devices and maintenance, and performance monitoring of signals with no physical links to agency communications infrastructure.
 - ▶ **Freeway management (variable speed limits/recommendations and lane-use control strategies).** More accurate and coordinated responses and shift towards in-vehicle signage reducing needs for infrastructure investments.
 - ▶ **Road weather management.** More timely and accurate information on road weather conditions, more complete coverage beyond fixed-location sensor stations, improved messaging, and reduced need for infrastructure investments.
 - ▶ **Work zone management.** Increased safety for workers and drivers, higher resolution maps of work zone geometries, and real-time information on new zone locations.
 - ▶ **Performance assessment and reporting.** Higher fidelity analysis, more comprehensive coverage of geography, and reduced need for infrastructure investments.

Q. What are common sources of crowdsourced data?

- A. Crowdsourced data are commonly available through:
- ▶ **Social media and networking platforms** (e.g., Twitter, Facebook).
 - ▶ **Third-party data providers** (e.g., HERE, INRIX, TomTom, Waze).
 - ▶ **Specialized mobile apps** (e.g., UDOT Citizen Report Program, Delaware DOT mobile app).

Crowdsourced data are available whenever and wherever people travel.

Q. What are common types of crowdsourced data?

- A. There are many types of crowdsourced data associated with TSMO. Below are the most common types of crowdsourced data in use by transportation agencies today:
- ▶ **Probe data** (e.g., speed and travel time).
 - ▶ **Event data** (e.g., crashes, stalled vehicles, weather).
 - ▶ **Travel behavior data** (e.g., where, when, how people travel).
 - ▶ **Social media data** (e.g., sentiment on road and agency performance).
 - ▶ **Vehicular data** (e.g., heavy braking, wiper status, temperature, and more from connected vehicles).
 - ▶ **Mobile infrastructure/Internet of Things (IoT) data** (e.g., work zone cones sharing location, surrounding speed).

Q. How accurate and timely are crowdsourced data?

A. There have been studies to assess the accuracy of various forms of crowdsourced data. In the case of passively crowdsourced data such as probe data, the timeliness and accuracy of the data depend on the sample size (number of data points). When there is a high use rate for a specific app, the accuracy of the collected information is likely to be improved up to a certain level. As the use of smartphones and navigations systems has increased over time, the accuracy of the data has also generally improved over time. In the case of actively crowdsourced data such as citizen reporting, the accuracy also depends on the ability of citizens to report information accurately. This is often achieved by putting citizen reporters through a short training or setting up rewards inside the application to incentivize good quality reports (e.g., gamification). To improve the usability of the data, third-party data providers and agencies typically employ strategies to filter data noise and poor reports to bring to attention data that is more actionable by traffic operators. Agencies can also use multiple sources of data to cross-check the accuracy of the data sources. The EDC-5 Crowdsourcing team can help your agency plan for the assessment of the quality of crowdsourced data available in your State or region.

Q. Are transportation agencies applying crowdsourcing for operations?

A. Yes. Many State Departments of Transportation (DOTs) and local agencies use crowdsourcing to improve one or more TSMO applications. Some agencies use multiple sources of crowdsourced data and integrate these data with traditional data sources to proactively monitor and manage operations. Following are a few examples of crowdsourcing applications among State and local agencies:

- ▶ **Utah DOT** launched the Citizen Reporter Program in 2013, which enlists volunteers to report on current road weather conditions along specific roadway segments. The app is freely available on iOS and Android, requires a brief training program for users, and provides a consistent way for the public to report changing road weather conditions.
- ▶ **Indiana DOT** uses third-party probe data to actively manage traffic on major highways and corridors of interest. They have worked with a local university to create Traffic Ticker, a tool that identifies locations that may need real-time attention. The tool also supports training and after-action reviews.
- ▶ **The Kentucky Transportation Cabinet** integrates data from two crowdsource providers, a third-party probe data and a mobile app to create email alerts for use by Traffic Operations Center staff. They have recently begun to share this data with staff to improve road maintenance.
- ▶ **The Delaware DOT** mobile app makes available multiple functions for users from reporting issues about traffic or roadways to users accessing traveler information and live traffic camera video, Department of Motor Vehicles (DMV) wait times, bus information, and Waze reports.
- ▶ **Florida DOT** is using crowdsourced data in combination with computer-aided dispatch (CAD) to improve the response for crashes and road closures.
- ▶ **The City of Louisville, Kentucky** uses archived crowdsource data from apps, including Waze, to assess the effects of signal retiming. They eliminated the cost and time-consuming effort of travel time runs and now can with the click of a few buttons determine with greater resolution whether the retiming was effective.

Q. *How does an agency determine where to acquire crowdsourced data?*

A. The sourcing of the crowdsourced data is a function of the specific needs of the agency, the resources available to them, and the availability and quality of the third-party data. The EDC-5 Crowdsourcing Team is available to work with your agency to help identify the right strategy for crowdsourced data.

Q. *How much does crowdsourced data cost?*

A. Crowdsourced data costs are a function of multiple factors, most importantly, the source of the data. When collected using in-house apps, agencies must consider development, marketing, and maintenance costs for the system. The costs associated with purchasing third-party data vary based on the lane miles of the road network for which data are desired, the frequency of data reports, and the data access and sharing agreements with the vendor. Regardless of the cost of the data, there is always an investment for processing, integrating, management, and using the crowdsourced data. These costs are also present when using “free” social media platforms or through the Waze Connected Citizen Program.

Q. *Can agencies create their own app to acquire crowdsourced data?*

A. Yes, agencies can develop their own mobile app to collect crowdsourced data. For instance, Utah DOT developed a smartphone app that provides a conduit for the traveling public to report road and weather conditions in real-time directly to the agency's Traffic Operations Center.

Q. *What is the added value of putting third-party data onto a public agency's informational site, versus relying on the third-party to provide the data/information?*

A. The added value of putting third-party data on a public agency website is the ability for the agency to first assess the data, establish its credibility and trustworthiness using other internal or external datasets, and then provide the public with reliable information they can trust. Third-party providers are not necessarily driven by data reliability or trustworthiness for use by transportation agencies. Public agencies must establish themselves as trusted data providers in the world of crowdsourced data if they want to remain credible to the public. In addition, having a consolidated single source of information for travelers is a value for day-to-day operations, and critical during adverse conditions such as flooding or evacuations.

Q. *How can crowdsourced data help in areas with limited or no cellular coverage?*

A. Crowdsourcing is inherently linked to connectivity. Crowdsourcing apps can cache the feedback and input from users and later reconnect and submit this feedback for analysis, but any real-time advantage is lost. The only way to increase presence and reporting in areas with limited or no cellular coverage is by using a technology called “peer-to-peer” or mobile ad hoc networks (MANET). This technology works by hopping communication from one cellphone to the nearest one until an internet access point is reached. This technology is used in disaster recovery to establish communications when cell service has been damaged, but a somewhat dense and distributed presence of cell phones is required for it to work. That said, cellular coverage is always improving, especially near public highways, and even a single report could provide valuable information and lead-time to an agency that may otherwise be unaware of an incident or road weather event until later.

Q. How are the Crowdsourcing implementation stages defined?

- A.** If your agency selects this innovation, you will need to choose your current and goal implementation stages. In doing so, consider the following:
- ▶ **Development stage.** The State intends to prepare for implementation of crowdsourcing by:
 - Assembling an implementation team/plan.
 - Conducting preliminary research or studies.
 - Identifying requirements, locations, candidate data sources, and operations strategies to evaluate with a test/pilot.
 - Initiating capacity-building efforts such as scans, peer-exchanges, training, best practice reviews.
 - ▶ **Demonstration stage.** The State is preparing to conduct testing of crowdsourcing for operations to:
 - Capture lessons learned and address challenges.
 - Develop performance measures by which to evaluate pilot.
 - Identify future test or pilots that may be necessary.
 - Refine funding estimates (up front and on-going) for use for crowdsourcing.
 - Make the business case for full/broader use of crowdsourced data.
 - ▶ **Assessment stage.** The State is actively implementing and assessing performance for larger-scale and widespread deployment. The program is beyond testing and is:
 - Assessing, documenting, and applying lessons learned; measuring performance; and exploring targets.
 - Discussing and documenting challenges and barriers.
 - Capturing and communicating benefits and costs.
 - Assessing the scope of the implementation.
 - Identifying and instituting process and/or policy improvements.
 - Considering complementary crowdsourcing applications.
 - ▶ **Institutionalized stage.** The State has adopted as a standard practice crowdsourcing for operations for an application area:
 - Crowdsourcing is embedded as integral to the success of operations programs, systems, and strategies.
 - Policies, processes, and procedures are in place that reflect “optimal” use of crowdsourced data.
 - Overall benefits and successes are understood and communicated.
 - Results and supporting data are routinely shared with executives, technical managers, and stakeholders.
 - Lessons learned and best practices are shared with other States.
 - Steps have been taken to ensure long-term sustainability of the program.

Q. What resources exist through the EDC-5 Program for the Crowdsourcing for Operations innovation?

- A.** The Crowdsourcing for Operations team is in the process of developing a variety of resources to assist agencies in exploring, learning about, and implementing opportunities for Crowdsourcing for Operations. These resources include a synthesis of the state of practice of crowdsourcing for operations applications,

fact sheets, in-depth case studies from peer agencies, videos, and marketing materials. In addition to these resources, throughout the EDC-5 period, the team will provide opportunities for transportation agencies to participate in webinars, workshops, peer exchanges, and technical assistance.

Q. What funding opportunities are available through EDC-5?

A. The following are potential funding opportunities that could be used to support EDC-5 efforts:

- ▶ **State Transportation Innovation Council (STIC) Incentive.** Offers technical assistance and funds. Up to \$100,000 per STIC per year to implement an innovation: <https://www.fhwa.dot.gov/innovation/stic/>.
- ▶ **Accelerated Innovation Deployment (AID) Demonstration.** The AID Demonstration program provides funding as an incentive for eligible entities to accelerate the implementation and adoption of innovation in highway transportation. Up to \$1M available per year to deploy an innovation not routinely used: <https://www.fhwa.dot.gov/innovation/grants/>.

Q. Do any of the other EDC-5 innovations overlap with the Crowdsourcing for Operations innovation?

A. Several of the other EDC-5 innovations overlap and/or have synergies with the Crowdsourcing for Operations innovation. The following EDC-5 innovations also promote the use crowdsourcing as one mechanism to engage constituents and improve operations. Please speak with the EDC-5 program leads on how to request support from multiple teams as your agency plans projects that overlap among these innovations:

- ▶ Virtual public involvement (VPI). https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/virtual_public_involvement.cfm.
- ▶ Weather-Responsive Traffic Management (WRTM) Strategies https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/weather_strategies.cfm.
- ▶ Reducing Rural Roadway Departures https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/roadway_departures.cfm.

If your crowdsourcing for operations plans involve these other innovations, you are welcome to request support from these innovation teams. Additionally, the EDC-5 reporting requirements for one innovation can be replicated for the complementary innovations.

Q. Who do we contact for more information?

A. For more information on the EDC-5 Crowdsourcing for Operations innovation, please contact the following: