Crowdsourced vehicle data for improved operations and safety.

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Crowdsourcing is a low-cost, powerful tool that leverages the public to collect data that can be applied to improve traveler information, traffic incident management, signal timing, weather-responsive management, work zone management, and more. Crowdsourcing overcomes gaps in geographic coverage of traditional intelligent transportation system (ITS) monitoring systems, lags in information timeliness, costs associated with monitoring equipment, and jurisdictional data stovepipes.

Crowdsourced data can come from social media, specialized apps, vehicle probe providers, and more recently, connected vehicle data providers. Crowdsourcing data from telematics on connected cars provides all types of second-by-second information such as vehicle speed, wiper use, rapid acceleration, hard braking, and vehicle routing.

“The vast amount of crowdsourced data generated by modern vehicles and smartphone apps is a deep well of insight that can be leveraged by departments of transportation and local agencies across the United States,” said James Colyar, FHWA crowdsourcing for advancing operations co-lead for Every Day Counts round six (EDC-6).

The Indiana Department of Transportation (INDOT) is one State transportation agency that uses multiple crowdsourced data as part of its real time traffic monitoring program and to identify broader operational improvements and safety enhancements. Crowdsourced data helps INDOT measure real world conditions much more efficiently than roadside observers, video collection, or test vehicles making circuits on the road network.

INDOT analyzes crowdsourced data in real time and near-real time as opposed to the weeks, months, and years that may be required for some types of data. Timely data means faster identification of emerging problems and hotspots and accelerated improvements to transportation system safety.

**Hard Braking Data Provides Insight on Safety Improvements**

Through an innovative partnership, Purdue University helps INDOT ingest and analyze approximately 11 billion anonymous connected vehicle records each month, accessed daily from a third-party data provider. This data represents 5 percent of vehicles on Indiana highways. Early applications for it include identifying and prioritizing safety improvements to work zones and the broader road network.

By comparing 4.5 years of crash data at eight locations with just 1 month of hard braking data, the Purdue team found a correlation between hard braking and rear-end crashes, meaning this type of crowdsourced data is a good surrogate for safety analysis. INDOT also pays close attention to hard braking events.
approaching work zones and uses that information to measure the effectiveness of various queue warning systems and queue warning trucks.

**Broader INDOT Crowdsourcing Program Improves Operations and Safety**

INDOT’s look at hard braking data is just one part of a robust crowdsourced data program and one of several partnerships with Purdue.

“Purdue is also analyzing crowdsourced data to help analyze origin-destination based construction diversions and determine the effectiveness of official detour routing," said Ed Cox, INDOT ITS Engineering Director. “This helps operations engineers to develop better messaging and signing plans for major projects.”

In addition to the data that Purdue processes for the collaborative R&D effort on hard braking, INDOT processes crowdsourced data for over 46,000 roadway segments every minute into its Traffic Management Database, or over 473 million records per week. INDOT uses this complete network coverage of segment speeds to deliver statewide travel-time information onto hundreds of message boards and dedicated travel-time signs.

“Before crowdsourced data, travel-time calculations were limited to the urban areas with traditional radar-based speed sensors," said Cox, “but now with crowdsourced data, the entire network is effectively instrumented.”

In addition, INDOT uses crowdsourced data to determine which signalized intersections and corridors should be prioritized for signal re-timing, to measure benefits of traffic signal timing on select corridors, to monitor work zone effectiveness, and to adjust maintenance of traffic plans. In the future, crowdsourced data could even serve functions such as helping to identify areas underserved by electric vehicle charging stations.

“These examples from Indiana show the value agencies can derive from crowdsourced data,” said Colyar. “And, as more vehicles become connected and more applications for crowdsourced data are discovered, crowdsourcing information will become invaluable for agencies of all sizes.”

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**MORE INFORMATION**

- Watch a webinar from the [Adventures in Crowdsourcing](#) webinar series.
- Visit the EDC-6 [Crowdsourcing for Advancing Operations](#) webpage.
- Contact [James Colyar](#) of the FHWA Office of Operations, or [Greg Jones](#) or [Ralph Volpe](#), both of the FHWA Resource Center, for information and technical assistance.
- Share this article on your social media accounts.
Award-Winning Projects Employ EDC Innovations

The 2021 America’s Transportation Awards featured several projects delivered with innovations that have been a part of Every Day Counts, such as **diverging diamond interchanges**, **data-driven safety analysis**, **design-build**, **ultra-high performance concrete**, **targeted pavement overlays**, **unmanned aerial systems**, and **community connections**.

The awards, sponsored by the American Association of State Highway and Transportation Officials (AASHTO), AAA, and U.S. Chamber of Commerce, recognized State department of transportation (DOT) projects in the categories of operations excellence, best use of technology and innovation, and quality of life/community development. Read more about the following projects and the rest of this year’s winners on the [America’s Transportation Awards website](#).

**Operations Excellence**
The Kansas DOT (KDOT) **Turner Diagonal Interchange** reconfiguration project addressed an interchange originally built in the 1960s to accommodate tollbooths. Because the tollbooths were never installed, this left a 3-mile corridor with obsolete ramps and cut off access to development of nearby land. KDOT worked with its Kansas City partners to construct a **diverging diamond interchange** to improve safety, increase development and job opportunities, provide access to public transit, reduce maintenance costs, and reduce congestion. The project was delivered using the **design-build** contracting method, which KDOT said reduced the delivery schedule by 20 months.

The South Carolina DOT (SCDOT) used **Rural Road Safety Program** strategies on the **SC Road 61** project. Local officials and the public wanted to preserve the aesthetics of the corridor, which is a designated scenic byway, and generally did not favor removing trees and other vegetation as would be needed for some roadway departure countermeasures. SCDOT applied predictive analysis using Part C of the AASHTO Highway Safety Manual to determine the impacts and crash reduction trade-offs associated with various alternatives, then developed a context-sensitive solution with minor landscape alterations for repaving the road’s shoulders and adding rumble strips. Read an FHWA case study to learn more about SCDOT’s **data-driven approach**.

**Technology and Innovation**
The California DOT (Caltrans) **U.S. Highway 50 Echo Summit Sidehill Viaduct** replacement project included several challenges, especially its location on a rugged mountainside near Lake Tahoe that did not have enough space to stage half of the work at a time. Caltrans’ solution was an accelerated bridge construction approach that involved building around and behind the existing foundation and connecting prefabricated concrete beams with **ultra-high performance concrete**.
performance concrete, enabling the project to be completed in one construction season.

The New Mexico DOT used a continuously reinforced concrete pavement overlay instead of a full reconstruction for the **NM 136 Pete Domenici International Highway** project. The pavement on this 9-mile highway corridor had reached the end of its useful life and was seeing increasing truck volume. NM 136 begins in the United States at the international border with Mexico at the Santa Teresa Port of Entry. Truck-traffic volume from Mexico is high, and permissible weights exceed otherwise enforceable U.S. limitations. A targeted overlay provided a long-term solution that the agency reported saved more than $20 million in reconstruction costs.

The Ohio DOT’s **Unmanned Aerial Systems (UAS) Center** monitors traffic signals, traffic flow, construction progress, and more. The UAS flights increase safety by reducing the number of DOT staff working alongside traffic. The UAS Center also reduces the number of staff needed to perform inspections, saving time and money. Ohio DOT is sharing the technology with other agencies in the State to streamline communications and increase collaboration.

The Illinois DOT employed UAS for its **I-255 Metro East** project. UAS were used along with traffic counters, cameras, staff, and traffic reporting services to monitor and evaluate travel times, problem spots, and traffic volumes during the I-255 rehabilitation. This information aided the agency in providing feedback to the public regarding underused alternate routes, helping to keep traffic flowing.

Quality of Life/Community Development

The Georgia DOT (GDOT) **Macon-Bibb County Bridges** project upgraded two bridges, one built in 1976 and one historic structure more than 125 years old, that serve as key connectors to ports for rail freight. The **design-build** approach allowed for faster construction while providing connections to retail establishments and a nearby university. GDOT reported that using design-build helped in completing the project ahead of schedule and increasing safety. The agency also worked with the community and local historians to preserve bricks from the historic bridge for a monument at a nearby park.

The Texas DOT (TxDOT) **U.S. 175/S.M. Wright Freeway** phase 1 project reconfigured an elevated highway that divided a neighborhood south of downtown Dallas and had several safety concerns. TxDOT converted that section of the freeway into a six-lane boulevard to improve safety, mobility, and the environment. The project reduced traffic volume from 107,000 vehicles per day to about 40,000. TxDOT said the project aims to keep drivers safer and reconnect a community long separated by the highway.
FHWA Celebrates Safety Innovation in First EDC Safety Summit Series

Safety should be celebrated.

Throughout September, 28 State and local agencies partnered with the FHWA Office of Safety to host the Every Day Counts (EDC) Safety Summit series. The summit highlighted the successes of safety innovations promoted in EDC over the last decade.

Each week of the five-part series focused on a different EDC safety initiative. Together, they represented 10 years of hard work and partnership between FHWA, State departments of transportation (DOTs), and local and tribal agencies to get people where they are going safely.

“Saving lives on our roadways is our highest priority. The EDC program—and the Safety Summit series in particular—help us focus on safety innovations that have already saved countless lives across the country,” said Cheryl Walker, FHWA Associate Administrator for Safety. “We want these proven safety innovations to become more widespread so more lives will be saved in the future. This year’s safety summit is now in our rear-view mirrors, but the information we all learned is still front and center—and it will help us drive safety forward in the year ahead.”

The sessions included success stories from FHWA, 15 State DOTs, and 13 local agencies. They can all be viewed on demand in the virtual conference platform.

Week 1: Safe Transportation for Every Pedestrian (STEP)

In 2018, more than 6,000 pedestrians died on the country’s roadways, the most since 1990. Nearly 75 percent of those fatalities happened away from intersections, at midblock or uncontrolled crossing locations.

There are many countermeasures proven to reduce pedestrian deaths. The prime focus of the STEP initiative is to help State DOTs and local agencies deploy these countermeasures systematically across their roadway systems.

The STEP session featured presentations on the STEP “Spectacular Seven” countermeasures and from three DOTs: Virginia, Maine, and North Carolina. A practitioner from each State shared how they have incorporated STEP countermeasures, as well as lessons learned and plans for the future.

Week 2: Data-Driven Safety Analysis (DDSA)

What if you could predict where severe crashes might happen and deploy countermeasures to prevent them? New software and analysis approaches make that possible.

These approaches include Local Road Safety Plans (LRSPs), the systemic approach to safety, and predictive analysis. Presentations were made by FHWA, the Minnesota and Massachusetts DOTs, and the Delaware Valley Regional Planning Commission. Topics included an overview of DDSA, project benefit evaluation criteria, and incorporating equity into DDSA.

Week 3: Rural Roadway Departures

Nearly 12,000 people die each year when their car leaves its travel lane on a rural road. That is 30 people, on average, every day. Many strategies and countermeasures exist to reduce these crashes. This session highlighted these...
life-saving tools, with a special focus on two past EDC initiatives: high friction surface treatments (HFST) and SafetyEdge™.

The session included presentations on all these topics, including California’s LRSP efforts, how the South Dakota DOT has deployed HFST, and Kentucky’s use of the systemic approach, among others.

**Week 4: Intersection/Interchange Geometrics**

Traditional intersections pose multiple safety issues for road users, especially during left turn movements. Fortunately, many alternative intersection designs exist that reduce conflict points and change the angle at which vehicles move through the intersection, making all road users safer.

The session included presentations from the Minnesota, Missouri, Indiana, North Carolina, and Georgia DOTs. Breakout session topics included communication and messaging in advancing innovative intersections and how alternative intersection designs can be incorporated into the Safe System Approach.

**Week 5: Road Diets (Roadway Reconfigurations)**

As communities desire “complete streets” and more livable spaces, agencies must better integrate pedestrian and bicycle facilities, as well as transit options. A road diet can be a great option for communities to convert an existing four-lane, undivided highway to a three-lane road with two through lanes and a center, two-way left-turn lane. Road diets are proven to reduce total crashes by up to 47 percent.

Presentations included road diet myth-busters, rightsizing streets for safety and community, and experiences with road diets from the Seattle, Arizona, and Minnesota DOTs.

**Celebrating Safety**

The first ever EDC Safety Summit series brought a decade of work and progress in road safety into one venue. Much progress has been made, but there is still so much to do to reach zero deaths on the Nation’s roadways.

Vic Lund, a traffic engineer for St. Louis County, MN, and a speaker at the summit, summed up his experience: “I greatly enjoyed participating in the Safety Summit series. I don’t take our team-work for granted. Bringing together all these safety efforts in one place was encouraging and helpful. I can’t wait for the next one!”
STICs Deploy Homegrown Innovations

Every Day Counts round six (EDC-6) kicked off with a Virtual Summit in December 2020 introducing the seven innovations FHWA is promoting in 2021 and 2022. The summit also featured a National State Transportation Innovation Council (STIC) Network Showcase that highlighted more than 200 innovations developed and deployed by agencies throughout the country. Following are just a few examples from the showcase in the areas of maintenance, emergency response, and operations.

When the town of Niles, NY, was experiencing flooding along its roadways, highway department officials found that beavers had packed the culvert under the roadway with sticks and mud. To solve the problem, they obtained unused steel baskets from another job and built a beaver pipe cage. The cage keeps beavers out of the culverts so water can flow freely. This low-cost solution also won a 2020 Build a Better Mousetrap award.

The Louisiana Department of Transportation and Development fabricated the RutBuster, a multi-use device that attaches to a skid steer loader. RutBuster is a low-cost tool for completing a variety of routine maintenance tasks quickly and efficiently, such as filling ruts in asphaltic roadway wheel paths, paving asphalt shoulders, cutting isolated high shoulder locations, and more. The agency said the RutBuster greatly increases yield and productivity during rut repairs versus using a motor grader.

A gravel-saver disc tool clears away debris and vegetation from roadsides to reduce hazards to drivers. These discs can crack or break when hit with rocks or other hard objects and can become clogged by vegetation. LaMoure County, ND, created the Spring Load Arm Enhancement as an attachment to the disc that increases its flexibility, allowing rocks and vegetation to flow more freely with less breaking and clogging. This innovation was also a 2020 Build a Better Mousetrap winner.

Maine DOT deployed a road weather temperature phone app that allows crew leaders and supervisors to enter road and weather condition data during winter storms. In the past, this data was called in and entered into the DOT’s New England Compass system manually. With the app, the data is entered from the field and automatically populated into the system, enabling it to be seen in near real time by maintenance and operations staff and by the public.

The Delaware DOT (DelDOT) implemented a crowdsourced data pothole reporting program. DelDOT developed an interface that uses crowd-sourced data from Waze, including confidence and reliability scores, and filters it to report potholes on State-maintained roadways. The system creates a report, which provides precise location information via a clickable map, for the proper maintenance district and yard. Adding crowdsourced incident data to its 511 system provided a low-cost solution for South Carolina DOT (SCDOT) that benefits users. A major overhaul to its 511 website and mobile app added crash, congestion, and hazard data from Waze along with real-time traffic speeds from HERE Technologies. This allows SCDOT to
provide incident data on roadways not monitored by sensors or cameras.

The Maryland DOT operations dashboard is an internet browser-based application framework that runs on any device, enabling staff to efficiently deploy resources with access to over 60 statewide essential operational data feeds. Clicking on an incident on the dashboard zooms to its map location, and data feeds adjust dynamically to display pertinent information and live streams from roadway video feeds.

The Missouri DOT (MoDOT) is using technology that enables emergency response vehicles to warn motorists of hazards directly through navigation apps such as Waze. When an emergency response operator activates their emergency lights, real-time digital warnings are sent instantly to nearby motorists via in-car systems and phone apps. Preliminary usage data in its St. Louis District shows a 40-percent reduction in third-party crashes.

The Tennessee DOT’s Traffic Incident Management (TIM) Training Facility enabled the agency to develop and deploy advanced TIM training with full-scale live exercises. The agency reports that the TIM Training Facility has increased its maturity level and the capabilities of its partners in responding to traffic incidents, and that learning retention has greatly improved through the inclusion of live exercises.

The California DOT (Caltrans) responder system helps incident responders, especially those in remote or rural areas where communication coverage is sparse, collect and transmit at-scene information quickly and efficiently. This communications tool allows details to be shared between responders, the traffic management center, public information officers, and outside agencies during an incident using WiFi, cellular, or satellite.

The city of Wilmington, NC, found a solution to better protect drivers and police officers at four-way intersections during widespread power outages, such as after a hurricane. Typically, two rotations of four officers are assigned to these intersections. To maintain safety and free more officers for other calls, the city used traffic cones to form temporary roundabouts with one officer assigned to each. This innovation was also a 2019 Build a Better Mousetrap competition winner.

Purdue University’s Joint Transportation Research Program (JTRP), operated in collaboration with the Indiana DOT, demonstrated the value of drones for photogrammetric crash scene documentation. The JTRP reported that drones, also called unmanned aerial systems (UAS), produce high-quality scaled maps and facilitate significantly faster scene clearance than terrestrial mapping, reducing public safety personnel’s exposure to traffic hazards and the likelihood of secondary crashes.

More information

Download the Homegrown Innovations spreadsheet from the FHWA website for more information on these and other innovations developed and deployed by State and local agencies across the country.

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States Innovate!

States Employ Digital Drill Rigs
As part of a project to widen and improve a major corridor, the New Hampshire Department of Transportation (NHDOT) instrumented a rig to use Measurement While Drilling (MWD), an advanced geotechnical methods in exploration (A-GaME) technology, to better understand the engineering properties of the soil and rock. The agency is using MWD on this project to enhance geotechnical site characterization and provide continuous, real-time monitoring and recording of data during the drilling process. NHDOT’s in-house mechanical services staff instrumented a conventional rig with sensors to measure and record parameters including torque, downward thrust, rotational speed and penetration rate. A readout on the rig allows for real-time monitoring that relates to the effort needed to penetrate the ground. Read more about this project in the A-GaME newsletter.

The Montana DOT is evaluating MWD technology as part of a 1-year, FHWA-funded pilot program. MDT staff instrumented a rig equipped with multiple MWD sensors to collect data that delivers a continuous profile of the subsurface material. During an A-GaME webinar, Nick Jaynes, MDT geotechnical engineer, described the installation of MWD equipment on the department’s drill rig and the use of MWD to collect data on several projects.

Alaska Deploys UAS for Project Design, Construction, and Monitoring
The Alaska Department of Transportation and Public Facilities (DOT&PF) has deployed unmanned aerial systems (UAS) across the State to aid in design, construction, and monitoring of large-scale projects. By augmenting traditional survey acquisitions, DOT&PF is able to fill in the gaps with UAS data. Alaska DOT&PF has used fixed wing and multirotor systems to collect light detection and ranging (LiDAR) data, imagery, and environmental documentation since 2019. One of the DOT&PF’s first projects to use data supplemented by UAS is its Sterling Highway Milepost 45–60 Project. The agency’s ability to quickly acquire imagery and LiDAR data and distribute it to the project team not only saves time, it also helps the agency keep the public updated on the project’s development through an online web portal.
PennDOT Tracks Roundabouts’ Safety Benefits
The Pennsylvania Department of Transportation (PennDOT) recently reviewed data for 26 roundabouts on State routes and found that fatalities, injuries, and crashes decreased overall in the time since they were built. An agency news release noted that the roundabouts are at intersections that were previously stop or signal controlled. PennDOT said these roundabouts were selected based on having at least 3 years of crash data available before and after the roundabouts were built. PennDOT data based on police-submitted crash reports from 2000 through 2020 shows that fatalities at these locations were reduced by 100 percent and the total number of crashes decreased by 22 percent.

North Carolina Improves Traveler Information Accuracy
The North Carolina Department of Transportation (NCDOT) has embraced crowdsourcing as a way to exchange real-time traveler information with road users in times of natural disaster. During Hurricanes Michael and Florence in 2018, North Carolina roads experienced unusual flooding and road closures. Realizing that mapping and navigation providers were not publishing accurate road closure information, NCDOT set out to improve the way it engages navigation providers with timely and accurate information. The agency identified key points of contact with each provider in order to maintain relationships that can be leveraged during emergencies. Because of these efforts, stakeholders now enjoy the benefits of better mapping information for closures, traffic incidents, new roadways, and truck routing.

Texas Uses Virtual Platform to Train New TIM Trainers
In Texas, where Traffic Incident Management (TIM) training is mandated for all law enforcement and firefighter professionals, there was a shortage of certified TIM trainers. The Texas Department of Transportation (TXDOT) bridged the trainer gap by using conferencing software to conduct three virtual Train-the-Trainer courses earlier this year. Virtual delivery required overcoming technology challenges, such as poor internet speeds, desktops without a microphone, or access to a shared laptop. Organizers addressed this by sharing the materials in advance, having a dedicated staff member monitor chat messaging, adjusting the instruction to include mini-breaks, including safety service patrol videos to complement the course, and using smaller breakout sessions for traditional tabletop exercises. In all, TXDOT’s three virtual Train-the-Trainer classes led to 77 certified TIM trainers in Texas, and many are already delivering training. Read more in FHWA’s TIM newsletter.

Virginia Institutionalizes VPI
The Virginia Department of Transportation (VDOT) began building capacity for virtual public involvement (VPI) in 2019 by hosting an FHWA peer exchange for its staff and partner agencies in the region. Since then, VDOT has rapidly expanded its use of VPI in response to the COVID-19 pandemic. An important part of the agency’s efforts has been working with the FHWA Virginia Division Office to develop guidance on the use of virtual public meetings to augment its public involvement for environmental review projects that require in-person hearings. VDOT staff discussed specific examples of how they have used VPI to support planning, project development, and environmental review in FHWA’s VPI Conversations video series.
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Crash Responder Safety Week

An Opportunity to Promote Roadway Safety

Nearly every week, a traffic incident responder is killed while clearing a roadway incident, while many more sustain life-changing injuries. These secondary crashes place a high toll on response communities, and they endanger road users.

Crash Responder Safety Week (CRSW) is a national effort to spotlight safe strategies that responder communities and travelers can apply around traffic incidents. This year, CRSW takes place November 8–14, 2021. To learn how your agency can use CRSW to promote road safety, please visit the FHWA CRSW Campaign Toolkit and the National Operations Center of Excellence CRSW website, or contact Jim Austrich, the FHWA Next-Generation TIM co-lead.

Credit: Florida Department of Transportation

Crash Responder Safety Week  
Show your support #CRSW - November 8–14, 2021

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