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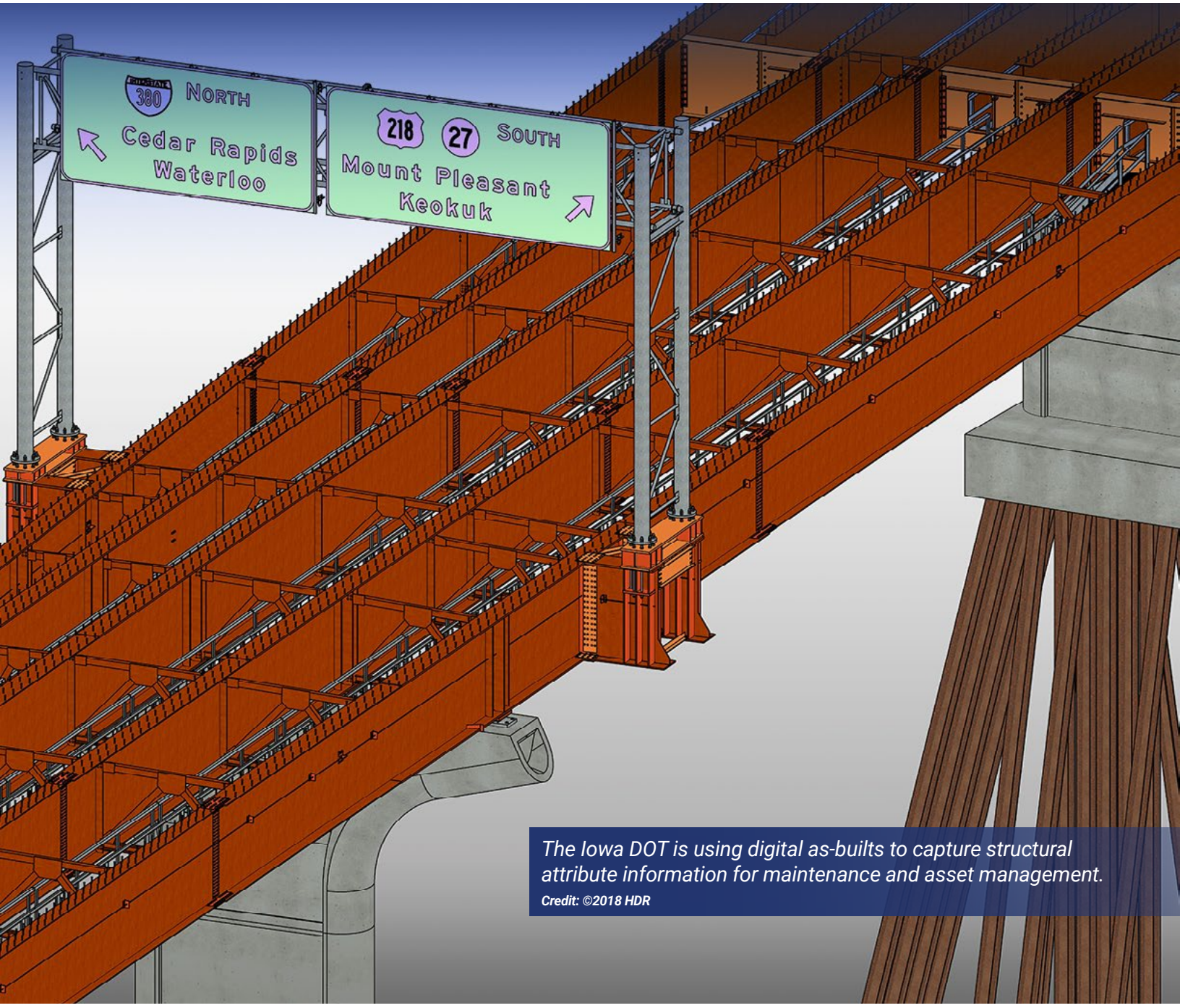
U.S. Department of Transportation
Federal Highway Administration

INNOVATOR



The Iowa DOT is using digital as-builts to capture structural attribute information for maintenance and asset management.
Credit: ©2018 HDR

States Continue the Move to Digital Project Delivery

The rapid evolution of digital technologies is offering State departments of transportation (DOTs) new opportunities to better collect and use data for project and asset management, including the creation of digital as-builts (DABs). DABs are digital records of the constructed condition of assets in an electronic format that can be shared, searched, and extracted for various uses. DABs are also durable—the information will be accessible over the life of the asset.

As State DOTs are at different stages of transitioning traditional paper-based workflows to digital, FHWA's Every Day Counts (EDC) program hosted a workshop in June 2022 that presented successful strategies from DOTs that are at various points in the process.

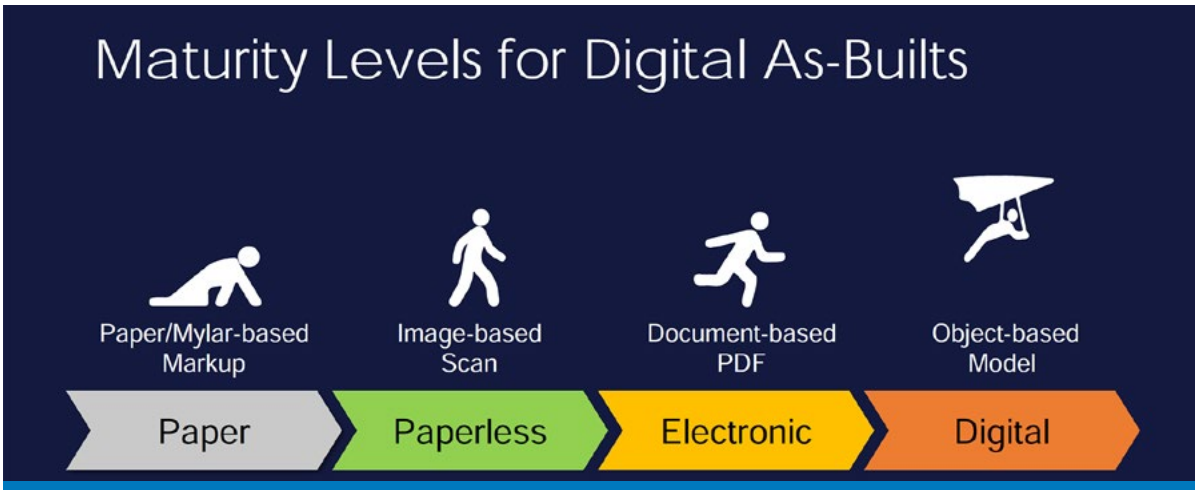
"Digital as-builts can include much more valuable information than their paper predecessors and are simply the accumulation of information we already create as part of current digital design and construction delivery processes," said David Unkefer, FHWA Resource Center engineer and **EDC digital as-builts** team lead. "We want to help agencies better utilize as-built data created during design and construction for business needs during operations and maintenance. It's a matter of determining how an agency can implement digital as-builts in a practical way using the tools available today."

Advancing Digital PDFs

The South Carolina DOT (SCDOT) currently maintains a searchable online inventory of as-built records that has 2,600 users, more than 700,000 searches per year, and contains as-built records dating back to the 1920s and 1930s. Over 2.5 million plan sheets are available online, including as-built plans.

New projects are submitted using digital PDFs created with as-built data collected by modern field surveying equipment. The digital PDFs have advanced features like searchable text, vector graphics, and information stored on layers for easier navigation. These PDFs provide as-builts in a way that is compatible with SCDOT's existing online access platform, presented in a repeatable, recognizable format but with more advanced features.

SCDOT is continuing to move into a more digital-based delivery. "We have lots of challenges ahead in getting into digital as-builts, so we are taking steps like this to ease into the process," said Jeff Brown of SCDOT's Design Automation Office.



States are continuing the evolution from paper-based to fully digital project delivery.

Credit: FHWA

The Florida DOT's (FDOT's) move to DABs emerged from its previous investment in **e-Construction**. Florida currently uses digitally signed PDFs for construction contract

documents, which laid the foundation for capturing as-builts in a digital PDF format.

FDOT captures as-builts as vector PDF markups in an official record set used to document and compute final quantity estimates. The digital mark-ups are more efficient to collate using productivity tools like copy and paste and automatically comparing documents. The digital format enables storing more robust information such as embedded photos, videos, and documents. It also offers better navigation features such as searchable text and hyperlinks to external content or bookmarks to locations within the file.

FDOT has made advances in additional areas related to implementation of DABs, including importing all materials certifications into a central database where they are easier to access than in the project archive and storing the unique identifier and location of certain manufactured items in a tracking system. They are also collecting 3D models to compute earthwork quantities and documenting Intelligent Transportation System assets using an import template for their facility management database.

Implementing DABs for Subsurface Utility Engineering

Due to frequent utility delays and several dangerous utility strikes by construction equipment, the Colorado legislature required the Colorado DOT (CDOT) to collect more as-built data on utilities in its right-of-way. CDOT now collects utility locations as part of an enhanced and standardized subsurface utility engineering (**SUE**) workflow, which includes as-constructed utilities. CDOT manages the 3D utility information for long-term reference as a digital as-built.

Contractors maintain a 3D database of subsurface utility information beginning with the SUE data collated during design. The SUE information is updated as utilities are exposed either through test pits or construction activities and when utilities are relocated, removed from service, or installed.

"Once a design is done and we are ready to go to construction, we have identified what existing utilities need to be relocated or moved or adjusted in place," said Rob Martindale, CDOT utilities program manager. "We then have the ability to push this data out to construction via mobile devices."

CDOT is also leveraging its 3D utilities map for use with new applications such as augmented reality and machine-guided excavation for damage prevention. "There are a lot of new tools and a lot of exciting things going on, and it's built around having a database that is completely accurate and reliable," Martindale said.

Collecting DABs for Asset Management

The Minnesota DOT (MnDOT) aligned its DABs program to its asset management plan, resulting in a list of about 75 asset classes. Currently, **MnDOT** routinely requires contractors to collect DABs for 12 asset classes such as guardrails, culverts, and signs that are included in its **Transportation Asset Management Plan**.

The digital as-built formats range from spreadsheets with 2D latitude/longitude locations to 3D survey files, all of which conform to specific formats to enable them to be incorporated into statewide or regional asset tracking tools. MnDOT realized a 30-percent efficiency in data collection when using the asset tracking tools on design projects.

Other uses for MnDOT's DAB data include One Call service call responses and an extreme flood vulnerability tool developed using bridge and culvert asset data and climate projections. MnDOT also has a **construction manager/general contractor** (CM/GC) project, the Elk River Freeway, which is piloting the use of digital delivery with DAB information. The project has a guaranteed maximum price of $130 million, and MnDOT reports documented savings of $15 million to date attributed primarily to use of 3D model-based project delivery combined with CM/GC contracting.

MORE INFORMATION

- To hear more from these States and others, contact FHWA's **David Unkefer** for links to the online Digital As-Built Workshop recordings.
- Visit FHWA's Every Day Counts **e-Ticketing and Digital As-Builts** webpage.

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Using TIM Data to Assess Performance

The collection and analysis of roadway and incident data is an important part of assessing **Traffic Incident Management (TIM)** performance and other operational characteristics of the road network.

TIM data includes incident response and departure times, time to re-open a closed roadway, and incident type (e.g., crashes, disabled vehicles, debris). TIM data collection can come from multiple sources, such as law enforcement traffic crash reports, public safety computer-aided dispatch system time stamps, transportation management centers (TMCs), and safety service patrol logs. TIM data is a valuable source of information because the metrics collected (such as clearance times and number of secondary crashes) allow agencies to identify areas that can improve TIM programs by quantifying and monetizing program performance.

Two examples from the Virginia Department of Transportation (VDOT) and Florida Department of Transportation (FDOT) help illustrate the real-world applications of TIM data. Each of these DOTs uses TIM data to improve performance and ensure all TIM activities are conducted safely and efficiently.

VDOT Evaluates Operations with TIM Performance Data

VDOT collects data statewide at five regional operation centers. This data primarily comes from the interstate system and is entered into a central Advanced Transportation Management System. In addition to TIM data, VDOT collects and reports on traffic speed and volume, work zone, and weather data to create real-time awareness of roadway operations for the agency.

VDOT primarily uses the collected TIM data for reporting three performance measures. The first is scene clearance time, which is measured from the start of an incident to when the incident scene is clear. The second, roadway clearance time, is measured from the start of the incident when at least one lane of travel is blocked to the time that all travel lanes are open to traffic. The third performance measure is estimating causes of congestion due to roadway incidents, which uses an algorithm to estimate the cause for interstate congestion.

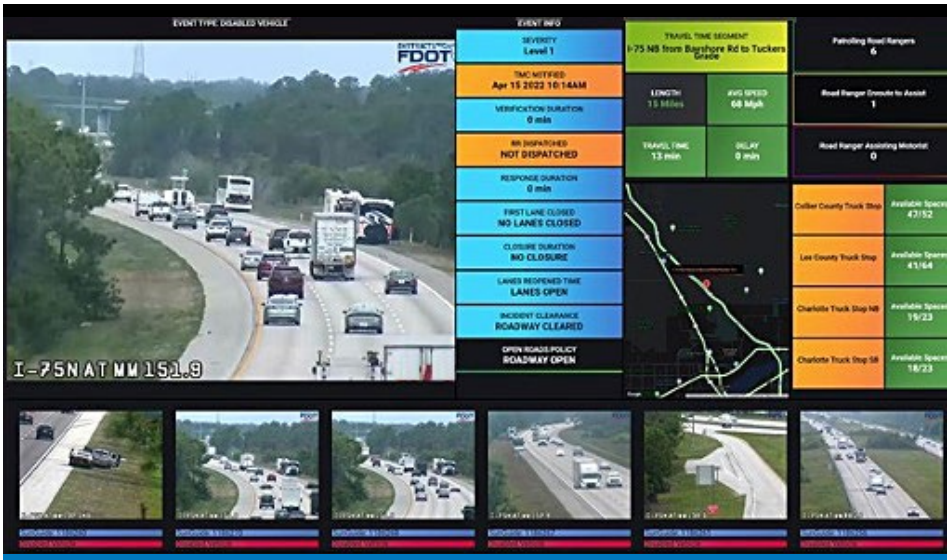
Though traffic incidents cause congestion, other factors such as work zones, weather, and recurring events can impact mobility. VDOT develops monthly and quarterly reports for executive and regional leadership using TIM data and publishes an annual **Operations Performance report** that is available to the public, which provides a statewide summary and overview of each VDOT district.

VDOT uses historical or archived TIM data to explore opportunities to expand and improve the

The Virginia DOT summarizes its TIM data in a publicly available Operations Performance report.

Credit: Virginia Department of Transportation

Safety Service Patrol routes and response times and to enhance the Towing Recovery and Incentive Program performance. In addition, VDOT uses TIM data to create a before-and-after analysis to evaluate the impact of a project, such as restriping, detour management, express lane extensions, and variable speed limit, after implementation.



The Florida DOT integrated TIM dashboard data into a local transportation management center video wall to create a combined, real-time display.

Credit: Florida Department of Transportation

"Overall, the use of traffic operations data, including TIM data, has been beneficial to the department," said Katie Felton, an engineer in VDOT's Traffic Operations Division who leads TIM performance reporting and data analytics. "We are committed to continuing to use TIM data to create opportunities to expand and improve existing programs and evaluate the performance of future projects. Also, we know that the analysis of TIM data to make data-driven decisions enhances comprehensive ways to improve the safety and operations of VDOT's roadway system."

FDOT Integrates TIM Data into TMC Video Wall

Florida started collecting roadway clearance time, incident clearance time, and secondary crash data in 2017. Using Florida's SunGuide® TMC software, they are now storing TIM performance measures, which are shared with the State's Central Office and subsequently used for graphical, **web-based dashboards of historical FDOT–TIM data**.

Participation in EDC round six **Next-Generation TIM** has FDOT looking for continued opportunities to use TIM data. A new TMC video wall in Southwest Florida provided such an opportunity. Agency information technology (IT) staff integrated TIM data from the statewide dashboard with the TMC video wall to create a real-time, local dashboard to track active incidents on the big screen. The TIM metrics for each active incident can now be displayed in a list form with graphical details and an individual event view with greater detail.

TMC operators and their co-located Florida Highway Patrol dispatchers now also get a contextual view of any event that includes camera views, incident severity, responders notified, dispatch status, incident duration, arrival status, roadway/lane blockage, and clearance activities. Average travel time on road segments, speeds, and estimated delay are also shown, reflecting roadway telemetry and third-party probe data. A related map of the area is also displayed. Road Ranger service patrol status is readily visible for resourcing.

"Enhancements to the video wall now present real-time data to operators and dispatchers, and the feedback has been very positive," said Tom Arsenault, FDOT District 1 TIM Program Manager. "The ability to track clearance times allows FDOT to train first responders to get the roads open faster and keep the motoring public moving safely."

MORE INFORMATION

@ Contact **Paul Jodoin** or **Jim Austrich** of the FHWA Office of Operations for NextGen TIM information, technical assistance, and training.

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Leaning Into Innovation

The national **State Transportation Innovation Council** (STIC) meeting held in June highlighted New Jersey's success at accelerating innovation through communication and collaboration, and it featured the results of a **U.S. Domestic Scan Program study** on how agencies are organizing to adapt to evolving technologies.

Amy Lucero, Associate Administrator for FHWA's Office of Transportation Workforce Development and Technology Deployment, told participants during the meeting's **webcast** to keep sharing ideas, keep trying new things, and keep encouraging staff to think outside of the box.

"This is how we become better and how our transportation system becomes better," said Lucero. "The STIC Network is a great way to stay engaged and to learn from each other, and I think we've seen tremendous benefit from that over the last 10 to 12 years."

Credit: New Jersey Department of Transportation

*The **New Jersey STIC Communications Plan** includes a variety of tools and practices for encouraging idea exchange and promoting innovation among the State's transportation community.*

New Jersey STIC Communications Plan

Brandee Chapman, Innovation Coordinator for the New Jersey Department of Transportation (NJDOT), described three efforts—the New Jersey STIC Communications Plan, an innovation deployment workshop, and the agency's drone program—that have helped further the agency's culture of innovation and improve the way they do business.

The **New Jersey STIC Communications Plan** was developed as a guide to encourage the exchange of ideas and promote innovation among STIC members and the broader New Jersey transportation community.

"The most effective communication methods will vary based on audience, which is where this plan comes in," said Chapman. "It identifies a range of communication tools that raise awareness of the STIC and Every Day Counts program, highlight success stories and challenges relating to implementing innovations, and convey the progress that New Jersey is making on all of those fronts."

Chapman said some of the most successful tools are their highly attended tech talks and webinars, which cover current practices and emerging issues in transportation.

Accelerating Innovation through Teamwork

NJDOT piloted a "Let's Go: Accelerating Innovation through Teamwork" workshop aimed at guiding a team in the creation of an action plan to accelerate innovation deployment. The participants focused on succession planning and three-dimensional (3D) project delivery, which aligns with EDC **e-Ticketing and digital as-builts**.

The workshop resulted in NJDOT's succession planning team exploring the reestablishment of a department-wide mentoring program, and it also helped the agency's 3D delivery team focus its vision and begin planning a pilot.

"We found that the Let's Go workshop was a great way to bring different people together to solve a problem and advance innovation in a structured, purpose-driven way," Chapman said.

Unmanned Aerial System Program

NJDOT's drone, or **unmanned aerial system** (UAS), program began in 2016 and currently includes a fleet of seven drones and 11 pilots with more in training. "STIC Incentive grants provided equipment, procedures, training, and software and allowed for a peer exchange," said Chapman. "Brainstorming with other States through this peer exchange was key to expanding the drone program."

From inspecting bridges and high mast light poles, to monitoring the progress of beach replenishment, to real-time construction project monitoring and traffic congestion assessments, UAS use is now a standard practice at NJDOT.

"Thanks to the support from the STIC, **the drone program** helped further our culture of innovation by enabling us to work better, faster, and smarter to get projects and tasks done more efficiently," Chapman said. "Our drone program is expanding every year, and we're always exploring new ways to incorporate this technology in day-to-day operations."

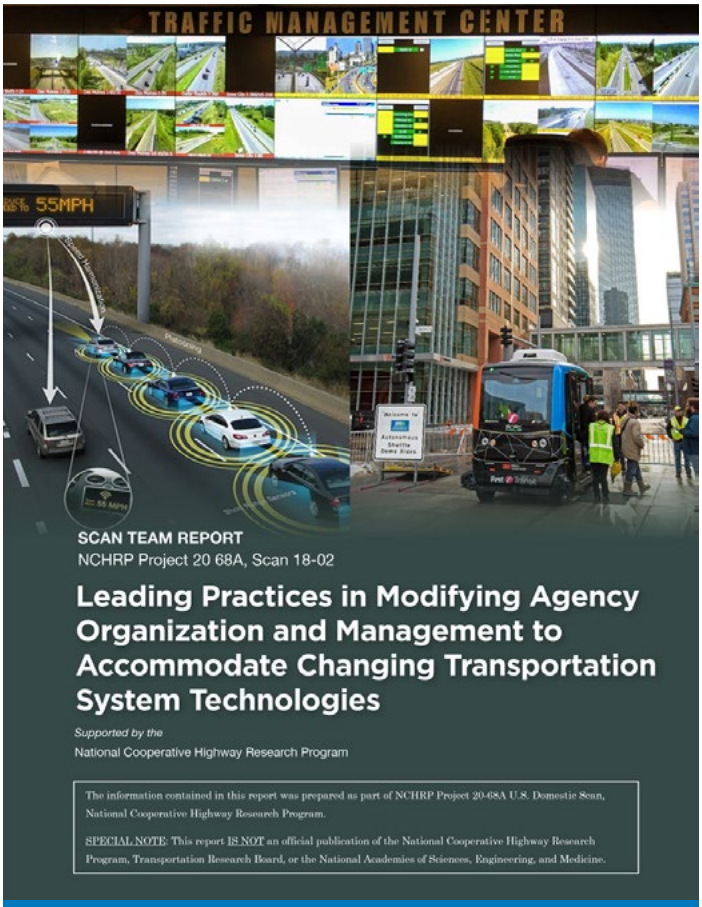
Adapting for Emerging Technologies

Bill Lambert, Bureau of Traffic Administrator at New Hampshire DOT, shared the findings of **U.S. Domestic Scan 18-02**, which investigated how DOTs are changing their organizational structure, institutional arrangements, and management practices to improve transportation system performance through the adoption of new technologies.

The scan team studied various aspects of several State DOTs. Among the findings was that the leadership and cultural traits of highly successful organizations include giving staff permission to make mistakes and encouraging and allowing risk taking.

The study also noted that required skillsets at transportation agencies are evolving. Among its workforce recommendations were to develop technology-driven job titles, which may differ from an agency's traditional engineering job titles, as well as to keep some of the more interesting projects in-house as a strategy for attracting and retaining employees.

"It's also critical to have staff development so that you have some internal expertise and are not outsourcing everything you need, recognizing that outsourcing some work may be necessary," said Lambert.



Credit: NCHRP Project 20-68 - U.S. Domestic Scan Program

*The final report from **U.S. Domestic Scan 18-02** reveals how agencies are organizing to adapt to evolving technologies.*

Lambert said the scan team found that technology changes now and in the future are going to drive organizational change, and organizations need to be fluid and flexible so they can adapt to those evolving changes. "We don't necessarily know what the new technologies will be a year from now or 5 or 10 years from now," he said, "but we do know that we need to be able to be flexible and adopt those technologies."

MORE INFORMATION

- Listen to a **recording** of the June 2022 national STIC Meeting.
- @ Contact **Sara Lowry** of the Federal Highway Administration for more information on the STIC Incentive program.

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STICs Celebrate 10-Year Milestones

During the first Every Day Counts (EDC) regional summits, FHWA encouraged the formation of State Transportation Innovation Councils (STICs). The idea was to bring the diverse highway community together in each State to identify and deploy the best innovations for their program while forming a strong culture of innovation. While several States at the time had entities similar to STICs, most did not have a group working cooperatively to deploy transportation technology and practices.

Now STICs are active in all 50 States, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and within Federal Lands Highway, and the earliest States to officially join the new STIC Network are celebrating 10 years of working together to get innovations into widespread use.

Credit: Michigan State Transportation Innovation Council

The Michigan STIC's storyboard includes information on membership and funding as well as project highlights.

Inaugurated on March 21, 2012, the Michigan STIC (MI-STIC) was the first in the Nation to sign a charter. MI-STIC members celebrated the council's 10-year anniversary at their March 21, 2022, meeting. Attendees said it was an opportunity to look back at innovation activities over the years and reflect on where they are today, and it was also an opportunity to look forward to the 50-year anniversary and envision what transportation innovation will look like in the year 2062. View a **storyboard** and the **MDOT Innovation Dashboard** to learn more about the MI-STIC and the innovations it has deployed.

Credit: Pennsylvania Department of Transportation

Pennsylvania's STIC created a 10th Anniversary webpage with a timeline and other highlights marking 10 years of moving innovation forward.

The Pennsylvania STIC (PA STIC), which held its inaugural business meeting on March 27, 2012, held a celebration of 10 years of innovation on July 27, 2022, following a regular meeting. To share the story of their STIC and the successes they have seen over the last decade, PA STIC created a **10th Anniversary webpage**, which includes an **article on their STIC's origins**, a **STIC podcast series**, and a timeline of STIC happenings and milestones over the past 10 years. They also plan to release a special issue of their Innovation in Motion e-newsletter.

Please share with us how you are celebrating your STIC's 10-year anniversary! Send an email to **Sara Lowry**, National STIC Network and Incentive Program Coordinator. To learn more about the STIC Network, visit the **program webpage**.

STIC
State Transportation Innovation Councils

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States Innovate!

Idaho Recognized for PEL Study

The Idaho Transportation Department (ITD) received a 2022 FHWA **Environmental Excellence Award** for its **I-15/US-20 Connector** planning and environmental linkages (PEL) study. According to the award description, stakeholders in Idaho Falls had been at an impasse on how to improve the Interstate 15 and U.S. Highway 20 junction and corridors there for more than 20 years, then ITD took a new approach and collaborated with local agencies to conduct a PEL study—the first to be done in Idaho. **PEL** represents a collaborative approach to decision-making that considers environmental, community, and economic goals early in the planning process. Through the PEL study process, ITD evaluated the potential impacts of more than a dozen alternative plans and removed from consideration those that would impact a veterans memorial park, a Tribal burial site, and historically disadvantaged communities. These efforts reduced what had previously been a 7- to 10-year process to 3 years. The project's success spurred five more PEL studies across the State.

Credit: Idaho Transportation Department

*The Idaho Transportation Department's first **planning and environmental linkages study** helped shorten the project timeline and build community support.*

Credit: Maine Department of Transportation

*Maine DOT's **Veranda Plan project video** tells the story of the agency's slide-in bridge replacement on Interstate 295 in Portland.*

Maine Accelerates Bridge Replacement with SPMTs

The Maine Department of Transportation (MaineDOT) used **accelerated bridge construction** techniques to replace an aging bridge carrying Interstate 295 over Veranda Street in Portland. The **Veranda Plan** project involved building the upper portion of the new bridge to the side of the existing one on temporary supports. At the same time, the new bridge foundations were built beneath the existing bridge. Then, during a weekend road closure, the new bridge was lifted and slid into place using self-propelled modular transporters (SPMTs). This was MaineDOT's first use of SPMTs for **slide-in bridge construction**. MaineDOT also incorporated **virtual public involvement** techniques, including virtual meetings and a **project story map**, to encourage stakeholder engagement, explain the need for the project and road closure, gather comments, and answer questions.

Oklahoma Cuts Fatal Crash Roadway Clearance Time with UAS

Measuring traffic crash scenes is an important part of an investigation that not only documents the evidence, but also forms the basis for calculations about vehicle speeds and trajectories that can point to causation and sometimes criminal charges. Using **State Transportation Innovation Council** funding, the Oklahoma Highway Patrol (OHP) purchased **unmanned aerial systems**

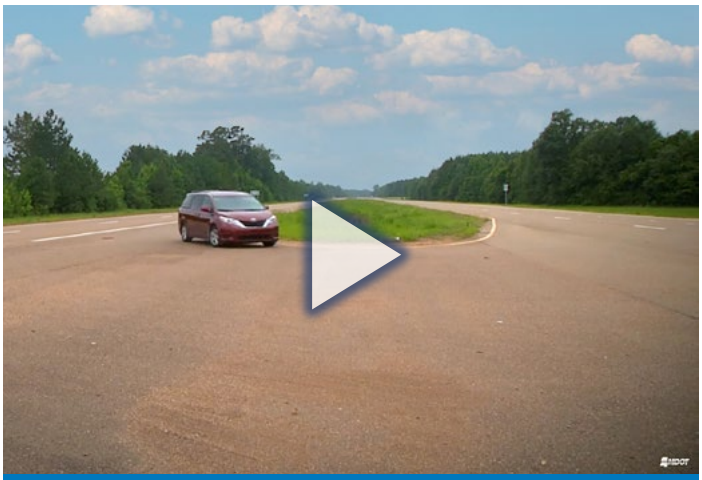
(UAS) to map fatal crash scenes on critical interstates and other highways. The OHP previously used total station and robotic total station technologies to map collision scenes, taking an average of 1 hour and 30 minutes to 2 hours, depending on the system used. With the adoption of UAS, troopers reduced that time to just 26 minutes, a savings of between 71 and 78 percent. When adding a real-time kinematic Global Positioning System, the scene time was slightly higher at 36 minutes but still provided savings of between 60 and 70 percent.

Ohio Employs Smarter Work Zone Technologies

The Ohio Department of Transportation (ODOT) introduced **smarter work zone** technology on a project in downtown Columbus to reduce the risk of congestion-related work zone crashes. To address potential backups due to construction at Interstates 70/71 and State Route 315, ODOT added queue detection systems along SR 315 south and I-70 east to warn drivers of slow traffic ahead. The system includes sensors along the road to detect the speed of traffic and relay that information to digital message boards. The message boards then alert drivers to real-time speeds, allowing them to safely slow down and avoid rear-end crashes. In an agency **news release**, ODOT District 6 Deputy Director Anthony Turowski stated, "With a project of this scale, it's important to think outside of the box. These innovative tools allow us to effectively and quickly communicate real-time information to help drivers make better decisions while traveling through this area."

Credit: Ohio Department of Transportation

The Ohio DOT is deploying queue detection systems and flashing signs at construction exits for its I-70/71 project in downtown Columbus.

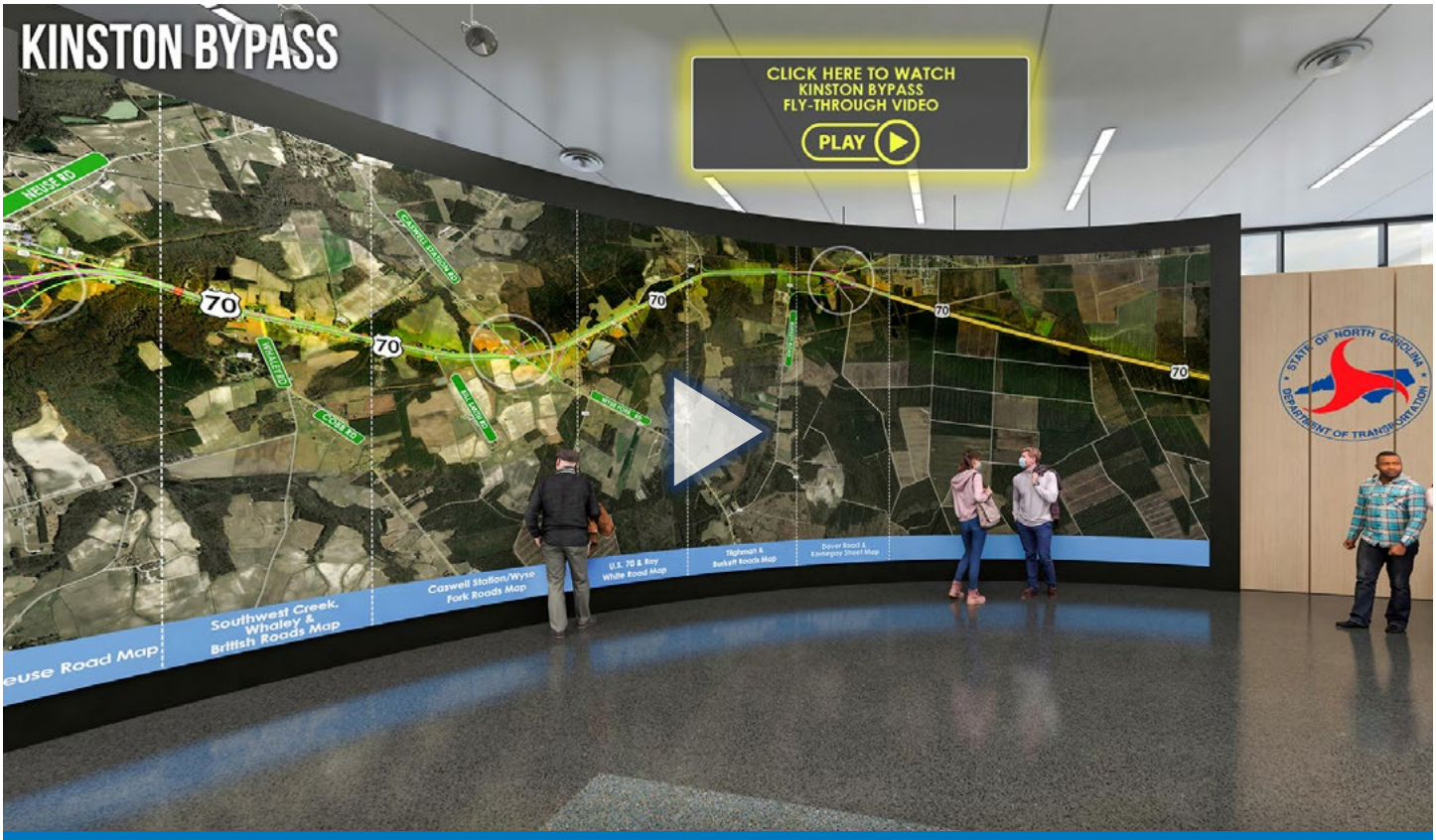


Credit: Mississippi Department of Transportation

*The Mississippi DOT **created a video to show travelers** how J-turns improve driver safety and efficiency at busy multi-lane crossings.*

Mississippi Boosts Safety with J-Turns

In recent years, the Mississippi Department of Transportation (MDOT) has been implementing **restricted crossing U-turns**, also known as J-turns, throughout the State. J-turns are a type of reduced left-turn conflict intersection where drivers approaching divided highways from a side street are restricted from making direct left turns or crossings. Instead, they are required to turn right onto the divided highway then make a U-turn at a designated median opening. According to a recent MDOT **news release**, the J-turns are a more cost-effective choice compared to other alternatives while offering significant safety advantages for travelers by reducing the number of conflict points for vehicles crossing or turning left at a multi-lane, divided highway intersection. MDOT's **Drive Smart MS** website includes a **video** explaining the benefits of J-turns and how to navigate them, as well as videos and information on other roadway or intersection features such as **rumble strips**, **diverging diamond interchanges**, and **roundabouts**.



Credit: North Carolina Department of Transportation

*North Carolina DOT created a **virtual, 3D meeting room** to increase public engagement during project planning .*

North Carolina Enhances Public Engagement

The North Carolina Department of Transportation (NCDOT) expanded its use of **virtual public involvement** techniques to include a new, online tool that provides a three-dimensional (3D) view of proposed projects. NCDOT developed the **3D virtual room** for its **Kinston Bypass project** to provide an interactive way to see the preliminary design. Visitors to the website navigate through a 3D room designed to look like an NCDOT public meeting. Within the virtual room, they can look through the large map of the proposed project, watch a fly-through video of the future bypass and 30-second videos at each interchange, and explore maps of each section of the project. According to an agency **news release**, NCDOT plans to continue using the 3D tool for future projects.

Concrete Overlays in Missouri Save Time, Improve Safety

The Missouri Department of Transportation (MoDOT) used concrete overlays to resurface a 9-mile stretch of Interstate-44 that serves as a main connector between the Lake of the Ozarks and St. Louis. With the Lake of the Ozarks being a major recreation and vacation destination, construction-related traffic delays were a major concern; therefore, the contract specified 90 calendar days for completion. Two miles of the project involved milling 11 inches of the existing asphalt pavement and inlaying an 11-inch concrete overlay. Seven miles of the project involved placing an 8-inch unbonded concrete overlay using a geotextile fabric as the separation layer. Using this **targeted overlay pavement solution**, the contractor paved 219,137 square yards of concrete in 47 days and turned over the project to the State in only 66 days.

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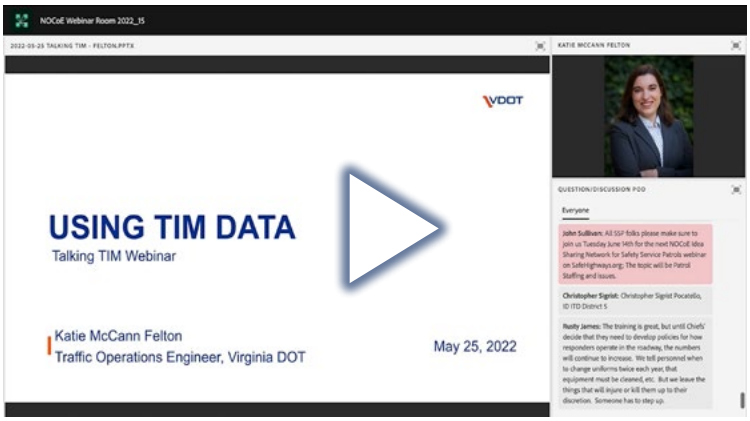
TIM Data Improves Operations

Agencies across the Nation are analyzing **Traffic Incident Management** (TIM) data to assess their TIM program performance, measure how well traffic incidents are managed, and look for ways to continue improving response activities. As data collection capabilities continue to develop, agencies will be better able to reduce clearance times, decrease secondary crashes, and improve efficiency for both motorists and responders.

The Federal Highway Administration Office of Operations hosts a monthly **Talking TIM** webinar series that provides a forum for sharing these TIM program strategies. View the May 22, 2022, **webinar** to learn how the Virginia Department of Transportation uses the TIM data they collect to evaluate their Safety Service Patrol routes and Towing Recovery & Incentive Program.



Credit: National Operations Center of Excellence

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