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Create a Top-Notch Pavement Network with "TOPS"

More than 40 percent of major roads in the United States are in poor or mediocre condition.¹ The U.S. Department of Transportation's 2015 **Conditions & Performance Report** estimated that America needs \$836 billion to fix highways and bridges. By enhancing overlay performance in priority locations, State and local highway agencies can help ensure safer, longer-lasting roadways.

Improved overlays are now available for both asphalt and concrete pavements that enable agencies to provide long-life performance under a wide range of traffic, environmental, and existing pavement conditions. Overlays are widely used, but not always targeted, so FHWA created the Targeted Overlay Pavement Solutions (TOPS) initiative as part of Every Day Counts round six (EDC-6). "Targeted" refers to high-priority or high-maintenance locations such as primary or interstate pavements, intersections, bus lanes, ramps, and curves where the standard fix is not performing well.

Targeted overlays can extend pavement life 15 to 40 years depending on the materials used. They also increase load-carrying capacity and improve safety, mobility, and user satisfaction in a cost-effective and sustainable manner.

Credit: Bill Vavrik, Applied Research Associates



Asphalt overlay mixtures have advanced significantly with the use of stone matrix asphalt, polymer-modified asphalt, and other materials and agents that reduce rutting, increase cracking resistance, and extend pavement life.

"The use of overlays is often based on an agency's experience and budget," said Tim Aschenbrener, FHWA's TOPS team co-lead. "With the Every Day Counts TOPS initiative, we're encouraging agencies to consider the variety of overlays that are now available. We want to help them expand the types of overlays that they commonly use."



Innovations in Overlays

The TOPS team is promoting eight asphalt overlays and two types of concrete overlays that offer many benefits to stakeholders. These overlays reduce maintenance, maximize previous investments, and reduce user delays (fewer work zones) due to extended service life of pavement structures. In addition, some TOPS products increase skid resistance, improve resiliency in flood-prone areas, reduce splash and spray, and reduce noise.

Success Stories

The New Jersey DOT uses a mixture called binder-rich intermediate course, which is similar to crack attenuating mix, and also uses highly modified asphalt and stone matrix asphalt. The agency's efforts in the past decade have paid off.

"Targeted overlay pavement solutions have made a significant difference in New Jersey's asphalt pavements," said Robert Blight, New Jersey DOT Pavement Design and Technology

¹"Key facts about the U.S. surface transportation system," May 2021, <u>https://tripnet.org/wp-content/uploads/2020/04/TRIP_Fact_Sheet_NATL.pdf</u>

TOPS Fact Sheets

Asphalt

- Asphalt rubber gap-graded
- Crack attenuating mix
- Enhanced friction overlay
- Highly modified asphalt
- High-performance thin overlay
- Open-graded friction course
- Stone matrix asphalt
- Ultra-thin bonded wearing course

Concrete

Concrete on Asphalt

- Bonded
- Unbonded

Concrete on Concrete

- Bonded
- Unbonded

Unit supervising engineer. "We've increased our good pavements by nearly 30 percent. Our goal is to create a balanced, cost-effective approach of preservation, resurfacing, rehabilitation, and reconstruction that best optimizes allocated funding to create the best possible roadway network condition."

The Colorado DOT has approximately 1,000 lanemiles of concrete overlays on existing asphalt pavements. The concrete overlay can be either a bonded system that acts with the underlying asphalt or an unbonded system that is paved on top of the existing asphalt to carry ever-increasing volumes of traffic.

"We've had great success with concrete overlays in Colorado for more than two decades," said Angela James Folkestad, American Concrete Pavement Association Colorado/Wyoming Chapter executive director. "They are faster and far more economical to deploy than reconstruction. The reduced frequency and duration of work zones means safer roadways for both workers and users."



Concrete overlays now benefit from performance-engineered mixtures and new design procedures that improve durability and performance.

EDC-6 Efforts

Twenty-eight States are participating in the TOPS EDC-6 initiative, with 26 interested in learning more about asphalt overlays, 15 focused on concrete, and 13 participating in both.

The TOPS team is developing resources to help transportation agencies select the right overlay product for the right location. The team has created **fact sheets** on different types of overlays and will release several case studies and how-to documents later this year. They are also planning webinars and workshops.

"While there's no single answer for everyone," said Aschenbrener, "by using good project selection practices, we believe every agency can find a targeted solution that is both cost-effective and durable."

MORE INFORMATION

- Contact Tim Aschenbrener (asphalt) or Sam Tyson (concrete) of the FHWA Office of Infrastructure Pavement Materials team.
- Output Description of the contract of the c
- Visit the EDC-6 TOPS webpage for additional resources.

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Driving FoRRRwD: Tools for Reducing Rural Roadway Departures

What if you could prevent rural roadway departure crashes from happening? Would you do it?

Nearly 12,000 people die each year when their vehicle leaves its travel lane. That is 30 people today, and every day. Thanks to new tools, research, and approaches, it is more possible than ever to reduce rural roadway departures and get more people home safely each day.

The FHWA Focus on Reducing Rural Roadway Departures (FoRRRwD) team is promoting these tools and approaches nationwide. Cate Satterfield, the FoRRRwD team co-lead, says true progress toward reducing or eliminating rural roadway departures starts with a new way of thinking.

"Historically, transportation practitioners looked for concentrations of crashes on their system. Those are called 'hot spots,'" Satterfield said. "When you find a hot spot, you analyze the location and customize a solution to mitigate the threat. It is site specific. However, that is a reactive approach. Something terrible has to happen before changes can be made. While hot spot analysis will always be important, there are rarely hot spots when it comes to rural roadway departures. There are other effective approaches that can actually get ahead of the crashes."

Site Specific or Systemic?

These new approaches include systemic analysis. The systemic approach considers where crashes have happened in the past but does not stop there. It uses roadway, traffic, and other data along with crash data to look for roadway characteristics that correlate with severe rural roadway departure crashes.

For instance, if 50 percent of severe crashes on a network are on curves with a radius between 300

and 500 feet, but only 30 percent of the curves fit that category, that is a potential risk factor. Other risk factors might be curves with shoulders less than 2 feet or with no edge lines.

With the systemic approach, practitioners can look for all the curves on their system with those characteristics because they signal risk of a severe crash. Agencies can then target cost-effective countermeasures to those locations, sometimes before crashes happen. They can even prioritize locations based on which curves have multiple risk factors. To further explain the principles of the systemic approach, FHWA recently published a **video**.

"The systemic approach has amazing potential to save lives," said Dick Albin, the FoRRRwD team co-lead. "And there are more tools than ever to help practitioners conduct systemic analysis."

New Tools for a New Approach

The Systemic Safety Project Selection Tool

provides a step-by-step process for conducting a systemic safety analysis and helps practitioners balance this approach with traditional hot spot treatments.

One of the most powerful tools are Local Road Safety Plans (LRSPs). They are one of FHWA's **Proven Safety Countermeasures**. LRSPs often rely heavily on the systemic approach, which allows agencies to analyze their systems and target investments to the highest-risk locations. The plans document the analysis and approach, making it easier to communicate investment decisions to stakeholders and provide for continuity through staff changes. These plans are so effective that several States, including Washington and California, either have or are planning to require LRSPs for counties and cities to apply for Federal Highway Safety Improvement Program funding. FHWA created a Local Road Safety Plans DIY website to help agencies develop LRSPs. The site includes step-by-step instructions, tutorial videos, and sample plans and templates.

Another powerful tool is the FHWA Crash Tree Maker. The

tool creates **crash tree diagrams**, which help agencies use crash datasets to identify the types of locations at most risk of severe crashes on their systems. Crash tree diagrams visualize safety issues and are a key part of systemic analysis. FHWA also developed a **tutorial video** on using crash trees and included an updated Crash Tree Maker on the LRSP DIY website.

The Crash Data Summary Template is another tool that many agencies have used to summarize crash data and detect over-representation, which helps agencies identify focus crash types. Both of these tools can be downloaded under the DIY website **Systemic Tools** dropdown menu.

FHWA conducted a **webinar** in April 2021 about the Crash Tree Maker and other analysis tools. The webinar included the experiences of States that have taken advantage of the tools. Representatives from Washington State and Alabama shared their stories.

"It is really encouraging to see States having success with these tools," Satterfield said. "They



have a passion to make the roads safer, and now they have the tools they need to use their data to great effect."

The Safe System Approach Brings It All Together

The **Safe System Approach** is a holistic philosophy of roadway management that starts with a challenge: Imagine a world where nobody dies from vehicle crashes.

The systemic approach works well with Safe System principles because humans make mistakes (like leaving their lane) and it is proactive (not waiting for crashes to happen). Rural roadway departure crashes account for nearly one-third of national roadway fatalities each year. These new methods and tools can help realize the vision of **zero deaths**.

"This is a very exciting time to be in transportation safety," Albin said. "We have unprecedented opportunities to really make a difference in saving lives because we have better tools than ever. Our goal is to help people use them."

MORE INFORMATION

- Visit FHWA's FoRRRwD website for details on this initiative, including an overview video and links to additional resources such as promotional materials, webinars, and articles.
- Ontact Cate Satterfield of the FHWA Office of Safety or Dick Albin of the FHWA Resource Center for information and technical assistance.



EDC Legacy: Advancing Effective Contracting Method Alternatives

For more than a decade, FHWA's **Every Day Counts (EDC)** program has promoted proven but underused innovations that enhance roadway safety, improve project delivery, and reduce traffic congestion. Across the country, agencies attest to the value of adopting these new technologies and practices, along with a cultural change in how they deploy innovation. As the transportation community participates in EDC round six, Innovator is featuring articles that reflect on what the program has accomplished.

Traditionally, highway projects have been let by State departments of transportation (DOTs) and local agencies after the design is completed and awarded to the lowest responsive bidder, a contracting method known as design-bid-build (D-B-B). As part of Special Experimental Project No. 14 (SEP-14), FHWA has partnered with the State DOTs to explore contracting options that better deliver projects of an increasingly complex nature.

While D-B-B is still the prevalent method, several alternatives have proven more effective for design-construction collaboration, addressing risk, and incorporating innovation by involving contractors earlier in the process. The result as confirmed by **FHWA research** is better projects that deliver transportation benefits to the public faster and often for less cost.

Expanding the Alternatives

EDC has highlighted several alternative contracting methods (ACMs) that facilitate earlier contractor involvement. These methods have since become standard practices for most State DOTs.

EDC rounds one and two promoted the **designbuild** (D-B) and **construction manager/general contractor** (CM/GC) ACMs. With D-B, an agency identifies the scope of work, solicits for and receives proposals, and selects a D-B team to assume the risk and responsibility for the design and construction phases. In CM/GC, the agency hires a contractor to act as a "constructability" consultant (CM) during the design phase. They work together, along with the agency's Independent Cost Estimator, to establish a price and schedule for the construction portion of the contract where the contractor acts as the general contractor (GC). With this design-construction integration, early work packages allow the team to complete long lead time construction activities more efficiently.

EDC's second round also included **alternative technical concepts** (ATCs), a procurement procedure that allows proposers to submit innovative ideas during bidding that improve on the contracting agency's design or construction criteria. Agencies have used ATCs most effectively with D-B, and some have used them with D-B-B. Caltrans has estimated savings due to D-B ATCs of 9 percent over a 4-year program.



This Colorado DOT U.S. 550–U.S. 160 Connection South project video includes a segment on why the agency chose to use D-B contracting.



The Sellwood Bridge project in Multnomah County, OR, used CM/GC contracting to incorporate innovations such as slide-in bridge construction and 3D modeling. Watch the old Sellwood Bridge be replaced in this time-lapse video.

Partnering for Success

EDC built networks between State and local agencies and other stakeholders that facilitated working together on these mutually beneficial initiatives. Peer exchanges and other activities allowed agencies already implementing ACMs to share lessons learned and effective strategies with those new to their use, increasing their chances of success. EDC also provided technical support through its deployment teams as well as **funding opportunities** for pilots and other deployment activities.

"Innovation deployment stories spread from State to State, creating momentum," said John Haynes, FHWA Utah Division. "When States started telling others how they got through the first projects, those events created a groundswell. It opened people's eyes a bit and helped bring the contractors on board. FHWA resources brought industry and agency-owners together in seeing ACMs as an effective way to partner on projects."

The raised awareness and acceptance of ACMs by both agencies and industry accelerated adoption in many States. For CM/GC, when EDC-2 began there were 10 States with enabling legislation and now there are around 30.

"We're also starting to see more contracts where agencies are using ATCs with D-B-B, and part of that is deciding which project is a good candidate," said John Huyer, FHWA Office of Infrastructure. "FHWA recently worked out a programmatic agreement with the Missouri DOT (MoDOT) for promoting ATCs on D-B-B projects, and it's now in MoDOT's strategic plan. D-B-B ATC use is also branching off into other areas. For example, the Michigan DOT has used it for controlling and maintaining traffic."

Looking Ahead

EDC supported implementation of contracting options that helped agencies to deliver an ever-increasing quantity of complex highway projects, and this has led to further exploration of new methods.

"EDC spawned a lot of innovative thinking about more effective project delivery methods and that has stimulated even greater utilization of other contracting and financing tools, such as **progressive D-B**, **project bundling**, **public-private partnerships**, and **indefinite delivery/indefinite quantity**," said David Unkefer, FHWA Resource Center. "It is helping to create a more innovative culture in the highway industry, which traditionally has been slow to adopt new things. EDC has shown that agencies benefit from adopting a more structured approach to change instead of innovation being a one-off."

MORE INFORMATION

- Read an FHWA **TechBrief** on ACM performance in highway construction.
- Visit FHWA's Alternative Contracting Methods Library and SEP-14 – Alternative Contracting webpage for additional resources.

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STICs Deploy Homegrown Innovations

The sixth round of Every Day Counts (EDC-6) kicked off with a Virtual Summit in December 2020 that introduced the seven innovations FHWA is promoting over the next 2 years. The summit also featured a National State Transportation Innovation Council (STIC) Network Showcase that highlighted 245 innovations in eight topic areas developed and deployed by agencies throughout the country. The following are just a few examples of the expertise and ingenuity agencies have put into action to save lives, time, and money in the areas of technology/materials and pavement/structures.



Among the innovations featured in the STIC Network Showcase were new ideas for improving safety and mobility during hazardous weather. The Kentucky Transportation Cabinet (KYTC) developed **snow and ice decision support software** that consolidates information for staff responding to weather events and allows them to view the status of operations and weather on a statewide scale. KYTC maintenance and information technology staff teamed to create the dashboard, which displays many different data sources on one **map**. Since the dashboard is public facing, roadway users can also view the data.

In low visibility conditions, snowplow operators frequently rely on visual cues such as guardrails and road paint to guide equipment. When large snowstorm events cover these visuals or reduce visibility to near zero, guardrails can be damaged, plow drivers can lose their orientation to the road, and dangerous and costly road departures can result. The Oregon Department of Transportation (DOT) deployed **GPS-guided equipment for improved maintenance management** to reduce this risk to snowplow drivers and the traveling public and to optimize operations.

Dust storms can also result in low or no visibility, severely impacting driving conditions. In some cases, the effects of these storms on traffic along Interstate 10 in New Mexico have been severe. The New Mexico DOT installed its I-10

Dust Storm Detection and Notification System

to advise the public of severe dust storms and provide appropriate actions to greatly reduce the likelihood of associated crashes. The **system** monitors local conditions and provides the appropriate response in real time without the input of human operators.

The Florida DOT also developed a software solution that increases automation, in this case for submitting, reviewing, approving, and posting data for transportation-related products. The agency's **Product Evaluation Tracking and History Application (PATH)** automates processes and communication and manages 2,000 applications



The Mississippi DOT implemented Sedimentation and River Hydraulics – Two-Dimension (SRH-2D) modeling for most of its bridge hydraulic projects.

annually to produce an approved product list. The agency documented a time savings of 60 hours per week in its Product Evaluation Section, with additional time savings for manufacturers and project engineers.

New technologies and approaches are helping the Texas DOT implement **pavement rehabilitation and design strategies for heavy loads**. Designing economical, long-life pavements to handle the intense traffic loads present in the State's energy development areas poses several challenges, including the need to keep the roadway operational at all times. State-of-the-art nondestructive test equipment was used to survey pavement conditions and develop materials handling options to meet early trafficking requirements and recommend improved pavement designs for overloaded vehicles.

The Alaska Department of Transportation & Public Facilities incorporated **geophysical investigation methods** into its in-house drilling program to obtain better data. The agency used capacitively coupled resistivity and ground penetrating radar equipment to locate subsurface anomalies during drilling programs by targeting borings more efficiently. This has resulted in cheaper and faster, but more thorough, geotechnical investigations, saving costs in design and reducing claims during construction.

The Mississippi DOT is using **two-dimensional** (2D) modeling for complex bridge hydraulics to inform, verify, and refine efficient designs. The

agency reported that 2D hydraulic modeling better represents the physics of flow, provides more realistic hydraulic results compared to one-dimensional methods, and is better suited to model the site conditions commonly encountered with bridges throughout the State.

FHWA's Office of Federal Lands Highway is performing **pavement structural evaluation using traffic speed deflectometers** (TSD), which measure pavement response to wheel load at traffic speed using a set of trailer-mounted, velocity-sensing lasers. TSD-based structural condition data can be incorporated into pavement management systems at the network level. Compared to traditional methods that require lane closures, TSD provides faster, safer data collection and processing.

MORE INFORMATION

Register for access to the EDC-6 Virtual Summit on-demand content to learn more about these and other homegrown innovations. After registering, click on the National STIC Network Showcase button.

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Every Day Counts: Innovation for a Nation on the Move

EDC-6 Summit Summary and Baseline Report May 2021





EDC-6 Summit Summary and Baseline Report Available Online

Visit FHWA's Center for Accelerating Innovation website to read the **EDC-6 Summit Summary and Baseline Report**, which describes the innovations in Every Day Counts' sixth round and documents the Virtual Summit held in December 2020. The report includes the deployment status of the innovations at the beginning of 2021 and the goals transportation stakeholders set to broaden their adoption by the end of 2022.

AID Demonstration Funds Awarded

FHWA's Accelerated Innovation Deployment (AID) Demonstration grants will help seven States advance innovative solutions for mobility and safety for all road users. Alabama, Arizona, Michigan, New Hampshire, Rhode Island, South Dakota, and Utah are receiving more than \$5.6 million in combined funding.

The Alabama Department of Transportation (DOT) will deploy **advanced geotechnical methods in exploration (A-GaME)**, an Every Day Counts round five (EDC-5) innovation, to help reduce construction delays and identify subsurface conditions that can mitigate risk in the repair and reopening of a section of U.S. Route 231 that closed after a mudslide in 2020.

The Arizona DOT and Mohave County will use Composite Arch Bridge System (CABS) technology to build a durable bridge crossing with reduced road closure times and construction costs. Its first use in Arizona, CABS provides rapid, simplified construction and arches that can be easily transported and placed without heavy equipment or large crews.

The Michigan DOT will use knowledge gained from previous efforts to bundle bridge projects on local agency routes. Expected outcomes with **project bundling**, a method supported during EDC-5 for awarding several projects under a single contract, include streamlined coordination and permitting and increased economies of scale.

Both New Hampshire and Rhode Island are incorporating pedestrian safety improvements promoted by the EDC-5 **Safe Transportation for Every Pedestrian (STEP)** initiative.

The New Hampshire DOT and the city of Nashua will improve pedestrian safety by installing crosswalk visibility enhancements, rectangular rapid-flashing beacons, pedestrian hybrid beacons, and road diets. These innovations are expected to reduce the number and severity of crashes involving pedestrians, help drivers yield to pedestrians more easily, and reduce traffic stress for pedestrians at 20 locations in the city.

The Rhode Island DOT is implementing the findings of its uncontrolled midblock crossing evaluation by installing enhancements such as rectangular rapid-flashing beacons, pedestrian hybrid beacons, leading pedestrian intervals, and pedestrian crossing islands to improve safety on 25 State-owned crossings.

The South Dakota DOT will deploy and evaluate its first use of **variable speed limits** on two interstate highway corridors throughout the State and help develop criteria for adjusting speed limits in response to weather, road, visibility, and traffic conditions.

The Utah DOT will use **three-dimensional (3D) modeling software, e-Construction, drones**, and other EDC technologies to improve project delivery.

The AID Demonstration Program has awarded more than \$86.9 million for 117 grants since it was launched in 2014 to help agencies accelerate the use of innovative traffic, safety, and construction practices.

MORE INFORMATION

- Read FHWA's official news release on this latest round of AID Demonstration grants.
- Visit the AID Demonstration program webpage for details on how to apply.
- Contact Fawn Thompson of FHWA's Center for Accelerating Innovation for information on the AID Demonstration program.

EDC Safety Summit Series – Save the Date(s)

Safety innovations have been a cornerstone of the Every Day Counts (EDC) program since 2011, resulting in their rapid deployment and institutionalization, and the upcoming EDC Safety Summit Series will build on that momentum.

The summit series, scheduled for each Wednesday during September 2021, will highlight seven safety innovations and share how they can save lives. The series will benefit those who are just beginning to implement these innovations, those who are further along and could gain from peer-to-peer engagement, and those with innovation stories to share. It will include opportunities to discuss hot topics with peers and establish relationships that can boost success now and in the future.

Each day of the summit will kick off with FHWA leadership perspectives with opportunities for questions and answers, followed by interactive State and local presentations and a topic-based breakout session, as well as a local innovation safety showcase.

Featured EDC Innovations

Sept. 1: Safe Transportation for Every Pedestrian (STEP)

Sept. 8: Data-Driven Safety Analysis (DDSA)

Sept. 15: SafetyEdgesM, Reducing Rural Roadway Departures (FoRRRwD), High Friction Surface Treatment

Sept. 22: Intersection/ Interchange Geometrics

Sept. 29: Road Diets

The summit will take place from 10 a.m. to 2 p.m. ET each day and is open to all State, local, and tribal stakeholders. Participants can join for one or all five Wednesdays. Contact Karen King, FHWA Virginia Division, for additional information.

States Innovate!

North Carolina Evaluates Durable Pavement Markings

Maintaining retroreflective pavement markings on over 80,000 miles of road is a challenge, but the markings are critical for **reducing lane departure crashes**. The North Carolina Department of Transportation (NCDOT) evaluated a solution using durable pavement markings and wider lines (6 inches versus 4 inches).

NCDOT installed durable markings, primarily thermoplastic, in 11 of its 14 divisions and measured retroreflectivity annually. While paint's retroreflectivity is typically inadequate after 2 years, NCDOT found that its durable markings maintained an adequate level of retroreflectivity for at least 6 years. An evaluation of over 400 miles of two-lane rural roads found that durable markings resulted in lane departure crash reductions of 13 percent for 4-inch lines to 18 percent for 6-inch lines.

NCDOT plans to restripe every 7 to 10 years versus painting lines every 2 years. While the wider, 6-inch stripes had a better crash reduction, using 4-inch stripes allows NCDOT to treat more road miles for the same amount of money, which results in a larger overall crash reduction. NCDOT plans to use the wider lines on select roads with concentrations of lane departure crashes.

INNOVATOR

INNOVATOR, published by the FHWA Center for Accelerating Innovation, advances the implementation of innovative technologies and accelerated project delivery methods in highway transportation.

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States Reach 98% of Their Goals – EDC-5 Report



The EDC-5 Final Report summarizes the progress achieved on implementing 10 innovations during the fifth round of Every Day Counts.

From January 2019 through December 2020, the fifth round of FHWA's **Every Day Counts** program (EDC-5) promoted 10 innovations that helped States shorten project delivery, enhance safety, reduce congestion, and integrate automation. In this cycle, States collectively reached 98 percent of their demonstration, assessment, or institutionalized goals. This is the highest implementation attainment since the EDC program began in 2009.

Read the **EDC-5 Final Report** to learn more about the 10 featured innovations, see which innovations each State implemented over the last 2 years, and read spotlight features from around the country highlighting agency successes in using these innovations in their programs.

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