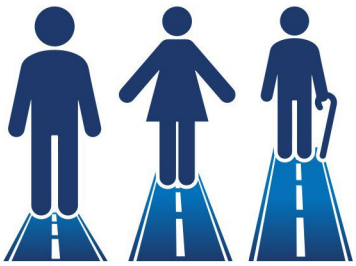
Every Day Counts
Innovation for a Nation on the Move

EDC-7 Summary of Innovation Suggestions
(November 2022)

Safety for All Users

Efficient Project Delivery



Equitable Transportation System

Sustainable & Resilient Infrastructure

U.S. Department of Transportation
Federal Highway Administration

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FOREWORD

The Federal Highway Administration (FHWA) is collaborating with State, local and industry partners, and the public to build for the future by identifying proven, market-ready but underutilized processes or technologies in round seven of Every Day Counts (EDC) program (2023-2024).

In March 2022 FHWA posted a Call for Ideas of innovations and processes for EDC-7. Those responding to the call were asked to consider how the innovation or process contributed to the following:

- **National Impact:** How will it benefit the transportation system nationally?
- **Game-Changing:** How is it transformative in making our transportation system adaptable, sustainable, resilient, equitable, and safer for all?
- **Urgency and Scale:** How will it positively impact the environment, safety, congestion, freight movement, construction techniques, contracting methods, project costs, maintenance, preservation, or emergency response?
- **Readiness:** Whether there are supporting specifications, guidelines, or procedures available to support technology transfer and national deployment.

FHWA received 76 comments in response to the Call for Ideas. Suggestions similar in content were combined for reporting in this document. Many ideas submitted need additional research or development, preventing deployment under the rapid process used by EDC. Some suggestions were not accepted due to small deployment markets. Some suggested innovations are proprietary, or require congressional action, and therefore were not considered under this process. All promising ideas remaining after the EDC selection will be considered by other programs within FHWA.

EDC-7 Summary of Innovation Suggestions

Asset Management & Planning

Digital Twins for Bridge Asset Management – The current process for bridge asset management relies largely on visual inspections. This process can be enhanced by incorporating data from electronic monitoring systems into a "digital twin" of the bridge. A digital twin is a realistic digital representation of the bridge in the built or natural environment that includes the structural components and their interactions during loading. Employing sensors on the bridge generates large amounts of data that can be fused with the digital twin to get a comprehensive look at the bridge's current condition and model its future condition for asset management.

Construction

Wireless Embedded Data Collectors for Construction – When driving piles, current inspection requires counting blows and taking measurements, generally on paper. States are using technologies that automate the pile driving process by using sensors to count blows and measure the pile penetration. Uses for these wireless technologies extend beyond driving piles to gathering other types of sensor data or serving as e-Construction data input devices for manual test data.

ID/IQ Contracting – Indefinite delivery and indefinite quantity (ID/IQ) project delivery methods are used when an agency anticipates a recurring need but has not determined the precise quantities of services that it will require during the contract period. Contractors bid unit prices for estimated quantities of standard work items, and work orders are used to define the location and quantities for specific work.

Real-Time Carbon Accounting for Construction Projects –Providing project construction stakeholders with tools to effectively manage, track, and understand the project's environmental impacts puts intelligent decision-making tools in the hands of those most able to positively impact the project's carbon footprint. This proposal would expand the use of e-Ticketing technology and combine construction materials information (e.g., source, transportation distance, specifications, delivery location) with data from environmental product declarations.

Hydraulics & Geotechnical

Resilient Drainage Pipes – State DOTs have established protocols for evaluating qualified drainage pipes to enable internal and external engineering partners to determine qualified materials and responsibly increase bid competition. Some evaluation protocols allow long-life (100-year) pipes to be used on critical routes or at critical locations.

Materials

Magnesium Phosphate Cement Concrete – Magnesium phosphate cement (MPC) is an alternative to portland cement concrete that combines the mechanical properties and durability of ultra-high performance concrete with the high early strength of rapid-setting concrete. When used for bridge or pavement repair, MPC can provide a durable repair to renew, protect, and extend the life of bridges or pavements.

Pavements

Asphalt Longitudinal Joint Sealant – The longitudinal joint in asphalt construction is difficult to compact and reduce the air void content in compared to the lane's interior. State DOTs and local agencies are using various void-reducing asphalt membrane materials to seal the longitudinal construction joint with extra asphalt placed as a membrane below the asphalt construction. This sealant reduces the voids in the asphalt mix in the joint and increases the asphalt content for improved performance.

Measuring Pavement Performance Characteristics in Construction – The technologies used to measure long-term pavement performance, such as road profilers and falling weight deflectometers, can also be used in pavement construction. The lightweight deflectometer measures the deflection of the pavement subgrade or base layers during construction to back calculate the stiffness of the layer, which is an improvement over density and moisture level. During construction, road profilers are being used on base layers to address pavement smoothness prior to the final surface layer.

Pavement In-Place Recycling – In-place recycling of the old road back into the new road is a sustainable way to build and preserve our Nation's infrastructure. Hot in-place recycling reheats the top few inches of an asphalt pavement, adds rejuvenating agents, and recompacts the pavement in place for a new surface without cracks or defects. Cold in-place recycling goes several inches into an asphalt pavement and adds asphalt and rejuvenating agents to rebuild the upper structure of the pavement into a new road. Full-depth reclamation recycles the asphalt and base layers, adds stabilizing and rejuvenating agents, and results in a new, highly stable base for new pavement that is constructed in-place.

Structures

Buried Approach Slabs for Integral Abutment Bridges – The "bump at the end of the bridge" generally comes from the joints in the bridge and settlement in the approach slab. The integral abutment bridge with buried approach slab removes joints and provides a stable platform for the approach pavement that minimizes the bump.

Continuous Galvanized Reinforcement – Rebar corrosion is a significant cause of concrete failure, resulting in repairs and replacements. Continuous galvanized reinforcement provides a barrier and cathodic protection through a metallurgically bonded pure zinc coating on the rebar. The result is an environmentally friendly and field-durable long-life bridge reinforcement.

Fiber-Reinforced Polymer Bridge Technologies – The use of fiber-reinforced polymers (FRP) in bridge systems provides highly durable materials. FRP systems can extend bridge service life through the reduction or elimination of steel. FRP technologies include carbon fiber-reinforced polymer (CFRP) prestressing and post-tensioning elements, FRP wraps for structural repairs, glass fiber-reinforced polymer, and CFRP reinforcement in composite structural elements and foundation piles. These FRP technologies can be used in all applications of bridge structures, from rural to urban, and at all traffic levels. FRP systems have been developed for restoring deteriorated existing bridge decks with FRP composite materials bonded into the existing

concrete deck. Materials verification and quality assurance for these FRP materials are enhanced through production processes and material testing in the laboratory.

Next Generation of Metal-Free Concrete Bridges with Zero Cement – This bridge construction technology incorporates fiber-reinforced polymer (FRP) technologies instead of traditional concrete and steel construction. These FRP elements do not rust or deteriorate like steel does, particularly in high-humidity and saltwater environments.

Concrete Waterproofing for Bridge Preservation – Integral waterproofing systems extend the service life of bridges through enhanced durability. These products are generally spray-applied waterproofing membrane systems designed for rapid set and provide a protective coating that improves resistance to deicing chemicals and water.

Safety

Video Analytics of Traffic Conflicts – Video data collection at hot-spot locations can be used with artificial intelligence (AI)-based video processing to detect and study high-conflict locations. The AI-based analysis provides accurate, reliable, and previously unavailable data and insights for decision-making across management, operations, and planning functions. Use cases include diagnostic analysis, countermeasure identification, before-after and with-without treatment analysis, benchmarking, and operational feedback.

Automated Safety Analyses through Digital 3D Modeling and Simulation – Using cloud computing, artificial intelligence, and rigorous simulation, digital three-dimensional (3D) models can be rapidly analyzed to identify critical safety deficiencies in roadway geometry and prioritize safety improvements. These automated safety analyses can be used for both existing conditions (light detection and ranging [LiDAR] based) and proposed designs (computer-aided design and drafting [CADD] based).

Separated Bike Lanes and Intersections – Separated bike lanes are exclusive lanes for bicyclists that are separated from motor vehicle traffic. When implemented at intersections, they put turning cars on an alignment where it is easier to see the cyclist, reducing the collision hazard. Implementing these improvements at both intersections and midblock locations creates networks of safer roadways for bicyclists.

Crowdsourced Data for Safety – Crowdsourced data (such as from connected vehicles and vehicle probes) and data from analytics services can be used to support data-driven safety analysis. Analyses could include vehicle movement data, pedestrian and bicycle interactions with vehicles, and local and rural road safety.

Reflective Post Sleeves – Reflective post sleeves are two-sided and three-sided sleeves made for installation on standard signposts. In rural areas, the sleeves enhance the presence and visibility of curves or chevron signs, particularly during dark and/or inclement weather. Reflective markings around the posts of chevron signs have been found to help drivers better gauge the sharpness of curves and may reduce the numbers of drivers who approach curves at higher speeds.

Cycle Lane Separators – Bike lanes help bicyclists to ride at their desired speed without intrusion from other road users. Modular systems can be installed to provide positive separation between bicycle lanes, special use lanes, and traffic lanes using multiple configurations.

Environmental, Planning, and Realty

Enhancing Network Connectivity and Safety – Highways and railways are significant barriers to pedestrian, bicycle, and trail network connectivity. For existing corridors, the opportunity exists to apply proven construction techniques to add culverts and tunnels to reconnect communities. Primarily used for drainage, box culverts can also be used as tunnels that accommodate bicycle or pedestrian traffic. They can be used to create waterway passages, urban trails, and industrial passages.

Operations

Connected and Autonomous Vehicles Outreach – The adoption of connected and autonomous vehicle (CAV) technologies by automakers, State DOTs, municipalities, and travelers can be a confusing topic for the general public. Outreach and education regarding the benefits of CAV is critically important for driver understanding. To date, the focus has been on the technology, terminology, and business sides of CAV. New outreach that broadens the message to include more stakeholders could accelerate CAV adoption.

Distracted Driving Corridor – Portable changeable message signs (PCMS) are often used in highway construction and maintenance, and they have also been used to provide messaging on distracted driving. Because their portability allows the signs to be moved around, drivers do not become numbed to the messaging and its impact remains high. PCMS coupled with increased or focused enforcement could have a significant impact on the frequency of distracted driving.

Mobile Truck-Mounted Barriers – Mobile truck-mounted barriers provide increased safety compared with traditional cones and barrels or mobile closure equipment. Current truck-mounted barriers integrate the barrier, utility vehicle, and flatbed trailer, creating a versatile vehicle for addressing construction and maintenance. Mobile barriers allow for rapid work zone set up and removal, reduce project duration, support work around peak traffic hours, and minimize roadway congestion.

Wrong Way Driver (WWD) Detection Strategies – Traffic professionals need proven technologies and systems to protect communities from confused or impaired drivers who go the wrong way on highway exit ramps. WWD alert systems include a detection zone, a correction zone, and a confirmation zone to detect and deter WWDs from entering the highway.