

 October 28-29, 2025

 Orlando, FL



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Smart Work Zones:

Leveraging Technology For Safer and Smarter Roadways

Panelists:

- Ryan Buck, FDOT
- David Feise, Arrive Alive Traffic Control (ATTC)
- Jason Lee, SmartCone
- Nagham Matout El-Zine, PE, ATSSA

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Safety Message

- **FDOT Safety Message:**
- October 1st to 31st: NHTSA Pedestrian Safety Month

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Traditional Work Zone Practices

Growing Infrastructure Demands: Increasing number of roadway projects causes traffic congestion and delays.

Higher Risk of Crashes and Injuries: Motorists who are not familiar with the roadway are particularly vulnerable in work zones conditions.

Limited Real-Time Communication: Motorists, workers, and transportation systems often lack coordination.

Safety Concerns: Distraction and speeding continue to be major hazards in work zones across the nation.

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Infrastructure Is Evolving, so are Work Zones



Technology Integration: Use of real-time data, sensors, mapping, and V2X (vehicle-to-everything) communication.



Growing Availability of Real-Time Data: Smart signage, dynamic warnings, and geo-fencing improve work zone visibility.



Enhanced Coordination: Contractors, DOTs, and motorists working more effectively together.



Safer Roads Through Information: Well-informed motorists react better, reducing potential for crashes and non-recurring congestion.



WZ Safety and Mobility (Subpart J) Final Rule: Data-driven assessment of work zone performance.

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Panel Session Objectives

- FDOT Smart Work Zone Design Strategies
- Expectations of Systems and Data Collection
- Implementation Considerations
- Where Are We Now: Update on SWIFTT Challenge-Winning WZ Safety Solution

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FDOT Smart Work Zone Design Strategies

Ryan Buck, P.E.
 State Construction Specialty Engineer
 Florida Department of Transportation

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FDOT SWZ Strategies

FDOT has developed combinations of SWZ technologies to create **strategies** in response to work zone traffic impact scenarios. FDOT SWZ strategies covered in the SWZ Guidebook and Developmental Design Concept (DDC) include:

- Work Zone Data Exchange (WZDx)
- Dynamic End of Queue/Slow Speed Warning (DQW)
- Dynamic Lane Merge (DLM)
- Dynamic Speed Harmonization (DSH)

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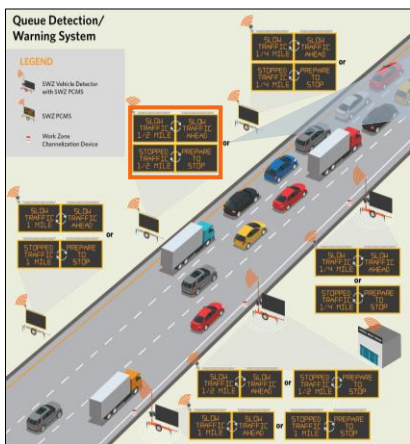
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- **Program Sponsor:** Federal Highway Administration (FHWA)
- **Goal:** Safe work zone navigation for vehicles equipped with automated driving systems (ADS)
- **Work Zone Data:** Near real-time work zone data for third party use
- **Recommended:** Use for projects impacting traffic or when workers are adjacent to open traffic lanes
- **Long Term:** Eventually use WZDx on all projects that potentially impact traffic

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Dynamic Queue Detection / Slow Speed Warning (DQW)



Goals

- Fewer work zone crashes
- Increased throughput

SWZ Vehicle Detectors

- Traffic speeds
- Traffic volumes

SWZ Central Processor

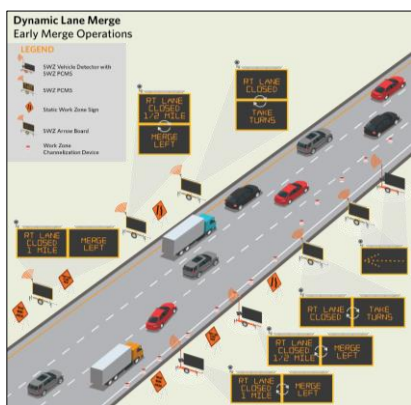
- Locate slower traffic
- Locate stopped traffic
- Locate end of queue
- Selects messages from pre-approved library
- Posts messages to PCMS

Portable Changeable Message Signs (PCMS)

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Dynamic Lane Merge (DLM)



DLM Scenarios

- Early Merge:** move traffic ($\leq 1,500$ vehicles/lane/hour) to open lanes as early as possible
- Late Merge / Zipper Merge:** keep traffic ($> 1,500$ vehicles/lane/hour) in all lanes until the lane closure

Goals

- Increase safety (hard braking, road rage)
- Reduce queue length
- Increase throughput

SWZ Detectors

- Speed and volume approaching merge and through the work area

SWZ Central Processor

- Determine applicability of **early merge** or **late merge** based on pre-determined algorithms
- Select PCMS messages from pre-approved library
- Post messages to PCMS

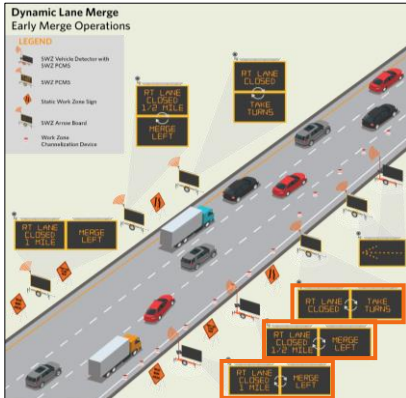
SWZ PCMS

- Post early merge or late merge messages from Central Processor

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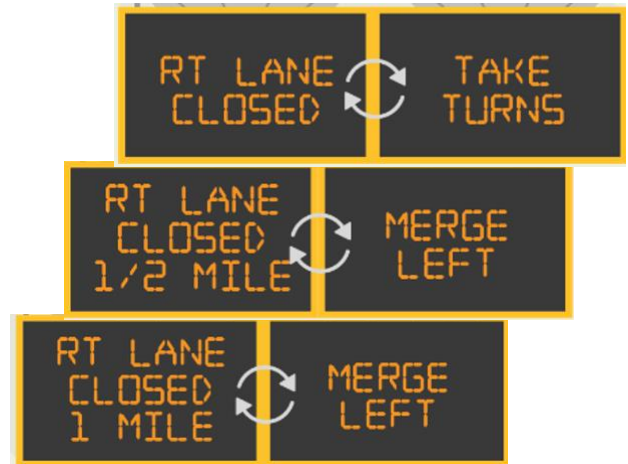
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Dynamic Lane Merge (DLM)



PCMS for DLM

Early Merge Scenario

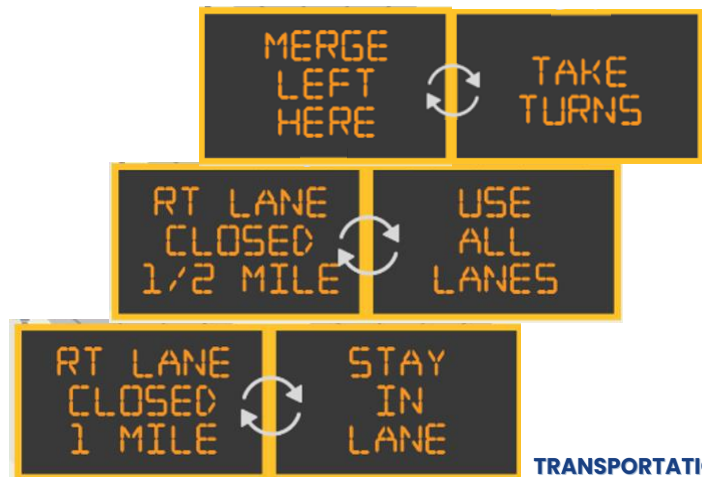
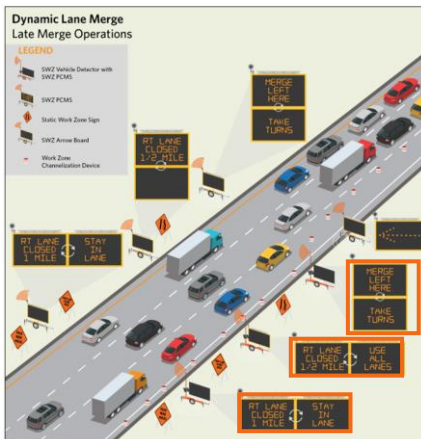


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PCMS for DLM

Late Merge Scenario



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Dynamic Speed Harmonization

LEGEND

- SWZ Vehicle Detector with SWZ PCMS
- SWZ PCMS
- VSL Sign with ESFS
- Work Zone Channelization Device

- **Goals**
 - Uniform speeds approaching and the through work zones
- **SWZ Vehicle Detectors**
 - Vehicle speeds approaching and through work area
- **SWZ Central Processor**
 - Locates slow traffic speed areas
 - Determines speed limits for traffic approaching slowed speed areas and posts speeds to SWZ VSL signs
 - Determines PCMS messages from pre-approved library and posts messages to SWZ PCMS
- **SWZ PCMS**
 - Reduced speed ahead messages
- **SWZ Variable Speed Limit (VSL) Signs with Electronic Speed Feedback Signs (ESFS)**
 - VSL: Current speed limit based on downstream traffic
 - ESFS: Displays speed of traffic passing the sign

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SWZ PCMS and VSL with ESFS for DSH

Dynamic Speed Harmonization

LEGEND

- SWZ Vehicle Detector with SWZ PCMS
- SWZ PCMS
- VSL Sign with ESFS
- Work Zone Channelization Device

REDUCE SPEED AHEAD

REDUCE SPEED 1/4 MILE

REDUCE SPEED AHEAD

REDUCE SPEED 1/4 MILE

REDUCE SPEED AHEAD

REDUCE SPEED 1/4 MILE

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Resources to Support Design & Construction

- Smart Work Zone Design and Operations Guidebook
- Developmental Standard Plans for 102-600 series
- Developmental Design Criteria (DDC) for FDOT Design Manual (FDM) Section 240 Transportation Management Plan
- Developmental Specs (DevSpecs) for:
 - Section 102 Maintenance of Traffic
 - Section 990 Temporary Traffic Control Device Materials

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Considerations

- Reach out if you have questions – get answers to your questions and provide feedback to help improve FDOT SWZ Strategies.
- Read through Guidebook – it provides a great overview to anyone involved in FDOT SWZ Strategies and points to other important FDOT resources.
- Look at the other resources, in particular the FDM, to determine when and what SWZ strategies may be applicable to the project.

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Smart Work Zone Implementation Considerations

David Feise
President
Arrive Alive Traffic Control (AATC) LLC

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Implementation Strategies (ground level)

Implementing a Smart Work Zone (SWZ) involves integrating advanced technologies to enhance safety, efficiency, and traffic management in construction zones. Key considerations for successful SWZ implementation:

- Device Location selection
- Training and System Access
- Repair and Maintenance
- Performance Monitoring and Evaluation
- Environmental and Community Impact
- Adaptability to Work Zone Type (Phase changes)

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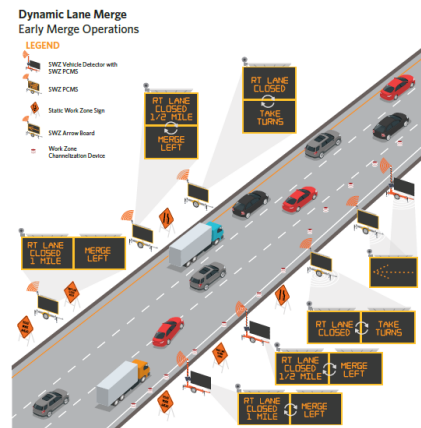
Implementation Strategies (ground level)

Dynamic Lane Merge (DLM)

Use DLM when traffic speeds and volumes typically and predictably change throughout the duration of the lane closure. When a lane closure is present, some drivers tend to move over immediately while others wait until the last possible moment to merge. This driver behavior causes speed differentials, hard braking, road rage, crashes, endangers workers, and reduces throughput in the lanes approaching the lane closure and in the open lanes past the closure.

Designers should consider these systems in long term deployments vs on nightly basis.

FIGURE 3: DYNAMIC LANE MERGE - EARLY MERGE OPERATIONS

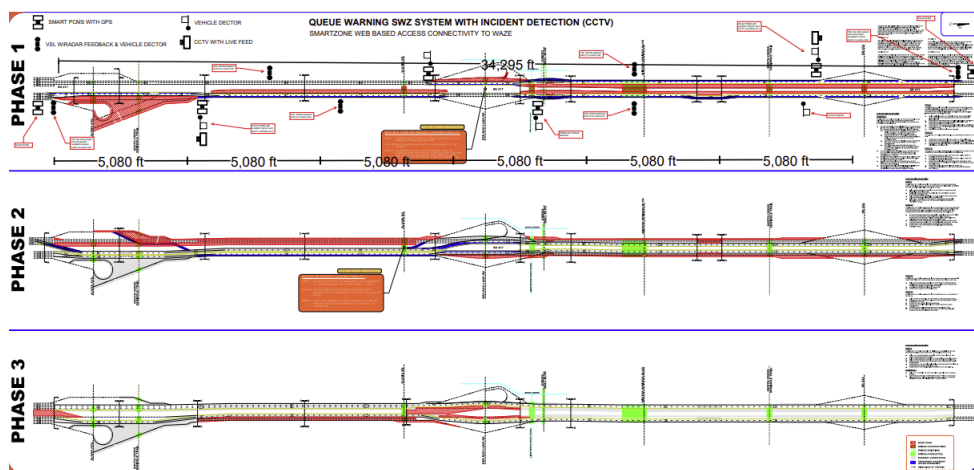


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Implementation Strategies (ground level)

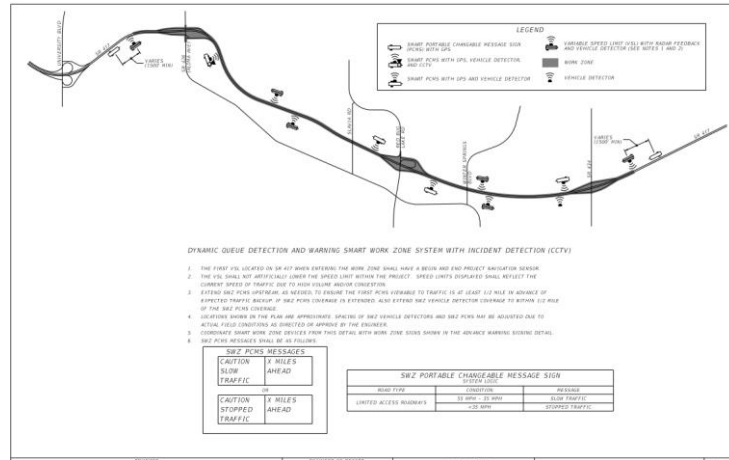


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Implementation Strategies (ground level)



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Implementation Strategies (ground level)

- RFP specifies devices and device requirements; it would be helpful to have verbiage on the Engineers intent of data collected and use of the system.
- Allow for modifications to be made through the RFM process and flexibility with contractor and vendor input.
- Number of devices should be considered, harmonize devices to reduce device count.
- Practicality of daily use vs long term deployment.

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Worker Presence Alert System: Update on SWIFTT Challenge-Winning WZ Safety Solution

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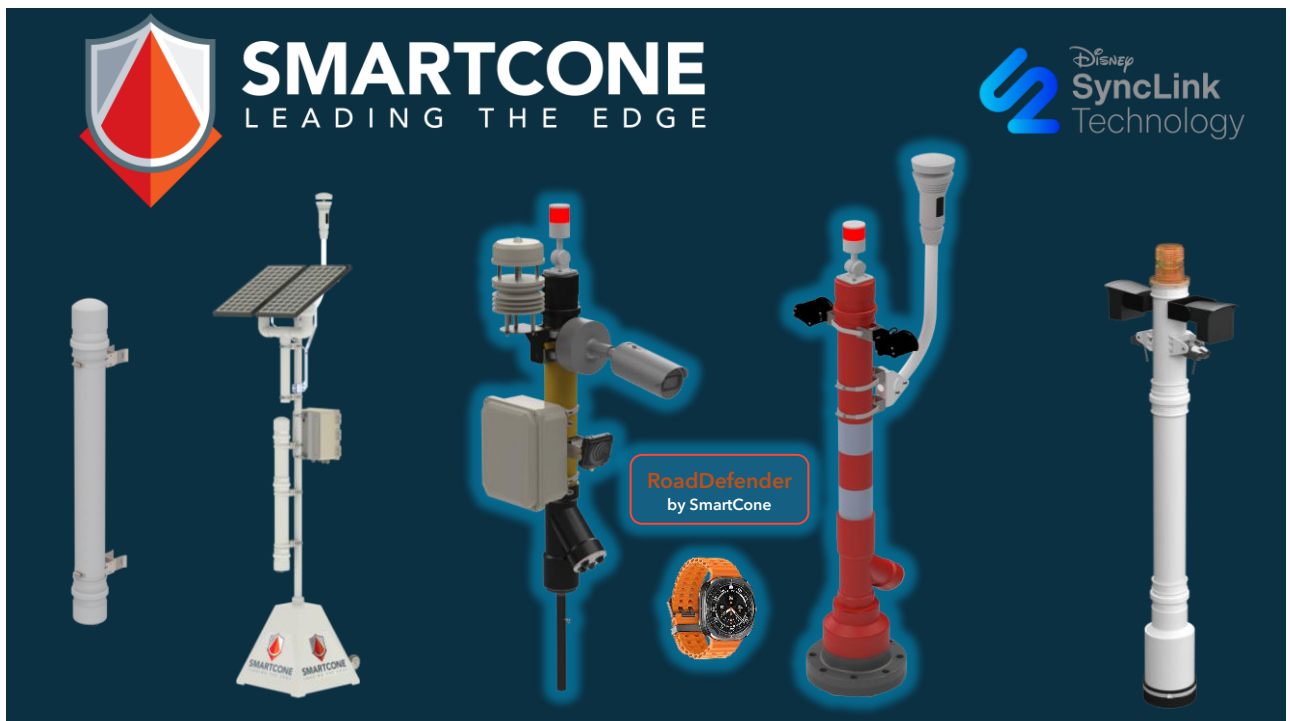
2024 SWIFTT Challenge

- 2024 Safety Work Zone innovations for Today and Tomorrow (SWIFTT) Challenge Winner
- Product will be deployed on programmed construction project within the next 24-months.

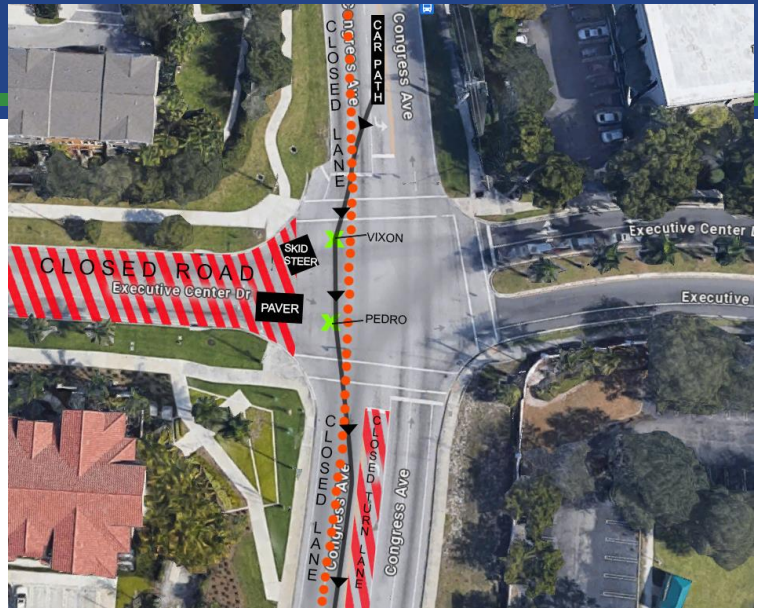
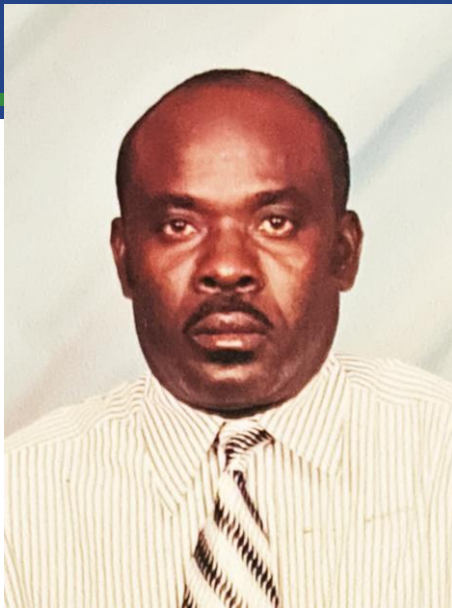
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Vixon Louis. MOT Crew Ranger Construction. **TRANSPORTATION SYMPOSIUM**

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The Problem



According to the National Highway Traffic Safety Administration (NHTSA), 80% of accidents and 60% of highway deaths are the result of distracted drivers.



Vehicle Intrusions are the leading cause of worker fatalities with the road construction industry. In 2013, there were 67,523 crashes in work zones. In 2014, there were 669 fatalities from crashes in work zones.

Why is it so hard to pay attention?

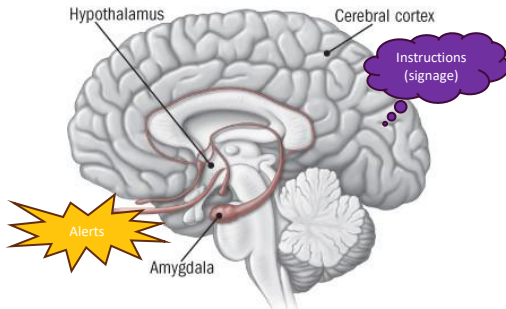
Our Bodies are
Designed to Conserve
Energy

- Muscle Memory
- Day Dreaming
- Staring off Into Space
- Distracted Driving
- Complacent Workers

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The Problem



When someone experiences a stressful event, the amygdala, an area of the brain that contributes to emotional processing, sends a distress signal to the hypothalamus. This area of the brain functions like a command center, communicating with the rest of the body through the nervous system so that the person has the energy to fight or flee.

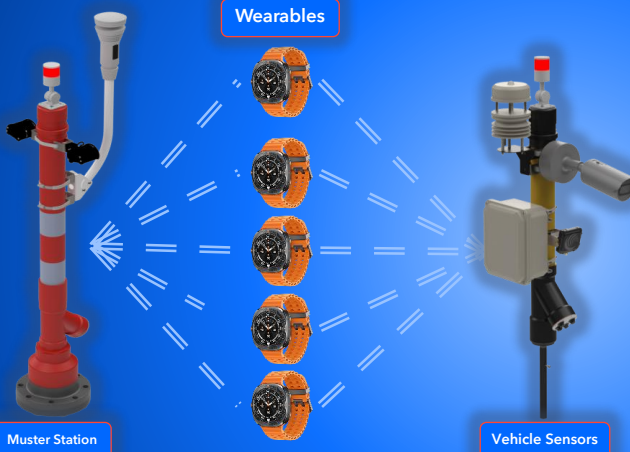
Pre-Cue, Cue, Alarm

The stress response begins in the brain (see illustration). When someone confronts an oncoming car or other danger, the eyes or ears (or both) send the information to the amygdala, an area of the brain that contributes to emotional processing. The amygdala interprets the images and sounds. When it perceives danger, it instantly sends a distress signal to the hypothalamus.

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A Solution



RoadDefender by SmartCone integrates advanced technologies and AI to proactively detect vehicle intrusions and alert workers.

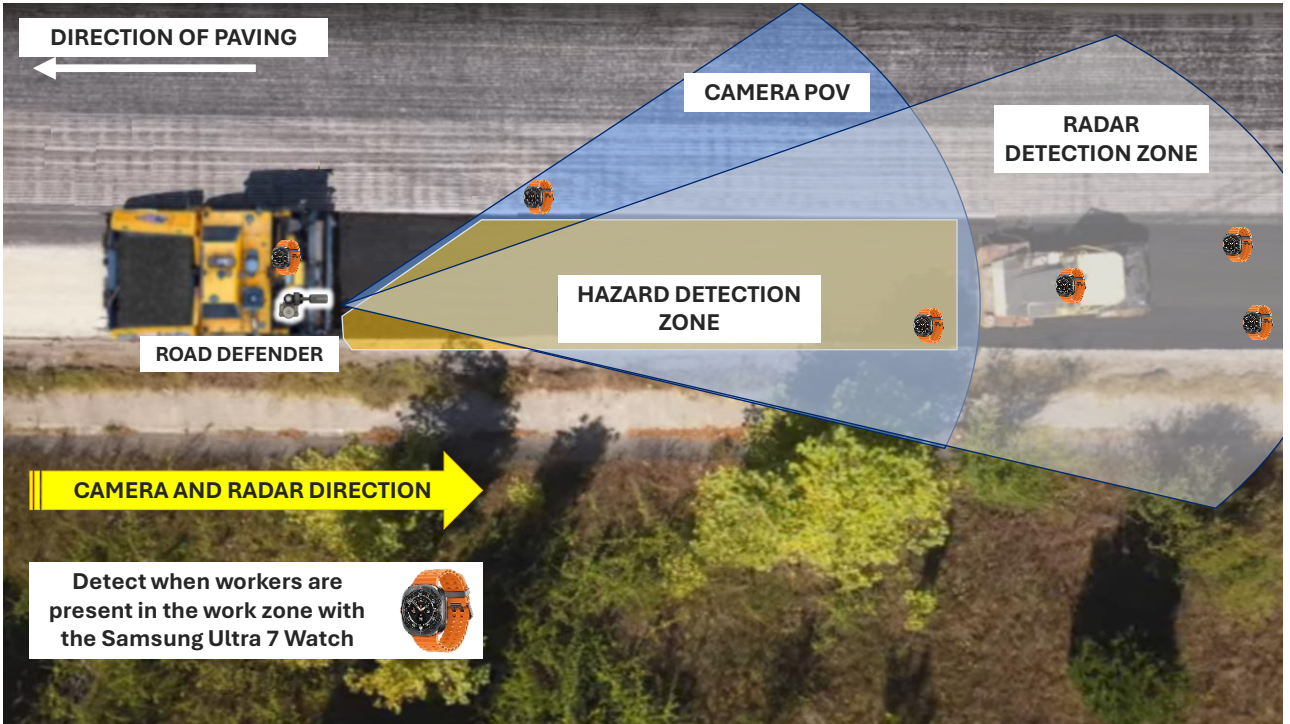
Key Features:

- **Vehicle-Mounted Sensors:** These sensors create a localized safety zone around the work area, ensuring the technology is always optimally positioned.
- **RealTime Wearables:** Workers receive immediate alerts and messages through wearable devices.
- **Muster Station:** Provides a designated safe assembly point for workers in case of emergencies.

** In The Works - Virtual Rumble Strip App for Road Users to alarm drivers of upcoming work zones when workers are present

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SMARTCONE
LEADING THE EDGE

Thank You!

Jason Lee

CEO SmartCone

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Smart Work Zone Solutions

Nagham Matout El-Zine, PE
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Market Ready Innovations

- 20 innovative solutions featured in 2025, including smart work zones solutions
- Many already deployed or piloted by state DOTs
- All are ready for market adoption.
- Designed to improve roadway safety.



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Program Overview

- The 2025 New Products Rollout (NPRO) featured 20 cutting-edge roadway safety innovations.
- Ready for market adoption and many of which have been already deployed or piloted by state DOTs.
- These innovations are designed to protect workers, motorists, and vulnerable road users, and are aligned with the national goal of zero roadway fatalities.

Innovation Award Highlights

Winner:
Safety Cloud® by HAAS Alert - Real-time digital alerts to drivers reducing crash risk by up to 90%. Deployed by over 5,000 agencies nationwide.

Honorable Mentions:

- Stripet® - AI-powered remote-controlled pavement marking removal system.
- SecurOS® SafeRt - AI-powered crosswalk dynamic lighting system enhancing pedestrian visibility.
- Work Zone Live - Cloud-based digital twin for real-time work zone mapping and alerts.

Key Trends in 2025 Entries

- AI & machine learning for predictive safety
- Smart work zone and connected vehicle technologies
- Modular, sustainable and recyclable materials
- Enhanced pedestrian and worker visibility
- Real-time data integration for proactive decision-making

2025 Innovations Saving Lives on America's Roads

Pavement Markings Innovations

Internally illuminated RPM - Solar-powered, snowplow-resistant markers

- Solar road stud light
- Comes in various colors including white and yellow
- Provides solar charging for up to 32 continuous hours of LED run time
- Improves safety and reduces damage to RPMs and supporting pavement

Markings Specification Tracker - Digital dashboard for DOT waterborne paint specs

- Electronic system of waterborne paint specifications
- Digital system for specifiers, formulators, transportation officials and contractors
- Streamlines product development
- Accelerates performance-driven innovation

Stamark 710IR Tape - Wet-reflective, high-visibility removable pavement tape

- Wet-reflective, enhanced strength tape
- Comes in black, white or yellow
- Easily removed in large sections (saving a mechanical speed)
- Maximizes internal strength for high volume, high speed applications

Stripet - AI-powered remote-controlled pavement marking removal system

- 2025 ATSSA Innovation Honorable Mention
- Remote controlled marking removal system
- System picks up markings for easy disposal
- Equipped with artificial intelligence (AI) for autonomous operation

Positive Protection Innovations

48-T Terminal - Flared, retro-reflective guardrail end

- MASH Test Level 3 flared retro-reflective end terminal
- Retro-reflective and gaging to absorb energy of impact of flare
- Reduces nuisance impacts and length of need

Ape Barrier - Lightweight composite barrier used by PA Turnpike & COOT

- Meets MASH TL-3 criteria
- Reinforced polymer design (fiberglass)
- 20-year design life
- Unit weight: 50 lbs/ft
- Inverted stacking allows transfer of 164 linear feet on one truck

Colorado Barrier - Recycled rubber barrier for low-speed zones

- Colorado barrier uses 75 to 100 recycled waste tires per barrier
- Designed for low-speed applications
- Approximately 75" deflection (MASH TL-3 Truck)
- Made from at least 100% recycled materials
- Sustainable, circular and environmentally friendly

Next Generation Terminal (NGT) - Non-gating, high-speed guardrail end

- MASH Test Level 3 non-gating guardrail end terminal
- Sections collapse together on impact
- 37' of total terminal length
- Designed to alleviate the need for the clear runout area

NOVUS 100 - Reusable crash cushion for permanent and temporary use

- MASH Test Level 3 crash cushion
- Designed with maintenance and repair in mind
- 27' length, 10" width, 34 1/2" height
- Requires 32 anchors

TALL42 - Movable concrete barrier for managed lanes

- Uses a barrier transfer machine to reposition barrier
- Easily repositioned while providing protection from large trucks
- MASH TL-3 deflection > 37"
- Successfully tested to MASH test level 4 criteria

Toucan City Barrier - Urban pedestrian protection system

- Designed for urban applications
- MASH Test Level 2 device
- Made of concrete, steel and rubber material
- 35-inch height
- Force panel addition reaches to 7 feet in height

Temporary Traffic Control Innovations

Guardian Smart Sign - Remote sign monitoring to reduce liability

- Sensor attaches to the back of a sign on a portable stand
- Information captured electronically can be used to maintain the work zone signage
- Records and archives data for future use (as needed)

Residential Driveway Signal - Directional alerts for driveway exits

- Recent FHWA Interim Approval
- RTTS controls side street traffic within work zones
- Device connects to PIS on both ends of a one-lane, two-way connection
- Controls traffic through directional signal indicators
- Enhances safety for motorists entering the traffic stream

Traffic Pro Trailer - Safer, more efficient TTC device deployment

- Truck bed and trailer systems designed for worker safety
- Minimizes installation and removal of devices water and safer for workers
- Truck bed and trailer system reduces fatigue and prevents pinches, strains, and soft tissue injuries
- Trailer can shield the work site

SIVEA Barrier - Urban barrier with sound and debris panel options

- Designed for urban applications
- 32" tall concrete barrier with steel frame
- May be enhanced using sound panels and fencing on top
- Includes drainage opening and lifting points

Worker & Road User Safety Innovations

Bolt Spider - Tool for safe, spark-free guardrail bolt removal

- Attaches to guardrail on traffic side to stabilize seized bolts for removal
- Improves worker safety
- Keeps guardrail sections intact for reuse
- Reduces saw-related fumes, fuel spills and discarded blades

Safety Cloud - Real-time digital alerts to drivers via VMS, Apple Maps and infotainment systems

- 2025 ATSSA Innovation Award winner
- Provides information to motorists 20 to 30 seconds prior to reaching an incident location
- Uses the V2X platform (vehicle-to-everything)
- Reduces hard braking and speed variability conflicts

SecurOS SafeRt - AI-powered crosswalk dynamic lighting system deployed in CA, FL, TX

- 2025 ATSSA Innovation Honorable Mention
- Draws driver attention to pedestrians
- Used on both signalized intersection crosswalks and mid-block crossings
- AI detects and analyzes pedestrian patterns

Work Zone Live - Cloud-based digital twin for real-time work zone mapping and alerts

- Connects work zone signage to a dashboard for management and real-time information to users
- Enhances worker safety through established boundaries and real-time alerts

Zone Command - AI camera system warning workers of imminent collisions

- Detects vehicle trajectories using AI
- Calculates potential risks using video data
- AI determines if mapping distance is not achievable based on vehicle location
- Sound alarm and activates colored flashing arrows on vehicles

Watch playlist of all NPRO 2025 entries
(or scan code next to product images for individual video)

2025 NPRO Summary Report and Recap Video

NPRO Program Information and 2026 Application

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Safer Roads Save Lives

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Resources

**2025 NPRO
Summary Report:**



**NPRO Resources
Webpage:**



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