

# Introducing...

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Work Zones and Dynamic Message Signs

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# Technologies to Improve SSP

- The AWARE Vehicle Intrusion Detection and Warning System
- Connected Vehicle Applications
- Upcoming Vehicle Lighting Research



# **AWARE** (Advanced Warning and Risk Aversion)

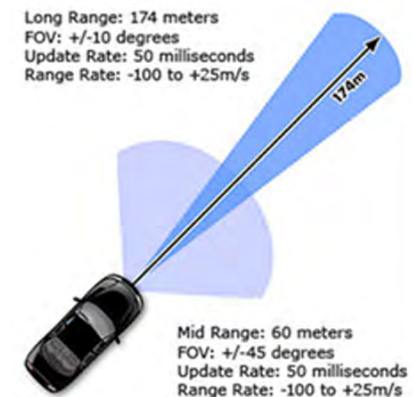
- Utilizes advanced radar-based detection and tracking technology of approaching vehicles
- Monitors vehicle trajectories
- Monitors worker locations



# AWARE Components – “Raven” Radar Unit



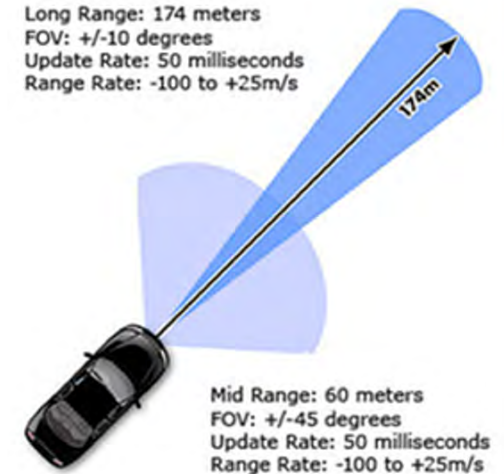
- Vehicle/equipment mounted
- Advanced radar detection and tracking
- “Learns” proper vehicle trajectories
- Deviations from proper trajectories activate alarms



# AWARE Components – “Raven” Radar Unit



Long Range: 174 meters  
FOV: +/-10 degrees  
Update Rate: 50 milliseconds  
Range Rate: -100 to +25m/s



# AWARE Components – Driver Warnings

- LED flashing lights
- Audible alarm





# AWARE Components – Worker Warnings

- Audible alarm
- “Worktrax” – Audible and haptic worker-worn devices



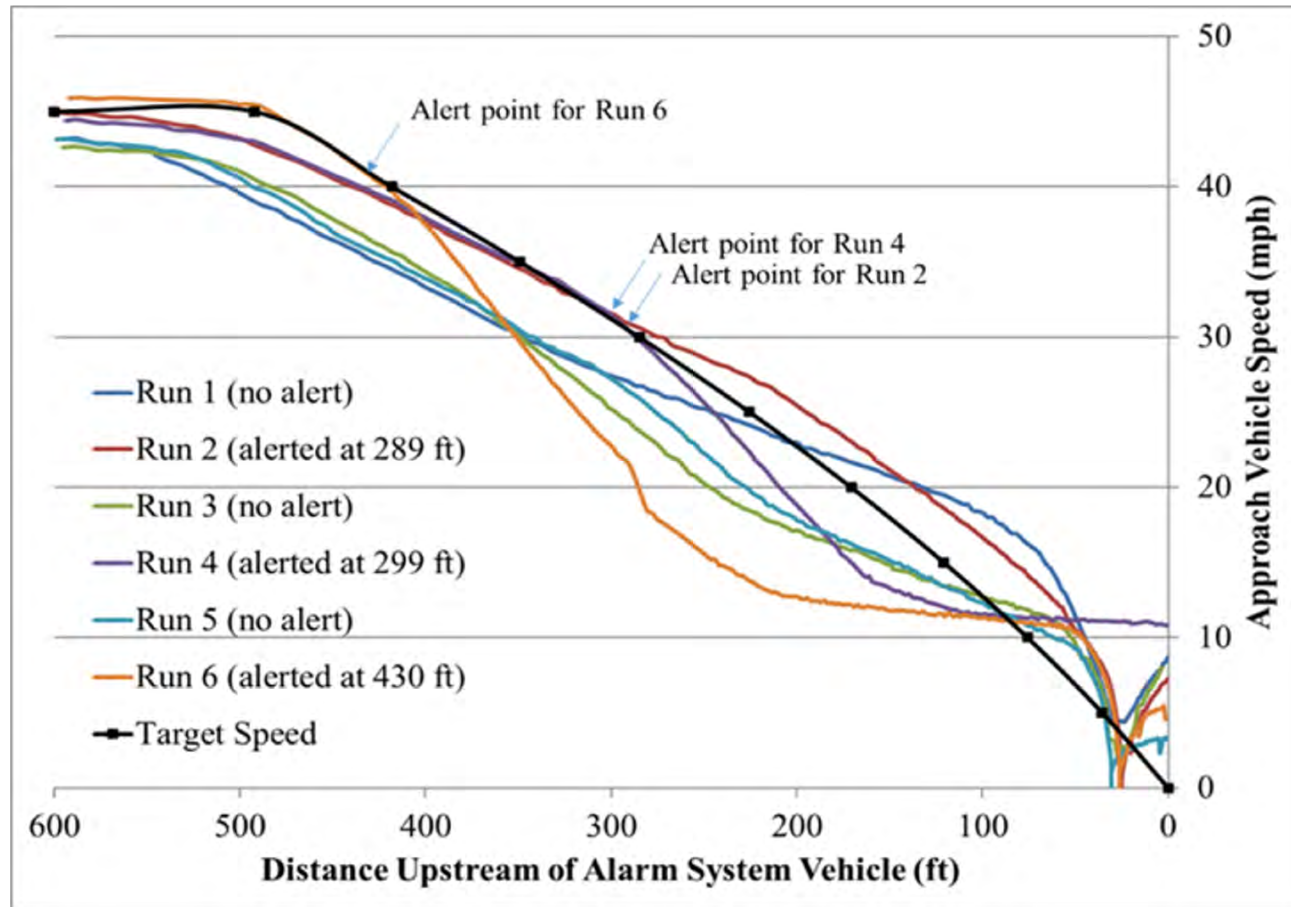
# AWARE Evaluations

- System performance testing
  - High detection rates
  - Low false alarm rates (depending upon configuration)
- Human factors testing
  - No erratic behaviors
  - Potential confusion about alarm
- Ongoing Oldcastle beta-testing
- MnDOT evaluation Summer 2018

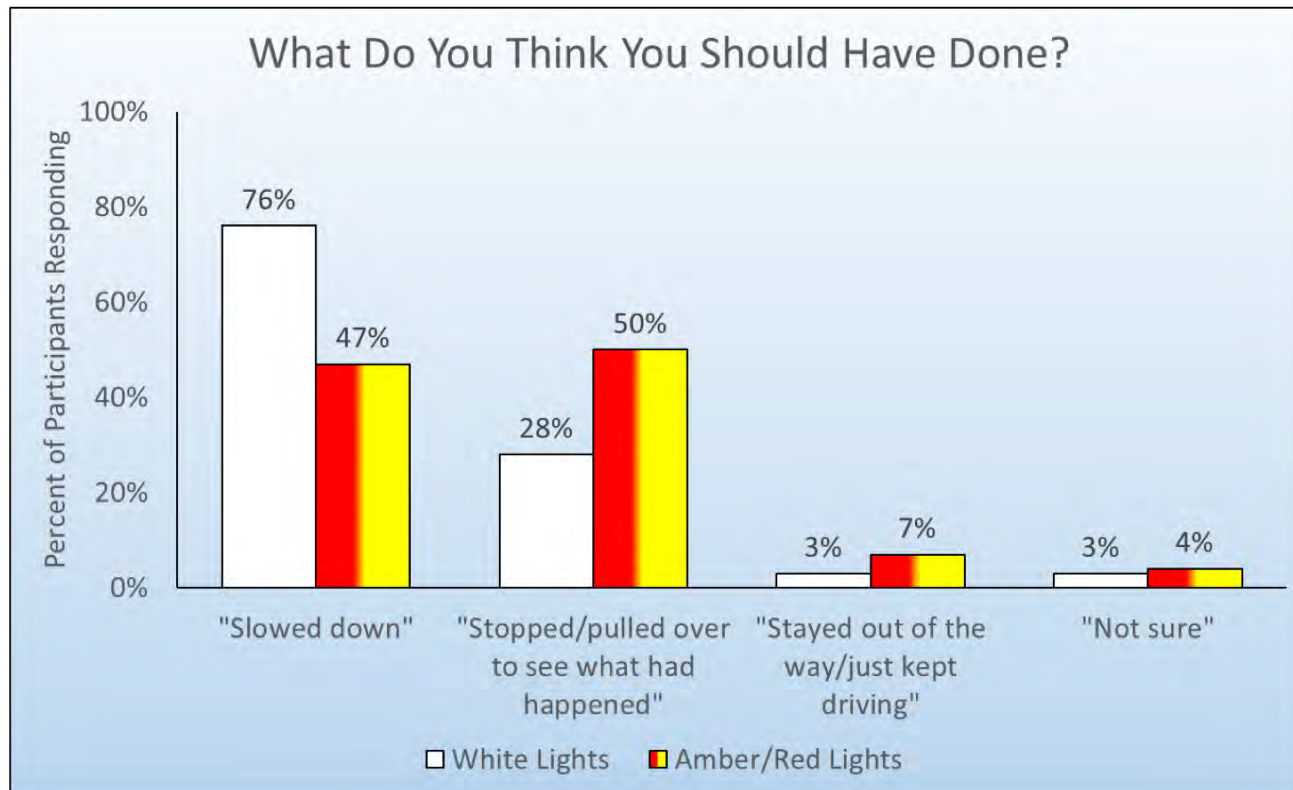




# AWARE Evaluations



# AWARE Evaluations



# Connected Vehicle Applications

- USDOT Connected Vehicle Reference Implementation Architecture (CVRIA)
  - Incident Scene Pre-Arrival Staging Guidance for Emergency Responders
  - Incident Scene Work Zone Alerts for Drivers and Workers
  - Emergency Vehicle Alerts
  - Warnings about Hazards in a Work Zone



# US DOT CVRIA

- Incident Scene Pre-Arrival Staging Guidance for Emergency Responders
- Incident Scene Work Zone Alerts for Drivers and Workers
- Emergency Vehicle Alerts



# Incident Scene Pre-Arrival Staging

- Provide situational awareness and coordination of emergency responders
- En-route guidance
- Staging area coordination
- Emergency vehicle status monitoring



# Incident Scene Work Zone Alerts

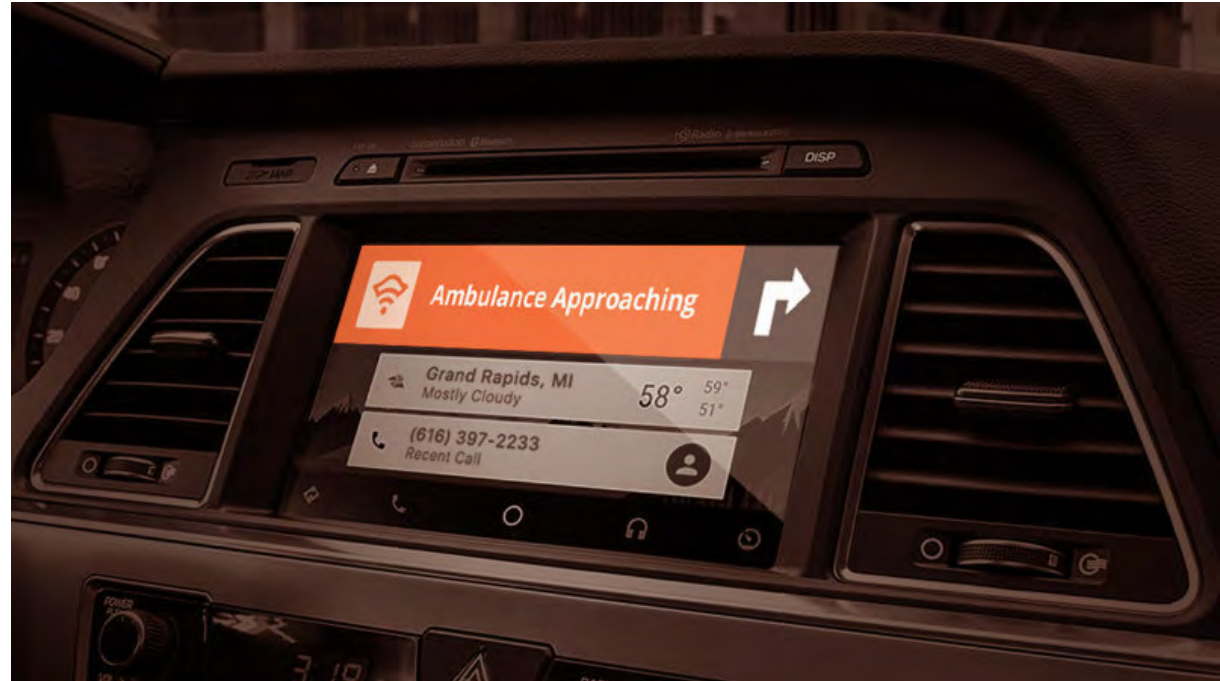
- Warnings to approaching drivers about merging, speed reduction needs, other alerts
- Warnings to on-site personnel about unsafe approaching vehicle behavior (excessive speeds, distraction/drowsiness, intrusion trajectory, etc.)





# Emergency Vehicle Alerts

- In-vehicle warnings to drivers about emergency vehicle locations and movements



# Vehicle Warning Light/Conspicuity

- NCHRP 05-24, Guidelines for Vehicle and Equipment Color, Markings, and Lighting
  - May 2018 to October 2020 (approx.)
  - Consider interactions between vehicle color, types and patterns of conspicuity markings, and flashing warning light colors and patterns
  - Follow-on to NCHRP Report 624



# Questions?

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