

Safer Streets, Smarter Signals

Improving Emergency Response
with Connected Signal Preemption
for First Responders



Panasonic

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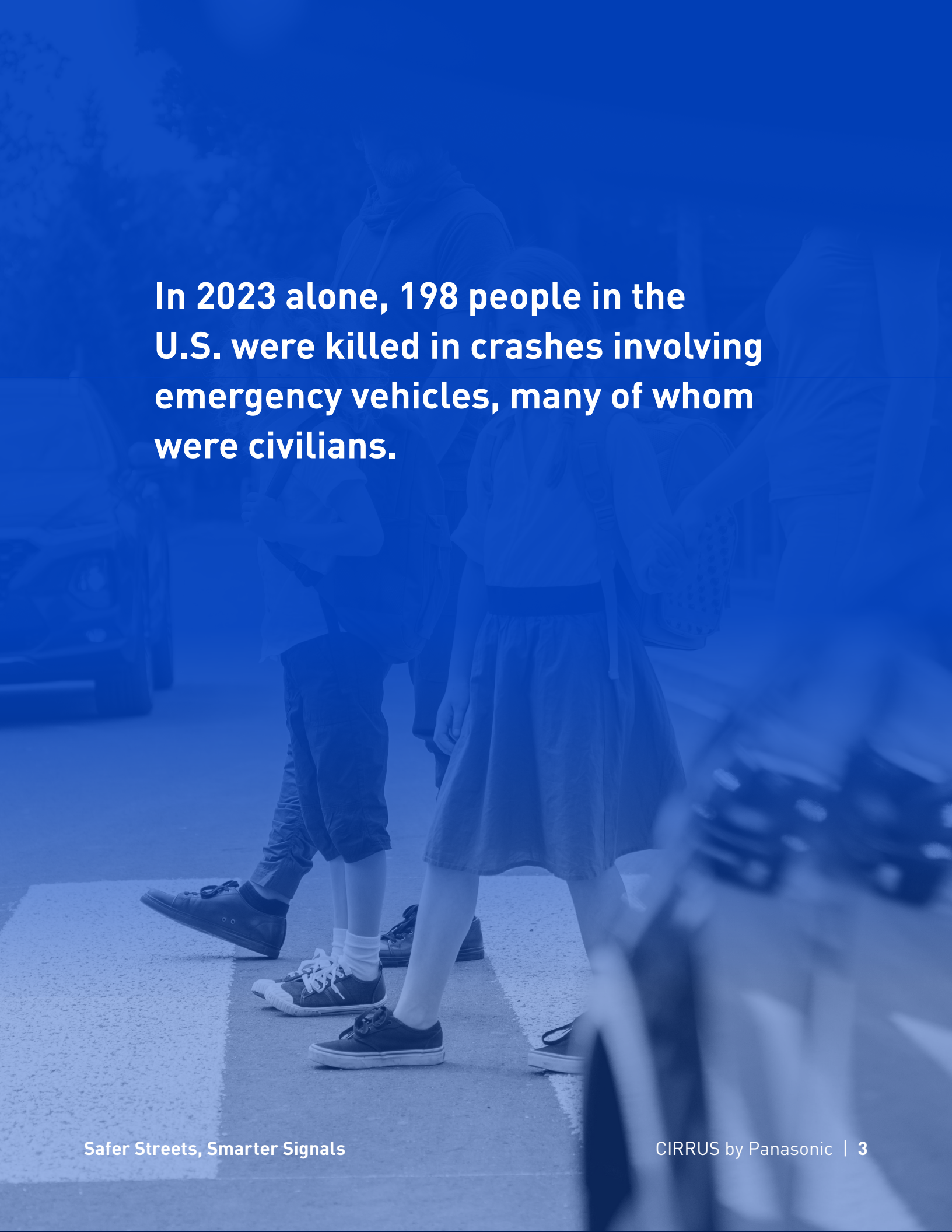
Improving Emergency Response with Connected Signal Preemption for First Responders

For emergency responders, the journey to a scene can be one of the most dangerous parts of the job. A considerable number of firefighter, police, and emergency medical service (EMS) line-of-duty injuries and fatalities result from motor vehicle crashes and other roadway incidents.^{1,2,3} In 2023 alone, 198 people in the U.S. were killed in crashes involving emergency vehicles, many of whom were civilians.⁴

One proven way to improve emergency vehicle safety is through signal preemption: a traffic control strategy that temporarily overrides normal traffic signal operation to favor emergency vehicles at intersections.⁵ When signal preemption is granted, traffic signals adjust phases to create a clear path – extending green lights, shortening red phases, or reordering the signal cycle. These adjustments can help reduce emergency response times and the risk of collisions.⁶

This approach, often referred to as Connected Intersection Preferential Treatment (CIPT), builds on more than a decade of connected vehicle research and pilot deployments. While the core concept of signal preemption is well established, recent innovations, including cloud-based signal control and digital traffic system modeling, have improved its scalability and reliability.

Panasonic's CIRRUS platform strengthens this safety strategy by surfacing and contextualizing key operational data captured through vehicle-to-infrastructure (V2I) communications between emergency vehicles and traffic management systems.⁷ By integrating with existing onboard and roadside systems, CIRRUS provides emergency response agencies with real-time visibility into signal preemption activity to monitor performance, support better decision-making, and promote safer travel.



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Real-World Results:

How Signal Preemption Improves Safety

Panasonic's Smart Mobility Office analyzed emergency vehicle activity at CIRRUS-connected intersections within a deployment region of a Western U.S. state. The study, covering January 1 to May 31, 2025, focused on ambulances and fire trucks requesting signal preemption in designated corridors.

The findings were compelling:

49%

Without preemption, emergency vehicles ran red lights 49% of the time.

24%

With preemption, that rate dropped to just 24%.

50%

This represents a roughly 50% **relative reduction** in red-light violations when preemption was granted.

Additional analysis showed this trend was consistent across both fire and ambulance vehicles, with CIPT reducing red-light running rates by similar margins for each vehicle type.

Furthermore, emergency vehicles that ran red lights did so at significantly lower speeds compared to those that did not, suggesting these maneuvers were cautious and calculated, rather than impulsive or reckless. Time-of-day factors, including rush hour and weekend periods, had no significant impact on red-light violation rates, underscoring the primary influence of CIPT status on driver behavior and intersection safety.

From Insight to Action

Emergency response agencies nationwide are under increasing pressure to deliver faster, safer service with fewer resources. CIRRUS helps meet this challenge by offering agencies a unified interface to monitor, evaluate, and optimize signal preemption performance. This approach aligns with broader research into connected vehicle strategies for emergency response.⁸

The study referenced here found that emergency vehicles granted preemption were half as likely to run red lights – highlighting the potential of connected signal systems to reduce risk and uncertainty at intersections. CIRRUS equips agencies with the insight and tools to further strengthen responder safety, reduce liability, and build public trust. With more actionable data on how preemption affects driver behavior, agencies can optimize their operations and drive measurable improvements in emergency response and intersection safety.

¹ U.S. Fire Administration, *Annual Report on Firefighter Fatalities in the United States* (Washington, DC: U.S. Department of Homeland Security, 2022). <https://www.usfa.fema.gov/statistics/reports/firefighters-departments/firefighter-fatalities.html> (accessed June 9, 2025).

² National Law Enforcement Officers Memorial Fund, “2024 Law Enforcement Fatalities Report Reveals Law Enforcement Deaths Increased.” <https://nleomf.org/2024-law-enforcement-fatalities-report-reveals-law-enforcement-deaths-increased/> (accessed May 14, 2025).

³ National Highway Traffic Safety Administration, *Analysis of Ground Ambulance Crash Data from 2012 to 2018*, Report No. DOT HS 813 480 (Washington, DC: U.S. Department of Transportation, 2023). <https://rosap.nhtl.bts.gov/view/dot/68225> (accessed May 14, 2025).

⁴ National Safety Council, “Emergency Vehicles – Injury Facts.” <https://injuryfacts.nsc.org/motor-vehicle/road-users/emergency-vehicles/> (accessed May 15, 2025).

⁵ U.S. Department of Transportation, Federal Highway Administration, “Giving First Responders the Green Light: Emergency Vehicle Preemption Speeds TIM Response,” *Innovator*, no. 99 (November–December 2023). https://www.fhwa.dot.gov/innovation/innovator/issue99/page_03.html (accessed June 2, 2025).

⁶ U.S. Department of Transportation, Federal Highway Administration, *Next-Generation Traffic Incident Management* (Washington, DC: FHWA Operations, 2024). <https://ops.fhwa.dot.gov/publications/fhwahop24019/fhwahop24019.pdf> (accessed June 2, 2025).

⁷ Panasonic Smart Mobility Office, “The V2X Intersection: Vehicle Priority and Preemption.” <https://mobility.na.panasonic.com/v2x-intersection> (accessed June 1, 2025).

⁸ National Academies of Sciences, Engineering, and Medicine, *Impacts of Connected, Automated Vehicle Technologies on Traffic Incident Management Response* (Washington, DC: The National Academies Press, 2023). <https://nap.nationalacademies.org/read/27655> (accessed June 1, 2025).



About CIRRUS by Panasonic

CIRRUS by Panasonic is a division of the Panasonic Corporation of North America's Smart Mobility Office. Formed in 2017, our connected vehicle applications are among the first to shift signal priority applications from legacy hardware units to cloud technology.

The CIRRUS platform enables instant and safe communication between vehicles, infrastructure, intersections, and the operations teams who manage them. Our optimized, patent-pending algorithms incorporate data from edge devices, external systems, and cloud products for a scalable, complete, end-to-end solution. Learn more at <https://mobility.na.panasonic.com/CIRRUS>.

About the Author

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Candace Smith is a quantitative researcher in Panasonic's Smart Mobility Office, where she focuses on the impact of connected vehicles on roadway mobility and safety. With over 10 years of experience, she has led research and analytics projects across the state government, energy, and transportation sectors. Candace holds a Ph.D. in sociology, with an emphasis on quantitative research methods, from the University of Oklahoma