



Emergency Vehicle Traffic Signal Preemption

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Photo: Courtesy of Natalie Villwock-Witte, WTI

Description: Traffic signal preemption interrupts normal traffic signal operation to allow an emergency vehicle the right-of-way. Traffic signal preemption reduces the disruption or slowing down of emergency vehicles responding to a call. It also halts traffic moving through an intersection that could conflict with the responding emergency vehicle and cause additional safety concerns.

There are several types of signal preemption systems: light-based, infrared-based, sound-based, Global Positioning Systems (GPS)-based (see [#OM3](#)), and radio-based emitter/detector systems. Signal preemption is also used for other situations, including giving priority signals for transit or switching a traffic signal at a highway-rail intersection (see [#CC6](#)) when a train is approaching.

Rural Transportation Critical Needs

- Crash Countermeasures
- Emergency Services
- Operations & Maintenance
- Rural Transit & Mobility
- Surface Transportation & Weather
- Tourism & Travel Information
- Traffic Management

Issues Addressed

- Emergency service notification time
- Emergency service response time
- Communications between multi-jurisdictional/multi-agency emergency service personnel

Strategies Achieved

- Road User
- Road
- Vehicle
- Safety Culture
- Engineering
- Emergency Response
- Enforcement
- Education





Applicability

- Traffic signal preemption for emergency vehicles is important for rural areas where response times are longer. Signal preemption will allow for these vehicles to have fewer disruptions while responding to a call.

Partnerships

- Applications benefit from collaboration among numerous agencies, which may include:
 - Departments of transportation (local, state, federal)
 - First responders
 - Local hospitals

Key Components

- Vehicle equipped with signal transmitter
- Signal detector (light-based, infrared-based, sound-based, GPS-based and radio-based emitter/detector)

Examples of Implementation

- **City of Savannah, Georgia**

The City of Savannah, Georgia installed radio-based GPS traffic signal preemption along a congested corridor. This [preemption system](#) reduced the average EMS response times by five to seven minutes.

- **City of Bismarck, North Dakota**

The City of Bismarck, North Dakota plans to add [snow plows to its emergency preemption system](#) to decrease plow times along emergency routes. The system will continue to give emergency service vehicles priority but will allow plows to quickly clear emergency routes so that the public can travel more safely.





Implementation Considerations (Pro)

- Signal preemption allows an emergency vehicle to safely travel through an intersection while responding to a call.
- Reduces response times.
- Reduces the number of emergency vehicles involved in crashes.

Implementation Considerations (Con)

- Drivers of emergency vehicles may be too confident when passing through an intersection – they should still make sure the intersection is clear before proceeding.
- This tool disrupts normal traffic flow, which may result in congestion.
- Light-based transmitters/detectors require a clear line of sight to work.
- Some agencies have concerns with hackers taking control of preemption or other illegal uses.

Opportunities for Future Expansion

- With vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) technology, traffic signal preemption can occur automatically without the need for the driver to activate the equipment. The signal preemption could also broadcast this information to other drivers to alert them of an approaching emergency vehicle.
- Traffic signal preemption could be used for other vehicles in addition to those for emergency services. Public works agencies could use traffic signal preemption to allow snowplows to quickly respond to snowy weather conditions. Traffic signal preemption could also be used for transit vehicles to keep transit services on schedule.

Additional Resources

- *Traffic Signal Preemption for Emergency Vehicles – A Cross-Cutting Study*, found here: http://ntl.bts.gov/lib/jpodocs/repts_te/14097_files/14097.pdf
- *Emergency Vehicle Preemption, State of the Practice Study*, found here: https://www.azmag.gov/Documents/ITS_2016-03-25_Emergency-Vehicle-Preemption-Best-Practices-Study.pdf





Useful Tip

To reduce costs an agency can choose to install these systems along specific routes where periodic congestion (e.g. during peak summer tourism season) or special events occur.

Cost Range

(Cost/financial information, where noted, is based on 2016 dollars (unless otherwise specified). Cost/financial information is estimated, and will vary based on size and scope of project, number of units, etc. In general, capital costs include initial purchase costs of hardware, software, and other required equipment. Maintenance and operations costs include staff time to operate, monitor and maintain systems; data collection; system upgrades; evaluation; etc.)



Capital Costs: The total capital cost for this tool is low (less than \$50,000). The cost to install a detector, phase selector, and system software is estimated at \$6,391¹. The cost to install a signal preemption emitter on a vehicle is estimated at \$1,024².



Operations Costs: The operations and maintenance costs for this tool are low (less than \$50,000). The operations and maintenance costs for a detector, phase selector, and system software are \$1,362¹.

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