



# Emergency Management

## ITS Benefits, Costs, and Lessons Learned: 2017 Update Report

### Emergency Management

#### HAZMAT Management

#### Emergency Medical Services

#### Response and Recovery

#### Highlights

- Results from research that tested the effects of transit signal priority on emergency evacuation clearance times show significant time savings.
- Tools and operational strategies that help manage traffic operations can be used in emergency operations for the purpose of increasing traffic capacity on evacuation routes and responding to traffic incidents that block traffic that can hinder the evacuation effort.
- Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E) applications utilize real-time connected vehicle data to improve traffic safety and mobility during crashes and other emergencies that affect the highway network.



## Introduction

*This factsheet is based on past evaluation data contained in the ITS Knowledge Resources database at: [www.itskrs.its.dot.gov](http://www.itskrs.its.dot.gov). The database is maintained by the U.S. DOT's ITS JPO Evaluation Program to support informed decision making regarding ITS investments by tracking the effectiveness of deployed ITS. The factsheet presents benefits, costs and lessons learned from past evaluations of ITS projects.*

In the United States every year, there are hundreds of events requiring emergency services including evacuations from tropical storms, hurricanes, tornadoes, and hazardous materials (HAZMAT) incidents. In order to improve safety and minimize loss of life, prompt action is required from multiple agencies before, during, and after each event. Responders must reach the scene, victims must be evacuated, and clearance and recovery resources must arrive on time. Smaller scale emergencies occur each day in communities across the nation, requiring emergency responders to travel quickly and safely to fires, traffic crashes, or crime scenes. ITS applications for emergency management aim to improve public safety by giving agencies the tools and equipment they need to plan for and implement response actions quickly and efficiently. In addition, good data analytics are important for performing analyses and understanding emergency management trends so that additional problems can be solved.

The ITS Knowledge Resources provide benefits, costs, and lessons learned information about the state of the art and the adoption of effective technologies by the emergency management community and its customers. This information includes private, public, and network-based benefits that can assist deployers with a greater understanding of resources available and implementation of useful technologies. The following information provides a sampling of the emergency management evaluation data that is included in the ITS Knowledge Resources.

**In Washington DC, allowing transit vehicles priority during a no-notice emergency evacuation resulted in a 26 percent time saving for transit buses without impacting personal vehicle travel time.**

## Benefits

A 2011 report provided results from research that tested the effects of transit signal priority on emergency evacuation clearance times and the results showed significant time savings.

The study area was a 14-intersection corridor located in the Southeast corner of Central Washington, DC (NW 7th Street from SW E Street (South) to NW Pennsylvania Ave, West to NW 12 Street). The corridor encompasses a major metro station in the city (L'Enfant Plaza), and is one of the 19 major corridors designated as a primary evacuation route to assist in the evacuation process. The scenario was the detonation of a dirty bomb at L'Enfant Plaza, setting in motion the city's emergency evacuation response.

The methodology used a microscopic traffic simulation of an evacuation environment merged with a transit operations and signal priority component. The evacuation environment consisted of socio-economic data, census data and regional evacuation data, and the transit operations and signal priority component was built from data on street geometry, signal timing data, traffic counts and transit information (schedule, stop location, dwell time, etc.). These models generated an evacuation origin destination (O-D) matrix to create a realistic emergency evacuation traffic model with measures of effectiveness (MOEs) including travel time, evacuation clearance time, and delay time. The simulation network included 17 of the 34 bus lines within the borders of the study area. The bus lines not included were those that do not require priority (right hand turns only) or do not use more than one intersection within the study corridor.

Allowing transit signal priority during the evacuation resulted in a 26 percent time savings for transit buses, meaning that three prioritized vehicles accomplish the same as four would without priority. The 26 percent time savings enables more transit units to make additional trips, resulting in shorter evacuation times. The results also found that the time saving is achieved without having an impact on evacuation clearance times or evacuee travel times for non-transit vehicles. Moreover, when transit signal priority is restricted to operate only on evacuation routes, evacuee travel and delay time decreases (in contrast to previous studies that found transit priority results in delays to vehicular traffic during high roadway demand) ([2012-00784](#)).

## Costs

The I-95 Corridor Coalition of states in the northeastern U.S. work together on initiatives to improve highway travel. The Coalition published a report in 2010 documenting one initiative to improve the collection and accuracy of crash data because of the importance of this data to many agencies including departments of transportation, law enforcement, and emergency services for both planning and operations based decision making. The Crash Data Reporting Methods (Final Report) provides data on crash reporting practices for the 17 states in the coalition. One of many examples provided in the report is the implementation of a crash data system in Virginia with results shown below in Table 1 ([2013-00280](#)).

**Table 1: Virginia Crash Data System Costs.**

<b>Component</b>	<b>Cost</b>
Fees for a consulting team to plan, design, develop and implement a new Traffic Records Electronic Data System (TREDS) (estimated 2006-2009)	\$2 million
TREDS software, system maintenance, and training to begin the design of comprehensive traffic records automated system	\$116,462
Cost to reduce the backlog of crash reports in the TREDS crash database and subsequently, its roadway database	\$66,000
Cost to change, reprint, and distribute the Model Minimum Uniform Crash Criteria (MMUCC) compliant, scannable police crash form	\$37,000
Provide statewide train-the-trainer training on the new FR300 Police Crash Report to over 400 local and state law enforcement trainers	\$20,000
Staff to perform database programming modifications in the State's crash database and Centralized Accident Processing System (CAP) to enable collection of new fields and attributes from the new FR300P	\$26,737
<b>TOTAL</b>	<b>\$2.27 million</b>

## Lessons Learned

**Utilize transportation tools in communications, traffic control, and monitoring and prediction to maximize the ability of the highway network to support evacuation operations.**

There are a multitude of transportation tools that can support evacuation operations in emergencies with advance notice. As the agency responsible for emergency management develops emergency response plans, it is useful to review the array of transportation tools available for support in emergencies. For example, transportation tools for communicating with the public can support emergency management's effort in communicating evacuation orders to the public. Similarly, tools that help manage traffic operations can be used in emergency operations for the purpose of increasing traffic capacity on evacuation routes and responding to traffic incidents that can harm the evacuation effort by blocking traffic. As the evacuation is ongoing, emergency management can use monitoring/predicting tools for monitoring conditions and predicting outcomes. These tools can improve the response team's situational awareness of the progress of the evacuation, help identify potential problem areas and determine optimal evacuation routes. Perhaps the most important message is that governments need a variety of tools at their disposal and the ability to choose which to use in an evacuation. The transportation tools listed below are identified by the FHWA as having potential to support emergency evacuations with advanced notices.



- **Communication Tools.** A critical element in emergency evacuations is the ability for emergency response officials to communicate to all segments of the population in the evacuation zone.
- **Traffic Control Tools.** The efficient and safe management of the highway network is a critical component of successful emergency evacuations. Traffic control tools can be used to manage highway operations in controlling traffic, assessing levels of congestion, responding and clearing incidents and optimizing traffic flow.
- **Assessment Monitoring and Prediction Tools.** The transportation community has generated advanced computerized modeling tools that can be used in evacuation planning and operations to predict weather, estimate losses and damages from weather events, evaluate evacuation plans and model traffic scenarios.

These tools can improve evacuation operations in communications, traffic control, and assessment and monitoring. They can be used in the readiness, activation and operations phase of the evacuation. To be used as effectively as possible, evacuation plans should identify which tools are available in the jurisdiction and how they can be used most effectively. By planning ahead, emergency management can use transportation tools to improve the safety, mobility, and efficiency of emergency evacuations with advance notice ([2008-00461](#)).

## Case Study – R.E.S.C.U.M.E.

Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E) is a bundle of dynamic mobility applications (DMA) that utilizes real-time connected vehicle data to improve traffic safety and mobility during crashes and other emergencies that affect the highway network. The following component applications have been studied to assess the potential benefits of leveraging wireless connectivity, center-to-center communications, and center-to-field communications to solve problems faced by emergency management agencies, emergency medical services (EMS), public agencies, and emergency care givers and persons requiring assistance.

- **Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG)** applications use real-time modeling outputs, satellite imagery, GIS data, and current weather data at dispatch centers to improve emergency responder routing, staging, and secondary dispatch decisions.
- **Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE)** applications use portable roadside detection systems, wireless communications, and in-vehicle messaging systems to provide drivers with merging and speed guidance as they approach work zone control areas. Audible alarm systems can also be integrated into worker handset radios and maintenance vehicle horn systems to alert workers if a vehicle is detected approaching the work zone at an unsafe speed or trajectory.
- **Emergency Communications and Evacuation (EVAC)** applications use traveler information systems to provide travelers with information on traffic and road conditions and the location of available lodging, fuel, food, water, cash machines, and other necessities required to plan an evacuation. By providing this information, EVAC strives to enable evacuees to reach destinations faster, reduce overall congestion and delay, and reduce the number of stops required for refueling.

## Key Findings

Simulation studies of RESP-STG and INC-ZONE applications performed on an 8.5-mile section of US 101 in San Mateo County, California showed that for long incident scenarios, incident scene guidance alerts through connected vehicle applications can reduce network delay by up to 14 percent and decrease travel time for emergency vehicles by up to 23 percent ([2015-01048](#)).

A simulation study that evaluated EVAC operations as if connected vehicle systems were in place during the Katrina evacuation of New Orleans in 2005 revealed that EVAC has the potential to reduce congestion by approximately 20 percent during major evacuation operations that involve large metropolitan areas ([2015-01047](#)).

## References

Data referenced is available through the ITS Knowledge Resources Database, which can be found at <http://www.itsknowledgeresources.its.dot.gov/>.