

Traffic Safety Facts

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Technology Applications for Traffic Safety Programs: A Primer

This document explores how emerging digital and communications technology can advance safety on the Nation's highways. The range of technology described in this report is available or will be available in the near future to improve traffic safety. As new traffic safety applications become widespread and implementation costs decrease, there could be a network of advanced systems that improve traffic safety by providing information and services to drivers, traffic operations agencies, emergency management services personnel, and law enforcement professionals.

Technologies

Electronic communications is the key to traffic safety technologies. Types of communications systems and example applications include:

- Vehicle to driver, in which the vehicle communicates information to drivers when predetermined criteria are met, such as if a vehicle drifts out of its lane.
- Vehicle to vehicle, which enables communication among vehicles for such applications as crash avoidance technologies and allowing law enforcement officials to acquire identification information about a particular vehicle.
- Vehicle to and from roadside, in which roadside communications devices send and receive message to and from passing vehicles. The most common application of this technology is electronic toll collection, but there are many potential traffic safety applications.
- Vehicle to and from traffic and emergency management centers, including such applications as automatic crash notification that notifies an emergency management center when a vehicle has been involved in a crash.

Haddon Matrix

The Haddon Matrix is a useful construct to assess the various stages of a crash (before, during, and after) and factors that contribute to crashes (human, vehicular, and environmental). Table 1 incorporates the technologies into the Haddon Matrix.

This report applies the Haddon Matrix to each of the "Four E's" of traffic safety:

- Engineering - Examples include anti-lock brake systems that prevent skidding and electronic stability traction control that helps avoid vehicle roll-overs. Engineering interventions generally occur in the pre- and during- crash phases of the Haddon Matrix.
- Emergency response – Examples include automated crash notification systems that notify emergency management centers that a vehicle has been in a crash and improved 911 services that can detect the location of cell phone callers (enhanced 911) and that can handle non-voice communication such as video and data streams (next-generation 911). Emergency response technologies apply to the post-crash time period.
- Enforcement and regulations – Examples include electronic vehicle tags that allow law enforcement personnel to identify specific vehicles and cameras that detect and identify vehicles that run red lights. Enforcement and regulatory activities occur primarily before a crash.
- Education and information – Examples include various driver information applications that inform the driver about road and traffic conditions. Education and information activities affect primarily per-crash conditions.

Challenges

As with all new technology applications, traffic safety technologies come with a variety of design challenges that must be met prior to full implementation. The human-machine interface (HMI) is perhaps the most important consideration in traffic safety technologies. The primary requirement of the in-vehicle HMI is to deliver needed or desired information while minimizing driver distraction. This can be done through careful placement of the HMI device within the vehicle and by the way it relays relevant information. Available technologies for HMI include voice activation, speech recognition, dashboard lights and icons, heads-up or panel displays, audio devices, voice synthesizers, haptic systems, and onboard printers. Other challenges include

the need to protect the security and privacy of data, the need for the various technologies to be interoperable, and the need to ensure that the data generated and communicated by these new technologies are accurate and reliable. There are other challenges that are less technical in nature, such as encouraging widespread deployment and managing interorganizational issues related to new technology applications.

If you have questions about **Technology Applications for Traffic Safety Programs: A Primer** please write to the Office of Behavioral Safety Research, NHTSA, NTI-130, 1200 New Jersey Avenue SE., Washington, DC 20590, fax 202-366-7394. Ian Reagan was the Contracting Officer's Technical Representative for this project.

Table 1. Fitting New and Emerging Technologies Within the Haddon Matrix.

Technology	Phase	Human	Vehicle	Environment	
Rear-end crash avoidance	Pre-Crash			x	
Merge		x	x		
Road departure		x	x		
Lane change		x	x		
Intersection crash avoidance		x	x		
Drowsy driver		x			
Night vision			x	x	
Variable speed limits		x	x	x	
Electronic stability program				x	
Roll stability control				x	
Electronic brake systems				x	
Steer-by-wire				x	
More protective belt designs	During Crash		x		
Automatic vehicle safety-feature adjustments			x		
Side air bags			x		
External air bags			x		
Materials to reduce pedestrian injury			x		
Automated crash notification	Post-Crash		x	x	
Passenger medical information			x	x	
Standardized information exchange			x	x	
Electronically collected crash data			x	x	
Consolidation of crash & medical data				x	
E911				x	
NG911			x	x	
EMS Technology Evaluation Template				x	



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1200 New Jersey Avenue SE., NTI-130
 Washington, DC 20590

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