The Exploratory Advanced Research Program Fact Sheet

Efficient and Safe Merging Solutions

Advanced Freeway Merge Assistance: Harnessing the Potential of IntelliDrive

Exploratory Advanced Research . . . Next Generation Transportation Solutions

One of the major traffic bottlenecks and safety concerns on today's busy roads occurs during freeway merges. "Advanced Freeway Merge Assistance: Harnessing the Potential of IntelliDrive,℠*" is an Exploratory Advanced Research (EAR) Program project designed to improve the efficiency and safety of freeway merges using IntelliDrive. This project was awarded by the Federal Highway Administration (FHWA) in 2009, and is being conducted by the University of Virginia Center for Transportation Studies (UVA CTS).

Utilizing IntelliDrive

IntelliDrive is an initiative designed to enable wireless communications among vehicles, the highway infrastructure, and travelers' personal communications devices. UVA CTS aims to develop and evaluate candidate freeway merge assistance systems that might significantly improve operations in an IntelliDrive environment. UVA created an IntelliDrive/Traffic simulation tool over a 3-year development process with funding from the National Science Foundation, FHWA, and the Virginia and California Departments of Transportation.

Using a previous 2008 study on the ability of IntelliDrive to improve ramp metering as the starting point for this study, the project team aim to develop and evaluate strategic algorithms designed to improve freeway merging. These algorithms will be developed specifically to take advantage of the capabilities provided by the system.

Improved Merging Algorithms

The freeway merge assistance system under development will consist of three algorithms: dynamic lane control, gap-responsive on-ramp signal, and merging control. Dynamic lane control encourages lateral movements of mainline vehicles by using a lower speed limit for the far right lane of the freeway. A gap-responsive on-ramp signal algorithm will give a ramp vehicle the green light based on the expected gap availability in the freeway mainline. As these algorithms have previously been developed, the project will focus on enhancing and refining them. Finally, the revolutionary merging control algorithm will control and advise speed changes for both mainline and ramp vehicles in order to allow for merging in the smallest space, at the highest speed possible.

Expanding Research

According to Bob Ferlis of FHWA, "this project provides a comprehensive means to address freeway merging. The team at UVA CTS is successfully building on and extending the results of previous ramp metering research to deliver improvements in efficiency and driver safety when merging."

One of the major objectives of this project is to utilize the communication capabilities of IntelliDrive. The research team plans to integrate microscopic transportation simulations with wireless network simulations. It is expected that the results from both simulations will help in designing control actions associated with freeway merging.

A safety evaluation module will also be developed to assess safety impacts under various scenarios. This module is unique in that it will generate a projected number of crashes. Vehicle trajectories reconstructed from actual crash data will also be investigated to explore drivers' response time as a contributing factor, as well as the potential to prevent crashes either by sending an alert to the driver, or else by using automated action where drivers would not have time to respond themselves.

Future Benefits

This research has the potential to significantly improve freeway merge areas, which present significant

* IntelliDrive is a service mark of the U.S. Department of Transportation

U.S. Department of Transportation
Federal Highway Administration

Efficient and Safe Merging Solutions

Advanced Freeway Merge Assistance: Harnessing the Potential of IntelliDrive℠

bottleneck and safety concerns today. The project will also help prepare transportation agencies to make full use of IntelliDrive technology as it emerges.

"Ultimately the project is expected to create freeway merge areas with greater capacity and fewer crashes," says Ferlis. "The algorithms under development here will continue to take advantage of emerging IntelliDrive capabilities to improve the safety and efficiency of future freeway merge operations."

For vehicle, system, and equipment manufacturers to build on these results in the future, additional research will be needed to further develop the concept of operations, understand its value, and to identify promising deployment scenarios. Success at this stage of research could lead to further traffic simulation studies with higher-level controls for the freeway and its environs. Also, additional simulations could be conducted using a driving simulator to assess the receptivity of people to advice, or control actions taken in response to the concept of operations. Success could eventually lead to testing a prototype on a closed course to identify further technical questions, assess human factors issues, and to support technology transfer activities.

©www.istockphoto.com/Joe_Potato

Traffic merging onto freeway.

Learn More

For more information on this EAR Program project, contact Bob Ferlis at FHWA, at 202-493-3268 (email: robert.ferlis@dot.gov).

EXPLORATORY ADVANCED **RESEARCH**

What Is the Exploratory Advanced Research Program?

FHWA's Exploratory Advanced Research (EAR) Program focuses on long-term, high-risk research with a high payoff potential. The program addresses underlying gaps faced by applied highway research programs, anticipates emerging issues with national implications, and reflects broad transportation industry goals and objectives.

To learn more about the EAR Program, visit the Exploratory Advanced Research Web site at www.fhwa.dot.gov/advancedresearch. The site features information on research solicitations, updates on ongoing research, links to published materials, summaries of past EAR Program events, and details on upcoming events. For additional information, contact David Kuehn at FHWA, 202-493-3414 (email: david.kuehn@fhwa.dot.gov), or Terry Halkyard at FHWA, 202-493-3467 (email: terry.halkyard@fhwa.dot.gov).

Image other side:
This is a merge sign by the road side with sky as background.
©www.istockphoto.com/zxcynosure

Publication No.
FHW-HRT-10-076
HRTM-04/09-10(1M)E