The Exploratory Advanced Research Program Fact Sheet

Increasing Highway Throughput

Communications and Control Technologies to Improve Traffic Flow

Exploratory Advanced Research . . . Next Generation Transportation Solutions

How can the new capabilities of intelligent vehicles and highway infrastructure be used to reduce congestion and effectively increase highway capacity? This question is the focus of "Development and Evaluation of Selected Mobility Applications for VII," an Exploratory Advanced Research (EAR) Program project launched by the Federal Highway Administration (FHWA) in 2007. Researchers at the Partners for Advanced Transit and Highways (PATH) program of the University of California, Berkeley, are conducting the 3-year project in cooperation with Caltrans.

Using the Potential of Intelligent Infrastructure Effectively

The ability to modulate the speed and spacing of individual vehicles in relation to unseen events further downstream has tremendous potential to keep traffic flowing smoothly, safely, and at its optimum density. With the dedicated short-range communication system being developed under IntelliDrive (previously the Vehicle–Infrastructure Integration or VII initiative), such long-range traffic management opportunities are now conceivable. This EAR project is modeling, testing, and demonstrating prototype systems in three areas:

- Improving traffic flow by calculating and communicating speed guidance directly to individual drivers.
- Achieving closer coordination, shorter vehicle separation gaps, and higher effective lane capacities through vehicle–vehicle communication, vehicle–infrastructure communication (VIC), and cooperative adaptive cruise control (CACC).
- Improving heavy-truck fuel consumption and doubling the capacity of truck-only lanes by forming and maneuvering automated three-truck platoons.

Managing Traffic Flow and Density

The new communication capabilities of VIC can be used to feed speed advisories directly to individual drivers. To generate speed guidance, systems will process highly accurate and complete real-time traffic data collected by instrumented vehicles—data probes that can gather information from a longer swath of the traffic stream than is possible with fixed sensors alone. The project is developing modeling capabilities and design tools for generating these speed advisories. In addition, to help determine systems feasibility, the researchers are examining how targeted drivers respond to the guidance and how nearby vehicles react when a targeted vehicle changes speed.

Taking Control for Greater Efficiency

The processing of real-time data from downstream traffic and adjacent lanes, provided by the moving probe vehicles, will enable CACC to function in synch with real-time traffic conditions as they evolve, responding to speed and following-distance commands for optimal flow moment by moment. With CACC designs that allow highly accurate and fast responses, shorter time gaps between vehicles can be set and the roadway surface area can be used at its maximum efficiency. The technical feasibility of this approach will be investigated, and user acceptance will be assessed.

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Maneuvering Three-Truck Platoons

The tight vehicle-to-vehicle coordination necessary for close-formation platoon driving of heavy trucks is a major focus of the project. Building on previous research that successfully demonstrated two-truck formations driving as closely as 3 m apart at highway speeds, this project will advance to three-truck platoons and will tackle the technical challenges of automating lane changing, merging, and joining and leaving the platoon. Automated truck speed and spacing can as much as double lane throughput capacity. Close-formation platoons also reduce aerodynamic drag, with fuel consumption savings—and carbon emissions reductions—in the range of 10 to 15 percent. Ultimately, successful platoon maneuvering on dedicated truck-ways may accommodate the heavy volumes anticipated in high-density corridors.

Future Efforts

The research underway will discover whether these next-generation solutions are feasible and, if so, what further work will be needed to move them toward deployment as VIC is more fully implemented. "This project offers highly advanced strategies to reduce bottlenecks, minimize congestion, and maximize throughput," says Bob Ferlis of FHWA's Office of Operations Research and Development. "If successful, they have the potential to increase the effective capacity of our infrastructure investment."

In addition to reports describing the results of the experiments, the project will produce software tools used for macroscopic traffic simulation, microscopic simulation of CACC performance, and truck platoon dynamics design and evaluation. The research will quantify the impact that the applications are likely to have on highway congestion, throughput, and energy consumption.

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).

Learn More

For more information on this EAR project, contact Bob Ferlis, FHWA Office of Operations Research and Development, at 202-493-3268 (email: robert.ferlis@fhwa.dot.gov).

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