FHWA BAA Program

Development and Evaluation of Selected Mobility Applications for VII

Project Summary

Start from 10/08/07, 3 years

The proposed project is a companion to a new project that FHWA has approved for funding under their Exploratory Advanced Research Program, and provides cost sharing for that project. In this way, the Caltrans funds are leveraging a larger sum of federal funding for related research. The work proposed here represents a portion of the broader project that FHWA is sponsoring, and in order to keep the relationship to the FHWA project clear, the task numbering has been made consistent with the numbering in that project.

We propose to design, test and evaluate innovative ways of using the wireless communication capabilities of VII to improve mobility. The proposed approach includes dynamically detecting bottlenecks, determining section-wise capacity and determining the preferred vehicle speed and density based on an analytic corridor traffic model. Probe vehicle data are used to characterize local freeway traffic speed and density, then that information is used to generate reference speed advisories to individual drivers and to govern the variable ramp metering rate. The same probe data are used to generate reference speed and gap adjustment commands to cooperative adaptive cruise control (CACC) systems, to help dissipate shock waves and improve throughput while improving driver acceptance. In the eventual implementation, detailed traffic information will come from VII-enabled probe vehicles, however, before adequate numbers of vehicles have been equipped with wireless communication, existing roadway detector data will be used for experimental assessment of the concept.

It is also proposed to develop mobility-enhancing service operation of heavy trucks in automated close-formation platoons, which enables a possible doubling of capacity per lane while reducing aerodynamic drag significantly. Prior research by the proposal team has shown the technical feasibility of two-truck platoon driving at highway speeds, as close as 3 m apart, and producing fuel consumption savings in the range of 10% to 15%. The new innovation proposed here is the extension to a three-truck platoon, which is significantly more challenging technically, and the addition of the vehicle maneuvers that would be necessary for an operational system (trucks joining and leaving the platoon and changing lanes and merging automatically).

The proposed ideas extend far beyond the current focus of the VII Program, which is centered on less ambitious concepts that are thought to be suitable for “Day One” deployment when VII first becomes available. Those ideas are based on vehicle-infrastructure communication and use of aggregate data, accumulated over a longer period of time, rather than the individualized and real-time data assumed here. The
addition of the vehicle-vehicle application also extends well beyond the current thinking in most of the transportation community.

The proposed project includes experiments to collect data from a small number of vehicles using the target Vll application systems. These experiments cannot show the full impacts of the systems. Rather, they provide data to characterize the interactions with the surrounding traffic of the manually-driven and CACC vehicles driving at the recommended speeds. These data are used to update the microscopic models of traffic interactions, and those models are in turn used to predict the impacts if the target applications were to be deployed at various levels of market penetration, up to 100%.