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# Intelligent Vehicle Highway Systems

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# Foreword

The papers in this Record represent results of research studies focusing on intelligent vehicle highway systems (IVHS).

Brand discusses predictive models to evaluate IVHS improvements, including the formulation of inputs that make it possible to anticipate the important consequences of IVHS and therefore carry out benefit-cost analysis of new investments as well as collect the appropriate data for planning and evaluating operational field tests.

Cheslow and Hatcher identify and evaluate five alternative architectures for advanced traffic management (ATM) and advance traveler information systems (ATIS). These activities were created to focus on several key architecture issues.

Hitchcock discusses the normal operation of one system of automated freeways as described by Hsu. This system is being used as a basis for many system engineering studies within Partners for Advanced Transit and Highways (PATH). The system minimizes the degree to which the infrastructure is involved in minute-to-minute maneuvers. In it, each vehicle, as it enters, is given a route including lane choices to the destination. As described, however, no account is given of procedures on entry or exit or of possible faults. The PATH safety program demanded a second example of the process of full specification and fault tree analysis to determine if this process was generally applicable.

Rao et al. discuss the application of simulation SmartPath, which models the passage of individual vehicles along the highway. The simulator allows the researchers to examine transient behavior of the traffic stream under various conditions. Three different strategies are discussed for allowing vehicles to enter and leave automated lanes and measuring the maximum flow rates that are attained. The authors conclude that although maximum theoretical capacity cannot be attained, through prudent design of entrance and express strategies extremely high throughput can be sustained.

Rao and Varaiya examine the potential flow increases when only a proportion of vehicles on a highway are equipped with autonomous intelligent cruise control (AICC). The authors use a simulator that models interactions between vehicles to give detailed information on achievable capacity and traffic stream stability. The authors conclude that capacity gains from AICC are likely to be small.

Kaub and Rawls present a single and inexpensive IVHS speed monitoring concept that can be easily adapted to existing vehicles and roadways. The concept relies on the speed-distance-time relationship and on an on-board impulse detector and constant times to calculate the travel time or posted speed of the roadway.

Chira-Chavala and Lechner discuss the preliminary engineering feasibility of early deployment of a roadway-powered electric vehicle in El Monte Busway (a 3+ high-occupancy-vehicle facility in Los Angeles). The evaluation consists of determinations of the scale of electrification, the location to be electrified, the mode of operation, the level of energy transfer, and consumption of energy.

Chira-Chavala and Zhang discuss the phased implementation of advanced lateral guidance systems in high-occupancy vehicle lanes with exclusive right-of-way. Steering assistance information systems, partially automated lane-keeping systems, and fully automated lateral control systems are described.

Kaysi et al. propose a system structure for real-time traveler information systems consisting of a surveillance module, a congestion prediction module, and a control and routing module. The focus is on the approaches that may be used for congestion prediction and the strategies that may form the basis for routing.

Vaughn et al. discuss the result of an experiment to collect sequential route choice data under the influence of ATIS. The experiment collected information on drivers' pretrip route choice behavior at three levels of information accuracy: 60, 75, and 90 percent. The results

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