Human-centered technology to enhance safety and mobility
Intelligent Transportation Systems Institute

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A report of research, education, and technology transfer activities of the Intelligent Transportation Systems Institute at the University of Minnesota for fiscal year 2008–2009

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This annual report marks my twelfth year as director of the ITS Institute. In that time, it has been my privilege to work with exceptional researchers from many academic disciplines in the search for innovative solutions to new and old problems. As I reflect on the past decade and look forward to fresh challenges in the coming year, I would like to highlight the importance of real-world collaboration to our success.

Our research is aimed at solving problems in the real world; deployability is a key criterion against which all our efforts are judged. In the current economic climate, it is more important than ever to focus our available resources on the safety and efficiency of our national transportation system to maintain its competitive advantage.

Researchers alone cannot succeed in bringing ITS technology from the research lab to the street. That is why the Institute seeks to develop productive collaborations with transportation agencies, local governments, and private-sector partners.

The SMART-Signal system, developed by civil engineering associate professor Henry Liu in collaboration with the Minnesota Traffic Observatory and local stakeholders, is one example of bringing the benefits of ITS to city streets. This project also exemplifies the Institute’s commitment to working with transportation agencies and other stakeholders to develop deployable solutions to real-world problems.

SMART-Signal addresses the need for more efficient management of arterial streets in urban and suburban areas. Numerous tools and technologies have been developed by ITS researchers to manage traffic flows on urban freeways—the Autoscope™ system, for example, is widely used—but relatively little work has been done to date on arterial traffic.

The name SMART-Signal stands for “Systematic Monitoring of Arterial Road Traffic and Signals”—and as the name implies, the system makes traffic signals...
“smarter” by collecting and archiving real-time data and generating performance measures that include travel time between intersections, queue length, intersection delay, and overall level of service. Dedicated hardware and software installed in the signal control cabinets at intersections carry out monitoring and analysis functions automatically, giving traffic managers an unprecedented level of detailed data on arterial traffic.

This accurate and timely performance data will be the foundation of future SMART-Signal development, as the system is intended to support automatic adjustment of arterial signals in response to changing traffic conditions. By enabling sets of traffic signals to work together in real time, SMART-Signal will make arterial corridors intelligent enough to reduce total congestion and driver delay.

The Minnesota Department of Transportation (Mn/DOT) and Hennepin County, which encompasses the city of Minneapolis, recognized that better arterial traffic management could significantly improve traffic operations. The county worked with Liu to identify an arterial corridor where a prototype of the SMART-Signal could be deployed for real-world testing. Alliant Engineering, headquartered in Minneapolis, joined the project as a private-sector partner with extensive ITS experience.

The Minnesota Traffic Observatory, one of the ITS Institute’s dedicated laboratories, played a key role in the development of SMART-Signal, providing hardware-in-loop simulation capabilities that allowed Liu to experiment and to calibrate the system in a highly realistic virtual traffic environment, including actual signal controller hardware and modeling of street traffic at the level of individual vehicles.

Development of the necessary hardware and software components for SMART-Signal began in 2006, with funding from the Minnesota Local Road Research Board, the ITS Institute, Mn/DOT, and significant in-kind support from Hennepin County. Today, the prototype system has been deployed on an 11-intersection arterial segment in Minneapolis as well as on a signalized suburban highway segment. A third test site, with 14 intersections, is scheduled to be instrumented this year.

The productive relationship between researchers, public agencies, and private industry that made the development of SMART-Signal a success was recognized this year with the Center for Transportation Studies’ Research Partnership Award, which honors collaborative research teams whose work has had a significant impact on transportation.

This project is just one example of the collaborative research and development efforts under way at the ITS Institute; others highlighted in this report include our work with the National Park Service to manage traffic through Alaska’s Denali National Park, the multi-state pooled-fund Intersection Decision Support project to reduce crashes at unsignalized rural highway intersections, and our work with local transit providers to expand bus rapid transit service in the Twin Cities.

In my second decade as director, I look forward to many more opportunities to collaborate with stakeholders on all sides of transportation issues. Together, we can move ITS technologies from the drawing board to the road—and create a legacy of innovation for future users.

In closing, I would like to take this opportunity to thank departing ITS Institute board member Ron Hynes, deputy associate administrator with the Federal Transit Administration. We will miss the valuable contributions he made to the Institute’s mission during his tenure.

Max Donath, Director
ITS Institute