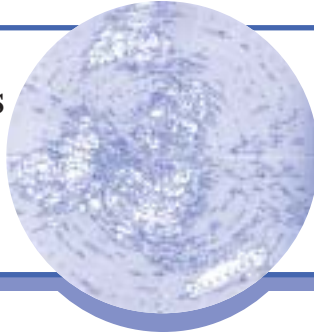


EVALUATING RAMP CONTROL STRATEGIES IN THE TWIN CITIES

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Why This Research is Needed

Although freeway ramp control was introduced in the late 1960s, excessive ramp delays often lead to public revolt through drivers ignoring the ramp meters or through the media and elected officials questioning ramp meter effectiveness. Following this trend, Mn/DOT is experiencing significant public opposition to its continuously expanding ramp metering system, which was introduced in the early 1970s. To counter this, Mn/DOT's Traffic Management Center (TMC) needs to develop a scientifically sound basis for establishing the effectiveness and validity of its ramp control strategy.

Research Objective

To assess the effectiveness of Mn/DOT's ramp meter control strategy on representative sections of Twin Cities freeway using TRAMLAB simulation software.

Methodology

Professor Michalopoulos and graduate research fellow John Hourdakos compared Mn/DOT's real-time ramp control strategy with the no control alternative on two test sites. The first was a 20-km section of Trunk Highway 169 northbound from the I-494 interchange; this section traverses the metro area without going into the city center. The second site was I-94 eastbound between I-394 and the Ninth Street exit ramp. This section is part of the connection between the two downtown areas, and is often severely congested during peak travel times. In both cases, the simulation encompassed the freeway proper and the ramps up to their intersections with the surface street. Data to create and calibrate the simulations were gathered from pavement-embedded vehicle detectors and by manual counts for three



Traffic waits at a ramp meter before entering I-35W in Minneapolis.

consecutive days at each test site.

Research Results

Analysis of the simulation results revealed that the use of ramp metering reduced total system travel time in both test areas by 6 to 16 percent. The average freeway mainline speed with ramp control increased by 13 to 26 percent. On both freeways, ramp metering sharply reduced the number of times vehicles stopped in traffic. This smoothing of traffic flow yielded measurable reductions in fuel consumption and pollutant emissions from vehicles traveling on the freeways.

A month-long ramp meter shutoff, mandated by the state legislature, provided a unique opportunity to compare the simulations with real-world data. At the end of the shutoff period, analysis confirmed that the simulations created in the ITS lab were consistent with traffic conditions observed during the shutoff.

In both the simulations and the real-world measurements, the data confirmed that Mn/DOT's ramp metering strategy has a beneficial effect on travel times for the freeway system as a whole; however, the researchers noted adverse effects on the ramps themselves, such as queues and traveler delays. Similarities between simulated and real-world delays support the hypothesis that certain delays are probably inherent in the current metering algorithm—but Michalopoulos and Hourdakis believe that these inefficiencies could be corrected.

The simulation research also supported the idea that the effects of ramp metering are likely to vary greatly according to traffic volume, which can change unexpectedly. This suggests that an optimal ramp metering algorithm should take into account these variations in daily demand patterns.

Research Impacts

Computer simulation has proven to be a useful tool in evaluating current and potential ramp metering strategies for the growing Twin Cities metropolitan area. The successful application of the TRAMLAB simulation software gives traffic managers a new tool for the development of next-generation meter control algorithms.

What's Next

As the process of developing better metering strategies gets underway, the simulation techniques used by Michalopoulos offer researchers and planners a new tool for testing new strategies prior to deploy-

ment and for fine-tuning the operation of metering strategies that have already been implemented. The ITS Institute's simulation lab will be used to evaluate several alternative metering strategies that may be employed by Mn/DOT on Twin Cities freeways.

Related Publications / Presentations

Hourdakis, J. and Michalopoulos, P.G., 2000, "Development and Implementation of a Virtual Traffic Management Center," Seventh World Congress on ITS, Torino.

Hourdakis, J. and Michalopoulos, P.G., 1999, *Towards the Development of the Next Generation Traffic Management Centers: TRAMLAB System*, proceedings of the Sixth World Congress on ITS, Toronto.

Koka, M., Hourdakis, J. and Michalopoulos, P.G., "Computer-Aided Testing and Evaluation of Adaptive Ramp Control Strategies," presented at the 2000 Annual TRB meeting, Washington D.C.

Michalopoulos, P.G. and Hourdakis, J., 2000, "Simplifying Simulation for ITS Applications," presented at the ITS America annual meeting, Boston.