

Identifying Number MPC-350

Title:

Modeling and Evaluation of Traffic Signal Preemption near Railroad Crossings in Small Urban Area

University:

North Dakota State University

Principal Investigator:

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Description of Research Problem:

Railroad crossings are prevalent in small urban areas in the Mountain Plains region. The Manual on Uniform Traffic Control Devices (MUTCD) has established different levels of priority control, which deal with different degree of modification of signal timing plans based on operating conditions and type of priority. Traffic signal preemption control is the most restriction priority control strategy. When the operation of a traffic signal is preempted, there is unconditional interruption of the normal signal timing. Signals on arterial corridors adjacent to railroad track have to be preempted from safety and efficiency standpoint. Different communities have practiced different traffic signal pre-emption strategies for signals near railroad crossings. The non-responsive traffic signal preemption may cause queue, congestion, and delay on surface/arterial streets as well queuing near tracks. Lack of clearance time for queues near railroad track can have safety implications. Traffic signal preemption disrupts the normal traffic signal cycle and the recovery time associated with this disruption is of interest and may result in congestion and increased delays on adjacent surface streets. This research would provide practical guidelines for low-cost operational and safety improvements using and related to traffic signal preemption strategies of signals near railroad crossings in small urban areas.

Research Objectives:

The immediate research objectives are to: (1) survey the practices related to traffic signal preemption near railroad crossings in smaller urban communities with resource constraints; (2) model and simulate the traffic signal preemption for different scenarios, which looks into safety and efficiency; and (3) develop framework for deciding on appropriate traffic signal preemption strategy near railroad crossings in small urban area. This last objective is important because it provides the DOT and cities in small urban area with a more systematic way of designing and operating traffic signal preemption strategies near railroad crossings. The long-term objective for the federal, state, and local agencies is to ensure safe, efficient, and cost-effective operation of surface streets and railroad crossings.

Research Approach/Methods:

The first task includes the completion of a literature review and survey of urban communities to understand various practices related to decision-making regarding traffic signal preemption near railroad crossings. There are varied practices in existence and the rationale for the differences will be of particular interest. The second task includes collection field data from locations near existing railroad crossings, at least one in Fargo, North Dakota and one in Moorhead, Minnesota. Data will be collected for rail movements at railroad crossing (number and times, vehicle queue length, track clearance times, queue clearance times), and movements on surface streets adjacent to the railroad crossings (traffic volume, intersection geometry, signal plans, preemption plans, queue lengths, vehicle delays, and others). Third task includes building a simulation model for the contexts in Fargo, North Dakota and Moorhead, Minnesota for the base case (in other words modeling for the operation as it currently exists), and calibrating and validating the base model. Fourth task includes identifying and developing various scenarios related to different traffic levels, train events, preemption plans, signal plans. Fifth task would be to run the model for different scenarios and develop results related to clearance times, delays, queue length, recovery times. Sixth task would be developing a report documenting the reviews, model building, analyses, and lessons learned.

MPC Critical Issues Addressed by the Research:

5. Low-Cost Safety Improvement

11. Traffic Operations and Management

Contributions/Potential Applications of Research:

The outcome of this proposed project is a comprehensive examination of issues related to preemption of traffic signals near railroad crossings. The exploration of reasons for different preemption strategies will be of interest to city traffic engineers. The analysis and modeling will further highlight the effectiveness of different traffic signal preemption strategies. The work of cities and state DOTs can be facilitated by such framework, analyses, and findings.

Potential Technology Transfer Benefits:

The project will develop a lessons learned workshop, which may be useful to small urban areas in states in the region and beyond. The results will be disseminated via the Transportation Learning Network and LTAP Centers in the region.

Time Duration:

July 1, 2010 – June 30, 2011

Total Project Cost:

\$52, 877

MPC Funds Requested:

\$24,620

Source of Matching Funds:

Dr. Amiy Varma will be devoting 14% of time to this project during the academic year (9 months) –funds from General Fund -- \$ 14,742

Indirect cost on MPC Request fund = $0.435 * 25964 \approx 11294$

Total Match = \$ 14,742 + \$ 11, 294 = **\$ 28,257**

TRB Keywords:

Railroad crossings, traffic signal preemption, simulation, modeling, traffic operations, safety.