Florida Department of Transportation Research

Coordinated Pre-Preemption of Traffic Signals to Enhance Railroad Grade Crossing Safety in Urban Areas and Estimation of Train Impacts to Arterial Travel Time Delay — BDK85-977-44

Rail lines present two major challenges to the roadways they intersect: potential for collisions and increased congestion. In addition, congestion can contribute collision hazards when drivers are impatient or vehicles are prevented from clearing the tracks in a timely manner. Congestion has other consequences, as well, including impacts on emergency services and increased pollution from hundreds of idling automobiles.

To improve safety and mobility of railroad crossings, the Manual on Uniform Traffic Control Devices (Federal Highway Administration) suggests implementing a preemption plan for signalized intersections within 200 feet of the crossing, which can help clear vehicles from the tracks before a train's arrival. Preemption introduces new elements into the overall management of a roadway network, especially during peak traffic periods. Therefore, it is necessary to utilize modern traffic control systems and develop effective traffic control strategies.

In this project, University of South Florida researchers investigated using advanced features of a widely used traffic signal system management software, ATMS.now (Trafficware, Sugar Land, TX), to resolve safety and mobility problems at highway-railroad crossings and adjacent roadways. Just as preemption precedes an anticipated traffic event (in this case, closing a railroad crossing), the researchers investigated coordinated plans preceding the preemptive phase, a period they termed pre-preemption (PPE). Intervention during PPE would be triggered when a train was detected entering a designated control section. Additional green time provided at intersections would help clear vehicles from crossings before a train's arrival. PPE plans require no new hardware or infrastructure; they use only existing traffic signal system management software.

Researchers simulated PPE plans using VisSim (Visual Solutions, Westford, MA), software which allows simulations to be developed through a sophisticated graphical interface. Simulations were based on three control sections selected from the Broward County, Florida. Simulations considered vehicle traffic volume, train speed (train blockage duration), and PPE strategies.

Long lines of cars waiting for a train to pass can severely reduce the efficiency of adjacent roadways.

Measures of effectiveness compared network performance, travel times, delay times, and queue lengths before and after implementation of PPE strategies. Average delay of the roadway corridor was used to evaluate the operational performance of the PPE strategy; average stops along the corridor were used to assess the traffic smoothness, the risk of vehicle-vehicle conflicts, and environmental impacts; and averaged queue length was used to assess the congestion level of the corridor.

Simulation results showed that a coordinated PPE plan can effectively reduce average delay, average stops, and average queue length on arterials near a railroad crossing. Although it was clear that PPE plans are very site specific, the researchers produced a generic plan to guide managers in the development and implementation of PPE plans using ATMS.now. This new tool will assist traffic managers in maintaining the efficiency and safety of roadways adjacent to railroad crossings by decreasing congestion and collisions.

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