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TRACK CLEARANCE TIME REQUIREMENTS AT RAILROAD-PREEMPTED TRAFFIC SIGNALS

PROBLEM STATEMENT

On October 25, 1995 at 7:10 am in Fox River Grove, Illinois, the transportation engineering profession received a chilling wake-up call that caught the attention of citizens throughout the country. A school bus stopped for a traffic signal near an at-grade railroad crossing was hit by a high-speed commuter train. Seven children were killed and 20 more were injured, many very seriously.

The railroad crossing was protected by flashing lights and gates, the safest form of at-grade protection. Accidents like this were not supposed to happen. The school bus driver apparently had traversed the crossing before the arrival of the train and before the actuation of the flashing lights and gates. The bus driver may have misjudged the amount of space available on the far side of the track or misjudged the length of the bus, or both. After crossing the tracks, the school bus was unable to fit into the space available and the rear of the bus encroached about three feet into the path of the train. The signal provided a short green to clear the tracks, but the driver apparently missed the signal due to a possible commotion in the back of the bus. At 60 mph, the train crew had no capability to stop the train.

A subsequent National Transportation Safety Board investigation determined that there was a problem of communications between the railroad and traffic authorities. This problem was compounded by a lack of understanding of the nature and requirements of the track clearance interval on the part of the traffic engineering agency.

The MUTCD requires that when a highway-railroad grade crossing is located within 200 feet of a signalized intersection, the signal should be provided with preemption capabilities to clear vehicles from the tracks when a train approaches. The MUTCD further requires that the flashing light signals at the crossing, that warn motorists of an approaching train, operate for a minimum of 20 seconds before the train is due to arrive at the crossing. If the train detection circuitry is used to trigger the preemption of the nearby traffic signal, an important issue is whether 20 seconds is adequate for track clearance. This potential problem is compounded by Florida Department of Transportation (FDOT) procedure (750-030-002-d) which requires preemption for signalized intersections up to 500 feet from a highway-railroad grade crossing.

OBJECTIVES

This tragedy has prompted state and local transportation agencies nationwide to examine their policies and practices with respect to signal preemption at railroad grade crossings. There are several issues that have been raised, and the purpose of this project is to address those issues and to develop practical guidelines for application in Florida.

The two primary objectives of this project, which respectively constitute Parts 1 and 2, are (1) to produce a model that determines the time required to clear a railroad crossing of an encroaching vehicle, based on the distance from the signalized intersection stop line to the preceding railroad crossing stop line; and (2) to evaluate an innovative pavement marking designed to deter drivers from entering the crossing unless they are able to clear the track exposure area.

FINDINGS AND CONCLUSIONS

PART 1 Traffic signals near railroad grade crossings that have active warning systems are normally interconnected and receive a signal from the railroad track circuitry when trains are approaching. This train approach signal is utilized by the traffic signal to interrupt and preempt its normal phasing and enter into higher priority special phasings to clear the track of any vehicles that might be in the pathway of a train, and then to proceed with signal phases that do not allow traffic movements to approach the track until after the train has passed. The amount of preemption time needed to clear a vehicle from the pathway of a train is necessary information for preemption signal settings, but there are no definitive guidelines on how to determine this amount of time. It is usually left to the judgment of the signal engineer, and, frequently, unfounded assumptions are required.

This phase of study investigated the time required to clear the *n^{th} vehicle in the queue* off the track(s) at railroad-preempted traffic signals. The two key time components are startup delay and repositioning time. Researchers found that queues where all preceding vehicles are short passenger cars cause the longest startup delays, and heavy trucks compel the longest repositioning times. The developed model is convenient, because once preemption is deemed necessary, the model does not need traffic volumes or the distribution of vehicle types or estimates of average vehicle spacings, including trucks; it needs only the minimum track clearance distance, clear storage distance, and the types of vehicles that are permitted to use the roadway.

PART 2 Researchers evaluated the special X-box pavement marking configurations for railroad-highway grade crossings that were being used in several European countries. These markings are intended to provide motorists with supplemental visual cues to enable them to determine whether sufficient space is available for safe storage of a vehicle beyond the track (i.e., sufficient space for a motorist to proceed across). They are intended for application at crossings where nearby intersections can cause queues to backup to the track. These conspicuous markings, configured as an “X” in a box, were tested at two Florida locations, one in an urban area and one in a rural area, over a 1 ½-year period. The rates of cars hazardously stopping on or closely adjacent to the railroad tracks at the crossings were compared under pre-and post-installation conditions. Results at the rural location showed a decline of more than 60% in the stoppage rates. Conversely, no significant differences were found between the pre-installation and post-installation tests at the urban location. A control site was utilized near the crossing in the urban location, and it showed no significant difference between the two test periods that were concurrent with the analysis at the treated site. A possible reason why, in the urban area, the test results showed no significant improvement is that at the selected crossing, the FDOT had implemented other measures to reduce the number of vehicles from stopping on the tracks. Recommendations are provided for application of these markings at rural highway-railroad grade crossing sites.

BENEFITS

The model developed in Part 1 of this study will be a useful tool for the design and the setting of preemption timing at railroad crossings. The chief benefit, of course, of improving rail crossing design is increased safety. That is, by improving the mechanisms and processes by which vehicle clearance from the track area is achieved, safety for the traveling public is improved. Likewise, the X-box pavement marking configuration evaluated in Part 2, despite circumstances at the urban test site that have rendered those test findings uncertain, appears to have potential for increasing the safety factor for motorists crossing railroad tracks. This pavement marking visibly lets the motorist know whether he/she has moved to a safe location. Such safety improvements are geared towards saving lives and improving the quality of transportation features for the traveling public.

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