

ABSTRACT

Brennan, Thomas M. PhD., Purdue University, December 2009. Quantitative Assessment Methods For Railroad Preempted Signalized Intersections. Major Professor: Darcy Bullock.

There are currently no systematic assessment procedures that quantitatively prioritize signalized intersections near railroad crossings based on their queuing potential across the tracks. In some cases when queue mitigation is warranted, an interconnect circuit between the railroad sensors and traffic signal controller is used to preempt the controller. Railroad preempted signalized intersections entail a number of calculations and parameter assumptions to estimate the time needed to clear a queue from the tracks. After the preempt enabled controller is field deployed there is no systematic monitoring to provide dynamic feedback to the engineer (design or operation) that indicates how well queues are clearing and if the preempted controller is consistently synchronized with the railroad warning system during its operational life.

This dissertation proposes 1) screening and prioritizing procedure for signalized intersection adjacent to highway-railroad crossings, 2) performance measures to evaluate track clearing effectiveness, and 3) confirmation of highway-railroad synchronization operation. The proposed screening and prioritization procedures were applied to 595 state maintained intersections, which identified 20 intersections for future field investigation. Changes in track clearing effectiveness were used to evaluate 2802 preempt events to compare a pre/post steerable signal head installation at a test bed. This analysis concluded there was no impact on the effectiveness of track clearance based on the signal head change. Lastly, railroad synchronization and controller transition to preempt was evaluated using over 7,648 preempt events. Improvements to the synchronization and transition were made based the incremental analysis of performance measures throughout the study period. As a result of this analysis, the fixed track clear green phase was first extended by 5 seconds, followed by a subsequent refinement implementing a variable track clear green phase. As a result of those improvements the frequency of gates going down after the end of track clear green was reduced from 42% to 10% to 0% respectively. The effectiveness of track clear green based on post track vehicle presence was also improved reducing vehicle presence from 33 to 3 to 0 vehicles respectively.