

Research Spotlight

Project Information

REPORT NAME: Timing Issues for Traffic Signals Interconnected with Highway-Railroad Grade Crossings

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Improving safety through traffic signal coordination near highway-railroad grade crossings

Crashes at highway railroad grade crossings tend to be severe. On average, approximately 10 percent of crashes result in fatalities each year, and approximately 38 percent in injuries. While these collisions are relatively uncommon in Michigan (roughly 50 per year), they can have a far-reaching impact on the communities where they occur. Properly coordinating highway-railroad grade crossing warning signals with nearby traffic signals is complicated, but critical for safety at these intersections.

Problem

Many highway-railroad grade crossings in Michigan are located near signalized intersections. Nearly 200 locations have interconnections between traffic signals and railroad crossings. At these sites, a railroad warning system preempts normal traffic signal operation and provides special phasing to clear traffic queues from railroad tracks.

No single standard is available to determine the timing of these phases or to identify the locations where interconnected signals are necessary. While the U.S. Manual on Uniform Traffic Control Devices (MUTCD) provides guidance for traffic signal preemption at intersections within 200 feet of a railroad crossing, queuing problems also are occurring at



The software tool researchers developed will help identify locations where traffic signals should be interconnected with railroad crossing warning signals.

some intersections more than 200 feet from the crossing.

Investigators consolidated and reviewed current interconnection and preemption literature and practices. The

“The best thing about this project is that it consolidates the available knowledge into one place and provides a tool we can use to analyze and make safety-related decisions more accurately.”

Kris Foondle
Project Manager

research was used to create templates and a software tool to identify locations where signal preemption is necessary, regardless of the distance from crossing and the time needed to preempt the signal.

Approach

Researchers compiled current interconnected traffic signal practices from state transportation agencies, published guidelines, state MUTCDs and other available documents.

Research

Most state DOTs only use the distance from a rail crossing as their standard for determining locations that require railroad preemption, typically using the 200-foot standard recommended in the U.S. MUTCD. Some states, however, provide guidance for preemption for intersections farther than 200 feet from a crossing, considering factors such as queue length and frequency, length of trains and crash history. The review of state practice also addressed criteria for pre-signals and necessary pedestrian clearance intervals.

Results

This project compiled existing information from federal, state and other sources into a number of usable tools. In the course of the project, researchers:

- Identified a wide variety of possible interconnected intersection and highway-railroad grade crossing configurations.
- Compiled templates used by various states for preemption signal timing.
- Developed the **Railroad Preemption Assessment Tool**, an Excel spreadsheet to help evaluate the need for preemption at intersections near railroad tracks based on traffic levels, commercial vehicle traffic, number of lanes, distance between the intersection and railroad tracks, and existing traffic signal timing. The tool estimates the 95th percentile queue length, at which point signal preemption is recommended. Proposed guidelines for designing preemption timing are based on the amount of time needed to clear cars or trucks from railroad tracks. Track clearance times depend on the number and type of vehicles in a queue. The report includes tables of track clearance times calculated for queues of up to 400 feet containing up to two trucks. Guidelines include calculations of track clearance distances and minimum warning times needed before a train arrives.
- Identified steps necessary for an engineering study of existing interconnected railroad-roadway grade crossings in Michigan to assess their preemption timing plans.

Value

This report should aid highway and railroad engineering staff with the identification of intersections for signal preemption, design of traffic signal phasing and timing, and selection of other traffic

control signs and signals to minimize the risk of future crashes.

The guidelines, assessment templates and software tool developed through this project are available for immediate use. Over the next several months, MDOT will identify locations to test the tool. Researchers recommend that implementation be phased in over time through short group workshops within MDOT. Assuming initial tests are successful, MDOT plans outreach to railroads and local authorities to promote the tool, with options for a targeted awareness campaign and training program for local agencies, including city, township and county personnel and other professionals.

Research Administration

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This final report is available online at

[www.michigan.gov/documents/mdot/
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