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Development of Railroad Highway Grade Crossing Consolidation Rating Formula

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Development of Railroad Highway Grade Crossing Consolidation Rating Formula

Abstract
The goal of this project was to provide an objective methodology to support public agencies and railroads in making decisions related to consolidation of at-grade rail-highway crossings. The project team developed a weighted-index method and accompanying Microsoft Excel spreadsheet based tool to help evaluate and prioritize all public highway-rail grade crossings systematically from a possible consolidation impact perspective. Factors identified by stakeholders as critical were traffic volume, heavy-truck traffic volume, proximity to emergency medical services, proximity to schools, road system, and out-of-distance travel. Given the inherent differences between urban and rural locations, factors were considered, and weighted, differently, based on crossing location. Application of a weighted-index method allowed for all factors of interest to be included and for these factors to be ranked independently, as well as weighted according to stakeholder priorities, to create a single index. If priorities change, this approach also allows for factors and weights to be adjusted. The prioritization generated by this approach may be used to convey the need and opportunity for crossing consolidation to decision makers and stakeholders. It may also be used to quickly investigate the feasibility of a possible consolidation. Independently computed crossing risk and relative impact of consolidation may be integrated and compared to develop the most appropriate treatment strategies or alternatives for a highway-rail grade crossing. A crossing with limited- or low-consolidation impact but a high safety risk may be a prime candidate for consolidation. Similarly, a crossing with potentially high-consolidation impact as well as high risk may be an excellent candidate for crossing improvements or grade separation. The results of the highway-rail grade crossing prioritization represent a consistent and quantitative, yet preliminary, assessment. The results may serve as the foundation for more rigorous or detailed analysis and feasibility studies. Other pertinent site-specific factors, such as safety, maintenance costs, economic impacts, and location-specific access and characteristics should be considered.

Keywords
At grade intersections, Emergency response time, Formulas, Lane closure, Railroad grade crossings, Ratings, Risk assessment, Safety, at-grade crossing, closure rating formula, rail-highway crossing, railroad crossing consolidation

Disciplines
Civil Engineering

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Development of Railroad Highway Grade Crossing Consolidation Rating Formula

tech transfer summary

The goal of this project was to provide an objective methodology to support public agencies and railroads in making decisions related to consolidation of at-grade rail-highway crossings.

Background

Crashes between motor vehicles and trains at highway-rail grade crossings is a significant concern to government agencies and railroad companies. The U.S. Department of Transportation (DOT) and railroad companies recognize the problem and have developed various programs that include incentives to encourage consolidation of these crossings.

This is particularly relevant to Iowa, which is a non-regulatory state and, therefore, does not have the authority to force the consolidation of highway-rail grade crossings on county (secondary) roads or municipal streets. Currently, even if various considerations identify a crossing as a candidate for consolidation, other factors and pressures often lead local agencies to leave a crossing open.

Problem Statement

While the literature documents many attempts to address various issues related to safety and risks at highway-rail grade crossings and strategies to minimize these risks and improve safety, limited information exists on a formula-based or systematic approach to evaluate crossings for consolidation.

While, the Iowa DOT Office of Rail Transportation Modal Division has an established procedure for evaluating highway-rail grade crossing safety and risk, as outlined in Federal-Aid Railroad-Highway Grade Crossing Program: Use of Benefit-Cost Ratio to Prioritize Projects for Funding, the purpose of the Federal-Aid Railroad-Highway Grade Crossing program is to eliminate hazards to vehicles and pedestrians at existing railroad crossings.

While the traditional basis for highway-rail grade crossing consolidation may be safety-related, safety does not necessarily need to be the impetus for consideration. Additional opportunities may exist in a more comprehensive and proactive assessment. General crossing necessity within the highway system may be systematically assessed through consideration of various factors beyond those that are strictly safety-related.

Ranking of crossings may be based on the potential impact on the public if a crossing is closed or consolidated. Safety-related factors may be considered independently and integrated, or evaluated in conjunction, with the general crossing assessment.

Project Objectives

The objectives of this project were to develop and present a quantitative approach to assess crossings for possible consolidation, focusing predominantly on factors beyond safety and risk.

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RESEARCH PROJECT TITLE
Development of Railroad Highway Grade Crossing Consolidation Rating Formula

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Research Description/ Methodology

The project team developed a weighted-index method and accompanying Microsoft Excel spreadsheet-based tool to systematically evaluate and prioritize all public highway-rail grade crossings in the state from a possible consolidation impact perspective. A technical advisory committee (TAC) was established to provide broad, diverse insight and guidance, including identification of pertinent factors of interest and their corresponding weighting.

To ensure that potentially differing perspectives and interests were represented, the TAC was comprised of individuals from local and state government as well as railroad, industry, and non-profit organizations.

Local agency representatives included a city engineer from a municipality with a population of approximately 28,000 and 50 highway-rail grade crossings, and a county engineer from a small, rural county with approximately 15 rural highway-rail grade crossings. Two individuals from the Iowa DOT Office of Rail Transportation were also on the TAC, representing the areas of crossing safety and rail regulation and analysis.

Non-government TAC members included a public project manager from Burlington Northern Santa Fe (BNSF) Railway, the executive director of the Soy Transportation Coalition, and an educator from Operation Lifesaver.

While the TAC served as the primary guidance for the project, the group was limited in number. Therefore, an effort was made to survey a more comprehensive stakeholder group via email. The objective was to elicit input from additional key stakeholders regarding their views and concerns with closing of highway-rail crossings within their jurisdictions.

In developing the survey, input was solicited from several pertinent stakeholder groups, including primary and secondary education transportation providers as well as statewide agriculture and insurance-based organizations. While these organizations chose not to participate in the survey or distribute it to their members, they provided valuable input in shaping its content.

Ultimately, the survey was distributed to all county engineers in Iowa, representing all 99 counties, and all Iowa League of Cities members. A benefit of distributing the survey to all county engineers was that individuals in a common position provided responses. This was not necessarily the case with city-based responses, in which a more diverse group of staff had the ability to respond.

Detailed results of the survey are included in the final project report.

Key Findings

Factors identified by stakeholders as critical were: traffic volume, truck traffic volume, proximity to emergency medical services, proximity to schools, road system, and out-of-distance travel. The survey revealed that primary factors considered by both cities and counties when assessing the necessity of a highway-rail grade crossing are traffic safety and access to residential areas. Farm access was also a primary factor for counties, while emergency vehicle blockage and access to businesses were additional, primary factors for cities.

Given the inherent differences between urban and rural locations, factors were considered, and weighted, differently, based on crossing location.

Application of a weighted-index method allowed for all factors of interest to be included and for these factors to be ranked independently, as well as weighted according to stakeholder priorities, to create a single index. If priorities change, this approach also allows for factors and weights to be adjusted.

Microsoft Excel served as an ideal data repository and prioritization tool platform, given its ease of use, flexibility, accessibility, and transferability. In addition, existing functionality could be employed easily, allowing users flexibility in refining analyses by filtering (or limiting) crossings of interest by any attribute, or attributes, associated with each crossing.

Highway-rail grade crossing consolidation prioritization is very data-reliant. Appropriate data update and maintenance practices are essential.

Many of the factors employed require only limited updates. Attributes may also be updated in a piecemeal fashion, as necessary, and all normalized factors, factor ranks, and the final composite rank will be automatically recalculated for each crossing.

Implementation Readiness and Benefits

The prioritization generated by this approach may be used to convey the need and opportunity for crossing consolidation to decision makers and stakeholders. It may also be used to quickly investigate the feasibility of a possible consolidation. In addition, the prioritized list may be used in conjunction with Iowa's existing safety-based benefit-cost ratio calculations.

Independently computed crossing risk and relative impact of consolidation may be integrated and compared to develop the most appropriate treatment strategies or alternatives for a highway-rail grade crossing. A crossing with limited or low consolidation impact but a high safety risk may be a prime candidate for consolidation. Similarly, a crossing with potentially high consolidation impact as well as high risk may be an excellent candidate for crossing improvements or grade separation.

The results of the highway-rail grade crossing prioritization represent a consistent and quantitative, yet preliminary, assessment. The results may serve as the foundation for more rigorous or detailed analysis and feasibility studies. Other pertinent site-specific factors, such as safety, maintenance costs, economic impacts, and location-specific access and characteristics should be considered.