Measure Name Grade separation

Definition Closing of an at-grade crossing and replacing it with an overpass or underpass to allow safe passage from one side of the tracks to the other.

Tags:

Type of Incident:

- ☐ Non-Motorized Users Only
- ☐ Motor Vehicles Only
- ☒ Both

Intervention Strategy:

- ☐ Data: application and planning
- ☐ Education: outreach and messaging
- ☐ Enforcement: policy development and rulemaking
- ☒ Engineering: technological and physical deterrents

Type of Problem:

- ☒ Non-Motorized Users Violating Warning Devices
- ☒ Motor Vehicles Violating Warning Devices
- ☒ Vehicle ROW Incursion
- ☒ Vehicle Congestion
- ☒ Blocked Crossing
- ☒ Vehicle Hang-up

Measure Category:

- ☐ Risk Assessment
- ☐ Policy and Enforcement
- ☐ Collaboration, Training, and Education
- ☐ Public Communication
- ☐ Physical Barriers
- ☐ Detection and Lighting
- ☒ Infrastructure Modification
- ☐ Post-Incident Management
- ☐ Warning Devices

Description

This measure refers to closing an at-grade crossing and replacing it with an underpass or overpass to provide safe passage from one side of the railroad tracks to the other. Providing a different grade level for trains and roadway users can reduce the possibility of train strikes. Both FRA [1] and American Association of State Highway and Transportation Officials (AASHTO) [2] have developed guidelines for crossing consolidation.

This measure should be considered where there are significant safety issues and delays to roadway users from trains that block crossings for extended periods of time. Special consideration should be given to crossings that are frequently used by emergency vehicles.

Closing an at-grade crossing and replacing it with a grade separation provides the highest level of crossing safety because it provides a different level for trains and roadway users. However, these grade-separated crossings are expensive and can take a long time to build. Also, if the grade separation is not properly designed, pedestrians may trespass and walk across the tracks instead of using the grade separated facility. According to the American Association of State Highway and Transportation Officials (AASHTO) guide for planning, design, and operation of pedestrian facilities, grade-separated crossings should incorporate the following conditions [3, p. 95]:

- The facility is located where it is needed and will be used.
- Crossing structures are built with adequate widths based on perception of safety and pedestrian volumes.
- The design is accessible to all users.
- Barriers/railings are provided to add an increased sense of safety to the pedestrian.
- The facility is well lit, which increases pedestrian security.

The likelihood of pedestrians using a grade-separated facility is strongly tied to the time it takes to utilize the grade-separated crossing compared to the time it takes to use an alternate route [4]. In other words, pedestrians tend to use grade-separated paths when it does not significantly lengthen their trip. One study investigated the effects of closing and replacing a grade crossing with a vehicular and pedestrian overpass bridge in Alabama. The study showed that after the construction of the overpass, trespassers entering the railroad Right-Of-Way (ROW) increased by 72 percent. However, trespassing while a train was blocking the crossing decreased by 84 percent, and the number of trespassers that jumped on a train decreased by 93 percent [5].

Additional search terms: *at grade, deterrent, overpass, underpass, closure, consolidation*

Advantages

- This measure eliminates collisions between trains and roadway users by removing the point of intersection between the modes.

- Closing an at-grade crossing and replacing it with a grade-separated crossing can improve train operations and eliminate maintenance cost associated with roadway and crossing warning devices. [6]
- Grade separation can also be used at stations.
- Closing of an at-grade crossing and replacing it with a grade separated crossing can reduce traffic congestion and eliminate train horn use at the crossing. [7]

Drawbacks

- Grade-separated crossings can be expensive and take a long time to build.
- These areas could become sites of crime and vandalism if not properly located to deter these actions. [3]
- Grade-separated crossings may not be used by pedestrians if they appear to be inconvenient for getting to their destinations. [3]

Notable Practices

- Ensure that the crossing is properly closed by removing all signs of a crossing and restricting access to railroad ROW by installing a fence. When determining the height of the fencing needed, consider the potential for individuals to jump or climb over the fence. [3]
- This measure is most beneficial where there are unacceptable traffic delays due to stopped trains at a crossing, and when residential neighborhoods are separated from schools by the railroad tracks. [3][4]
- This measure may be more effective when combined with educational and environmental interventions to inform the public about trespassing risks, such as brochures, presentations, and signage. Findings showed that the proportion of pedestrians who used an overpass bridge to cross the tracks increased substantially from 41 percent to 60 percent immediately after education and environmental interventions. [8]
- Consider right-of-way and land acquisition near the at-grade crossing as replacing it with a grade separated crossing requires significantly greater footprint than the existing at-grade roadway. [7]
- Consider the feasibility of consolidating nearby at-grade crossings. [7]
- Consider the effect of closing an at-grade crossing and replacing it with a grade separated crossing on trespassing along the corridor.
- Ensure that communities are involved in the process from the beginning. [6]

References

[1] US Department of Transportation Federal Railroad Administration. (2009). Crossing Consolidation Guidelines.

Excerpt: Crossing consolidation is crucial to public safety and economic development. Consolidating crossings ensures the ability of the railroads to play a constructive role in the national transportation system and to reduce congestion. The best practices, success stories, and tools offered in this document are a means to provide support and technical assistance in developing a successful program.

[2] American Association of State Highway and Transportation Officials, Standing Committee on Rail Transportation. (1995). Highway Rail Crossing Elimination and Consolidation.

Document Except: This document is a collaborative effort of Federal, State, and local agencies and associations, and railroad companies interested in promoting the consolidation of highway-rail grade crossings. It explains the purpose and benefits of crossing consolidation from a national as well as a local perspective, and from a highway as well as a railroad perspective. It is intended for use by highway authorities and railroad officials when initiating corridor reviews or crossing consolidation projects in their jurisdictions or on their rail lines.

[3] American Association of State Highway and Transportation Officials. (2004). *Guide for the Planning, Design, and Operation of Pedestrian Facilities.* The American Association of State Highway and Transportation Officials.

Document Excerpt: The purpose of this guide is to provide guidance on the planning, design, and operation of pedestrian facilities along streets and highways. Specifically, the guide focuses on identifying effective measures for accommodating pedestrians on public rights-of-way. Appropriate methods for accommodating pedestrians, which vary among roadway and facility types, are described in this guide. The primary audiences for this manual are planners, roadway designers, and transportation engineers, whether at the state or local level, the majority of whom make decisions on a daily basis that affect pedestrians. This guide also recognizes the profound effect that land use planning and site design have on pedestrian mobility and addresses these topics as well. [see Section 4.4 Maintenance of Pedestrian Traffic in Construction Work Zones for relevant information].

[4] Moore, R. and Older, S. (1965). Pedestrian and motor vehicles are compatible in today's world. *Traffic Engineering, 35*(12) 20-23, 52-59.

Description: This book describes a study was conducted in London, England to observe pedestrian use of highway grade separated crossings. A formula was devised where R is equal to the time required to utilize the grade separated crossing divided by the time required to cross at street level.

[5] Ngamdung, T. (2019*). Effect of Grade Separation on Pedestrian Railroad Trespass Activity at Shuttlesworth Drive in Collegeville, AL.* Technical Report No. DOT/FRA/ORD-19/11. Washington, DC: U.S. Department of Transportation, Federal Railroad Administration.

Abstract: The Volpe Center, under the direction of FRA's Office of Research, Development, and Technology, conducted a research study to evaluate the effects of closing and replacing the Fred L. Shuttlesworth Drive grade crossing (Crossing ID 352514C) with a vehicular and pedestrian overpass bridge on trespassing along a rail corridor in Birmingham, AL. Trespassing events were coded for 10 hours per day for 5 weekdays before construction of the overpass bridge and then again for approximately 5 months after the opening of the overpass bridge.
Results indicate that the rate of trespassers increased by 72 percent, from 44.74 to 76.91 per 100 pedestrians entering the railroad right-of-way, after the construction of the overpass bridge. However, high-risk trespass activities (trespassing during train events and trespassers physically interacting with a train) decreased significantly after the construction of the overpass bridge. Trespassing during train events decreased by 84.3 percent, from 7.05 to 1.10 trespassers per train event, and trespassers physically interacting with a train decreased by 92.6 percent, from 1.62 to 0.12 trespassers per train event after the construction of the overpass bridge.

[6] U.S. Department of Transportation. (2019). Highway-Rail Grade Crossing Handbook – Third Edition.

Abstract: The purpose of the Highway-Rail Crossing Handbook, 3rd Edition is an information resource developed to provide a unified reference document on prevalent and best practices as well as adopted standards relative to highway-rail grade crossings. The handbook provides general information on highway-rail crossings; characteristics of the crossing environment and users; and physical and operational changes that can be made at crossings to enhance the safety and operation of both highway and rail traffic over such intersections. The guidelines identified and potential alternative improvements presented in this handbook reflect current best practices nationwide.

[7] Cambridge Systematics, Rail Strategy Study – Grade Crossing Toolkit, July 2018.

Excerpt: The Grade Crossing Toolkit provides information and tools to identify candidate crossing improvements across a range of options. The Toolkit describes rail crossing treatments, such as grade separations, closures, consolidation, passive treatments, active devices, quiet zones, and specialized treatments for pedestrian/bicycle issues.

[8] Lobb, B., Harré, N., and Suddendorf, T. (2001). An evaluation of a suburban railway pedestrian crossing safety programme. *Accident Analysis & Prevention. 33*(2) 157-165

Abstract: This study evaluated a programme of educational and environmental (access prevention) interventions designed to reduce the incidence of illegal and unsafe crossing of the rail corridor at a suburban station in Auckland, New Zealand. Immediately after the programme of interventions, the proportion of those crossing the rail corridor by walking across the tracks directly rather than using the nearby overbridge had decreased substantially. Three months later, the decrease was even greater. However, the educational and environmental interventions were introduced simultaneously so that the effects of each could not be separated; nor could other unmeasured factors be ruled out. Anonymous surveys administered immediately before and 3 months after the interventions indicated that while awareness of the illegality of walking across the tracks had increased slightly, perception of risk had not changed. This suggests that the educational interventions may have had less effect than the access prevention measures.

Additional Resources

National Academies of Sciences, Engineering, and Medicine. (2019). Prioritization Procedure for Proposed Road Rail Grade Separation Projects Along Specific Rail Corridors.

Excerpt: NCHRP Research Report 901: Prioritization Procedure for Proposed Road–Rail Grade Separation Projects Along Specific Rail Corridors provides tools to assist state and local planners in making better prioritization and investment decisions for road–rail at-grade crossing separations.

Toole, J. (2010). *Update of the AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities*, National Cooperative Highway Research Program (NCHRP) Project 20-07.

Description: This document provides literature review and survey results regarding how to improve the previous version of the AASHTO Pedestrian Guide.

Related Measures

- Collaboration with local government and communities
- Grade crossing safety education in communities

Images

Figure 1. Example of a grade separated crossing in Birmingham, AL
Image Credit: Volpe Center

Figure 2. Example of a grade separated crossing in Birmingham, AL
Image Credit: Volpe Center