APTA STANDARDS DEVELOPMENT PROGRAM
RECOMMENDED PRACTICE
American Public Transportation Association
1300 I Street, NW, Suite 1200 East, Washington, DC 20006

APTA RT-RGC-RP-003-03, Rev. 4
Published: June 8, 2003
First Revision: Dec. 8, 2005
Second Revision: Not Known
Third Revision: February 6, 2008
Fourth Revision: December 6, 2017

APTA Rail Transit Grade Crossing Working Group

Rail Transit Grade Crossing Safety Assessment

Abstract: This *Recommended Practice* provides a structured approach for assessing new and existing highway rail grade crossings.

Keywords: assessment, evaluation, identifier, inventory, safety

Summary: This *Recommended Practice* provides an organized, structured approach for assessing the safety of new and existing rail transit system (RTS) highway rail grade crossings.

Scope and purpose: This document applies to new-start and existing rail transit, light rail and rapid rail lines on an exclusive right-of-way. The purpose of this *Recommended Practice* is to verify that highway rail grade crossing systems are operating safely and as designed through periodic assessment, thereby increasing safety, lowering risk and reducing the number of highway rail grade crossing collisions, deaths and injuries involving people who interact with rail transit operations (motorists, employees, passengers, pedestrians and members of the general public).

Table of Contents

List of Figures and Tables

Participants

The American Public Transportation Association greatly appreciates the contributions of the **APTA Rail Transit Grade Crossing Working Group**, which provided the primary effort in the drafting of this document.

At the time this standard was completed, the working group included the following members:

Matthew Baaccitich, *Chair*
Aderemi Omotayo, *Vice Chair*
Vacant, *Secretary*

Ed Boni, *Interactive Elements Inc.*
Richard Brown, *Transpo Industries Inc.*
Terry Byrne, *VHB*
Lynda Bybee, *LA Metro*
Rick Campbell, *CTC Inc.*
Mike Choat, *Railroad Controls Ltd.*
Brian Clark, *Parsons Brinckerhoff*
John Cyrus, *Oregon DOT*
Andrew Davis, *Energy Absorption Systems*
Victor Demmons, *MARTA*
Charles Dickerson, *New Jersey Transit*
Gary Ferguson, *Oregon DOT*
Manuel Galdo, *Federal Railroad Administration*
David Genova, *Regional Transportation District*
Susan Gilbert, *Interactive Elements Inc.*
Brian Gilleran, *Federal Railroad Administration*
Dan Guerrero, *CTC Inc.*
Vernon Hartsock, *Maryland MTA*
Zack Hunter, *Oregon DOT*
Michael Hursh, *SCVTA*
John Lech, *Jacobs*
Justin Lee, *TriMet*
Reginald Mason, *MARTA*
Michael Martino, *VTA*
Michael McArdle, *Vanasse Hangen Brustlin*
John McGrevey, *BNC*
John Mitchell, *MBCRC*
Abraham Mooney, *TriMet*
Jim Morrison, *North Carolina DOT*
Paul O'Brien, *independent transportation adviser*
Brent Ogden, *Kimley-Horn Associates*
Lorraine Pacocha, *MBTA*
Ron Ries, *Federal Railroad Administration*
Mark Robinson, *SCVTA*
Joyce Rose, *Operation Lifesaver*
Paul Schneider, *New Jersey DOT*
John Sharkey, *CTC Inc.*
Deirdre Smith, *Jacobs*
Libby Rector Snipe, *Operation Lifesaver*
Bob Stolle, *Oregon DOT*
Drew Thomas, *NCDOT*
Abdul Zohbi, *LA Metro*

Project consultant
Phil Olekszyk, *World Wide Rail Inc.*

Project team
Charles Joseph, *American Public Transportation Association*

Introduction

This introduction is not part of APTA RT-RGC-RP-003-03, Rev. 4*, "Rail Transit Grade Crossing Safety Assessment."*

The content of this *Recommended Practice* is based on the "Rules and Regulations Governing Signal and Train Control Systems," published by the Department of Transportation, Federal Railroad Administration, Office of Safety. Specific reference is herein made to the Code of Federal Regulations, Title 49, Part 234 – Grade Crossing Signal Safety, Subpart D, as related to Maintenance, Testing and Inspection and Subpart E as related to Emergency Notification Systems.

49 CFR 234 was specifically written to address Class One and other railroads or rail-transit operations that are connected to the general railroad system of transportation and thereby under the jurisdiction of the FRA. Where necessary, these recommended practices have been modified and/or extended to address issues unique to rail transit properties not under FRA jurisdiction.

APTA rail transit safety recommended practices represent an industry consensus on safety practices for rail transit systems to help achieve a high level of safety for passengers, employees, and the general public. This *Recommended Practice* provides procedures for inspecting, maintaining, and testing RTS highway rail grade crossings.

APTA recommends the use of this *Recommended Practice* by:

- individuals or organizations that operate rail transit systems;
- individuals or organizations that contract with others for the operation of rail transit systems; and
- individuals or organizations that influence how rail transit systems are operated (including but not limited to consultants, designers and contractors)

This *Recommended Practice* intends to meet the following objectives:

- to ensure that special life/safety equipment is operational and reliable;
- to help rail transit systems incorporate safety considerations during the inspection and maintenance process; and
- to identify inspection criteria and maintenance *Recommended Practices* that provide a high level of passenger and personnel safety.

The application of any standards, recommended practices, or guidelines contained herein is voluntary. In some cases, federal and/or state regulations govern portions of how a RTS operates. In such cases, the government regulations override any conflicting practices this document requires or recommends.

Rail Transit Grade Crossing Safety Assessment

1. Highway rail grade crossing safety assessment process

The RTS should assess each new highway rail grade crossing using a process that includes the activities presented in Sections 1.1–1.8 as a minimum.

1.1 Diagnostic review team

The RTS should assemble a diagnostic review team that is interdisciplinary in nature and represents all groups that share responsibility for safety at the grade crossings, such as rail and highway systems, law enforcement agencies and local municipalities.

The diagnostic team should have experience in the following:

- rail and highway traffic operations
- rail and highway traffic engineering
- railroad and highway signals and their interconnection
- system safety
- administration
- applicable regulatory Recommended Practices

1.2 Site visit and data collection

The diagnostic team should study each proposed crossing by gathering all relevant data and engineering documents. The team should then conduct a group review of the data and a group inspection of the proposed/existing physical crossing location and its surrounding area. The objective is to determine the characteristics and factors at the proposed crossing that affect safety. This information should be kept in a database for easy reference and updating as conditions change.

1.3 Evaluation/engineering analysis

An evaluation of each crossing should be made using a documented methodology that takes into account factors such as those shown in Annex B. The methodology should identify potential hazards related to people (employees, passengers, pedestrians and members of the general public), trains, equipment, highway vehicles and other property that may exist at each crossing. Additionally, the grade crossing safety evaluation should be tied to the rail transit system's overall system safety program plan.

1.4 Development of recommendations

Recommendations to eliminate or control hazards should be identified and documented. The following should be primary considerations:

- closure or consolidation of existing crossings
- grade separation of existing crossings
- design recommendations

Examples of specific design-related recommendations for retained crossings include the following:

- improved sight distance (e.g., removal of obstructions in the sight triangle)
- raised median or divider
- signage
- pavement markings

- curbs
- roadway surface
- highway realignment
- improved cross-section (humped crossings)
- illumination of the crossing (street lighting, etc.)
- crossing surfaces
- rehabilitation of the highway structure or track structure, including installation of drainage and subgrade filter fabric if required
- installation of active traffic control and warning devices:
    - flashing warning lights
    - bells and other audible devices
    - gates (highway and pedestrian)
    - data recorders
    - health monitoring
    - interconnection with highway traffic signal systems

All recommendations should comply with appropriate federal, state and local regulations; relevant APTA *Rail Standards* and *Recommended Practices*; MUTCD, the FRA/FTA Joint Policy on Shared Corridors; and the AREMA Recommended Practices for Highway Rail Grade Crossings.

NOTE: See the References section at the end of this document for the above references.

1.5 Implementation of recommendations

The design and construction of the system should address all recommendations so that they are implemented prior to operation. Recommendations should be included in the project safety certification process of the system safety program plan.

In addition to the recommendations developed in Section 1.4, the following areas should be made part of the highway rail grade crossing system safety program plan:

- operating and maintenance procedures
- training programs
- safety education programs
- law enforcement programs

1.6 Grade crossing inventory

Each RTS should maintain a highway rail grade crossing inventory that includes all public, private and pedestrian highway rail grade crossings, both at grade and grade separated (underpasses and overpasses). Each crossing should be assigned an appropriate unique identifier.

It is recommended that any RTS desiring to establish a crossing inventory should obtain and use USDOT crossing inventory numbers. See the FRA Crossing Inventory Program web page for details on how to obtain valid Crossing Inventory numbers. For information on completing and submitting new or updated Inventory Forms, see the FRA publication "Guide for Preparing U. S. DOT Crossing Inventory Forms" available for download from the FRA website. Information on the recently published regulation "Highway-Rail and Pathway Crossing Inventory Reporting" found in Subpart F of 49 CFR 234 can be found starting on Page 786 of the Federal Register, Volume 80, No. 3, or on the public website of the FRA at www.fra.dot.gov.

At crossings, this unique identifier, along with an emergency notification system (ENS) telephone number, as described in Subpart E of 49 CFR 234, should be posted on all approaches to the crossing on a signal mast, signpost or pole. The ENS sign must be posted so that it is conspicuous to the motorist by day or night. While

49 CFR 234 does not regulate rail transit systems in general, the information on ENS will be of use to those properties desiring to establish such a system. Information on the FRA's ENS regulation is contained in Annex C.

1.7 Follow-up

There should be a procedure in place to ensure that the grade crossing recommendations have been implemented in accordance with Section 1.4. As soon as practicable after the start of revenue operation, each highway rail grade crossing should be reviewed to determine whether the initial assumptions are still valid. The database discussed in Section 1.2 and the inventory discussed in Section 1.6 should be updated if appropriate.

1.8 Periodic review

1.8.1 System-wide review

System-wide review of new and existing highway rail grade crossings should be done on a regular basis in accordance with the rail transit system's system safety program plan. This review should identify factors at crossings that may have changed or are emerging that may create the potential for new hazards not previously addressed. The inventory and the factors in Section 1.4 may be used in the system safety program plan if the RTS deems it appropriate.

1.8.2 Site-specific review

Additionally, site-specific review should be done as deemed necessary by management or when any of the following occur:

- changes in the safety factors considered in the grade crossing evaluation (Section 1.4).
- system expansion
- an accident (collision)
- a near miss (near hit)

1.8.3 Database and USDOT inventory update

The database and inventory should be updated as appropriate.

1.8.4 Diagnostic team/engineering study

During a system-wide or site-specific review, conditions may warrant a full diagnostic team/engineering study.

References

AREMA, Recommended Practices for Highway Rail Grade Crossings.

Federal Highway Administration, "Manual on Uniform Traffic Control Devices (MUTCD)," 2003 edition. http://mutcd.fhwa.dot.gov/

Federal Railroad Administration (FRA), "Highway Rail Crossing Inventory, Instructions and Procedures Manual," December 1996. http://www.fra.dot.gov

FRA/FTA, Joint Policy on Shared Corridors.

U.S.C. Title 49, Section 20152 – Swift Rail Development Act 1994.

Definitions

diagnostic review team: A group of knowledgeable representatives, interdisciplinary in nature, that represents all groups having responsibility for safety at highway rail grade crossings.

rail transit system (RTS): The organization or portion of an organization that operates rail transit service and related activities. Also called operating agency, operating authority, transit agency, transit authority, transit system.

Abbreviations and acronyms

ENS emergency notification system
NATSA North American Transit Services Association
RTS rail transit system

Summary of document changes

- Document formatted to the new APTA *Rail Recommended Practice* format.
- Sections to reflect APTA Recommended Practices format added to Content Index.
- Section 1.6 last two paragraphs added to reflect the ability of a transit property to incorporate its grade crossings into the USDOT crossing inventory system.
- Annex C was totally rewritten to reflect the recent regulatory change found in 49 CFR 234 Subpart E, 49 CFR §234.309 and 49 CFR §234.311.

Document history

Document Version	Working Group Vote	Public Comment/ Technical Oversight	Rail CEO Approval	Rail Policy & Planning Approval	Publish Date
First published	Oct. 9, 2002	—	—	June 8, 2002	June 8, 2002
First revision	—	—	—	Feb. 2, 2008	Dec 8, 2005
Second revision	—	—	—	—	—
Third Revision	-	--	-	-	Feb 6, 2017
Fourth Revision	Oct 6, 2015	Aug 1, 2017	Sept. 18, 2017	November 2, 2017	December 6, 2017

Annex A (informative): Bibliography

1. AREMA C&S Manual, Section 3-Highway-Rail Grade Crossing Warning System.
2. FHWA-SA-07-010, "Railroad-Highway Grade Crossing Handbook, Revised-Second Edition," August 2007.
3. http://www.fra.dot.gov. FRA publication "Summary of the USDOT Rail-Highway Crossing Resource Allocation Procedure – Revised."
4. ITE Recommended Guidance on Preemption.
5. The AASHTO Green Book, "A Policy on Geometric Design of Highways and Streets," 2011.
6. USDOT Highway Railroad Grade Crossing Technical Working Group "Guidance on Traffic Control at Highway Rail Crossings," 2002.
7. http://www.apta.com. American Public Transportation Association. Provides information on public transportation issues.
8. http://www.oli.org. Offers information on Operation Lifesaver, its mission, state programs, structure, volunteer opportunities, partners, safety brochures, approved vendors of safety materials, etc.
9. http://www.fta.dot.gov. Federal Transit Administration. Provides information on current grade crossing technology demonstration projects as well as information on a variety of highway rail grade crossing issues.
10. http://www.arema.org. American Railway Engineering and Maintenance of Way Association (AREMA). Provides Manual of Recommended Practices for railroad engineering.
11. http://www.trb.org. Transportation Research Board. Provides information and resources on various transportation issues.
12. http://ite.org. Institute of Transportation Engineers. Provides information and resources on various transportation issues.

Annex B (informative): Safety factors to consider during assessment of crossings

The assessment and recommendations for highway rail crossings should take into consideration the following factors:

a) maximum speed of rail vehicles
b) number of tracks, mainline or other
c) number and types of rail vehicles daily and during peak periods
d) multiple trains approaching crossing simultaneously
e) types of existing warning and traffic control devices if any
f) sight distances, motor vehicle to rail
g) number of traffic lanes
h) condition of highway rail grade crossing surface
i) number of motor vehicles daily and during peak periods, including specialty vehicles such as heavy trucks, school buses, HAZMAT vehicles (hazardous material transport carriers) and emergency response vehicles
j) speed of motor vehicles over tracks
k) queuing potential across tracks
l) accident information/history
m) multiple adjacent or parallel grade crossings in close proximity
n) nearby vehicle and pedestrian traffic generators, such as businesses, schools, heavy industry, churches, and parks and playgrounds
o) geometry of the highway rail grade crossing, both horizontal and vertical:
    - storage space between highway traffic devices and highway; rail crossing devices
    - turning lanes
p) impact on adjacent highway/street operations
q) rail operating characteristics—e.g., braking distances
r) rail operating rules—e.g., horn blowing and near-side station stops
s) signal interconnection with highway traffic devices including preemption and priority
t) visibility of warning devices
u) switching operations in the area that may trigger nuisance operation of the grade crossing

Annex C (informative): Systems for telephonic notification of unsafe conditions at highway rail and pathway grade crossings

While transit systems are generally not required to comply with this regulation, the ENS system does provide many safety and operational benefits. Transit systems may wish to avail themselves of these benefits by establishing such an ENS on their properties. The FRA's regulation will provide beneficial information and guidance to any such transit operator.

Section 205 of the 2008 Rail Safety Improvement Act required FRA to develop, and railroads under FRA jurisdiction to implement, a "telephone number to report grade crossing problems."

The system as described by 49 CFR 234 Subpart E is intended to receive calls reporting four types of unsafe conditions at highway-rail or pathway grade crossings:

1. a warning system malfunction;
2. disabled vehicles or other obstructions blocking railroad tracks;
3. obstructions to the view of a pedestrian or a vehicle operator for a reasonable distance in either direction of a train's approach; or
4. any information relating to other unsafe conditions at the crossing.

Upon receiving report of signal malfunction, disabled vehicle or other obstruction, the railroad must:

- Immediately contact trains.
- Contact appropriate law enforcement agency so they can assist as necessary.
- Investigate the report.
- Correct the malfunction or unsafe condition.

Upon receiving a report of sight obstructions or other unsafe conditions, the railroad must:

- Investigate the report in a timely manner.
- Remove the obstruction if possible, or correct the safety condition if lawful and feasible.

An essential element of this system is the posting of a special ENS sign as described in Subpart E of 49 CFR 234. In general, the sign must satisfy the following conditions:

- It must measure at least 12 × 9 in.
- It must be retroreflective.
- It must have text at least 1 in. in height.
- It must have white text on a blue background with a white border.
- The DOT Inventory Number only may be black text on white background (see the alternate design shown in **Figure 1**).

Figure 1

ENS Sign Design

Example of MUTCD ENS sign.

Example of an alternate design as found in the section-by-section analysis within the ENS regulation

Within 49 CFR 234, § 234.309 describes the ENS signs in general terms, and §234.311 covers the requirements for proper placement and maintenance of the ENS signs. Any transit operator wishing to establish its own ENS and place the related signs would be well served to follow the guidance of these two parts, even though transit operators are not generally bound by these regulations.