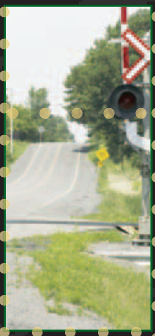
Railroad-Highway Grade Crossing *Handbook*



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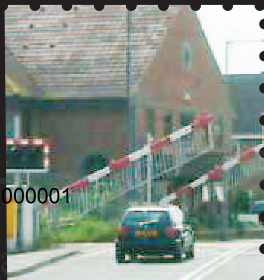

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16. Abstract

The purpose of the *Railroad-Highway Grade Crossing Handbook – Revised Second Edition* is to provide a single 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 the physical and operational improvements that can be made at highway-rail grade crossings to enhance the safety and operation of both highway and rail traffic over crossing intersections. The guidelines and alternative improvements presented in this handbook are primarily those that have proved effective and are accepted nationwide.

This handbook supersedes the *Railroad-Highway Grade Crossing Handbook*, published in September 1986. This update includes a compendium of materials that were included in the previous version of the handbook, supplemented with new information and regulations that were available at the time of the update. Updates were drawn from the current versions of relevant legislation, policy memoranda, Federal Register notices, and regulatory actions.

17. Key Words	18. Distribution Statement
Grade Crossing, Railroad, Traffic Control, Crossing Surfaces, Crossing Safety	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

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brake pipe to atmospheric pressure and the resulting rapid rate of brake pipe pressure reduction causes the car valves to dump the contents of both auxiliary and emergency reservoirs into the brake cylinder.

Braking distances are dependent on many factors that vary for each train, such as the number and horsepower rating of locomotives; number and weight of cars; adhesion of wheels on rails; speed; and grade. Therefore, the braking distance of a train cannot be stated exactly. An estimate is that a typical 100-car freight train traveling at 60 mph would require more than 1 mile to stop in emergency braking.

The majority of crossing collisions involve freight trains, as shown in Table 12.

Generally, crossings with higher numbers of trains per day would be expected to have more crossing collisions because the "exposure" (the number of trains per day multiplied by the number of cars per day) is higher for any given highway traffic level. Figure 2 shows the number of collisions in 2004 by the number of trains per day per crossing. Although Figure 2 indicates a dip in the number of collisions for crossings with 21 to 30 trains per day, due to the fact that there are fewer crossings with these activity levels, crossings with higher activity levels have higher collision rates as well.

2. Track

In the United States, railroad trackage is classified into six categories based upon maximum permissible operating speed. FRA's track safety standards set maximum train speeds for each class of track, as shown in Table 13.

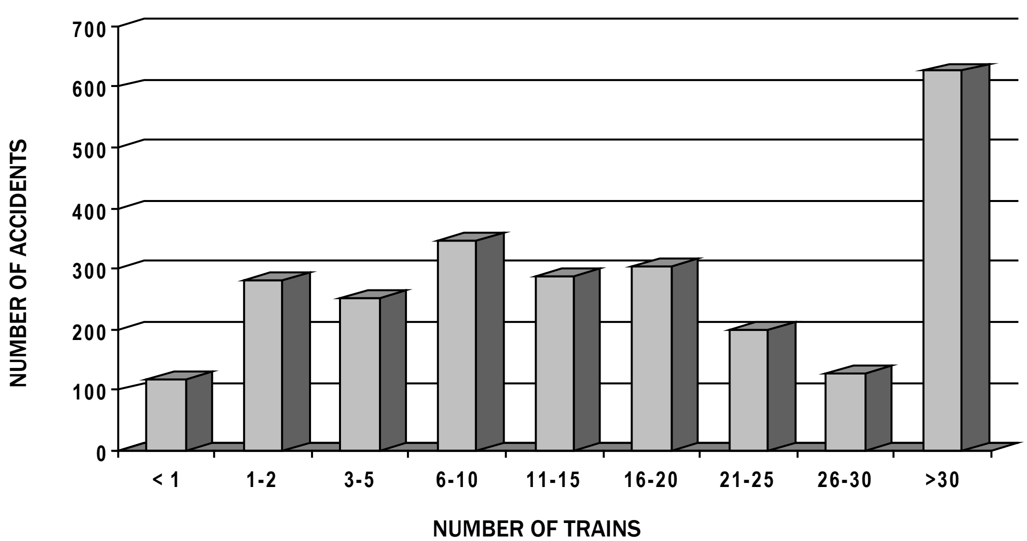
Table 12. Collisions at Public Crossings Involving Motor Vehicles by Type of Train, 2004

Type of train	Collisions
Freight	1,997
Passenger/commuter	227
Yard switching	167
Other*	232
Total	2,623

** Note: "Other" includes work trains, light locomotives, single car, cut of cars, maintenance/inspection car, and special maintenance-of-way equipment.*

Source: Unpublished data from Federal Railroad Administration.

Figure 2. Number of Collisions by Number of Trains per Day per Crossing, 2004



Source: Unpublished data from Federal Railroad Administration.

Table 44. Countermeasure Type, Effectiveness, and Cost

Countermeasure	Effectiveness	Cost
STOP signs at passive crossings	Unknown	$1,200 to $2,000
Intersection lighting	52-percent reduction in nighttime collisions over no lighting	Unknown
Flashing lights	64-percent reduction in collisions over crossbucks alone 84-percent reduction in injuries over crossbucks 83-percent reduction in deaths over crossbucks	$20,000 to $30,000 in 1988
Lights and gates (two) with flashing lights	88-percent reduction in collisions over crossbucks alone 93-percent reduction in injuries over crossbucks 100-percent reduction in deaths over crossbucks 44-percent reduction in collisions over flashing lights alone	$150,000
Median barriers	80-percent reduction in violations over two-gate system	$10,000
Long arm gates (three-quarters of roadway covered)	67 to 84–percent reduction in violations over two-gate system	Unknown
Four-quadrant gate system	82-percent reduction in violations over two-gate system	$125,000 from standard gates $250,000 from passive crossing
Four-quadrant gate system with median barriers	92-percent reduction in violations over two-gate system	$135,000
Crossing closure	100-percent reduction in violations, collisions, injuries, deaths	$15,000
Photo/video enforcement	34 to 94–percent reduction in violations	$40,000 to $70,000 per installation
In-vehicle crossing safety advisory warning systems	Unknown	$5,000 to $10,000 per crossing plus $50 to $250 for a receiver

Note: The effectiveness of a countermeasure is expressed as a function of the percentage reduction in collisions and other violations over some previous treatment. Costs are expressed in U.S. dollars (approximate year 2000 amounts).[1]

Source: Guidance on Traffic Control Devices at Highway-Rail Grade Crossings. *Washington, DC: Federal Highway Administration, Highway/Rail Grade Crossing Technical Working Group, November 2002.*

1 "A Human Factors Analysis of Highway-Railway Grade Crossing Accidents In Canada." Transportation Development Centre, Transport Canada, September 2002 (www.tc.gc.ca/tdc/summary/14000/14003.htm).