U.S. Department
of Transportation

**Federal Railroad
Administration**

NATIONWIDE STUDY

OF

TRAIN WHISTLE BANS

Office of Safety
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EXECUTIVE SUMMARY

On July 26, 1991, the Federal Railroad Administration (FRA) issued Emergency Order No. 15 requiring the Florida East Coast Railway Company (FEC) to follow rules requiring train horns to be sounded at highway-rail crossings. This action was taken in response to a dramatic increase in the number of crossing accidents after seven counties and twelve cities in Florida issued ordinances prohibiting the sounding of train whistles at 511 crossings during nighttime hours.

Following the imposition of Emergency Order No. 15, the nighttime accident rate declined 68.6 percent to pre-whistle ban levels. It was clear that prohibiting train horns had significantly increased the risk of accidents.

FRA is very concerned that other locations throughout the country might be experiencing a similar increased risk of crossing accidents as a result of whistle bans. In consideration of a possible future rulemaking, FRA announced it would conduct a national study of whistle bans to determine how many crossings were affected and examine the accident histories of those crossings.

The study was performed using data from a survey conducted in 1992 by the Association of American Railroads (AAR) which identified crossings with whistle bans. Twenty-five railroads surveyed their systems. Seventeen reported operating over highway crossings subject to whistle bans. After screening, 2,122 public, at-grade crossings on 17 railroads and located in

27 states were considered in this study.

FRA believes the AAR survey accounted for a major portion of all crossings subject to whistle bans. The responding railroads operate over 61 percent of the nation's public, at-grade crossings and operate 91 percent of the annual train miles. Of the total number of interactions between highway users and train traffic that occur at crossings subject to whistle bans, FRA believes only a small share take place at crossings not included in this survey.

A breakdown of the types of motorist warning devices installed at crossings with whistle bans showed 40 percent with gates, 22 percent with flashing lights, 26 percent with crossbucks, and 12 percent with other types of signs or train crew flagging. Overall, crossings subject to whistle bans have a higher level of warning device than the general population of crossings, wherein, 17 percent have gates, 18 percent have flashing lights, and 51 percent have crossbucks.

Ninety-four percent of the whistle bans were effective 24 hours a day. Fewer than six percent of the bans (at 118 crossings) were nighttime-only, typically from 6:30 PM to 6:30 AM.

The "Study Group" of 2,122 crossings were located in 227 cities in 27 states. The states with the greatest number included Illinois with 286, Wisconsin with 183, Kentucky with 158, New York with 157, and Minnesota with 153.

Among the seventeen railroads that reported crossings with whistle bans, CSX, Conrail, and Soo Line accounted for about 56

percent of the total crossings. Amtrak reported operating over 77 crossings.

As of the 1992 survey, the number of crossings with whistle bans had reportedly decreased by 721. Whistle bans at crossings in 65 cities had either been cancelled by public officials or were being ignored by the railroads in a conscious decision to not abide by ordinances that appeared to compromise safety. As of 1992, there were 1,401 remaining bans in 164 cities and 24 states. Of these remaining bans, 84 were nighttime-only bans in 18 cities and 8 states.

The cancellations of whistle bans enabled FRA to make direct comparisons of the number of accidents during the bans and during equal time intervals when the bans were not in effect. Twelve "before and after" case studies resulted, involving eight railroads and 831 crossings. Overall, this comparison showed the accident rate declined 38 percent when whistle bans were cancelled. However, for 288 Conrail crossings, the accident rate declined 53 percent, and for 293 CSX crossings, it declined 59 percent.

In addition, an analytical comparison of 1,222 crossings subject to whistle bans from 1989 through 1993 against all other 167,000 public grade crossings in the national inventory was made. The comparison showed crossings with whistle bans had a significantly higher average accident frequency than the non-ban crossings. In performing this analysis, 1,222 whistle ban crossings were divided into ten groups of nearly equal size based

on similar estimated accident frequencies, as calculated by an established accident prediction formula. Within each risk level, which ranged from low to high, the accident histories of the crossings were tabulated. A similar procedure was followed for all other 167,000 public crossings in the national inventory. In nine of the ten risk levels, the group of crossings with whistle bans had accident frequencies significantly higher than the national population in the corresponding risk level group. Overall, whistle ban crossings experienced an average of 84 percent more accidents than crossings without bans.

For the 118 crossings reported to have nighttime-only whistle bans, FRA found a notably higher frequency of accidents during the hours bans were in effect, especially between 6:30 PM and midnight. There were 15 accidents during that 5 1/2 hour period, compared to 24 accidents during the 12 daytime (non-ban) hours.

From January 1988 through June 1994, there were a total of 948 accidents at crossings with whistle bans in effect, resulting in 62 fatalities and 308 injuries. Accidents occurred on all 17 of the railroads reporting whistle bans. Railroads with the highest number of accidents included Soo Line with 157, Wisconsin Central with 142, CSX with 113, Union Pacific with 101, Norfolk and Western with 89, and Burlington Northern with 80.

During this period, Amtrak experienced 54 accidents with 5 fatalities and 19 injuries. The Northeastern Illinois Regional Commuter Railroad (METRA) reported 36 accidents with 2 fatalities

and 7 injuries.

Accidents during whistle bans occurred in 24 states. The greatest number were in Wisconsin with 162 accidents, followed by Illinois with 144, Minnesota with 92, Indiana with 93, Kentucky with 47, and Michigan with 41.

A comparison of the circumstances of accidents indicated that sounding train horns reduced the frequency of accidents during the hours of darkness and also reduced the frequency of motorists driving around lowered gates. This review served to identify the conditions where whistle sounding reduced accidents.

Overall, the results of this study indicate that the safety risks associated with the whistle bans in Florida are **not** unique to that area. Twelve case studies, involving 831 crossings in eight states other than Florida, showed an overall 38 percent decline in the accident rate when whistle bans were cancelled, There were 53 percent and 59 percent reductions on 288 Conrail and 293 CSX crossings.

Unlike the crossings in Florida, which were located along the same right of way with relatively uniform rail traffic, the crossings in this study reflect a very diverse population with respect to physical configurations, motorist warning devices, and highway and rail traffic mixes. Their geographical dispersion contributes to a more credible indication of the national safety implication of train whistle bans.

However, in spite of the differences between the groups of crossings involved in this study and the Florida study, the

results are similar and significant. The national group showed a 38 percent reduction in the crossing accident rate when whistle bans were cancelled, and the Florida group, a 68.6 percent reduction. These trends add credence to both studies and indicate that whistle bans, whether 24 hour or nighttime-only, increase the risk of accidents at crossings.

NATIONWIDE STUDY
OF
TRAIN WHISTLE BANS

I. INTRODUCTION

Background

Railroad transportation fostered early economic and population expansion in the United States. Long before the invention of motor vehicles and aircraft, which prompted the need for the interstate highway system and airports, a new generation of cities such as Atlanta appeared. The location of these cities was due solely to the presence of railroad lines that crossed or ended at that particular point.

During the 1830s, when commercial rail service began, the population of the United States averaged about fifteen million. By 1870, just after the Central Pacific (now part of Southern Pacific) and the Union Pacific completed the first trans-continental railroad in 1869, the U.S. population was approximately forty million. Today, the U.S. population exceeds 250 million. The railroad right-of-way, once the only sign of civilization in most parts of the United States, now finds itself surrounded by residential populations and industrial facilities never envisioned by early railroad pioneers. To fulfill the needs of commerce and private travel, public highways cross railroad rights-of-way at more than 168,000 locations.

Highway-Rail Grade Crossing Accidents

The railroad industry's steel wheel on steel rail technology makes the economic transportation of bulk commodities possible. However, the laws of physics do not allow rapid deceleration of trains to avoid accidents. As a result, there are many tragic accidents involving motor vehicles at highway-rail grade crossings as well as railroad trespasser fatalities. It takes a 100-car train traveling 30 miles per hour approximately half a mile (2,640 feet) to stop, compared to about 40 feet for the average passenger vehicle. At 50 miles per hour, a 100-car train's stopping distance increases to one and a third miles (7,040 feet), compared to less than 150 feet for the average passenger vehicle.

Accident data indicates that the train speed in 87 percent of crossing accidents is less than 50 miles per hour, and evenly distributed between 10 and 50 miles per hour. When an accident occurs, train speed is a factor in its severity. Collisions between trains and motor vehicles are eleven times more likely to result in fatalities than collisions between two motor vehicles on highways. Each year, highway-rail grade crossing accidents claim about 600 lives and injure 2,400.

Motor vehicles, even large trucks, are severely crushed when struck by the mass of a moving train. The average freight locomotive weighs between 140 and 200 tons, and a 100 car train

can weigh 10,000 tons. In comparison, the average automobile weighs approximately one to two tons.

Highway-rail crossing accidents can cause death and injury to train crews and passengers, particularly in collisions with large trucks, buses, or other heavy equipment. Moreover, the release of hazardous materials by trucks or trains following grade crossing collisions can endanger anyone near the right-of-way or downwind of the collision point.

More than fifty percent of highway-rail collisions occur at crossings equipped with active warning devices. Perhaps the motor vehicle operators in these accidents do not cross railroad tracks often enough to be familiar with the warning devices designed for their safety. Or perhaps they become careless about heeding the warning indications. Statistics show that very few accidents are due to the infrequent failures of crossing warning lights or gates.

Train whistles, horns, and bells are warning devices which enhance railroad safety by giving motorists an audible indication of a train's proximity. The Federal Railroad Administration (FRA) requires that each lead locomotive in a train have an audible warning device.[1] However, FRA's regulations do not

[1] 49 CFR 229.129. The minimum sound level for train locomotives is specified at 96 decibels (dB) ± 4 dB--at 100 feet forward of the locomotive in its direction of travel. (A decibel is a unit for measuring the relative loudness of sounds which for humans range from zero, for the average least perceptible sound, to about 130 for the average pain level.)

specify when train audible warning devices should be sounded.[2] Individual railroads and state laws mandate those requirements. Typically, railroad operating procedures require engineers to sound train horns at most highway-rail grade crossings. The audible train horn provides the only indication of an approaching train at crossings with only passive warning devices.[3]

Florida Whistle Ban

Railroads are powerless to restrain the growth of residential populations along their rights-of-way. Train whistle use is an important deterrent to highway-rail crossing accidents in densely populated areas. However, special interest groups formed in the late 1970s, sought ways to silence train whistles, and concentrated their attention on nighttime bans, which gained much support from nearby residents. One Florida-based group, Project Whistle Stop, Inc., approached Federal agencies and the State of Florida's Federal legislators to sponsor a national whistle ban. When the national ban could not be obtained, the Florida State Legislature was persuaded to enact state whistle ban legislation. Local jurisdictions, cities, and counties were allowed to establish nighttime (10:00 P.M. to 6:00 A.M.) train whistle bans. However, the bans could be imposed only at

[2] 49 CFR 218. FRA's railroad operating practice regulations require that safety devices be operational; they do not specify when audible warning devices should be sounded.

[3] Passive highway-rail grade crossing warning devices may include crossbuck signs, stop signs, advance warning signs, and pavement markings.

crossings with active warning devices[4] and only on railroads that operate totally within the State of Florida.

Effective July 1, 1984, the Florida legislation applied only to the Florida East Coast Railway Company (FEC), an intrastate carrier.[5] Not affected were highway-rail crossings of a competing carrier, CSX Transportation, Inc. (CSX), an interstate rail carrier with lines parallel to those of FEC. However, response to the permissive legislation was widespread. By December 31, 1989, seven counties and a dozen additional cities had established whistle bans for 511 of FEC's 600 public grade crossings equipped with active warning devices. Unfortunately, the nighttime accident rate soared at the whistle ban grade crossings.

During House Appropriations Hearings on March 21, 1990, FRA received a congressional request to study FEC's nighttime train accident rate. Representative William Lehman (Florida's 17th District) asked FRA to determine if there was any correlation between those areas that had whistle bans and the number of highway-rail crossing accidents. Using a 1984-89 study period, the agency found that FEC's nighttime accident rate at the 511 affected crossings increased 195 percent following the imposition of whistle bans. FEC's daytime accident experience at the same

[4] All affected highway-rail grade crossings were required to be equipped with crossing gates, flashing lights, bells, and special highway advance warning signs.

[5] Florida Statute: 351.03 (4)(a), dated 8-20-91.

511 crossings remained virtually unchanged.[6] The study clearly showed the only identifiable difference between the number of accidents occurring at the crossings was the existence of the nighttime whistle bans themselves.

FRA provided copies of its 1990 study to officials of each Florida county and municipality with whistle bans in effect. Copies were also sent to the Florida Department of Transportation, and to fifteen members of the Florida state legislature. In the year following release of the study, no county or municipality acted to repeal or modify its whistle ban ordinance. The Florida state legislature also did not act in response to FRA's findings. Unfortunately, the number of FEC highway-rail crossings subject to the ban increased to 537. Furthermore, neither state or local authorities took action to compensate for the hazard introduced by whistle bans. Appropriate measures could have included increased law enforcement, installation of immovable highway dividers, grade separation at high-traffic crossings, or temporary nighttime or permanent closure of low-use crossings.

While waiting for state and local responses to its study, FRA continued to monitor accidents at FEC crossings. In some accidents, the highway vehicle went around or through grade crossing gates. In other accidents, the highway user failed to

[6] U.S. Federal Railroad Administration. *Florida's Train Whistle Ban* 2nd ed., September 1992.

clear the crossing before the train's arrival.[7] These events suggested that without the train whistle warning, motorists were unaware of the proximity of the train, or the direction of the train's travel.

FRA Emergency Order No. 15

Based on its investigation, FRA issued Emergency Order No. 15 on July 26, 1991. This decision requires the FEC to sound train horns when approaching public highway-rail grade crossings. Specifically, FEC was ordered to follow the operating rules governing horn use that were in effect before the state-permissive train whistle ban. While the FRA recognized that nighttime train whistles can be an inconvenience to residents near the railroad right-of-way, whistles can also save lives.

The effects of FRA's emergency order were dramatic and immediate. During the two years following the emergency order, "Day Accidents" (6:01 A.M. - 9:59 P.M.) declined 8.8 percent and "Night Accidents" (10:00 P.M. - 6:00 A.M.) declined 68.6 percent. Reported accidents returned to pre-whistle ban levels. This data is summarized in the table that follows.

[7] FRA also believes that the train whistle can prevent accidents involving a second train on an adjacent track. If the view of adjacent tracks is blocked by the first train, a highway user who decides to go around a "down" highway crossing gate after the first train passes, is totally dependent on hearing the warning of the second train's whistle.

FEC ACCIDENT REPORTS 7/27/89-7/25/93	DAY ACCIDENTS 6:01 AM - 9:59 PM	NIGHT ACCIDENTS 10:00 P.M. - 6:00 P.M.
Two Years Prior to E.O. #15	34	51
Two Years After E.O. #15	31	16
Percent Change	- 8.8	- 68.6

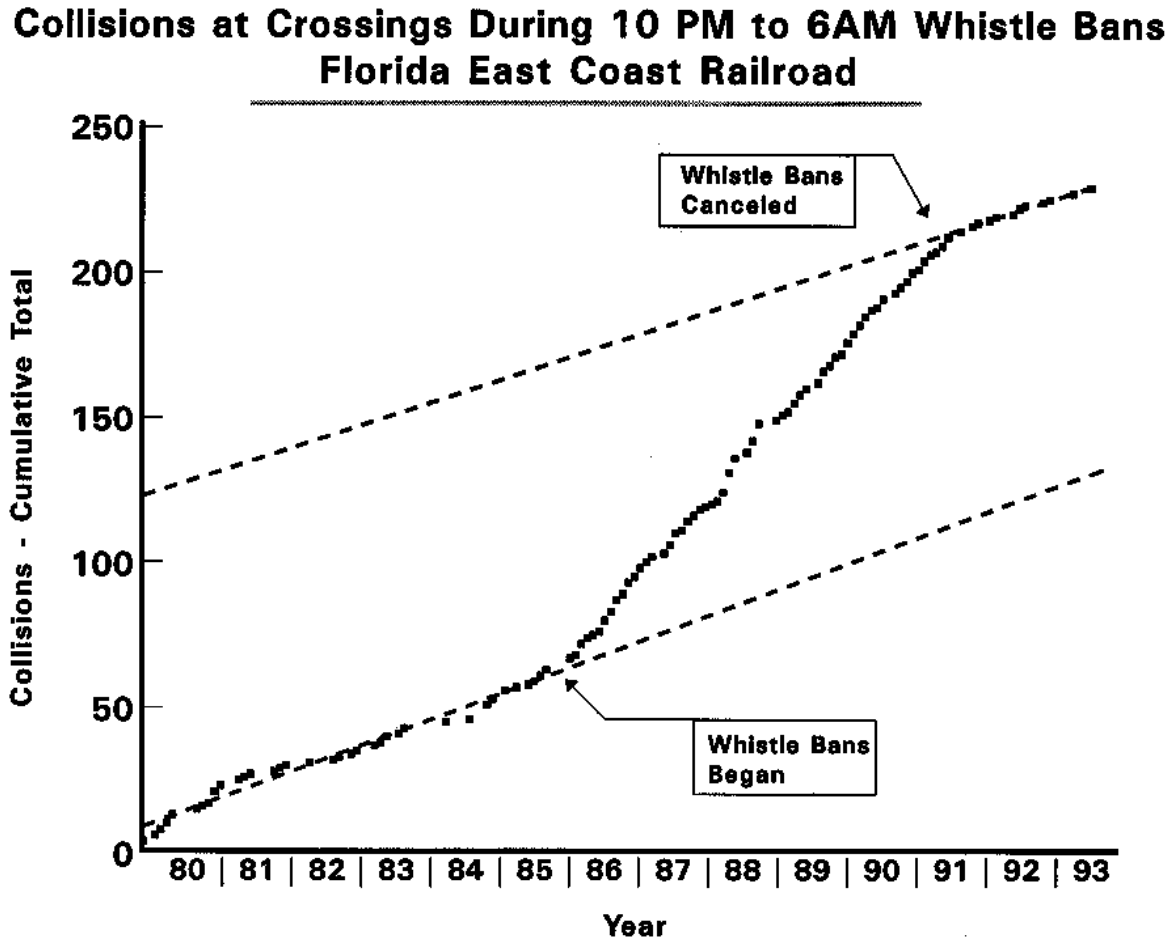
The graph in Figure A shows a summation of FEC's pre- and post-whistle ban crossing accidents from 1980 through 1993.

In the Florida legislative session of 1992, the whistle ban statute was revised. Whistle bans on all railroads operating in Florida are now permitted. However, to be in compliance with FRA's Emergency Order No. 15, affected crossings must meet one of five FRA criteria. The five criteria are described in Appendix 1 and are intended to preclude unsafe actions by motorists.

Nationwide Whistle Ban Study

As a result of FRA's study and subsequent actions, the whistle bans in Florida received widespread publicity. However, many other counties, cities, and towns around the nation also have ordinances prohibiting whistles. Over time, some have been repealed and some new ones enacted. Generally, safety considerations have prevailed in decisions regarding whistle bans. Since 1975, reports show that 30 new municipal bans have been enacted while 72 have been cancelled. However, FRA has not been monitoring ordinances against train whistle use.

FIGURE A



First Ordinance, July 84; Preempted, July 91
Source: Federal Railroad Administration

During administrative appeals to FRA's Emergency Order No. 15, the agency began an informal conference process with affected Florida parties on September 13, 1991. On December 5, 1991, FRA issued Conference Notice No. 3. This notice announced FRA's intention to issue an Advance Notice of Proposed Rulemaking regarding a nationwide rule for train whistles at highway-rail grade crossings.[8] In consideration of the rulemaking, FRA agreed to conduct a national survey of train whistle bans in cooperation with the Association of American Railroads (AAR). The AAR, a railroad industry trade association, requested its member railroads to submit information on state and local whistle bans of any type. Seventeen of twenty-five railroads responding to the AAR survey reported being affected by whistle bans at various crossing locations and that 94 percent of the reported bans were in effect 24 hours a day. An examination of the accident histories at these crossings provided the basis for FRA's Nationwide Study of Train Whistle Bans.

[8] U.S. Federal Railroad Administration. *Conference Notice No. 3*, December 5, 1991, Pages 15-16.

II. PURPOSE

Objectives

This study had two primary objectives. The first was to determine how many crossings (other than those on the FEC) were subject to whistle bans. The second was to evaluate whether those crossings were subject to the same elevated safety risk shown by the FEC whistle ban crossings in Florida.

Need for Study

Experiences in the states of Florida and Oregon[9] have provided compelling evidence about the safety benefits of sounding train horns at highway-rail grade crossings. FRA is very concerned that other locations throughout the country, where whistle bans are being observed, could be experiencing an increased risk of crossing accidents. However, FRA recognizes that the sounding of train horns is often regarded as an unnecessary disturbance of the peace and quiet of residential and commercial areas. Consequently, FRA was not prepared to initiate a national rulemaking without first examining the safety records of affected crossings.

The findings from this study will be considered by FRA in its decision with respect to possible regulatory actions. These findings will also provide citizens, local government officials,

[9] The Public Utility Commission of Oregon rescinded whistle bans in two cities after a 200 percent increase in the accident rate. See U.S. Federal Railroad Administration, *Florida's Train Whistle Ban,* 2nd ed., September 1992, Appendices L and M.

railroads, and other concerned parties with information that will clarify the safety implications of train whistle bans.

III. DATA DESCRIPTION

Collection and Scope

Before this study, no information about whistle bans in states other than Florida and Oregon had been compiled. In 1992, the AAR asked member railroads to prepare lists of all crossings on their respective systems subject to whistle bans. Carriers were asked to include information about the types of bans, and the dates of origins and cancellations, if applicable. Copies of the lists were provided to the FRA. Crossings were identified by their U.S. DOT/AAR National Rail-Highway Crossing Inventory Number.[10] The survey identified 2,705 crossings that were subject to whistle bans which included 24 hour and nighttime-only bans.

Twenty-five railroads responded to the AAR survey, seventeen of which reported operating over crossings subject to whistle bans. The respondent railroads operate over a total of 102,737

[10]FRA is custodian of this computer-based file of all highway-rail crossings in the United States. This data base, initiated by States, railroads, and the US DOT, circa 1973-75, is kept current by States and railroads who voluntarily provide information for newly established crossings and updates for existing crossings to FRA on a " U.S. DOT - AAR Crossing Inventory Form", Form FRA F 6180.71. See Appendix 2. (In the year ended March 31, 1993, FRA processed more than 103,255 inventory updates.) Each crossing in the country is assigned a unique number which facilitates precise identification. Among other uses, this number is included in all crossing accident reports.

public, at-grade, crossings. These represent about 61 percent of the national total of 168,223. Crossings not included in the survey are on the properties of approximately 603 other railroads, all of which are smaller railroads.

FRA believes that nearly all crossings of the Class I railroads were covered by the survey. Because the Class I railroads, as a group, accounted for about 91 percent of the total annual train miles operated in 1993, the crossings listed in the AAR survey experience a very large share of the total interactions between highway-users and trains that occur at crossings subject to whistle bans.

Initial Summary

An initial tabulation of the survey information showed that the crossings subject to whistle bans were located in 27 states.[11] The state with the greatest number was Illinois, with 306 crossings. Arizona had the fewest, with one. The distribution is shown in the following table and on the map in Figure B.

[11] The 537 crossings of the FEC, which had whistle bans prior to Emergency Order No. 15, have not been included in this tabulation or elsewhere in this study.

STATES WITH WHISTLE BAN CROSSINGS

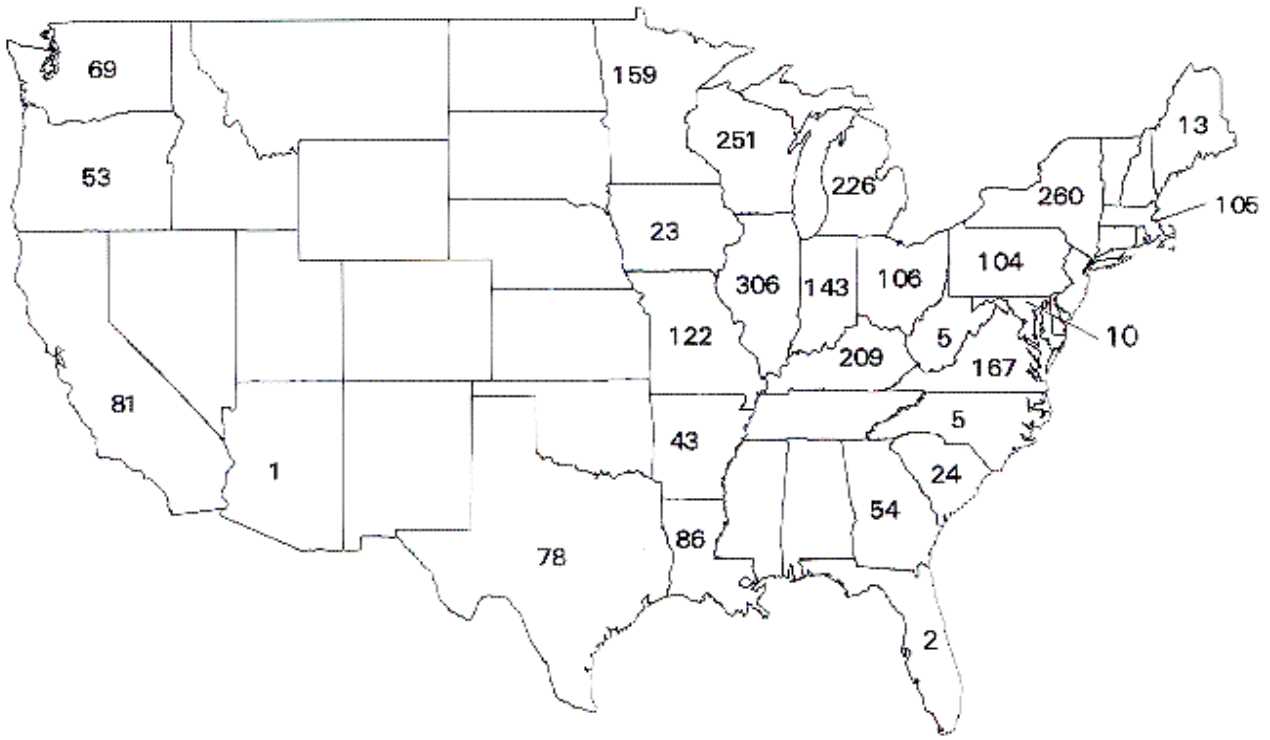
(Initial Count)[12]

AR.....43	MN.....159
AZ.....1	MO.....122
CA.....81	NC.....5
FL.....2[13]	NY.....260
GA.....54	OH.....106
IA.....23	OR.....53
IL.....306	PA.....104
IN.....143	SC.....24
KY.....209	TX.....78
LA.....86	VA.....167
MA.....105	WA.....69
MD.....10	WI.....251
ME.....13	WV.....5
MI.....226	

Initial Count: 27 States with 2,705 Crossings

[12] This initial count was subsequently adjusted downward as the result of screening procedures.

[13] Excluding 537 crossings on Florida East Coast Railway Company.



INITIAL SURVEY RESULTS - NUMBER OF CROSSINGS SUBJECT TO WHISTLE BANS

FIGURE 8

NUMBER OF CROSSINGS 2705
NUMBER OF STATES 27

Of the 17 railroads reporting crossings subject to whistle bans, CSX, Conrail, and Soo Line had the greatest number, accounting for about 56 percent of the total between them. The initial survey results are shown below:

RAILROADS WITH WHISTLE BAN CROSSINGS

(Initial Count)[12]

ATK.....91
ATSF.....41
BAR.....13
BN.....147
CNW.....87
CR.....530
CSX.....581
DH.....16
GTW.....11
KCS.....92
NS.....62
NW.....185
SOO.....401
SP.....35
SR.....13
UP.....228
WC.....172

Initial Count: 17 Railroads and 2,705 Crossings

Key to Railroad Abbreviations:

ATK - *National Railroad Passenger Corporation (AMTRAK)*
ATSF - *The Atchison, Topeka, & Santa Fe Railway Company*
BAR - *Bangor and Aroostook Railroad*
BN - *Burlington Northern Railroad Company*
CNW - *Chicago and Northwestern Transportation Company*
CR - *Consolidated Rail Corporation (Conrail)*
CSX - *CSX Transportation, Incorporated*
DH - *Delaware and Hudson Railway Company*
GTW - *Grand Trunk Western Railroad, Incorporated*
KCS - *The Kansas City Southern Railway Company*
NS - *Norfolk Southern Corporation*
NW - *Norfolk and Western Railway*
SOO - *Soo Line Railroad Company*
SP - *Southern Pacific Transportation Company*
SR - *Southern Railway Company*
UP - *Union Pacific Railroad*
WC - *Wisconsin Central, Limited*

Screening

Using information in the DOT/AAR Inventory, the list of 2,705 crossings was screened to identify and delete private crossings, pedestrian-only crossings, non at-grade crossings (railroad over or under roadway), closed crossings, crossings where the ban had been canceled before January 1, 1988,[14] and garbled crossing inventory identification numbers. The result was a final list of 2,122 public at-grade crossings where 24 hour or nighttime-only bans were in effect.

Locations and Types of Bans

Crossings which passed the screening process comprised the "Study Group" and were used in the subsequent compilations and analyses performed by FRA.

The locations of the crossings are shown in the following table and on the map in Figure C.

[14]For this study, FRA established a time frame of January 1, 1988 through June 30, 1994. This was based on the availability of the most recent accident data, which was through June of 1994, and a need to minimize potential changes in highway and rail traffic volumes as well in the physical characteristics of the crossings, while ensuring there would be sufficient accident data to enable meaningful analysis. The resulting study time frame spanned 6.5 years.

An exception to this time frame was made for those analyses involving an FRA accident prediction model, for which five years of accident data was used. The model's computer program was developed using this time span. The five year time frame used by the accident prediction model was from January 1, 1989 through December 31, 1993. (See page 32).

STATES WITH WHISTLE BAN CROSSINGS
(Post Screening Count)

AR.....41	MN.....153
AZ.....1	MO.....118
CA.....69	NC.....1
FL.....2[13]	NY.....157
GA.....52	OH.....74
IA.....19	OR.....49
IL.....286	PA.....73
IN.....118	SC.....24
KY.....158	TX.....65
LA.....70	VA.....93
MA.....88	WA.....62
MD.....8	WI.....183
ME.....12	WV.....5
MI.....141	

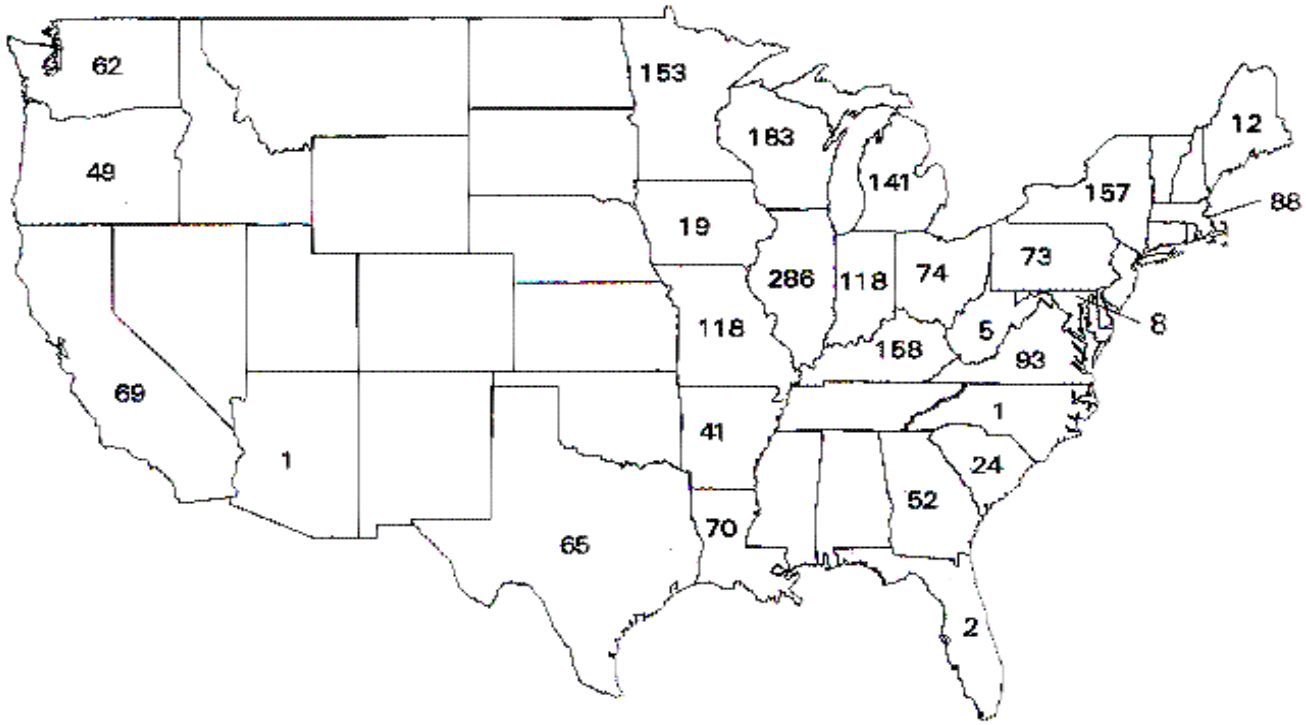
27 States with 2,122 Crossings

Railroads operating over the crossings are shown in the table below:

RAILROADS WITH WHISTLE BAN CROSSINGS
(Post Screening Count)

ATK.....77	GTW.....9
ATSF.....41	KCS.....82
BAR.....12	NS.....59
BN.....128	NW.....101
CNW.....74	SOO....335
CR.....350	SP.....28
CSX.....436	SR.....11
DH.....16	UP.....198
	WC.....165

17 Railroads and 2,122 Crossings



NUMBER OF PUBLIC CROSSINGS SUBJECT TO WHISTLE BANS

EXCLUDES PRIVATE AND PEDESTRIAN CROSSINGS

"STUDY GROUP"

NUMBER CROSSINGS 2122
NUMBER OF STATES 27

FIGURE C

The types of highway-user warning devices installed at the crossings are shown in the following table and in Figure D, which also provides a comparison with the general population of crossings in the U.S. As a group, crossings with whistle bans have a higher level of motorist warning device.

TYPES OF WARNING DEVICES AT WHISTLE BAN CROSSINGS[15]

Gates	852
Cantilevered Flashing Lights	99
Flashing Lights	373
Crossbucks	551
Other or None	247

The post-screening count identified 227 cities with whistle bans. Their state locations are shown in Figure E. Of the 2,122 crossings with whistle bans, 94 percent of the bans (at 1,993 crossings) were effective 24 hours a day.

Fewer than six percent of the bans (at 118 crossings) were effective only during nighttime hours, usually between the hours of 6:30 p.m. and 6:30 a.m. Figure F shows the locations of the crossings with nighttime-only bans. They were located in 9 states and 20 cities. The types of warning devices installed at these crossings include 49 with gates, 36 with flashing lights, and 33 with passive signs. Some of the nighttime-only whistle bans were reported to have been rescinded prior to the date of

[15]For this study, crossings were classified according to the highest level of highway-user warning device installed at the crossing. For example, if a crossing is equipped with gates, it will also have flashing lights and passive warning signs such as crossbucks. In this study, the crossing would be classified and counted as a "gate" crossing and not counted in any other group.

the AAR survey, but subsequent to January 1, 1988 (the beginning date of the study's time frame). Figure G shows the locations of 84 crossings that are believed to continue to have nighttime-only whistle bans in effect. They are located in 18 cities in 8 states.

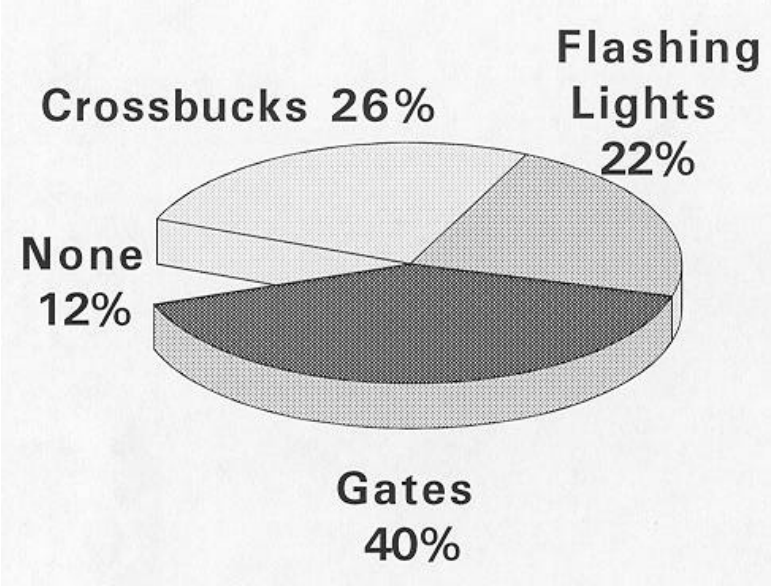
Eleven crossings had restrictions that permitted train whistles, but restricted them to "one sounding at 500 feet" or required the horn to be sounded, but only at "minimum intensity".

In reviewing the reports from the AAR survey, many indicated that a substantial number of whistle bans had been terminated by the municipalities or were being ignored by the railroads in a conscious decision to not abide by ordinances that appeared to compromise safety. In a few cases, new whistle bans had been implemented by communities. (These terminations and implementations provided the opportunity to compare accident frequencies during ban and non-ban periods). From the initial study group of 2,122 whistle bans, the number of crossings subject to bans decreased by 721. The observance of whistle bans in 63 cities has been discontinued.

The locations of the remaining 1,401 bans are shown in Figure H. They are located in 164 cities in 24 states. This total includes both 24 hour and nighttime-only bans.

FIGURE D

TYPES OF WARNING DEVICES AT CROSSINGS WITH WHISTLE BANS



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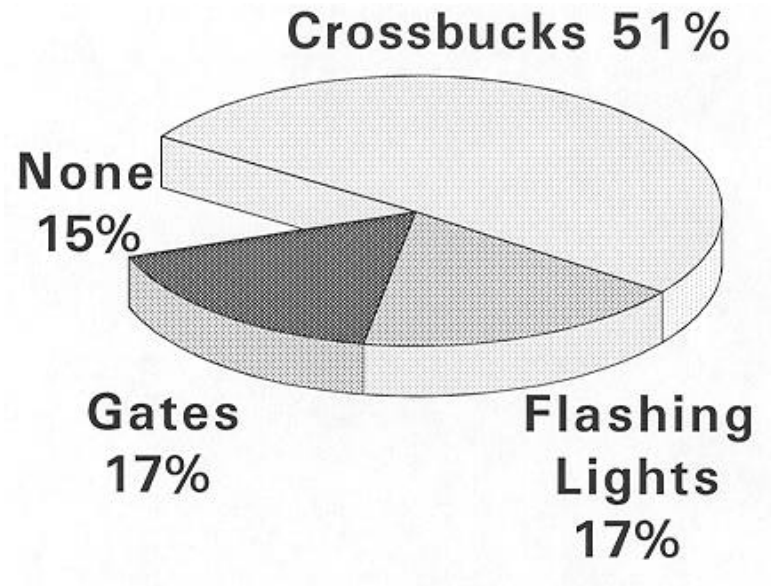
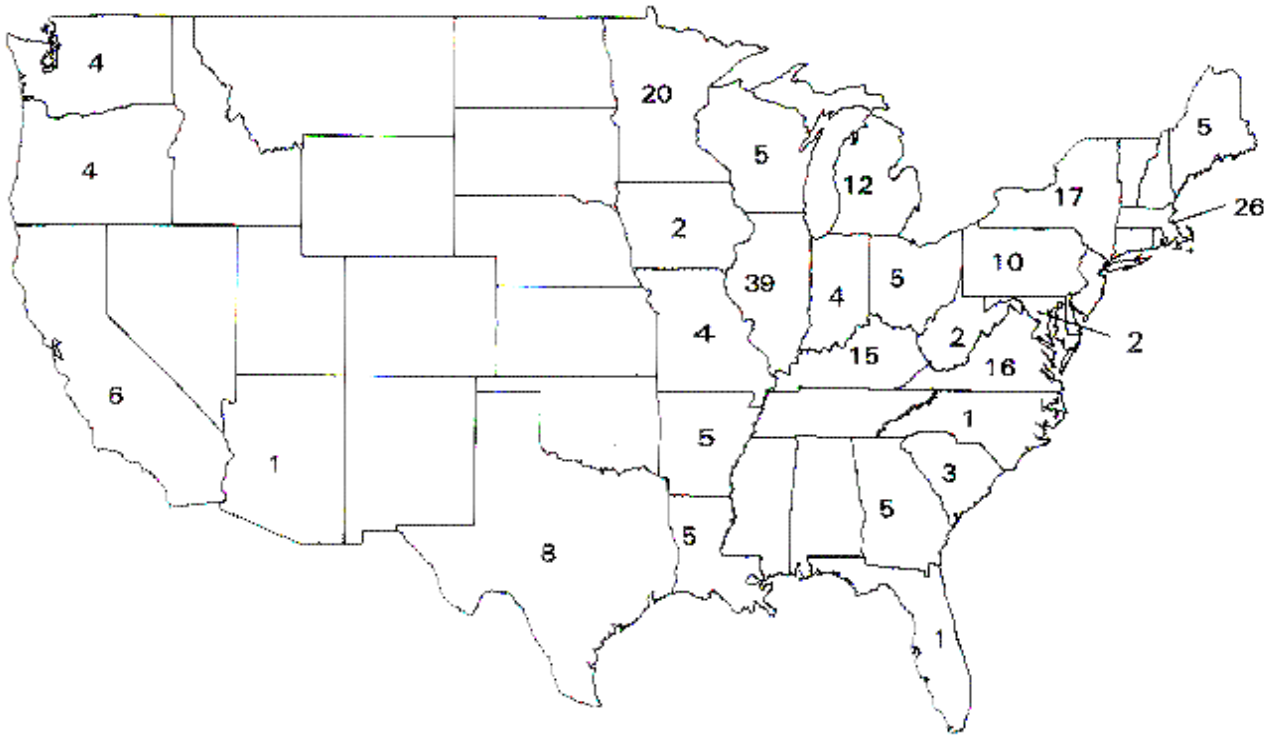
TYPES OF WARNING DEVICES AT ALL PUBLIC CROSSINGS IN THE U.S.



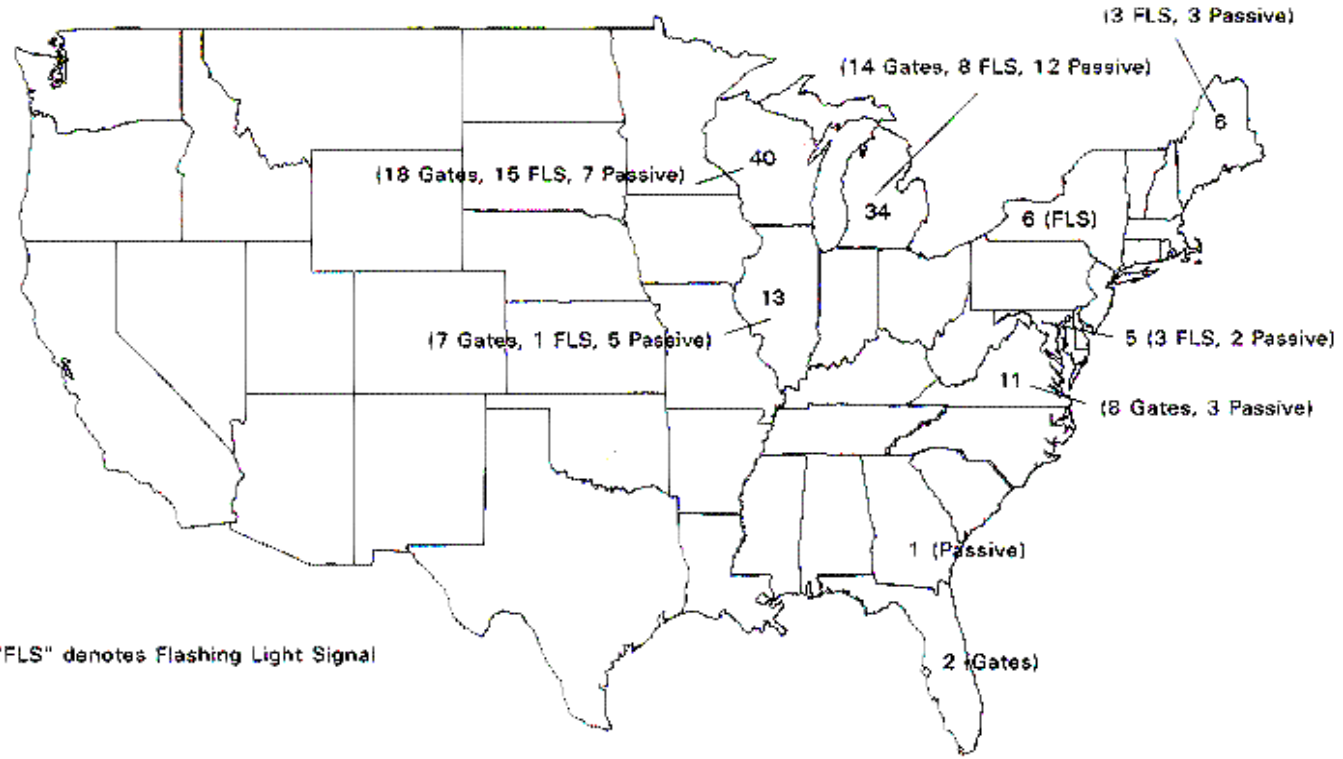


NUMBER OF CITIES WITH WHISTLE BANS

EXCLUDES PRIVATE AND PEDESTRIAN CROSSINGS

NUMBER OF CROSSINGS 2122
NUMBER OF CITIES 227
NUMBER OF STATES 27

FIGURE E

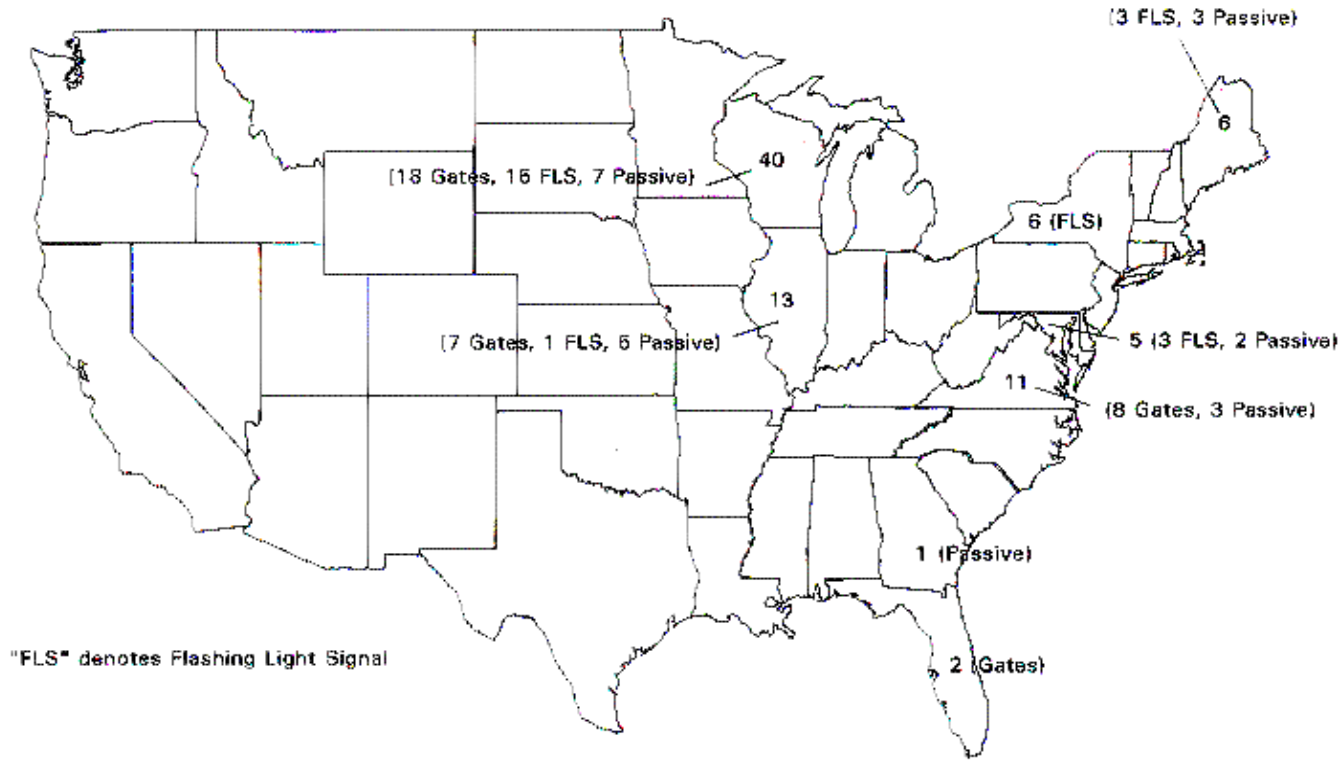


NUMBER OF CROSSINGS WITH NIGHT-ONLY WHISTLE BANS

EXCLUDES PRIVATE AND PEDESTRIAN CROSSINGS

NUMBER OF CROSSINGS 118
WITH GATES 49
WITH FLS 36
WITH PASSIVE 33
NUMBER OF CITIES 20
NUMBER OF STATES 9

Figure F

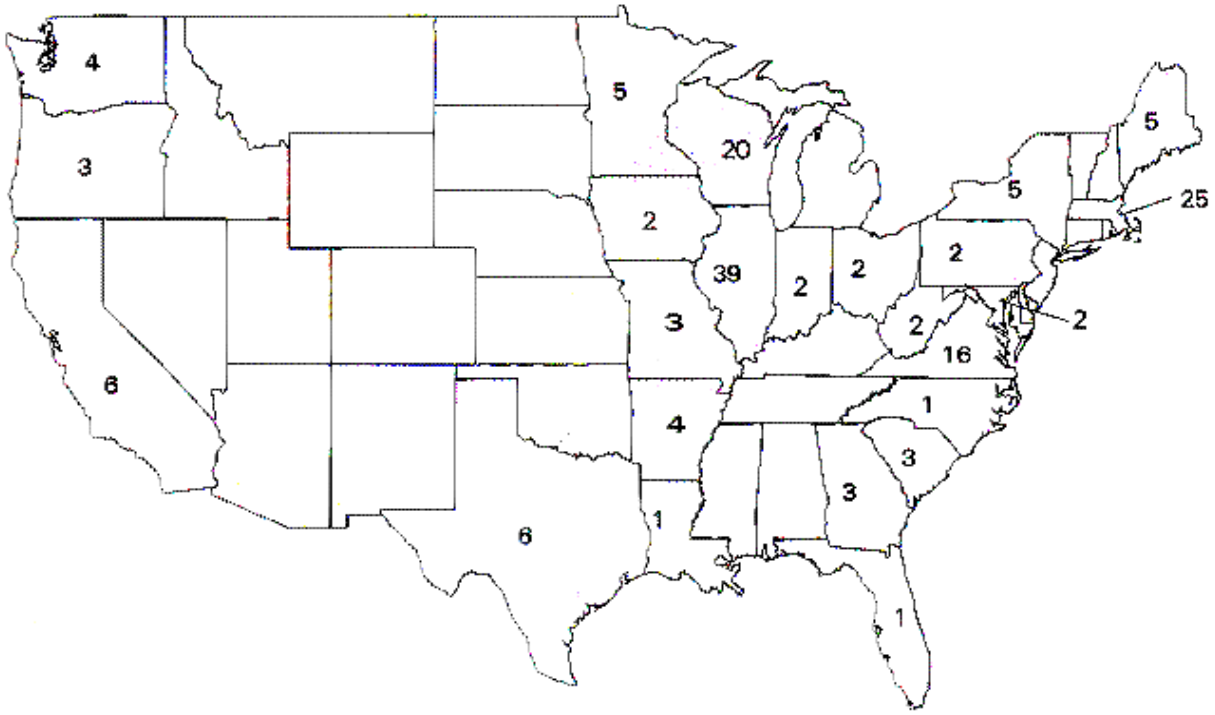


NUMBER OF REMAINING CROSSINGS WITH NIGHT-ONLY WHISTLE BANS

EXCLUDES PRIVATE AND PEDESTRIAN CROSSINGS

NUMBER OF CROSSINGS	84
WITH GATES	35
WITH FLS	26
WITH PASSIVE	23
NUMBER OF CITIES	18
NUMBER OF STATES	8

Figure G



REMAINING NUMBER OF CITIES WITH WHISTLE BANS

EXCLUDES PRIVATE AND PEDESTRIAN CROSSINGS

NUMBER OF CROSSINGS 1332
NUMBER OF CITIES 162
NUMBER OF STATES 24

FIGURE H

Legal Basis and History

Ordinances prohibiting train whistles have been passed by many municipalities. At least one dates back to 1910. Many ordinances specifically mention train whistles or bells, while others are general ordinances against objectionably loud sounds of any type and have been interpreted as applicable to train whistles. Nominal fines have been established in some cases.

However, most of the ordinances originated between 1950 and 1970. The precise dates and municipal code sections for many of them were beyond the immediate recall of city and county personnel presently responsible for maintaining code records. Some localities believe they simply have informal agreements with the railroads.

Of greater interest to the FRA was the documentation of any recent implementations or cancellations of whistle bans. Such changes would provide opportunities to compare accident frequencies both with and without whistle bans. This technique provided significant results in the earlier Florida whistle ban study. For the nationwide study, twelve such cases were documented involving Conrail, CSX, GTW, KCS, NS/SR, BAR, Soo Line, WC and UP railroad operations.

IV. METHODOLOGY

General Overview

Formulated to derive as much insight as possible from the survey information, FRA's methodology used two types of analytical procedures. The first was a direct comparison of

empirical data using a case study approach. The second was also a comparative approach, but employed an established analytical model for predicting the likelihood of accidents at highway-rail crossings based on certain physical and operational parameters. The predicted accident frequencies were compared with the actual accident histories for crossings with whistle bans. As an independent control group, accident predictions for all other crossings in the 168,223 DOT/AAR national crossing inventory were computed and compared to their actual accident histories. The amount of variance between the predicted and actual accidents for whistle ban and non-whistle ban groups was then examined. Of interest was any difference in how well each group conformed (or did not conform) to its predicted frequency of accidents.

Before and After Case Studies

Using information about whistle ban cancellations and implementations from the AAR survey, in conjunction with accident data from FRA's crossing accident/incident file,[16] direct comparisons of accident occurrences for twelve groups of crossings were made. As shown in Table 1, each case study covered equal periods of time when the crossings **were** and **were**

[16] Pursuant to the Federal Railroad Safety Act of 1970 (P.L. 91-458) and the Accident Reports Act (45 U.S.C. 38-34), railroads are required to file accident/incident reports with the FRA. Any impact which occurs between railroad on-track equipment and an automobile, bus, truck, motorcycle, bicycle, farm vehicle, pedestrian, or other highway user at a highway rail crossing must be reported to the FRA on the "Rail-Highway Grade Crossing Accident/Incident Report," Form FRA F 6180.57. See Appendix 3. The FRA has maintained a computer-based file of these reports since 1975.

not subject to whistle bans. This type of "before and after" comparison is similar to the technique used to study the impact of whistle bans in Florida.

In conducting this analysis, equivalent time periods were established by counting an equal number of months and weeks before and after the date a whistle ban was terminated (or in a few cases, implemented). Limited by the end dates of January 1, 1988 or June 30, 1994, the equal time intervals were maximized. They ranged from as long as 38 months and 2 weeks to as short as 19 months and 1 week. Accident records for the crossings during each of the two time intervals were then compared. Because, in all cases the time periods were equal, no normalizing procedure was required.

For the twelve case studies, there were a total of 130 accidents during whistle bans and 80 accidents when whistles were sounded, indicating a 38 percent reduction in the overall rate of accidents after whistle bans were cancelled. Eleven fatalities occurred during the whistle bans compared to 4 in the non-ban periods. Forty-one people were injured during the whistle bans compared to 28 when whistles were sounded.

At the 288 Conrail crossings included in Case Study 1, accidents declined 53 percent when whistle bans were cancelled, and for the 293 CSX crossings in Michigan and Kentucky of Case Studies 3 and 4, there was a 59 percent reduction in accidents.

However, not all whistle ban periods proved to have more frequent accidents. Four of the case studies showed fewer

accidents during the whistle ban periods. For example, in Case Study 5, the KCS had 11 accidents reported for the whistle ban period compared to 18 during the non-ban period. A representative of the KCS commented that rail traffic had doubled in some areas during the post ban period. Such a change could explain the increased frequency of accidents.

In conducting these case studies, a number of repeat accidents at particular crossings were noted. One crossing had five accidents during the 33 months and 2 weeks of the non-ban period reviewed. Three crossings had 4 accidents, 5 crossings had 3 accidents, and 13 crossings had 2 accidents during the periods whistles were not sounded.

The case studies reflect a very diverse group of crossing configurations, warning devices, traffic mixes, and locations. Unlike the Florida crossings, where there was a high order of similarity from one crossing to the next, especially with regard to the number of trains, the crossings in these case studies embody such a variety of situations that the results should be free from significant bias. FRA also believes the eight state geographical distribution represented in the case studies contributes to a more credible portrayal of the national safety implication of train whistle bans.

TABLE 1 - ACCIDENT COMPARISIONS FOR EQUAL TIME INTERVALS WITH AND WITHOUT WHISTLE BANS

PUBLIC CROSSINGS - EXCLUDES PRIVATE AND PEDESTRIAN CROSSINGS

CASE STUDY	RAILROAD AND LOCATION	NUMBER OF CROSSINGS	TIME INTERVAL	BAN STATUS	NUMBER OF ACCIDENTS	NUMBER OF FATALITIES	NUMBER OF INJURIES	NUMBER OF CROSSINGS WITH MULTIPLE ACCIDENTS 2 ACC	3 ACC	4 ACC	5 ACC
1	CONRAIL SYS-WIDE EXCEPT S.BEND	288	32Mo-3Wks	BAN	32	2	10	4	1	-	-
			32Mo-3Wks	NO-BAN	15	1	0	1	-	-	-
2	CONRAIL S.BEND & MISHAWAKA	62	19Mo-1Wk	BAN	10	3	0	2	-	-	-
			19Mo-1Wk	NO-BAN	8	1	3	2	-	-	-
3	CSX KENTUCKY	158	23Mo-2Wks	BAN	18	0	7	2	1	-	-
			23Mo-2Wks	NO-BAN	12	1	8	2	-	-	-
4	CSX MICHIGAN	135	38Mo-2Wks	BAN	38	1	10	3	2	1	-
			38Mo-2Wks	NO-BAN	11	0	9	1	-	-	-
5	KCS SYSTEM WIDE	82	33Mo	BAN	11	1	9	1	-	-	-
			33Mo	NO-BAN	18	1	5	4	-	-	-
6	UP CAMDEN,AR	11	22Mo	BAN	2	0	0	-	-	-	-
			22Mo	NO-BAN	2	0	2	-	-	-	-
7	UP DALLES,OR	4	22Mo	BAN	0	0	0	-	-	-	-
			22Mo	NO-BAN	0	0	0	-	-	-	-
8	CSX GEORGIA EXCEPT GARDEN CITY	35	31Mo-3Wks	BAN	3	0	1	-	-	-	-
			31Mo-3Wks	NO-BAN	0	0	0	-	-	-	-
9	CSX GEORGIA GARDEN CITY	5	21Mo-1Wk	BAN	0	0	0	-	-	-	-
			21Mo-1Wk	NO-BAN	2	0	0	1	-	-	-
10	SR & NS HAPEVILLE GEORGIA	5	33Mo-2Wks	BAN	13	0	4	1	1	2	-
			33Mo-2Wks	NO-BAN	5	0	0	-	-	-	1
11	BAR MAINE	12	32Mo	BAN	1	0	0	-	-	-	-
			32Mo	NO-BAN	2	0	0	-	1	-	-
12	SOO WINONA,MN	34	38Mo-2Wks	BAN	2	0	0	-	-	-	-
			38Mo-2Wks	NO-BAN	5	0	1	-	-	-	-
			TOTALS DURING BANS:		130	11	41	13	5	3	0
			TOTALS WITHOUT BANS:		80	4	28	11	1	0	1

National Comparison

For a more generalized indication of the impact of train whistle bans, FRA collated crossing information for the entire nation for the five year period from January 1989 through December 1993. Without regard to state borders or railroad identities, national information and information about the crossings with whistle bans were compared as two large groups. An analytical model was used to predict the expected frequency of accidents within the two groups and the results were compared with actual accident information.

This procedure applied FRA's crossing accident prediction model developed in the early 1980's. This model, referred to as the "Accident Prediction Formula" (APF) is routinely used to decide which crossings should be given priority for upgrading motorist warning devices.

It uses information about the physical characteristics of a crossing, such as the number of tracks, the number of highway lanes, types of existing warning devices (gates, flashing lights, and signs), whether its location is urban or rural, and whether the roadway is paved. Operational information about the number of highway vehicles using the crossing per day and the number, type, time of day, and maximum speed of trains is also used in the formula to predict the frequency of accidents at a particular crossing.

The formula was developed using data from thousands of accidents and incidents spanning many years. It does not consider whether a crossing has a whistle ban.

For this comparison, the formula was used without a supplemental factor normally used to adjust its output for recent accident occurrences at a specific crossing. As a result, the analysis considered only the essential crossing characteristics, and was not skewed by local, accident-causing anomalies.

For this comparison, the "Study Group" of 2,122 crossings was purged of 900 crossings that either had a change in the status of its whistle ban or had a change to the type of motorist warning device installed during the five years of 1989 through 1993. Either change would have invalidated the results of the APF for the crossings. The resulting accident estimates were based solely on each crossing's physical and operational parameters. FRA applied the accident prediction formula to estimate the five-year accident rates for the remaining 1,222 crossings reported to be subject to whistle bans.

The 1,222 crossings with whistle bans were sorted in order of increasing risk according to their APF ratings, divided into ten groups of nearly equal size, and labeled A through J. Based on the APF ratings, Group "A" had the least risk and Group "J" had the highest risk.

A similar procedure was followed for 167,000 crossings in the U.S. DOT/AAR national crossing inventory, wherein FRA used

the APF to estimate the five-year accident rates for crossings that did **not** have whistle bans in effect throughout the period 1989 through 1993.[17] As with the whistle ban crossings, the inventory crossings were sorted and divided into corresponding risk groups A through J according to their APF ratings.[18]

For each group, "with" and "without" whistle bans, the number of accidents for the five-year period for the group was divided by the number of crossings. This calculation produced an accident rate per crossing group independent of group size. This data is shown in Tables 2 and 3. Finally, the percentage difference in the rates between whistle ban and non-ban crossings was determined by subtracting the non-ban rate from the whistle ban rate, and then dividing by the non-ban rate. This produced the percentage by which the whistle ban rate exceeded the non-ban rate. The results of this calculation are shown in Table 2 and Table 4.

The results of this analysis were dramatic. For nine out of ten theoretically similar risk groups, the whistle ban crossings had significantly higher accident rates over the five year period

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[17] Crossings which had a ban for part of the period were included in the "non-ban" group. This inclusion caused the differences between the two groups to be understated.

[18] The ten groups, "A" (least risk) through "J" (highest risk) vary in size. Since the subsequent analysis is based on accident **rate** per crossing, the variance in group size did not affect the validity of the analysis. The technique of stratification is normally used to prevent a preponderance of a certain characteristic, or a large number of low or high risk values from masking differences or skewing a comparison based on fully aggregated groups.

than did the non-ban crossings. While one group showed whistle ban crossings had fewer accidents per crossing (by 17.5 percent), the other nine groups clearly showed that crossings with five year whistle bans were less safe than similarly grouped non-ban crossings. The average difference for all ten groups, including the group with the 17.5 percent reduction, was an increase of 84 percent.

TABLE 2
STUDY PERIOD CROSSING ACCIDENTS
(With And Without Whistle Bans)

	WITHOUT WHISTLE BANS			5-YEAR WHISTLE BANS			
APF GROUP	NUMBER OF CROSSINGS	5-YEAR ACCIDENTS	ACCIDENT RATE	NUMBER OF CROSSINGS	5-YEAR ACCIDENTS	ACCIDENT RATE	INCREASE WITH BAN
A	35,056	954	0.02721360	123	9	0.07317073	168.88%
B	38,460	1,786	0.04643786	121	8	0.06611570	42.37
C	25,059	2,199	0.08775290	122	20	0.16393443	86.81
D	19,761	2,443	0.12362735	122	46	0.37704918	204.99
E	18,552	3,232	0.17421302	126	43	0.34126984	95.89
F	9,478	2,207	0.23285503	119	58	0.48739496	109.31
G	7,205	2,219	0.30798057	122	31	0.25409836	- 17.50
H	6,291	2,543	0.40422826	121	74	0.61157025	51.29
I	4,556	2,230	0.48946444	122	66	0.54098361	10.53
J	2,582	1,707	0.66111541	124	156	1.25806452	90.29

TABLE 3

ACCIDENT HISTORY

1989 THROUGH 1993

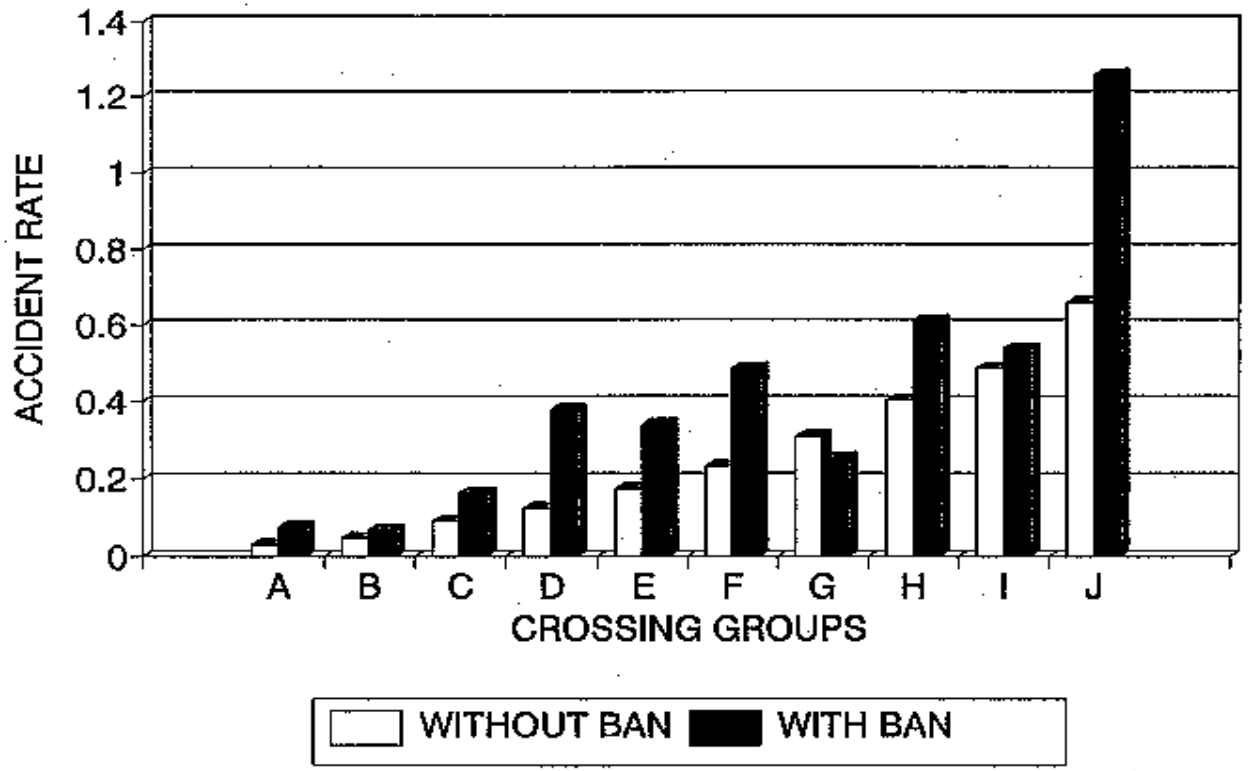
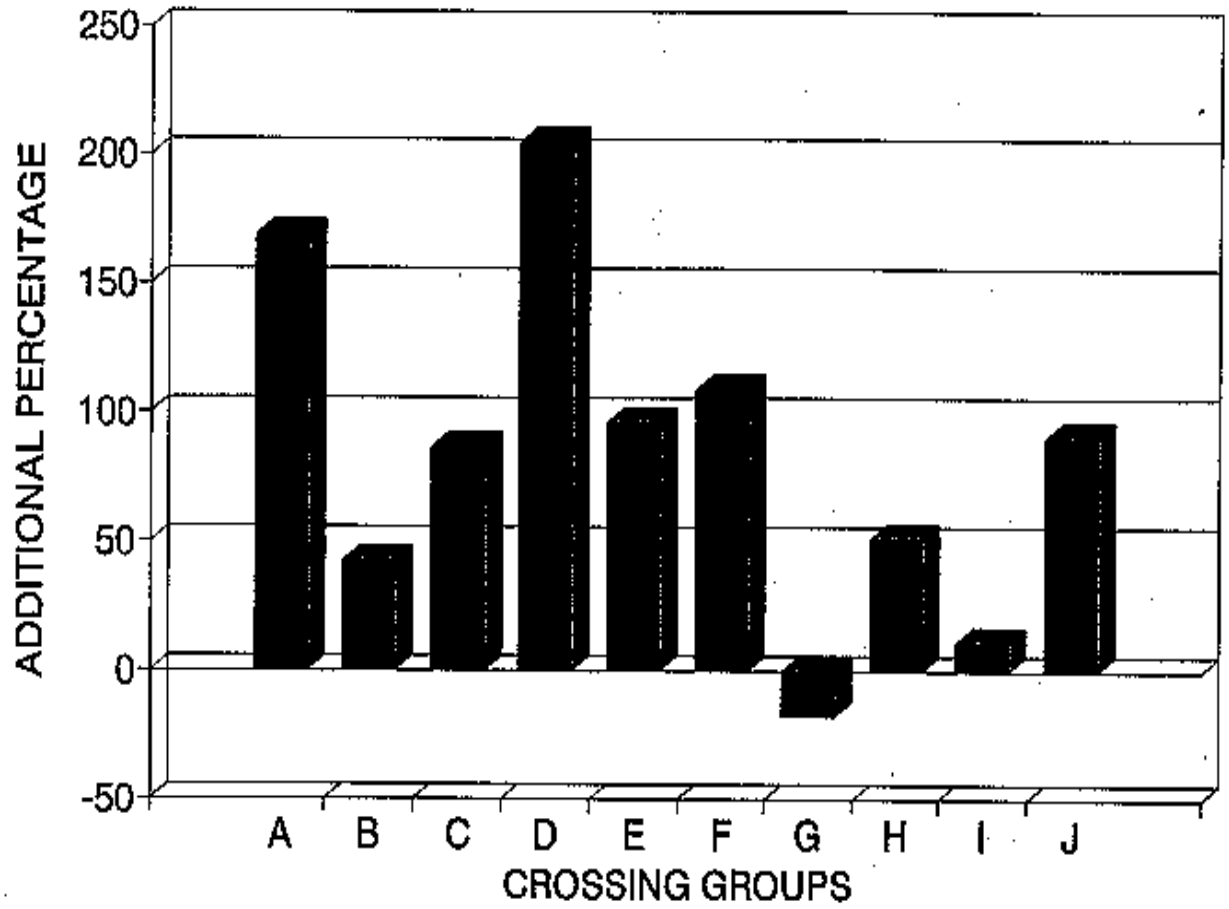


TABLE 4

ADDITIONAL ACCIDENTS

WHISTLE BAN vs NON-BAN



V. WHISTLE BAN ACCIDENTS

Accident Summary

A review of the accidents at crossings when whistle bans were in effect indicated a total of 948 accidents between January 1, 1988 and June 30, 1994. These accidents resulted in 62 fatalities and 308 injuries.

All seventeen railroads that reported operating over crossings with whistle bans experienced at least one accident at a crossing subject to a ban during the time period. The numbers of accidents, and the resulting fatalities and injuries are shown in the following table:

ACCIDENTS EXPERIENCED BY RAILROADS AT CROSSINGS DURING WHISTLE BANS

January 1, 1988 through June 30, 1994

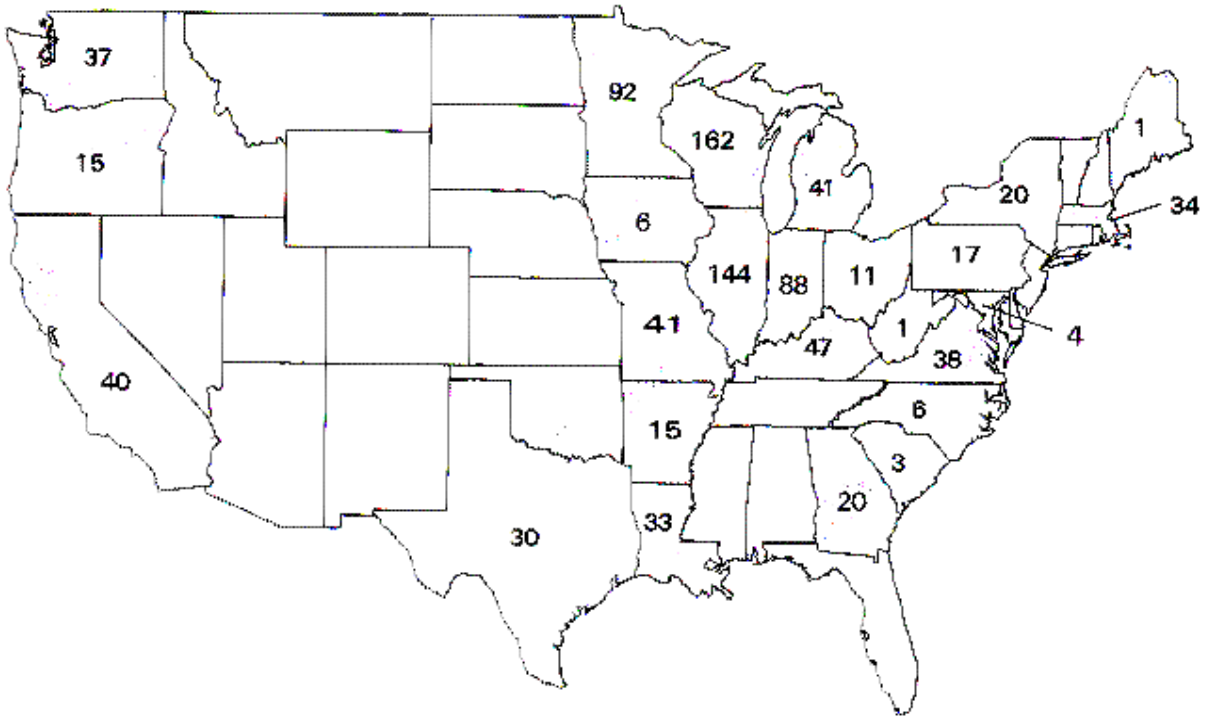
RAILROAD	NUMBER OF ACCIDENTS	NUMBER OF FATALITIES	NUMBER OF INJURIES
ATK	54	5	19
ATSF	20	2	6
BA	1	0	0
BN	80	13	20
CNW	49	8	19
CR	81	11	26
CSX	113	4	31
DH	4	0	5
GTW	3	0	1
KCS	11	1	9
NS	10	0	4
NW	89	5	31
SOO	157	2	33
WP	28	2	7
SR	5	0	0
UP	101	7	36
WC	142	2	61
TOTALS	948	62	308

The 948 accidents included 54 reported by Amtrak, with 5 fatalities and 19 injuries. Thirty-six accidents with 2 fatalities and 7 injuries were reported to involve Metra commuter trains (Northeastern Illinois Regional Commuter Railroad) operating on SOO Line trackage. Eleven of the METRA accidents occurred at the same crossing.

Geographically, 24 of the 27 states with crossings subject to whistle bans experienced accidents at one or more of their crossings during the study time period. A tabulation of the locations of the accidents is provided in the following table and on the maps of Figure I and Figure J:

ACCIDENTS IN STATES AT CROSSINGS
DURING WHISTLE BANS
January 1, 1988 through June 30, 1994

STATE	NUMBER OF ACCIDENTS	NUMBER OF FATALITIES	NUMBER OF INJURIES
AR	15	1	4
CA	40	5	17
GA	21	0	5
IA	6	0	1
IL	144	25	41
IN	93	11	34
KY	47	2	15
LA	33	1	12
MA	34	1	15
ME	1	0	0
MI	41	1	10
MN	92	0	15
MO	41	1	13
NC	6	0	1
NY	20	2	10
OH	11	0	2
OR	15	3	8
PA	17	0	2
SC	3	0	0
TX	30	1	10
VA	38	5	16
WA	37	1	5
WI	162	2	72
WV	1	0	0
TOTALS	948	62	308



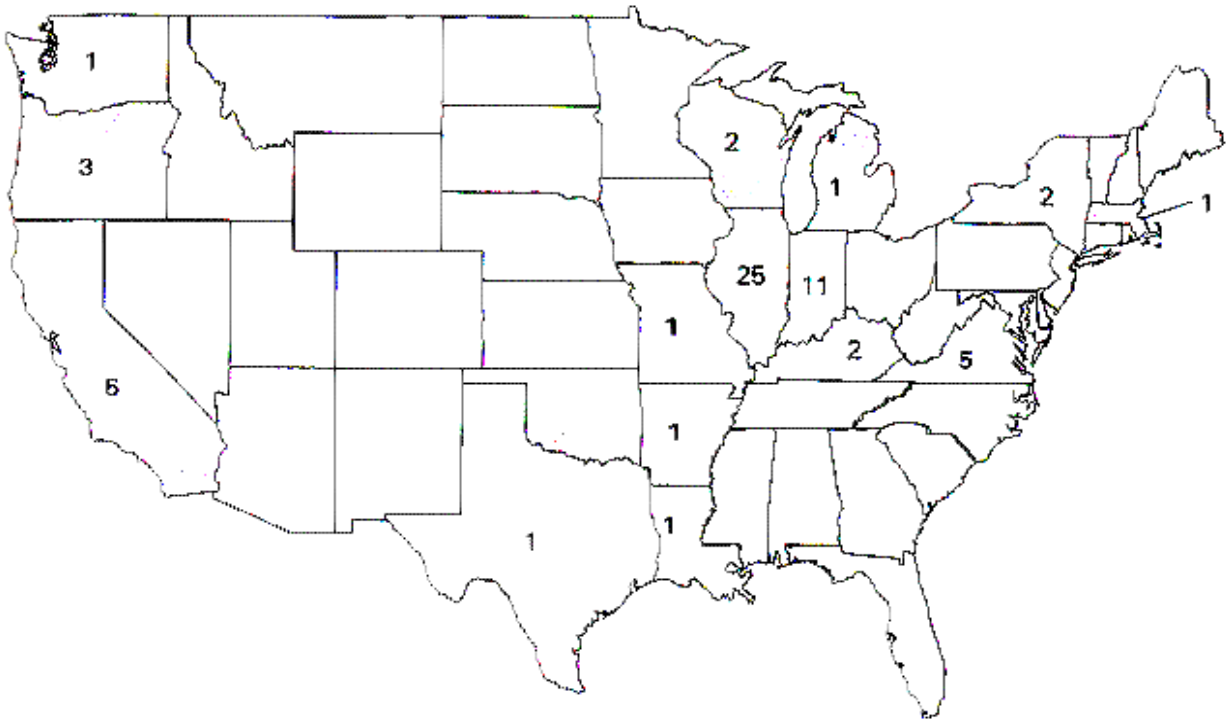
NUMBER OF ACCIDENTS AT CROSSINGS DURING WHISTLE BANS

JANUARY 1988 THROUGH JUNE 1994

EXCLUDES PRIVATE AND PEDESTRIAN CROSSINGS

NUMBER OF ACCIDENTS 943
NUMBER OF FATALITIES 62
NUMBER OF INJURIES 307
NUMBER OF STATES 25

FIGURE I



NUMBER OF FATALITIES AT CROSSINGS DURING WHISTLE BANS
JANUARY 1988 THROUGH JUNE 1994
EXCLUDES PRIVATE AND PEDESTRIAN CROSSINGS

NUMBER OF FATALITIES 62
NUMBER OF STATES 15

FIGURE J

Accident Circumstances

The circumstances of accidents occurring during whistle bans were compared with those of accidents during non-ban periods to determine whether the sounding of train horns reduced or prevented accidents under certain conditions. Accidents at the crossings where whistle bans were cancelled or enacted were grouped according to whether they occurred during the ban or non-ban periods. The circumstances for the two groups are shown below:

ACCIDENT CIRCUMSTANCES

	WHISTLES BANNED		WHISTLES SOUNDED	
CIRCUMSTANCES	**NUMBER**	**%[19]**	**NUMBER**	**%[19]**
Clear Weather	617	65%	62	62%
Cloudy	195	21	25	25
Rain	98	10	6	6
Fog	8	1	0	0
Sleet	2	0	1	1
Snow	28	3	6	6
Daylight	421	44	52	52
Dusk or Dawn	69	7	5	5
Night	458	48	43	43
View Obstructed	56	6	6	6
Signal Failure	1	0	0	0
Hit by 2nd Train	17	2	2	2
Struck Side of Train	206	22	21	21
Drove Around Gates	270	28	15	15
Total Accidents	948		100	

[19] Percent of total. Multiple circumstances are possible.

Almost two thirds of the accidents occurred in clear weather (65 and 62 percent). Accidents during bad weather, including rain, fog, sleet, and snow, showed a negligible difference when whistles were sounded (14 percent compared to 13 percent). Night accidents accounted for 48 percent of the total during the ban period, compared to 43 percent when whistles were permitted. Accidents at dawn and dusk were about the same during the ban and non-ban periods (7 percent compared to 5 percent).

However, accidents that occurred when motorists drove around lowered gates accounted for 28 percent of the cases when whistles were banned and only 15 percent when whistles were sounded.

Motorists were struck by a second train with the same frequency during both ban and non-ban periods (about 2 percent of the cases).

Similarly, accidents where motorists struck the side of the train occurred with about equal frequency during both ban and non-ban periods (22 percent compared to 21 percent).

In the combined total of 1,048 accidents, there was only one instance where the crossing warning device had failed to operate. That one accident was at a crossing with a whistle ban in effect.

While these samples are admittedly small and of unequal size, they do show some differences that could logically be attributed to the use of train horns. Accidents at night or involving motorists who drove around lowered gates, showed a reduced frequency when train horns were sounded and suggest a

conclusion that train horns reduce accidents in instances of darkness and motorist impatience.

Nighttime-Only Accidents

When FRA examined the accident histories of the 118 crossings subject to nighttime-only whistle bans, the data was found to be insufficient to support statistically meaningful conclusions.

There were a total of 41 accidents at the 118 crossings. Of these, 24 accidents occurred during daytime or non-ban periods and 17 occurred during the hours the whistle bans were in effect. Of the 17 accidents, 15 of them (88 percent) occurred during the 5 1/2 hour period between 6:30 PM and midnight. When compared to the 24 accidents that occurred during the non-ban hours of the day, a period more than twice as long (e.g. the 12 hour period generally between 6:30 AM to 6:30 PM), the frequency of accidents during the early nighttime ban hours is notably higher. However, without information about the relative volumes of train and highway traffic at the crossings during the ban and non-ban time periods, the higher accident frequency cannot be attributed entirely to the whistle bans. But, if it were determined that the exposure to accidents was lower during the evening hours, because of reduced highway and/or train traffic, then the higher frequency of accidents would become more significant.

Low highway and/or train traffic volumes after midnight are probably responsible for the relatively small number of accidents that occurred during the nighttime whistle ban hours between

midnight and 6:30 AM. Only 2 of the 17 accidents (approximately 12 percent) occurred during those hours.

VI. CONCLUSIONS

A total of 2,122 public grade crossings subject to whistle bans were identified in a 1992 survey conducted by the AAR. Of these, 94 percent of the whistle bans were in effect 24 hours a day. Fewer than 6 percent (at 118 crossings) were effective only during nighttime-hours, typically from 6:30 PM to 6:30 AM.

The crossings were located in 227 cities in 27 states and on 17 different railroad properties. Whistle bans at many of the 2,122 crossings were reported to have been cancelled or were being ignored. As of the 1992 survey, there remained 1,401 crossings subject to whistle bans located in 164 cities in 24 states. Of these, 84 were reported to be nighttime-only bans and were located in 18 cities in 8 states.

The accident histories of the crossings with whistle bans were examined and indicated that the safety risks associated with the whistle bans in Florida are **not** unique to that area. Overall, in twelve "before and after" case studies involving 831 crossings in eight states other than Florida, a 38 percent reduction in accidents occurred when whistle bans were cancelled. However, for 288 Conrail crossings, the accident rate fell 53 percent, and for 293 CSX crossings, it dropped 59 percent when whistle bans were ignored or canceled.

An analytical comparison of 1,222 crossings subject to whistle bans from 1989 through 1993, against the other 167,000 public grade crossings in the national inventory was made. The comparison disclosed that the crossings with whistle bans had a significantly higher average accident frequency than the non-ban crossings. In performing this analysis, 1,222 whistle ban crossings were divided into ten groups of nearly equal size, based on similar estimated accident frequencies, as calculated by an established accident prediction formula. Within each risk level, which ranged from low to high, the accident histories of the crossings were tabulated. A similar procedure was followed for the other 167,000 crossings in the national inventory. In nine of the ten risk levels, the group of crossings with whistle bans had accident frequencies significantly higher than the national population. Overall, this analysis indicated the whistle ban crossings experienced an average 84 percent greater frequency of accidents than the crossings without bans.

Unlike the crossings in Florida, which were located along the same right of way with relatively uniform rail traffic, the crossings in this study reflect a very diverse population with respect to physical configurations, motorist warning devices, and highway and rail traffic mixes. Their geographical dispersion contributes to a more credible indication of the national safety implication of train whistle bans.

However, in spite of the differences between the groups of crossings involved in this study and the Florida study, the

results are similar and significant. The national group showed a 38 percent reduction in the crossing accident rate when whistle bans were canceled, and the Florida group, a 68.6 percent reduction. These trends give credence to both studies and indicate that whistle bans, whether they are effective 24 hours or nighttime-only, increase the risk of accidents at crossings.

APPENDIX 1
FRA CRITERIA FOR IMPOSING WHISTLE BANS

1. PERMANENT CLOSURE OF THE HIGHWAY-RAIL CROSSING:

Eliminate the at-grade crossing through permanent closure of the street or highway or through grade separation (overpass or underpass).

2. NIGHTTIME CLOSURE OF THE HIGHWAY-RAIL CROSSING:

Close crossings to highway traffic during nighttime hours subject to the following conditions:

a. The closure system must completely block highway traffic from entering the crossing.

b. Activation and deactivation of the system will be the responsibility of the county or municipality responsible for the street or highway. The crossing should be closed continuously during the hours of 10:00 P.M. to 6:00 A.M.

c. The crossing must be part of a quiet zone, as defined in these specifications.

d. The system must be vandal proof.

e. The Manual on Uniform Traffic Control Devices (MUTCD) standards must be met for any barricades and signing used in the nighttime closure of the facility. Signing for alternate routes must also be included.

3. FOUR-QUADRANT GATE SYSTEM:

Install gates at crossings designed to block all highway traffic from entering a crossing when the gates are lowered, subject to the following conditions:

a. Approaches on both sides of the highway-rail crossing will be separated with medians with non-mountable curbs or traffic separators. Such median construction will include energy dissipaters and median striping as required by MUTCD.

b. Any median construction will extend at least 200 feet or to a major intersection, which ever is less. All major intersections must be a minimum of 100 feet from the highway-rail crossing. Any minor intersections within 200 feet of the crossing will be closed to crossing traffic.

c. At low traffic volume streets, median curbs with vertical delineators (rubber pipes and low curbing) between opposing lanes may be used for non-mountable curbs or traffic separator.

d. The maximum length of a gate arm will not exceed 40 feet.

e. Gate timing for full closure systems should be based on these suggested times:

Step	Inc. Time	
Lights start flashing	0	sec.
Entrance gates start down	3-5	"
Entrance gates fully lowered	9-15	"
Exit gates start down	4-6	"
Exit gates fully lowered	9-15	"

Exit gates will be equipped with a presence detection loop located between the outside track and the exit gate arm. This loop will raise or prevent the lowering of the exit gate arm if an automobile is detected within the loop. The loop or loops will be of sufficient size and number to detect an automobile in all exit lanes.

f. The gap between the end of a lowered gate and the median will be less than one foot.

g. Four-quadrant gates will not be an option where traffic signal preemption exists.

h. The crossing must be part of a quiet zone, as defined in these specifications.

i. The system must be vandal proof.

j. General principles of the AASHTO Roadside Design Guide regarding median barrier construction will be adopted where applicable.

4. GATES WITH MEDIAN BARRIERS:

Install median barriers at crossings that prevent highway traffic from driving around lowered gates subject to the following conditions:

a. Approaches on both sides of the highway-rail crossing will be separated with median barriers. Any barrier so constructed will include markers as required by the MUTCD, and energy dissipaters.

b. Median barriers will extend at least 200 feet or to a major intersection, whichever is less. All major intersections must be a minimum of 100 feet from the highway-rail crossing. Any minor intersections within 200 feet of the crossing will be closed to crossing traffic.

c. The maximum length of a gate arm will not exceed 40 feet.

d. The gap between the end of a lowered gate and the median barrier will be less than one foot.

e. The crossing must be part of a quiet zone, as defined in these specifications.

f. The system must be vandal proof.

g. General principles of the American Association of State Highway and Transportation Officials (AASHTO) Roadside Design Guide regarding median barrier construction will be adopted where applicable.

5. ONE-WAY PAIRING OF ADJACENT STREETS:

Adjacent streets would be made into one-way pairs and gates modified or relocated to block the approaching lanes of traffic, subject to the following conditions:

a. Streets to be made into one-way pairs should ideally be no more than one city block (300'-500') apart. Cross streets connecting the one-way pairs should be no more than one city block from each side of the crossings in Central Business Districts, nor more than one-quarter mile from each side of the crossings in suburban areas.

b. Lane capacities of both streets should be approximately the same.

c. Preferably, the gate arms on the approach side of the crossings should be extended to within one foot of the left edge of pavement. The left edge of the pavement on the approach side in this pattern will include a non-mountable curb extending at least 200 feet or to a major intersection, which ever is less. Alternatively, the gate mechanisms on the far side of the crossings may be relocated to the left side of the approach lanes. This choice requires the gate arms size to provide a maximum of one foot between the tips of the gate arms when in the lowered position.

d. The maximum length of a gate arm will not exceed 40 feet.

e. Two two-lane roadways one-way in the same direction may be paired with a single intervening multi-lane undivided roadway in the opposite direction provided all other conditions are met.

f. Both crossings of a one-way pair must be part of a quiet zone, as defined in these specifications.

g. Signing for one-way streets shall be in conformance with the MUTCD.

OMB-2130-0011

U.S. DOT — AAR CROSSING INVENTORY FORM

APPENDIX 2

A. INITIATING AGENCY ☐ RAILROAD ☐ STATE

B. CROSSING NUMBER ⌊⌊⌋⌊⌊⌋⌊⌊⌋

C. REASON FOR UPDATE:
☐ CHANGES IN EXISTING CROSSING DATA
☐ NEW CROSSING
☐ CLOSED CROSSING

D. EFFECTIVE DATE ⌊⌋⌊⌋⌊⌋ M D Y

Part I Location and Classification of All Crossings (Must Be Completed)

1. Railroad Operating Company ⌊⌊⌋⌊⌊⌋⌊⌊⌋
2. Railroad Division or Region ⌊⌊⌋⌊⌊⌋⌊⌊⌋
3. Railroad Subdivision or District ⌊⌊⌋⌊⌊⌋⌊⌊⌋
4. State ⌊⌊⌋⌊⌊⌋⌊⌊⌋
5. County ⌊⌊⌋⌊⌊⌋⌊⌊⌋
6. County Map. Ref. No. ⌊⌊⌋⌊⌊⌋⌊⌊⌋
7. City ⌊⌊⌋⌊⌊⌋⌊⌊⌋
8. Nearest City ⌊⌊⌋⌊⌊⌋⌊⌊⌋
9. Highway Type and No. ⌊⌊⌋⌊⌊⌋⌊⌊⌋
10. Street or Road Name ⌊⌊⌋⌊⌊⌋⌊⌊⌋
11. RR I. D. No. ⌊⌊⌋⌊⌊⌋⌊⌊⌋
12. Nearest RR Timetable Station ⌊⌊⌋⌊⌊⌋⌊⌊⌋
13. Branch or Line Name ⌊⌊⌋⌊⌊⌋⌊⌊⌋
14. Railroad Mile Post ⌊⌊⌋⌊⌊⌋⌊⌊⌋

DO NOT WRITE IN THIS SPACE
State ⌊⌋ County ⌊⌋⌊⌋⌊⌋
City ⌊⌋⌊⌋⌊⌋ Nearest City ☐
RR Code ⌊⌋⌊⌋ Timetable Station ⌊⌋⌊⌋⌊⌋⌊⌋

15. Pedestrian Crossing
☐ 1. at grade
☐ 2. RR under
☐ 3. RR over

16. Private Vehicle Crossing
A. ☐ 1. Farm ☐ 2. Residential ☐ 3. Recreational ☐ 4. Industrial
B. ☐ 5. at grade ☐ 6. RR under ☐ 7. RR over
C. ☐ 8. signs-specify ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋
☐ 9. signals-specify ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋
☐ 0. none

17. Public Vehicle Crossing
☐ 1. at grade
☐ 2. RR under
☐ 3. RR over

COMPLETE REMAINDER OF FORM ONLY FOR PUBLIC VEHICLE CROSSINGS AT GRADE

Part II Detailed Information for Public Vehicular at Grade Crossing

1A. Typical Number of Daily Train Movements

Daylight (6 AM to 6 PM)		Night (6 PM to 6 AM)	
thru trains	switching	thru trains	switching
⌊⌋1	⌊⌋2	⌊⌋3	⌊⌋4

1B. Check if Less Than One Movement Per Day ☐5

2. Speed of Train at Crossing
A. Maximum time table speed ⌊⌋⌊⌋⌊⌋1
B. Typical Speed Range Over Crossing from ⌊⌋⌊⌋⌊⌋2 to ⌊⌋⌊⌋⌊⌋3 mph

3. Type and Number of Tracks
main ⌊⌋1 other ⌊⌋⌊⌋2 If other specify ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋3

4. Does Another RR Operate a Separate Track at Crossing?
☐ Yes 1 ☐ No Specify: RR ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋2

5. Does Another RR Operate Over Your Track at Crossing?
☐ Yes 1 ☐ No Specify: RR ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋2

6. Type of Warning Device at Crossing

A. Signs

Crossbucks		Standard Highway Stop Sign	Other Stop Signs	Other Signs: Specify
reflectorized	non-reflectorized			
⌊⌋01 Number	⌊⌋02 Number	⌊⌋03 Number	⌊⌋04 Number	⌊⌋05 Number ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋06 ⌊⌋07 Number ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋08

B. Train Activated Devices

Gates		Cantilevered Flashing Lights		Mast Mounted Flashing Lights	Other Flashing Lights	Highway Traffic Signals	Wigwags	Bells
red & white reflectorized	other colored	over traffic lane	not over traffic lane					
⌊⌋09 Number	⌊⌋10 Number	⌊⌋11 Number	⌊⌋12 Number	⌊⌋13 Number	⌊⌋14 Number Specify ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋15	⌊⌋16 Number	⌊⌋17 Number	⌊⌋18 Number

C. Specify Special Warning Device not Train Activated ⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋⌊⌊⌋19

D. No Signs or Signals ☐ 20

7. Is Commercial Power Available? ☐ Yes ☐ No
8. Does Crossing Signal Provide Speed Selection for Trains? ☐ Yes ☐ No ☐ N/A
9. Method of Signalling for Train Operation: Is Track Equipped with Signals? ☐ Yes ☐ No

Part III Physical Data

1. Type of Development ☐ 1. Open Sp. ☐ 2. Res ☐ 3. Comm. ☐ 4. Ind. ☐ 5. Inst.
2. Smallest Crossing Angle ☐ 0°-29° ☐ 30°-59° ☐ 60°-90°
3. Number of Traffic Lanes Crossing Railroad ⌊⌋ Number
4. Are Truck Pullout Lanes Present? ☐ Yes ☐ No
5. Is Highway Paved ☐ Yes ☐ No
6. Pavement Markings ☐ Stoplines ☐ RR Xing Sym. ☐ None
7. Are RR Advance Warning Signs Present? ☐ Yes ☐ No
8. Crossing Surface ☐ 1. Sec. Timber ☐ 2. Full Wd. Plank ☐ 3. Asphalt ☐ 4. Concrete Slab ☐ 5. Concrete Pave. ☐ 6. Rubber ☐ 7. Metal Sections ☐ 8. Other Metal ☐ 9. Unconsolidated ☐ 0. Other Specify
9. Does Track Run Down A Street? ☐ Yes ☐ No
10. Nearby Intersecting Highway? ☐ Yes ☐ No

Part IV Highway Department Information

1. Highway System ⌊⌋
2. Is Crossing on State Highway System? ☐ Yes ☐ No.
3. Functional Classification of Road over Crossing ⌊⌋
4. Estimate AADT ⌊⌋⌊⌋⌊⌋⌊⌋⌊⌋
5. Estimate Percent Trucks ⌊⌋⌊⌋

I. D. Number

Form FRA F 6180.71 (5-82)

*U.S. G.P.O.:1994-301-719:15876

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

RAIL-HIGHWAY GRADE CROSSING ACCIDENT/INCIDENT REPORT

APPENDIX 3

FORM APPROVED
OMB NO. 04R4033

1. NAME OF REPORTING RAILROAD — Amtrak ☐ Autotrain ☐ | 1a. Alphabetic Code | 1b. Railroad Accident/Incident No.

2. NAME OF OTHER RAILROAD INVOLVED IN TRAIN ACCIDENT/INCIDENT | 2a. Alphbetic Code | 2b. Railroad Accident/Incident No.

3. NAME OF RAILROAD RESPONSIBLE FOR TRACK MAINTENANCE *(single entry)* | 3a. Alphabetic Code | 3b. Railroad Accident/Incident No.

4. U.S. DOT-AAR GRADE CROSSING IDENTIFICATION NUMBER | 5. DATE OF ACCIDENT/INCIDENT month / day / year | 6. TIME OF ACCIDENT/INCIDENT am ☐ pm ☐

LOCATION

7. NEAREST RAILROAD STATION | 8. COUNTY | 9. STATE *(two letter code)* CODE

10. CITY *(if in a city)* | 11. HIGHWAY NAME OR NUMBER *(if private crossing, so state)*

ACCIDENT/INCIDENT SITUATION

HIGHWAY USER INVOLVED

12. TYPE — 1. Auto 2. Truck 3. Truck-Trailer 4. Bus 5. School Bus 6. Motorcycle 7. Pedestrian 8. Other *(specify)* — CODE

13. SPEED *(estimated mph at impact)*

14. DIRECTION *(geographical)* — 1. North 2. South 3. East 4. West — CODE

15. POSITION — 1. Stalled on crossing 2. Stopped on crossing 3. Moving over crossing — CODE

RAILROAD EQUIPMENT INVOLVED

16. EQUIPMENT — 1. Train *(units pulling)* 2. Train *(units pushing)* 3. Train *(standing)* 4. Car(s) *(moving)* 5. Car(s) *(standing)* 6. Light loco(s) *(moving)* 7. Light loco(s) *(standing)* 8. Other *(specify)* — CODE

17. POSITION OF CAR/UNIT IN TRAIN — CODE

18. CIRCUMSTANCE — 1. Train struck highway user 2. Train struck by highway user — CODE

19. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway user 2. Rail equipment 3. Both 4. Neither — CODE

ENVIRONMENT

20. TEMPERATURE *(specify, if minus)* °F

21. VISIBILITY *(single entry)* — 1. Dawn 2. Day 3. Dusk 4. Dark — CODE

22. WEATHER *(single entry)* — 1. Clear 2. Cloudy 3. Rain 4. Fog 5. Sleet 6. Snow — CODE

TRAIN AND TRACK

23. TYPE OF TRAIN — 1. Freight 2. Passenger 3. Mixed 4. Work 5. Yard/Switching 6. Light Locomotive(s) — CODE

24. TRACK TYPE USED BY TRAIN INVOLVED — 1. Main 2. Yard 3. Siding 4. Industry — CODE

25. TRACK NUMBER OR NAME

26. FRA TRACK CLASSIFICATION

27. NUMBER OF LOCOMOTIVE UNITS

28. NUMBER OF CARS

29. TRAIN SPEED *(recorded speed, if available)* Est ☐ MPH Recorded ☐

30. TIME TABLE DIRECTION — 1. North 2. South 3. East 4. West — CODE

CROSSING WARNING

31. TYPE *(place X in appropriate box(es))*
1 ☐ Gates 2 ☐ Cantilever FLS 3 ☐ Standard FLS 4 ☐ Wig Wags 5 ☐ Hwy. Traffic Signals 6 ☐ Audible 7 ☐ Crossbucks 8 ☐ Stop Signs 9 ☐ Watchman 10 ☐ Flagged by crew 11 ☐ Other *(specify)* 12 ☐ None

32. SIGNALED CROSSING WARNING — Was the signaled crossing warning identified in item 31 operating? 1. Yes 2. No — CODE

33. LOCATION OF WARNING — 1. Both sides 2. Side of vehicle approach 3. Opposite side of vehicle approach — CODE

34. CROSSING WARNING INTERCONNECTED WITH HIGHWAY SIGNALS — 1. Yes 2. No 3. Unknown — CODE

35. CROSSING ILLUMINATED BY STREET LIGHTS OR SPECIAL LIGHTS — 1. Yes 2. No 3. Unknown — CODE

MOTORIST ACTION

36. MOTORIST PASSED STANDING HIGHWAY VEHICLE — 1. Yes 2. No 3. Unknown — CODE

37. MOTORIST DROVE BEHIND OR IN FRONT OF TRAIN AND STRUCK OR WAS STRUCK BY SECOND TRAIN — 1. Yes 2. No 3. Unknown — CODE

38. MOTORIST — 1. Drove around or thru the gate 2. Stopped and then proceeded 3. Did not stop 4. Other *(specify)* 5. Unknown — CODE

39. VIEW OF TRACK OBSCURED BY *(primary obstruction)* — 1. Permanent structure 2. Standing railroad equipment 3. Passing train 4. Topography 5. Vegetation 6. Highway vehicles 7. Other *(specify)* 8. Not obstructed — CODE

HIGHWAY VEHICLE PROPERTY DAMAGE/CASUALTIES

40. HIGHWAY VEHICLE PROPERTY DAMAGE *(est. dollar damage)*

41. DRIVER WAS — 1. Killed 2. Injured 3. Uninjured — CODE

42. WAS DRIVER IN THE VEHICLE? — 1. Yes 2. No — CODE

43. TOTAL NUMBER OF OCCUPANTS KILLED

44. TOTAL NUMBER OF OCCUPANTS INJURED

45. TOTAL NUMBER OF OCCUPANTS *(include driver)*

46. IS A RAIL EQUIPMENT ACCIDENT/INCIDENT REPORT BEING FILED? 1. Yes 2. No — CODE

47. TYPED NAME AND TITLE

48. SIGNATURE

49. DATE