Regulatory Evaluation and Regulatory Flexibility Assessment
for
Use of Locomotive Horns at Highway-Rail Grade Crossings
Final Rule
(49 CFR PARTS 222 AND 229)

Federal Railroad Administration
Office of Safety Analysis
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1.0 Introduction

One of the more persistent problems facing railroads and motorists is highway-rail grade crossing collisions and their resulting casualties. Public and private initiatives to improve grade crossing safety have increased motorist awareness of approaching trains at crossings. Of the nearly 154,000 public at-grade crossings in the United States, approximately 62,000 are equipped with automatic gates and/or flashing lights. However, many motorists fail to heed even these warnings, limiting their effectiveness in preventing collisions.

In 1996, the Federal Railroad Administration (FRA) issued a rule requiring railroads to equip locomotives that operate at speeds greater than 20 mph over one or more public highway-rail grade crossings with auxiliary alerting lights at the front of the locomotive. With the headlight, these auxiliary lights form a triangular pattern which provides motorists at crossings an additional visual indication of a train's presence and rate of approach. The rule required compliance by December 31, 1997.

Locomotive horns also alert motorists to a train's approach, and provide indications of speed, direction and proximity. The information conveyed by the sound of a locomotive horn can be particularly important to motorists at crossings with passive warning devices such as crossbucks and at crossings where the view of the track is obstructed.

Some communities, especially those with many crossings and a high volume of train traffic, believe that the sounding of locomotive horns at every crossing is excessive and diminishes community quality of life. Many such communities have enacted "whistle bans" that ban trains from sounding their horns entirely, or during particular times (usually at night). Where whistle bans are in effect, motorists traversing crossings do not benefit from the audible sound of the horn as a warning that a train is approaching. FRA is concerned that the increased risk at grade crossings due to the silencing of locomotive horns will result in more collisions and casualties at grade crossings. FRA believes that this has already happened in many communities where whistle bans have been implemented. However, it is not FRA's intention to burden communities which have not seen an increase in collisions and casualties nor does FRA wish to unnecessarily burden communities seeking to establish New Quiet Zones.

This document presents the results of an evaluation of the economic impacts of FRA's interim final rule which requires the use of the locomotive horn at highway-rail crossings and provides conditions under which the locomotive horn can be silenced at such grade crossings.

2.0 Problem Statement

The problem considered by this rule is highway-rail grade crossing collisions and their resulting casualties at crossings where locomotive horns are not routinely sounded. Motorists at passively marked crossings where horns are not sounded must detect approaching trains based solely on visual information. Unfortunately, hills, structures, vegetation, track curvature, road curvature, as well as sun angle, inclement weather conditions, and darkness often impair motorists' view of a train's approach. Under such circumstances, train horns provide invaluable warning.

Motorists at crossings with active warning devices often rely on the warning provided by locomotive horns as well. Sometimes the "fail safe" characteristics of warning devices may result in extended activation periods that give a false impression to the motorist that they are malfunctioning. In some very rare cases, active devices fail to activate. Sometimes motorists attempt to drive over crossings in an effort to beat trains. In such circumstances, the horn blast may provide the final warning needed to check that impulse. Finally, even a motorist in a stalled vehicle may benefit from the urgent warning that the train's arrival is imminent and it is time to vacate the vehicle.

FRA believes, and studies show, that not sounding locomotive horns at grade crossings increases the potential for highway-rail collisions at those crossings. During the five-year period between 1997 and 2001, 301 collisions that were potentially preventable by sounding locomotive horns occurred at whistle-ban crossings. These collisions resulted in 21 fatalities and 110 non-fatal injuries. This translates into an annual average of 60 collisions, 4 fatalities, and 22 injuries.

FRA has documented both the increase in risk at whistle-ban crossings and the effectiveness of the locomotive horn. Effective July 1, 1984, Florida authorized local governments to ban the nighttime use of locomotive horns by intrastate trains approaching grade crossings equipped with flashing lights, bells, crossings gates, and highway signs warning motorists that train whistles would not be sounded at night. Many local jurisdictions passed whistle ban ordinances. FRA studied the effects of these bans and found that the nighttime collision rate increased at whistle-ban crossings dramatically after the nighttime bans were established, while the daytime collision rates remained virtually unchanged for the same crossings. Collision rates of an interstate railroad at similarly equipped crossings in Florida and along the same route at crossings with no whistle bans did not increase nearly as much. On July 26, 1991, FRA issued an emergency order to end whistle bans in Florida. Once the horns began to sound again, the collision rate returned to its pre-ban level.

A national study using both empirical data and a computer model showed significant increase in the number of collisions at crossings with whistle bans[1]. "An analytical comparison of 1,222 crossings subject to whistle bans from 1989 through 1993 against all other 167,000 public grade

[1] US Department of Transportation, Federal Railroad Administration, *Nationwide Study of Train Whistle Bans*, April 1995.

crossings in the national inventory was made. The comparison showed crossings with whistle bans have a significantly higher average accident frequency that the non-ban crossings." "Furthermore, a comparison of the circumstances of accidents indicated that sounding of locomotive horns reduced the frequency of accidents during the hours of darkness and also reduced the frequency of motorists driving around lowered crossing gates." FRA was concerned about the higher risk at whistle-ban crossings disclosed by this nationwide study.

While crossing collisions are generally very infrequent events at individual crossings, the 1995 nationwide study and the experience in Florida showed they were more frequent when locomotive horns were not sounded. Subsequent updates and revisions to the nationwide study continue to indicate that collision rates are significantly higher at grade crossings with whistle bans than at similar crossings where locomotive horns are routinely sounded.

Section 20153 of Title 49 of the United States Code, requires the Secretary of Transportation to issues rules requiring the use of locomotive horns at grade crossings and provides authority to make reasonable exceptions. A 1996 amendment (Public Law 104-264) requires the FRA to take into account the interests of communities that have in effect restrictions on the sounding of a locomotive horn at highway-rail crossings, to work in partnership with affected communities to provide technical assistance, and to provide a reasonable amount of time for local communities to install supplementary safety measures taking into account local safety initiatives.

3.0 Summary of the Final Rule

FRA's locomotive horn rule has several provisions. First, it requires that horns be sounded at all public at-grade highway-rail crossings in the United States; second, it sets a maximum sound level for locomotive horns; third, it prescribes how and when locomotive horns are to be sounded; and fourth, it provides an opportunity for any community in the nation to establish a quiet zone. These provisions apply to all public highway-rail grade crossings, including those now subject to whistle bans promulgated by local or state authorities.

The rule also incorporates many mitigation measures, which are intended to minimize potential direct impacts in communities that are now subject to whistle bans and to assist communities that may want to establish quiet zones in the future. The rule describes a series of supplementary and alternative safety measures that can be employed to establish a quiet zone. These provisions constitute a means of substituting other safety measures for locomotive horns. A full description of what constitutes a quiet zone and the process for establishing a quiet zone is provided below.

As required by 49 USC 20153, FRA has taken into account the interest of communities that either have whistle bans in effect or are not yet subject to the routine sounding of locomotive horns. In implementing the rule, FRA will work in partnership with affected communities to provide technical assistance and allow a reasonable amount of time for the communities to install added safety measures.

The key substantive elements of the interim final rule are summarized below in Items 1 through 8. Additional details on the rule's procedural and administrative elements are contained in the interim final rule, which is being published in the Federal Register and is available on the FRA's website at: www.fra.dot.gov.

1. Requirement for Sounding Horn. Locomotive horns must be sounded while each train is approaching and entering upon each public highway-rail grade crossing.

2. Maximum Horn Sound Level. Locomotive horn sound levels shall be at least 96 dB(A) and no louder than 110 dB(A) measured at 100 feet in front of the locomotive and at 15 feet above the rail.

3. How Locomotive Horns are to be Sounded. All trains must sound the horn in the standard signal sequence of two longs, a short, and a long, starting at least 15 seconds, but no more than 20 seconds, before reaching the crossing, however, in no case may locomotive horns be sounded more than ¼ mile in advance of a crossing, regardless of train speed.

4. Application of Use of Locomotive Horn Rule. Applies to all railroads, both freight and passenger, that operate on the general railroad system of transportation throughout the country. Rapid transit operations sharing tracks and public crossings with general system railroads, or otherwise sharing public crossings with general system railroads, are connected to the general

railroad system at the crossing and are thus subject to the rule, except that transit operations operating on separate tracks are not subject to the horn volume provisions. The quiet zone provisions of the rule also apply to public authorities responsible for safety and maintenance at public highways, streets, or roads crossing railroad tracks at grade.

The use of locomotive horn rule applies to every railroad except:

1) Rapid transit systems within urban areas that are not connected to the general railroad system of transportation.

2) Railroads that exclusively operate freight, tourist, or scenic trains only on track that is not part of the general railroad transportation system.

3) A railroad may, with certain exceptions, decide to not sound the locomotive horn at a crossing if the locomotive speed is 15 miles per hour or less and train crew members or equipped flaggers flag the crossing to provide warning of the approaching train to motorists.

5. <u>Creation of a Quiet Zone in Lieu of Sounding Horns</u>.

a) <u>Definition of a Quiet Zone.</u> A *quiet zone* means a segment of rail line containing one or more consecutive highway-rail grade crossings at which locomotive horns are not routinely sounded. The rule distinguishes between two types of quiet zones. A Pre-Rule Quiet Zone refers to crossings at which local ordinances restricted the routine sounding of locomotive horns, or at which locomotive horns did not sound due to formal or informal agreements between the community and railroads, enforced or observed as of both October 9, 1996 and the date of publication of the interim final rule. A New Quiet Zone refers to crossings at which routine sounding of locomotive horns would be restricted pursuant to provisions of FRA's locomotive horn rule and which does not qualify as a Pre-Rule Quiet Zone.

b) <u>Methods For Establishing Quiet Zones</u>.

Method 1: Public Authority Designation allows communities to establish quiet zones without formal application to FRA, provided one of three conditions is met:

1) One or more supplementary safety measures (SSMs) are applied to every public grade crossing within the proposed quiet zone; or

2) The Quiet Zone Risk Index is at, or below the Nationwide Significant Risk Threshold. Additional safety measures beyond the minimum quiet zone requirements discussed in item c) below are not required; or

3) SSMs are implemented that are sufficient to reduce the Quiet Zone Risk Index either to a level at, or below the Nationwide Significant Risk Threshold or to the risk level which would exist if locomotive horns sounded at all crossings within the quiet zone. The public authority

has discretion as to how the Quiet Zone Risk Index is reduced, and may choose the type of SSMs to be applied and the crossings at which they are to be applied.

Method 2: Public Authority Application to FRA is a flexible method that uses SSMs and alternative safety measures (ASMs) to deal with problem crossings. The public authority has discretion as to the type of SSMs and ASMs to apply and the crossings at which they are to be applied. If, in response to an application from a public authority, FRA determines that safety improvements will compensate for the absence of the locomotive horn or that safety improvements will reduce risk with respect to loss of life or serious injury to a level at, or below the Nationwide Significant Risk Threshold, a quiet zone may be established.

If Method 2 is selected by the public authority, it must demonstrate, in an application to FRA, through data and analysis that implementation of the proposed measures will reduce the Quiet Zone Risk Index to either the risk level that would exist if locomotive horns sounded at all crossings in the quiet zone or to a risk level below the Nationwide Significant Risk Threshold.

c) Minimum Length of Quiet Zone. The minimum length of a New Quiet Zone shall be one-half mile (2,640 feet or 805 meters) along the length of railroad right-of-way, while the length of a Pre-Rule Quiet Zone may continue unchanged. The addition of any crossing to a Pre-Rule Quiet Zone ends the grandfathered status of the quiet zone, resulting in the requirement that the zone be at least one-half mile in length. The deletion of any crossing from a Pre-Rule Quiet Zone, with the exception of a grade separation or crossing closure, must result in a quiet zone of at least one-half mile in order to retain Pre-Rule Quiet Zone status.

d) Requirement For Active Grade Crossing Warning Devices. Except for those situations defined in the rule, each public highway-rail grade crossing in a New Quiet Zone must be equipped with active grade crossing warning devices comprising both flashing lights and gates that control traffic over the crossing and that conform to the standards contained in the Manual on Uniform Traffic Control Devices (MUTCD). Such warning devices must be equipped with power out indicators and constant warning time devices. Pre-Rule Quiet Zones may retain, but not downgrade, the grade crossing safety warning devices that exist as of the date of publication of the interim final rule.

e) Requirement For Advance Warning Signs. Each highway approach to each public and private highway-rail crossing within a Pre-Rule Quiet Zone or a New Quiet Zone shall be equipped with an advance warning sign advising the motorist that locomotive horns are not sounded at the crossing. Signs must conform to the standards contained in the MUTCD. Such signs must be installed at crossings in Pre-Rule Quiet Zones within three years of publication of the interim final rule.

6. Supplementary and Alternative Safety Measures. Section 222.41 of the rule discusses those measures that can be employed by public authorities to designate a quiet zone. Appendix A: Supplementary Safety Measures and Appendix B: Alternative Safety Measures are included as appendices to 49 CFR 222. These SSMs and ASMs represent mitigation strategies and are

described in Chapter 4. Implementation of these measures in accordance with the procedures outlined by FRA would constitute mitigation of potential impacts resulting from adoption of the rule.

7. Communities With Pre-Existing Restrictions on the Use of Locomotive Horns. Section 20153(i)(1) requires that FRA take into account the interests of communities that "have in effect restrictions on the sounding of a locomotive horn at highway-rail grade crossings, or have not been subject to routine sounding of a locomotive horn at highway-rail grade crossings." FRA is taking the following measures to address the interests of these communities:

    a) A Pre-Rule Quiet Zone will be considered approved and may remain in effect if (1) the Pre-Rule Quiet Zone is in compliance with the requirements for Method 1; or (2) if there have been no relevant collisions at any public grade crossing within the quiet zone for the five years preceding the date of publication of the interim final rule and the Quiet Zone Risk Index was less than twice the Nationwide Significant Risk Threshold as last published by FRA.

    b) If a Pre-Rule Quiet Zone cannot qualify for approval under 7(a)(1) or 7(a)(2) above, the restrictions may remain in place on an interim basis. Such restrictions may continue for a period of five years if, within three years from the date of publication of the interim final rule, the public authority files with FRA a detailed plan for maintaining the Pre-Rule, or establishing a New Quiet Zone. Locomotive horn restrictions may continue for an additional three years beyond the five-year period if, prior to the date three years after publication of the interim final rule, the appropriate state agency provides FRA a comprehensive statewide implementation plan and makes physical improvements within the quiet zone, or in a quiet zone elsewhere within the State, within three years and four years after publication respectively.

8. Wayside Horns. Section 222.59 of the interim final rule provides for the use of wayside horns to be used in lieu of locomotive horns at individual or multiple at-grade crossings, including those within quiet zones. Certain requirements must be met by the wayside horn system and the crossing must be equipped with flashing lights, gates, a constant warning device and a power out indicator. Wayside horns have not yet been classified by FHWA as a traffic control device. If FHWA does classify them as a traffic control device, the wayside horn must also be approved in the Manual of Uniform Traffic Controls Devices or FHWA must issue an exemption before it may be used.

FRA will annually calculate the Quiet Zone Risk Index for New Quiet Zones created by having Quiet Zone Risk Indices less than the Nationwide Significant Risk Threshold, versus compensating for the effectiveness of the horn. FRA will notify each public authority of the Quiet Zone Risk Index for the preceding calendar year for each quiet zone in its jurisdiction. If the Quiet Zone Index is above the Nationwide Significant Risk Threshold, the quiet zone will terminate six months from the date of notification from FRA, unless the public authority (a) provides FRA with a written commitment to lower the potential risk at crossings within the quiet zone to below the Nationwide Significant Risk Threshold, or to a level fully compensating for the absence of a locomotive horn, and (b) completes within three years implementation of SSMs or ASMs sufficient to reduce the Quiet Zone Risk Index to a level below the Nationwide Significant Risk Threshold, or to a level fully compensating for the absence of a locomotive horn.

FRA will annually calculate the Quiet Zone Risk Index for each Pre-Rule Quiet Zone. FRA will notify each public authority of the Quiet Zone Risk Index for the preceding calendar year for each quiet zone in its jurisdiction, and if a relevant collision occurred at a grade crossing within one of its quiet zones during that year. If the Pre-Rule Quiet Zone was created with a Quiet Zone Risk Index of less than the National Significant Risk Threshold and if the newly calculated Quiet Zone Risk Index exceeds a value equal to the National Significant Risk Threshold, the quiet zone will terminate six months from the date of notification from FRA, unless the public authority within three years implements SSMs or ASMs in accordance with Section 222.39(b) of the rule. If the Pre-Rule Quiet Zone was created with a Quiet Zone Risk Index of less than twice the National Significant Risk Threshold with no relevant collisions, and if the newly calculated Quiet Zone Risk Index exceeds a value equal to twice the National Significant Risk Threshold, or if a relevant collision occurred at a grade crossing within the quiet zone during the preceding year, the quiet zone will terminate six months from the date of notification from FRA, unless the public authority within three years implements SSMs or ASMs in accordance with Section 222.39(b) of the rule.

4.0 Findings

Implementation of this rule will reduce the risk of collisions at grade crossings by requiring the sounding of the locomotive horn at grade crossings unless it has been specifically determined that the crossings in question have a risk profile that justifies silencing the horn. FRA believes communities will take advantage of the many options available to compensate, in terms of risk, for the silencing of the horn. FRA is confident that the benefits in terms of lives saved and injuries prevented will exceed the costs imposed on society by this rule.

The table below presents estimated twenty-year monetary costs associated with complying with the requirements contained in the interim final rule. Given the high prevalence of existing whistle-ban crossings in the Chicago area[1] and the significant level of interest commenters from this area have shown regarding this rulemaking, Pre-Rule Quiet Zone costs for this area are presented separately from the rest of the nation.

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1 The Chicago area is comprised of the following six counties: Cook, Du Page, Kane, Lake, Mc Henry, and Will.

Total Twenty-Year Costs (PV[2], 7%)

	Nationwide	Chicago	Rest of Nation
<u>Locomotive Horns Sounded</u>			
Maximum Horn Sound Level	$ 2,902,478	Not Applicable	Not Applicable
Relocations Due to Locomotive Horn Noise	$ 1,724,590	$ 47,927	$1,676,663
<u>Pre-Rule Quiet Zones</u>			
Advance Warning Signs	$ 170,493	$ 33,504	$ 136,989
Quiet Zones (QZ) w/ CCRI[3] < NSRT			
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 1,182,292	$ 59,537	$1,122,755
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions			
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 882,814	$ 179,248	$ 703,566
SSMs/ASMs Installation & Maintenance	$ 1,575,797	$ 156,604	$1,419,193
QZs w/ CCRI > 2xNSRT; No Collisions			
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 335,529	$ 211,513	$ 124,016
Install & Maintain Safety Improvements	$ 2,200,158	$1,382,915	$ 817,243
QZs w/ CCRI > NSRT; With Collisions			
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 899,259	$ 275,733	$ 623,526
Install & Maintain Safety Improvements	$ 7,755,538	$1,650,533	$ 6,105,005
Periodic Affirmation/Inventory Update	**$ 274,066**	**$ 58,426**	**$ 215,640**
TOTAL PRE-RULE QUIET ZONES	**$15,275,946**	**$4,008,013**	**$11,267,933**

	Total	Non-Existing Quiet Zones	Whistle Bans Est. Post 10/9/96
<u>New Quiet Zones</u>			
Advance Warning Signs	$ 42,605	$ 36,832	$ 5,773
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 787,160	$ 726,564	$ 60,596
QZ CCRI < NSRT			
Install & Maintain Safety Improvements	$ 8,234,940	$7,801,613	$ 433,327
QZ CCRI > NSRT			
Install & Maintain Safety Improvements	$12,349,909	$10,852,960	$1,496,949
Periodic Affirmation/Inventory Update	**$ 87,182**	**-------**	**-------**
TOTAL NEW QUIET ZONE COSTS	**$21,501,796**	**$19,417,969**	**$1,996,645**

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2 The Present Value (PV) of cost and benefit flows is calculated in this analysis. PV provides a way of converting future benefits and costs into equivalent dollars today so that benefit and cost streams that involve different time paths may be compared. The formula used to calculate these flows is: $1/(1+I)^t$ where "I" is the discount rate, and "t" is the year. Per guidance from the Office of Management and Budget, a discount rate of .07 is used in this analysis.

3 Crossing Corridor Risk Index

	Federal Railroad Administration
Annual Update of NSRT/QZRIs and Notification	$25,426

Total Twenty-Year Costs associated with implementation of this rule are estimated to be $41,430,236 (PV, 20 Years, 7%).

In general there has been a downward trend in collisions at grade crossings nationwide due to the implementation of various private and public safety initiatives such as Operation Lifesaver and other public education and awareness campaigns. Costs presented in this analysis may be overstated to the extent that such initiatives would lead to the eventual implementation of some of the same or equivalent safety measures that this rule requires for the establishment of quiet zones. In such cases, this rule may be merely accelerating implementation and the rate of expenditures.

The safety benefit of this final rule is the reduction in casualties that result from collisions between trains and highway users at public at-grade highway-rail crossings. Implementation of this rule will ensure that (1) locomotive horns are sounded to warn highway users of approaching trains; or (2) rail corridors where train horns do not sound will have a level of risk that is no higher than the average risk level at gated crossings nationwide where locomotive horns are sounded regularly; or (3) the effectiveness of horns is compensated for in rail corridors where train horns do not sound.

The Regulatory Evaluation prepared for the NPRM presented two safety benefit scenarios; one assumed a constant collision rate and the other a 4% annual decline in collision rate. No comments were received regarding these two collisions rates. FRA has reviewed trends in collision rates for whistle-ban crossings going back to 1980 and determined that these two rates probably bound the range that will be experienced over the twenty-years that this analysis covers. FRA developed a regression model that closely fits the rates since 1980. This model was used to develop relevant collision forecasts for the next twenty years. None of the forecasted annual collision rates indicates a decline of greater than 4 percent per year. Appendix C presents these findings in detail.

The tables that follow present safety benefits under both scenarios.

Total Twenty-Year Safety Benefits Monetized (PV, 7%)
Constant Collision Rate (0% annual decline)

	Nationwide	Chicago	Rest of Nation
Locomotive Horns Sounded			
Maximum Sound Level	---------	Not Quantifiable	---------
Casualties Prevented (Cancellation of W-Bans)	$8,837,888	$424,759	$8,413,129

Pre-Rule Quiet Zones: Value of Injuries and Fatalities Prevented by Implementing Safety Measures

	Nationwide	Chicago	Rest of Nation
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions	$ 8,376,011	$ 2,465,999	$ 5,910,012
QZs w/ CCRI > 2 x NSRT; No Collisions	$19,664,084	$14,164,517	$ 5,499,567
QZs w/ CCRI > NSRT; With Collisions	$44,114,379	$16,277,752	$ 27,836,627
Total	**$72,154,474**	**$32,908,268**	**$ 39,246,206**

New Quiet Zones: Value of Injuries and Fatalities Prevented by Implementing Safety Measures

	Total	Non-Existing Quiet Zones	Whistle Bans Est. Post 10/9/96
CCRI greater than NSRT	$30,675,161	$25,965,858	$ 4,709,303
TOTAL	**$111,667,523**		

Total Twenty-Year Collisions and Casualties Prevented[4]
Constant Collision Rate (0% annual decline)

	Nationwide, Including the Chicago Area		
Pre-Rule Quiet Zones:	Collisions	Injuries	Fatalities
Cancellation of W-Bans	57	13	1
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions	16	7	2
QZs w/ CCRI > 2 x NSRT; No Collisions	35	17	7
QZs w/ CCRI > NSRT; With Collisions	48	23	8
Pre-Rule Quiet Zone Total	**156**	**60**	**18**
New Quiet Zones:	36	34	8
TOTAL	**192**	**94**	**26**

FRA also estimates that reductions to highway vehicle, rail equipment, and track damage over the next twenty years will total nearly $600,000 assuming a constant collision rate.

[4] These estimates represent the sum of forecasted collisions and resulting casualties. These are rarely whole numbers. The totals in the table are only the integer portion of the actual forecasts.

Total Twenty-Year Safety Benefits Monetized (PV, 7%)
Declining Collision Rate (4% annual decline)

	Nationwide	Chicago	Rest of Nation
<u>Locomotive Horns Sounded</u>			
Maximum Sound Level	---------	Not Quantifiable	---------
Casualties Prevented (Cancellation of W-Bans)	$6,102,371	$291,582	$5,810,789

<u>Pre-Rule Quiet Zones: Value of Injuries and Fatalities Prevented by Implementing Safety Measures</u>

	Nationwide	Chicago	Rest of Nation
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions	$ 5,223,028	$ 1,574,618	$ 3,648,410
QZs w/ CCRI > 2 x NSRT; No Collisions	$13,433,811	$ 9,676,700	$ 3,757,111
QZs w/ CCRI > NSRT; With Collisions	$30,137,393	$11,120,388	$19,017,005
Total	**$48,794,232**	**$22,371,706**	**$26,422,526**

<u>New Quiet Zones: Value of Injuries and Fatalities Prevented by Implementing Safety Measures</u>

	Total	Non-Existing Quiet Zones	Whistle Bans Est. Post 10/9/96
CCRI greater than NSRT	$21,976,553	$18,602,675	$ 3,373,878
TOTAL	**$76,873,156**		

Total Twenty-Year Collisions and Casualties Prevented
Declining Collision Rate (4% annual decline)

	Nationwide, Including the Chicago Area		
<u>Pre-Rule Quiet Zones:</u>	Collisions	Injuries	Fatalities
Cancellation of W-Bans	37	8	0
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions	9	4	0
1QZs w/ CCRI > 2 x NSRT; No Collisions	22	11	4
QZs w/ CCRI > NSRT; With Collisions	31	15	5
Pre-Rule Quiet Zone Total	**99**	**38**	**9**
<u>New Quiet Zones:</u>	24	22	4
TOTAL	**123**	**60**	**13**

FRA also estimates that reductions to highway vehicle, rail equipment, and track damage over the next twenty years will total approximately $400,000 under a declining collision rate of 4 percent annually.

Additional benefits that are not quantified in this analysis include reductions in train delays resulting from collisions, and community disruption where horns are sounded resulting from limiting the duration and level of sound emitted by horns. It is very difficult to quantify the value of "quality of life" and other indirect safety benefits which may result from silencing locomotive horns at locations where they currently sound. FRA believes that these benefits are substantial and significant.

5.0 Grade Crossings, Communities, Railroads, and Locomotives Affected -

Quiet zones in the following communities have already been established using Supplementary Safety Measures: Burlington, Vermont; Louisville, Kentucky; Cortland, Illinois; Koon Rapids, Minnesota; Spokane County and Yakima, Washington; and McNabb Road, Southeast Florida. Since these quiet zones are in compliance with the requirements of this final rule, this analysis does not include regulatory costs or safety benefits associated with their establishment.

Pre-Rule Quiet Zone Crossings and Communities: Pre-Rule Quiet Zones are segments of a rail line with one or more consecutive public highway-rail crossings at which locomotive horns were not sounded routinely as of October 9, 1996[1] and the date of publication of the interim final rule. For purposes of identifying Pre-Rule Quiet Zones, FRA used the DOT Grade Crossing Inventory database to identify "whistle ban jurisdictions" (WBJ) which are political subdivision/railroad combinations. A city or village might comprise one, two, or more WBJs. Generally, crossings within WBJs have similar collision risk levels (as measured by the FRA Accident Prediction Formulas and information regarding the severity of collisions considered preventable by implementation of this rule) and the communities in which they are in probably have similar desires regarding the sounding of locomotive horns at crossings. This first cut identification of WBJs resulted in the grouping of crossings that are along more than one rail line (sidings, yard track, etc) and have significantly different levels of collision risk in absence of the routine sounding of the locomotive horn. To correct for this, FRA further segmented certain WBJs into two or more WBJs as necessary to group crossings along individual rail lines. To accomplish this, FRA reviewed individual crossing information such as the number of main tracks and train traffic along with risk levels.

FRA is aware of 1,988 crossings located in a total of 260 cities nationwide that are in potential Pre-Rule Quiet Zones. Depending on their risk profile, these crossings may be affected by the final rule requirements for sounding the horn or establishing quiet zones.

Illinois: According to comments from the Chicago Area Transportation Study (CATS), the "Illinois Commerce Commission has excused railroads from routinely sounding their horn at grade crossings that are equipped with automatic warning devices and experienced less than three collisions in the past five years." CATS comments go on to state that, "according to the FRA inventory, 4,828 grade crossings met these criteria. Throughout the state, 1.9 million people reside within 1/4 mile of a Commerce Commission excused grade crossing; 3.8 million people reside within ½ mile and, 6.6 million live within one mile of a Commerce Commission excused grade crossing. A potential problem exists in that FRA does not currently include the Commerce Commission set of 4,828 grade crossings as currently operating under a ban. This is important in that these crossings are similar to a crossing that has a whistle ban in place, since the horn is not currently required to be sounded. Whether or not these crossings are included is

[1] October 9, 1996 was the last time Congress passed legislation addressing restrictions on the sounding of locomotive horns at grade crossings.

critical when evaluating the cost - benefit of the proposed rule. The addition of 3,000 plus grade crossings to the cost side of the cost-benefit analysis is likely to indicate that the costs would exceed the benefits."

Information provided by the Association of American Railroads (AAR) on October 24, 2000 indicated a total of 28 no-whistle freight-only crossings in the Chicago Region and 227 no-whistle crossings on the Metra route system for a total of 255. The AAR noted that "none of these railroads operates at public crossings in Chicago without sounding the whistle unless the crossings are equipped with gates or trains operate at speeds under 10 m.p.h." At approximately the same time Metra informed FRA that 130 crossings on their property were no-whistle crossings. When combined and checked against year 2002 DOT Grade Crossing Inventory records 304 Chicago area crossings were considered no-whistle based upon AAR and Metra sources. In November of 2002, the Illinois Commerce commission (ICC) provided their inventory of crossings in the state of Illinois indicating current whistle status (based on actual practice). It showed 278 no-whistle crossings in the Chicago Region and of those 226 corresponded with the 304 provided by AAR and Metra. FRA also learned of 29 additional quiet crossings in some other suburban Chicago communities for a total of 385. One crossing has since closed. FRA's reconciliation in effect adds no-whistle crossings on Metra's home lines to the AAR estimates and the information from the ICC.

New Quiet Zone Crossings and Communities: For purposes of this rule, a New Quiet Zone is a segment of a rail line with one or more consecutive public highway-rail crossings at which routine sounding of locomotive horns is restricted and which does not qualify as a Pre-Rule Quiet Zone. New Quiet zones can be grouped into two categories: (1) those that will be established based on whistle ban ordinances passed after October 9, 1996 and (2) those that will be established after this rule is issued. FRA is aware of 66 whistle-ban crossings in existence today that were established after October 9, 1996. This analysis assumes that communities will comply with the requirements of this rule for establishing and maintaining New Quiet Zones.

FRA has received numerous requests for guidance from communities desiring to establish quiet zones. In general, such communities have elected to wait for the final rule before proceeding with the actual creation of quiet zones. FRA has specifically received notice form Olmstead Falls and Berea, Ohio; Fargo, North Dakota; Moorhead and Farmington, Minnesota; Salt Lake City, Utah; Richardson, Texas; Peoria, Morrison, and Dekalb, Illinois; Stevens Point and Fox Point, Wisconsin; and Lansing, Michigan.

Some communities once expressed a desire to silence locomotive horns, but the railroads that operate through those communities have rejected the notion due to concerns about safety and liability. In 1991, Consolidated Rail Corporation (Conrail), one of the largest railroads in North America at the time[2], began ignoring whistle bans that had been enacted by local communities

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[2] Norfolk Southern Corporation and CSX Transportation have since purchased most of Conrail's railroad assets.

along its rail lines. Other whistle ban ordinances along rail lines of the Norfolk Southern, CSX, Burlington Northern and Santa Fe, Kansas City Southern Railroad, Wisconsin Central, Union Pacific and the former Southern Pacific were also canceled prior to October 9, 1996. FRA believes that these communities will consider establishing New Quiet Zones along these corridors once this final rule is issued.

FRA estimates that communities will consider establishing New Quiet Zones incorporating a total of 867 crossings nationwide (excluding Florida) in the first three years of the rule. Information collected for the Final Environmental Impact Statement from the 2000 Census indicates that, outside of the corridors that currently have whistle bans in place, no persons would be severely impacted at 105 of these crossings and that less than 20 persons are severely impacted by train horn noise at 245 of these crossings. This analysis assumes that communities will establish New Quiet Zones where train horns routinely sound today only to the extent that more than 20 persons are severely affected along the corridor. In addition, communities may not include in New Quiet Zones crossings with less than five daytime train traffic volumes and no nighttime train traffic to the extent that these crossings would require added safety measures. FRA identified 75 such crossings[3] in the remaining group of 517. Therefore, FRA expects that New Quiet Zones established in the first three years of this rule will be comprised of a total of 442 public crossings.

The group of crossings is reduced to 339 when crossings with less than ten daytime trains are excluded as well.

This rule also addresses private crossings. Although FRA does not know how many such crossings would be included in New Quiet Zones, for purposes of this analysis, FRA estimates that for every 20 public crossings there will be an average of 1 private crossing, that is 17 private crossings.

As time passes and rail traffic increases in certain rail corridors situated along highly populated areas, additional New Quiet Zones may be established.

Crossings where locomotive horns sound routinely: Approximately 152,000 public at-grade crossings nationwide will be affected by the requirements for maximum locomotive horn sound levels. All public, at-grade crossings will be affected, except where the locomotive horns will not be sounded**.**

Railroads: All 685 passenger and freight U.S. railroads will be affected by the requirements for maximum locomotive horn sound levels, testing and certification of locomotive horns, and when to use locomotive horns. Railroads are currently responsible for the maintenance of active warning devices installed at grade crossings. Many railroads will incur additional maintenance costs associated with the installation or upgrade of active warning devices.

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[3] Seventy-two of the 75 crossings have less than one per day, the other 3 have an average of less than 5 trains per day.

Locomotives: With the exception of about 150 steam locomotives, all locomotives operating on railroads subject to this rule will be affected by the requirements for maximum locomotive horn sound levels as well as the requirements for the testing and certification of locomotive horns. There are approximately 23,000 locomotives currently in service in the United States. FRA holds this number constant for analysis. Determining the number of future locomotives is complicated by several factors. For example, locomotives that are retired may not be replaced one for one, as a railroad may choose to replace several lower horsepower locomotives with fewer higher horsepower locomotives. Also, rather than retiring locomotives or rebuilding them, they may be sold to Class II or III railroads. Without information on factors affecting the future number of locomotives, FRA holds the number of locomotives constant for analysis.

6.0 Costs

Costs associated with implementation of this interim final rule for the use of locomotive horns at highway-rail grade crossings will be incurred by (1) railroads subject to this rule, (2) communities that have existing whistle bans and those that desire to establish New Quiet Zones, (3) residents of communities that are not able to retain whistle bans, and (4) local, state and federal governments.

What costs affected parties will incur will depend on the decisions communities make regarding the sounding of locomotive horns at crossings in their communities. The next section presents costs associated with maximum horn sound requirements. The following section presents the criteria that FRA used to estimate how many communities that have whistle-ban crossings will retain these and how many may not. Cost estimates for not retaining bans are also presented. The sections that follow present the estimated costs of complying with the requirements for establishing and maintaining quiet zones.

Many commenters from the greater Chicago area indicate that safety levels at grade crossings in that area are not affected by whistle bans. A current study performed for FRA concludes that the effectiveness rate of locomotive horns at gated crossings in the Chicago area is different from national levels. Therefore, this analysis presents impacts of this rulemaking for the Chicago area separate from the rest of the nation where appropriate.

6.1 '229.129 Audible Warning Device' Maximum Sound Requirements

Much of the resources expended as a result of this regulation will be for testing existing locomotives, and retesting locomotives because of major maintenance, routine service, and non-compliant horns. To model these costs, the labor rates for three different methods to conduct horn tests were approximated. Horns may be tested by the railroad itself, by contractors, or by the railroad using rental equipment. Noting that dissimilar sized railroads may find it advantageous to use the three testing methods in different amounts, assumptions were made as to which classes of railroads will use what methods. New locomotives will face much lower costs, as horn adjustments are easier to make in the manufacturing process than in the field. Costs are assigned, however, for implementing the new regulation.

The maximum volume provision will also result in incremental equipment costs for railroads and other stakeholders that perform sound level testing of locomotive horns. Although railroads and others who perform tests currently have sound level meters (SLMs), they will likely need to acquire additional meters to meet the burden of testing all locomotives in five years. Some will also need to buy meters than can accept a remote microphone. The analysis estimates that 122 new meters will be required. Calibration costs are also designated for these meters, with only a portion of costs allocated after five years, reflecting the reduced testing burden. All testing entities will need to purchase tripods (or some other testing fixture) to mount the remote microphone at the new testing height of fifteen feet. A cable to connect the remote microphone to the SLM is also necessary. Of course, if a horn exceeds the maximum volume standard, it will need to be adjusted and retested. Costs to adjust non-compliant horns were calculated using a non-compliance rate of 30%, and estimated separately for labor required to make the change and the cost of parts. One of the possible ways for a railroad to test locomotive horns is by renting a SLM. This method will especially appeal to smaller railroads with fewer locomotives, for whom renting may be a cost-effective option. Rental costs are determined by multiplying the average SLM rental cost of $60 per day by the number of locomotives that will be tested in this way (estimated using the Who-Does-What assumptions). The table below itemizes the costs from this provision. Labor rates appear in Exhibit 1.

Summary of Costs

Cost Description	Total NPV Cost
Existing Locomotive Horn Tests	$1,209,392
Non-Compliant Locomotives (Adjustment)	$86,881
Non-Compliant Locomotives (Retests)	$367,720
Retesting Horns Due to Major Service	$501,899
Retesting Horns Due to Minor Maintenance	$156,240
Administrative and Planning	$36,871
New Meters	$211,884
New Meters: Calibration	$80,460
Additional Equipment: Tripod & Remote Microphone Cable	$28,984
Non-Compliant Locomotives (Parts)	$57,921
Rental SLM	$164,226
Total NPV Costs	$2,902,478

Total discounted costs are estimated at about $3 million for the upper sound level limit on the locomotive horn. Appendix D presents costs and benefits associated with this requirement in greater detail.

6.2 Existing Whistle Bans That Will Not Be Retained

Some communities that would otherwise establish quiet zones may no longer do so as a result of this rulemaking. Such communities would only retain existing whistle bans to the extent that they could take advantage of the exceptions the rule offers to quiet zones with low risk indexes. When determining whether or not to retain whistle bans, communities will consider factors such as population density and proximity to the crossings, train traffic levels and times of day, costs associated with the safety improvements necessary to establish quiet zones, and availability of funding for such improvements. Communities with low train traffic levels, particularly at nighttime, and low population densities may decide to cancel certain whistle bans if they have to make improvements to the crossings.

FRA does not have information regarding how many communities may not be able to retain existing whistle bans. However, the Draft Environmental Impact Statement that accompanied the NPRM for this rulemaking did estimate the number of *severely impacted persons* by locomotive horn noise for each whistle-ban crossing identified at the time and for cancelled bans. The estimates for existing whistle bans were updated for the Final Environmental Impact Statement using data from the 2000 census. The number of persons severely impacted was calculated as a function of proximity of residents to grade crossings, locomotive horn sound level over sound of train, numbers of daytime and nighttime trains passing through, speed of trains, and population densities.

This analysis assumes that nationwide communities will make every effort to fund improvements necessary to retain whistle bans at grade crossings where the sounding of the locomotive horns would severely impact more than 20 residents. This analysis assumes that communities where the levels of night-time train traffic are very high[1], may make extra efforts to retain whistle bans when more than 10 persons are severely impacted. Note that the average household is comprised of 2.3 persons. Therefore, severely impacting 20 residents is the equivalent of severely impacting 8.7 households. FRA estimates the sounding of locomotive horns would severely impact 0 persons at 277 existing whistle-ban crossings and between 1 and 20 persons at each of approximately 442 existing whistle-ban crossings.

As a result of not retaining existing whistle bans, the health and/or safety of residents, young children in daycare centers, patients in hospitals, and other persons in the immediate vicinities of crossings where horns are routinely sounded may be negatively impacted. The routine sounding of horns may also serve as a learning impediment to students who need to concentrate in order to learn. Surgeons and other medical care providers who need to concentrate in order to perform critical medical procedures may find it difficult to perform their duties well when locomotive horns are sounded nearby. The routine sounding of horns may further be an impediment to residents in the close proximity trying to get their daily rest and sleep. The chronic inability to rest or sleep without interruption may result in a reduction in attentiveness while a person is performing safety sensitive activities.

Unfortunately, FRA cannot estimate the costs of the safety and health effects caused by routine locomotive horn noise. Such negative effects, however, should be reflected to some extent in property values that can be more readily measured. Noise experts consider residential land use more noise sensitive than industrial land use. Property values of residences in the immediate vicinities of whistle-ban crossings that are not retained may decrease due to the disturbances caused by the noise of the horns.

The effects of the sounding locomotive horns on property values have been studied recently in response to this rulemaking. The results have neither established nor excluded the possibility of adverse effects on property values. David E. Clark, Associate Professor of Economics, Marquette University and Argonne National Laboratory, Decision and Information Sciences Division performed a study for FRA entitled *Ignoring Whistle Bans and Residential Property Values: An Hedonic Housing Price Analysis*. This is the only study to date that has directly analyzed the impact of horn sounding on property values. As indicated earlier, in 1991, Conrail, began ignoring whistle bans that had been enacted by local communities along its rail lines. Clark studied the effects of this action on property values in three counties (two in Ohio and one in Massachusetts) where Conrail began sounding locomotive horns. According to Clark "Findings regarding impacts of the action by Conrail are mixed. Property values fell by almost

1 Many crossings in the Chicago area have average train traffic levels well over 50 per day.

7% (6.7%) in one area (Middletown, Ohio) following the implementation of the Conrail policy, but they gradually increased over time. Within three years, the detrimental impact of the Conrail action was eliminated. For the other two areas, no (statistically) significant impacts from the Conrail action were revealed."

Clark also indicates "other things equal, being within 1,000 feet of an operating rail line depresses the sale price of a property from 5% to 13% on average."

Although FRA does not have evidence of any long-term effects of resuming the sounding of train horns, a worse case scenario of a temporary drop in property values is presented. Information regarding median housing values can be obtained at the county level using the *Census 2000 American FactFinder*. Certain existing whistle-ban crossings where the sounding of the horn would severely impact 20 persons or fewer will probably not be retained as a result of the requirements of this rulemaking unless the quiet zone qualifies for a low risk exemption or the particular crossing has a low risk level. Based on this assumption, train horn sounding would resume at a total of 36 crossings nationwide. At 18 of these crossings, horn sounding would not severely impact any persons and property values should not be impacted. Assuming (1) a 9 percent differential from median county housing values for the properties nearest the crossings, (2) a 6.7 percent decline in property values for residences of those persons severely impacted by train horn sounding, and (3) an average household size of 2.3 persons, the estimated total decline in values of residences of those severely impacted nationwide would total up to $201,034 (PV, 7%). The value of approximately 34 residences would be affected[2]. FRA believes that this is a worse case theoretical scenario and not one that it expects will occur for various reasons. Those who value quiet most would probably elect to reside a considerable distance from railroad lines to avoid other noise and vibration impacts resulting from train movements. Those that do purchase homes close enough to railroad crossings to be severely impacted by the sounding of the horn are aware of the possibility that one day horn sounding may resume.

To the extent that certain communities believe that there is a significant adverse impact on property values, they may decide to implement the safety measures necessary to establish quiet zones in compliance with this rule so as to retain the community tax base. Appendix A to this document discusses the effects of sounding locomotive horns on property values and presents the limited findings of the studies in greater detail.

Even if property values do not fall, homeowners that are forced to move away may incur other real economic costs associated with relocation. The Chaddick Institute indicates that it is very likely that some level of relocation costs will be incurred as a result of implementing the locomotive horn sounding requirements presented in the NPRM. Some residents may incur costs associated with mitigating the impacts of the locomotive horn sound. Since (1) the effect of locomotive horn noise on property values is not known at this time, and (2) the types of mitigation that will occur are not known with certainty, this analysis also uses relocation costs as a surrogate for the monetary costs that some residents that are severely affected by the cancellation of existing whistle bans will incur once this rule is implemented.

Relocation costs include planning, actual moving costs, time off from work to pack and unpack, and could also include the cost of buying and selling a residence. Actual expenditures vary greatly depending on the number of people in a household being relocated, the distance between the old and new residences, the time it takes to find a new permanent residence, the items being relocated (furniture, automobile(s), and other personal belongings), and whether a residence is sold and another purchased.

This analysis assumes that residents relocating due to the perceived disturbance caused by the sounding of locomotive horns alone will not elect to leave the general neighborhood where they reside. Relocation costs included in this analysis are limited to the same general neighborhood and similar home. To the extent that affected residents use this opportunity to achieve other residential goals, they may relocate further away or to smaller/larger homes. Such moves would no longer be solely direct impacts of the rule. Therefore, any additional costs involved with such relocations are not included in this analysis.

Following are estimates of average relocation costs attributable to this rule.

<u>All Relocations</u>	
Planning (evaluation of disturbance):	6 household labor hours
Seeking New Residence ((2 people visiting/ evaluating potential residences):	30 household labor hours
Moving costs:	$1,000 - $2,000
Time Off Work to Pack/Unpack:	24 household labor hours
Meals:	$50 - $150
Closing Costs & Realtor Fees:	$6,000 - $24,000
<u>Some Relocations</u>	
Temporary Storage (1 - 4 weeks):	$ 75 - $180
Temporary Housing (1 - 4 weeks):	$ 300 - $2,500

According to the U.S. Census Bureau, Historical Income Tables for Households, in 2000, the mean household income in the U.S. was $57,047. Such information is not presented by State. However, in 2000, the median household income in the U.S. was $42,151 and in Illinois $46,435. Assuming that the median household income ratio of Illinois to the U.S. was approximately the same for mean household incomes, the mean household income for Illinois in 2000, was approximately $62,845. Further assuming a 2,080 work hour year, the average hourly labor rate per household was $27.43 in the U.S. and $30.21 in Illinois in 2000. Applying these rates to the household labor hour estimates presented above and adding the other relocation costs, the average total cost per relocation is $19,774 in the U.S. and $20,941 in Illinois. Some relocations will also include an additional $375 to $2,680 for temporary housing. This analysis assumes that approximately 30 percent of relocations will require temporary storage and housing.

	Moving Costs	Temporary Storage & Housing	Range	Average
U.S.	$8,696 - $27,796	$375 - $2,680	$9,071 - $30,476	$19,774
Illinois	$8,863 - $29,963	$375 - $2,680	$9,238 - $32,643	$20,941

This analysis uses these costs as a surrogate for relocation costs incurred by renters even though renters are generally more mobile than homeowners and, on average, would likely incur significantly lower relocation costs.

The Chaddick Institute study *Alternatives to the Whistle: The Role of Public Education and Enforcement in Promoting Highway-Rail Grade Safety in Metropolitan Chicago* indicates it would be appropriate to include relocation costs for 20 percent to 40 percent of properties near whistle ban grade crossings where the locomotive horn may begin to sound as a result of complying with the requirements proposed in the NPRM. The study further indicates that it is likely that any costs associated with actual annoyance caused by whistles will be born in lower income areas where communities may not be able to afford implementation of SSMs or ASMs. FRA believes that this is not always the case. Many lower income areas are in metropolitan cities where a large business base provides significant income to the community. In some cases the estimated cost of relocation will serve as a surrogate cost for the disturbance caused by the sounding of locomotive horns or the costs incurred by residents, businesses, hospitals, schools, places of worship, and others to mitigate the impacts of such noise.

Certain existing whistle-ban crossings where the sounding of the horn would severely impact 20 persons or fewer will probably not be retained as a result of the requirements of this rulemaking unless the quiet zone qualifies for a low risk exemption or the particular crossing has a low risk level. The process for identifying expected whistle ban cancellations is presented in section 6.5 of this analysis. This analysis assumes that each whistle ban cancellation will affect an average of five households and that, of the five households affected, three will relocate, see a reduction in property value, or take action to mitigate the effects of the locomotive horn.

Applying these assumptions, 3 households in the Chicago area and 117 households in the rest of the nation will incur relocation or mitigation costs associated with the cancellation of existing whistle bans in the first 20 years of the rule. **The NPV of such costs are approximately $47,927 in the Chicago area and $1,676,663 in the rest of the nation. Exhibit 3 presents annual costs.**

6.3 Advance Warning Signs at Quiet Zone Crossings

Every crossing at which the locomotive horn is not sounded will require an advance warning sign advising motorists the horn is not sounded. Whistle-ban crossings do not currently have such signs. Therefore, this analysis assumes that a pair of signs will be installed at all crossings where whistles will not be sounded. A plate with the warning imprinted on it attached to an already existing advance warning sign post (W – 10) will meet the requirement. Most of the installation cost will probably be for labor. FRA estimates that the cost of the plate and labor to attach it to a pre-existing post will total $100.

Crossings in Pre-Rule Quiet Zones must have advance warning signs in place three years after this final rule is published**.** This analysis assumes that costs associated with posting signs at existing whistle-ban crossings that are expected to be included in Pre-Rule Quiet Zones will be distributed evenly in the first three years of the rule. New Quiet Zone crossings should have these signs in place before the locomotive horns are silenced.

Following are the twenty-year costs (PV) for the requirement for advance warning signs.

Pre-Rule Quiet Zones	
Chicago Area	$ 33,504
Nationwide (excluding Chicago Area)	$136,989
Total	$170,493
New Quiet Zones	
Existing Whistle Bans established after 10/9/96	$ 5,773
New Quiet Zones (horns are currently sounded)	$ 36,832
Total	$ 42,605
Total Twenty-Year Costs (PV):	**$213,098**

6.4 Train Operations Which Do Not Require Sounding of Horns at Individual Crossings

Locomotive horns need not be sounded at individual highway-rail grade crossings at which the maximum authorized operating speed for that segment of track is 15 miles per hour or less and train crewmembers or properly equipped flaggers (as defined in by 49 CFR 234.5) provide warning to motorists. This exception is intended to avoid unnecessary noise impacts on railroad personnel working on the ground in very close proximity to the locomotive horn in industrial areas where substantial switching occurs at very low speeds with flaggers providing warning to motorists. Typically, a conductor or brakeman on the train provides such flagging protection. These situations typically involve local trains that are traversing short distances to serve an industry location by ‘spotting’ or ‘pulling’ freight cars. FRA does not encourage indiscriminate proliferation of this type of practice, and nothing in this final rule requires a railroad to have a crossing flagged.

This rule preempts state laws requiring the sounding of the locomotive horns. Locomotive engineers probably use discretion when sounding train horns under such circumstances to minimize the noise disturbance generated. This rule will allow engineers to stop sounding the horn under these circumstances at no additional cost.

6.5 Establishing Quiet Zones

This rule permits the establishment of two types of quiet zones (1) Pre-Rule Quiet Zones and (2) New Quiet Zones.

A Pre-Rule Quiet Zone is a segment of a rail line with one or more consecutive public highway-rail crossings at which locomotive horns did not sound due to formal or informal agreements between the community and the railroad or railroads that were in place and enforced or observed as of both October 9, 1996 and the effective date of the final rule.

The final rule offers communities three alternatives for establishing Pre-Rule Quiet Zones. The first is by determining that the Crossing Corridor Severity Index (CCRI) of the quiet zone, which is the average of the individual crossing risk indexes, is at a level permissible under the rule. That is, either (1) the CCRI (taking into account the silencing of the locomotive horn) is below the Nationwide Significant Risk Threshold (NSRT), which is the average risk index of individual gated horn-sounding crossings nationwide or (2) the crossings in the quiet zone have not had any collisions considered preventable by sounding the locomotive horn in the past five years and the CCRI is below the product of two times the NSRT. The second alternative for establishing a quiet zone is by applying a supplementary safety measure (SSM) to every public crossing in the quiet zone. Temporary closures of a public grade crossing, four-quadrant gate systems, gates with medians or channelization devices, and one-way streets with gate(s) are currently approved SSMs. FRA has determined that each SSM is an effective substitute for the sounding of the horn in preventing grade crossing collisions. The third alternative allows communities to install alternative safety measures (ASM) and/or automatic gates and flashing lights at one or more of the crossings in the quiet zone. For purposes of this rule, ASMs include all of the SSMs as well as photo-enforcement, programmed enforcement, and public education and awareness. Under this corridor approach, risk reduction of the entire quiet zone following implementation of the ASMs and/or flashing lights and gates has to (1) fully compensate for not sounding locomotive horns or (2) reduce the quiet zone's CCRI below the NSRT. Applicants electing to implement this corridor approach must demonstrate risk compensation or reduction through data and analysis.

Locomotive horn use appears to have an effectiveness rate at gated crossings in the Chicago Area that is different from the rest of the nation. In 2002, a study performed for FRA in support of this rulemaking by Westat, Incorporated, a nationally respected statistical firm, *Analysis of the Safety Impact of Train Horn Bans at Highway-Rail Grade Crossings: An Update Using 1997 – 2001 Data* estimated a distinct horn effectiveness rate for gated crossings in the Chicago area that was lower than that for gated crossings in the rest of the nation. The findings of this study are discussed in greater detail in the section *7.0 Benefits* of this document. Since a permissible level of risk for pre-rule quiet zones is one that fully compensates for the effectiveness of the locomotive horn, crossings in the six county-Chicago area may compensate for less risk to meet this standard than crossings in the rest of the nation. This analysis presents costs associated with establishing pre-rule quiet zones for the Chicago area separate from those for the rest of the nation.

For purposes of this analysis, Pre-Rule Quiet Zones will be composed of the following four categories.

1. Pre-Rule Quiet Zones With a CCRI Below the NSRT
2. Pre-Rule Quiet Zones With No Relevant Collisions[3] in the Past Five Years and a CCRI Above the NSRT and Below Twice the NSRT
3. Pre-Rule Quiet Zones With No Relevant Collisions in the Past Five Years and a CCRI Above Twice the NSRT
4. Pre-Rule Quiet Zones With Relevant Collisions in the Past Five Years and a CCRI Above the NSRT

As discussed earlier, affected communities will consider many factors in determining whether or not to make the investments necessary to retain whistle bans by establishing quiet zones. Safety measure implementation costs, train traffic volumes and times of operation, as well as the number of residents affected and their proximity to affected crossings will likely be the principal factors communities consider.

A <u>New Quiet Zone</u> is a segment of a rail line with one or more consecutive public highway-rail crossings at which routine sounding of locomotive horns is restricted and which does not qualify as a Pre-Rule Quiet Zone. The final rule offers communities the same three ways to establish New Quiet Zones as Pre-Rule Quiet Zones with the additional requirement that all public crossings included be equipped with flashing lights and automatic gates. New Quiet Zones can be classified as follows:

1. New Quiet Zones That Qualify Without Improvements- CCRI Below the NSRT
2. New Quiet Zones That Require Improvements - CCRI Above the NSRT

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[3] Highway-Rail Crossing collisions between trains and highway vehicles where (1) at least one the first four units of a train (including any locomotives) is involved and (2) the driver of the highway vehicle is in the vehicle at the time of the collision.

New Quiet Zones will be comprised of crossings with existing whistle bans that were established after October 9, 1996, of former whistle-ban crossings, and of crossings where locomotive horns have always been routinely sounded.

The following two tables present the costs and effectiveness rates associated with the various approved safety measures and warning device upgrades that communities may use to reduce their risk levels so that they may establish and maintain quiet zones.

Approved Safety Measure	Initial Cost to Community	Annual Cost	Effectiveness Rate
Temporary Closures (daily w/ swing or sliding gates)	$2,000	$2,000	1.00
Permanent Closures	$5,000	$0	1.00
Grade Separation	$3 million - $5 million	$0	1.00
4-6 Inch Mountable Curbs w/ Frangible Delineators	$13,000 (100 ft each side)	$500	0.75
6-9 Inch Non-Mountable Concrete Curbs	$15,000	$0	0.77
No Gates to four-quad Gates	$280,000 (4 - 6 gates installed)	$5,000	at least 0.82
Two Quad to four-quad Gates	$100,000 (no vehicle presence detection) $128,000 (w/ VPD)	$2,500	0.82 (no vehicle presence detection) 0.77 (w/ VPD)
Paired One-Way Streets	$35,000 (relocate existing gates)	$0	0.82
Photo-Enforcement	Single Crossing: $65,500 2 Crossings: $40,500 ea. 3 Crossings: $32,167 ea. 4 Crossings: $28,000 ea.	Single Crossing: $24,000 2 Crossings: $12,400 ea. 3 Crossings: $8,533 ea. 4 Crossings: $6,600 ea.	Must establish a baseline (60% assumed for purposes of estimating benefits in this analysis)
Programmed Enforcement	$20,000 - $25,000 to establish baseline	$4,600 average Communities recoup costs through fines collected	Must establish a baseline sufficient to reduce risk to a permissible level
Public Education and Awareness	$20,000 - $25,000 to establish baseline	$5,000 for materials $5,000 for labor	Same as Programmed Enforcement Above

Warning Device Upgrade	Initial Cost to Community	Annual Cost	Effectiveness Rate
Passive Warning Devices to Automatic Gates & CWT	$140,000	$2,500	0.79
Passive Warning Devices to Flashing Lights & CWT	$94,000	$2,000	0.59
Flashing Lights to Automatic Gates & CWT[4]	$40,000 (average assuming half of the crossings already have CWT or are CWT ready)	$500	0.66

Photo-enforcement, programmed enforcement, and public education and awareness require establishment of baseline violation rates (number of violations/train movements). The baseline monitoring period must be a minimum of 4 weeks if conducted without public notice or media coverage and 16 weeks if conducted with public notice or media coverage. Once a baseline has been established, photo-enforcement may begin and violation rates must be monitored for the next 6 months. Semi-annual analysis, verifying the last quarter's violation rates remain at or below the levels established prior to initiation of the program, must be performed for the first five years (until the crossings have 5 years of collision history with photo-enforcement). Thereafter, analysis will be required every fourth quarter. For purposes of this analysis, FRA is assuming that it will cost communities approximately $7,000 to establish a baseline, $3,000 annually to monitor violation rates every other quarter, and $1,500 annually to monitor violation rates very fourth quarter. This analysis assumes that the level of effort will be maintained throughout the twenty-year period of this analysis and therefore, effectiveness rates will remain at or below the required levels. This analysis assumes that communities will voluntarily continue to respond to increases in highway vehicle traffic or train traffic by adjusting or adding safety measures.

Photo-enforcement is generally a more feasible alternative for communities that treat more than one crossing because equipment can be shared and thus costs reduced. Once photo-enforcement is implemented, annual operating costs can be paid for with the revenue generated from motorist violations. The Illinois General Assembly has not yet approved the use of photo-enforcement in Illinois. However, given the very favorable results of demonstration projects and tests in Illinois and California, and the strong trend now associated with photo-enforcement to prevent red-light running, it is very likely that the Illinois General Assembly would approve the use of photo-enforcement. This analysis assumes that such approval will be granted in the very near future. FRA is participating in an evaluation study of three wayside horn installations in Mundelein,

[4] Assuming that half of existing crossings equipped with flashing lights already have CWT. The average incremental cost for CWT is $20,000.

Illinois. The rule contains provisions to allow the use of wayside horns that are placed at crossings and directed at oncoming motorists. Wayside horns are activated by the same track circuits used to detect the train's approach by other automated warning devices. Use of wayside horns in lieu of train-mounted horns reduces net community noise impacts. Although wayside horns do not provide motorists with information about the proximity, speed, and direction of approaching trains, demonstrations have thus far indicated that they may be as effective as train horns. This interim final rule permits their use as a one-for-one substitution at individual crossings either within or outside of quiet zones. This rule requires communities that install wayside horns to notify FRA at what crossings they have been placed. Minimal costs are associated with this requirement.

This rule contains provisions for the development of new alternatives for the testing and introduction of new grade crossing safety technology that would provide a sufficient level of safety to enable locomotive horns to be silenced. Communities will likely take advantage of such opportunities to the extent that these can be implemented at a lower cost than the already approved safety measures. This analysis allocates costs for all affected communities to implement a sufficient number of already approved SSMs, ASMs, and/or add automatic gates and flashing lights to meet the requirements of the rule for establishing and maintaining quiet zones. Therefore, to the extent that communities take advantage of the opportunity to develop new alternatives, this analysis may overstate costs. FRA anticipates that many communities will indeed take advantage of this flexibility and develop alternatives based on variations of the approved SSMs and ASMs. For instance, some crossings may be treated with distinct additional safety measures on each highway approach (e.g. two gates blocking all lanes on one approach and mountable curbs with frangible delineators on the other).

Interested parties may demonstrate proposed new SSMs or procedures to determine if they are an effective substitute for the locomotive horn in the prevention of collisions and casualties at public highway-rail grade crossings. Following successful demonstration, such parties may apply for approval by submitting detailed descriptions of the design and results of the demonstration as well as implementation cost information. Again, this analysis assumes that such demonstrations will occur only to the extent that demonstration and implementation are less expensive than using one of the already approved safety measures. Therefore, estimated compliance costs presented in this analysis may be overstated to the extent that communities take advantage of this flexibility.

What safety measures communities will select

Not all approved safety measures (SSMs and ASMs) can be implemented at all crossings. Physical characteristics of certain crossings as well as other constraints will not permit the implementation of certain safety measures. For instance, according to the Northwest Municipal Conference, paired one-way streets with gates may contribute to the failure of business districts as one-way streets have done in the past. One-way streets may limit access to businesses and therefore reduce sales. Cost alone will make grade separation an infeasible measure for many communities. Although crossing closures appear to be low cost alternatives, communities must ensure that highway traffic from those crossings could be safely diverted to nearby streets. Appendix B Safety Measures discusses in greater detail the safety measures (including implementation costs, feasibility, and effectiveness) presented in the table above.

For purposes of this analysis, FRA is assuming that, in general, a community's first choice for implementation of a safety measure will be the lowest cost feasible option. For many gated crossings this should be mountable-curbs with frangible delineators. Distance to the nearest intersection, is an important determinant of feasibility for this option because the medians must extend 100 feet on each approach, unless there is an intersection within that distance (in that case the median or channelization device must extend at least 60 feet). The DOT Grade Crossing Inventory contains information regarding the distance of the nearest intersection for grade crossings. This information is presented in ranges of (1) less than 75 feet, (2) 75 to 200 feet, and (3) 200 – 500 feet. For purposes of estimating which crossings communities would choose to install mountable curbs and frangible delineators or non-mountable concrete curbs, FRA is assuming that communities will do so at all gated crossings where the nearest intersection is 200 - 500 feet away. Installation costs are higher for concrete curbs and maintenance costs are higher for mountable curbs with frangible delineators. Overall, twenty-year implementation costs are higher for mountable curbs. In an effort to produce conservative cost estimates, this analysis assumes that all curb installations will be of the mountable type with frangible delineators. Although photo-enforcement is probably the next least expensive safety measure, some communities may not have the resources to view tapes and process any resulting violations. As a result, some communities may install four-quadrant-gate systems. Some four-quadrant gate systems may include vehicle presence detection systems to prevent highway vehicles from becoming trapped by four-quadrant gate systems at such crossings. In metropolitan areas where traffic signals may be in close proximity of grade crossings, there may be long queues at crossings. This analysis assumes that half of all four-quadrant gate installations will include vehicle presence detection systems. Of the gated crossings that have intersections within 200 feet that must be treated, this analysis assumes that half will be equipped with four-quadrant gates and half will be able to accommodate median arrangements. Finally, this analysis assumes that communities that have to treat more than one gated crossing where the nearest intersection is within 200 feet will implement photo-enforcement with 2 to 4 crossings sharing equipment.

This analysis does not allocate costs for communities to implement any SSMs or ASMs other than mountable curbs with frangible delineators, photo-enforcement, and four-quadrant gate systems. However, this should not affect the overall estimated cost of treating crossings because the costs of implementing other SSMs and ASMs are generally in line with, if not lower than, the costs of implementing mountable curbs with frangible delineators, four-quadrant gates, and photo-enforcement. Furthermore, some SSMs may not be implemented solely in response to this rulemaking. For instance, grade separations and permanent closures are probably much more dependent on roadway traffic planning needs than on quiet zone needs. It would not be reasonable or proper to assign the full costs of such measures to this rule. Communities will generally improve the crossings with the highest individual risk index with the lowest cost feasible safety measure. This will ensure the greatest reduction per safety measure addition.

For purposes of this analysis FRA is making the simplifying assumption that the calculation of the QZRI following the addition of gates to crossings already equipped with flashing lights will generally yield the same result whether the effectiveness of .66 is applied to the flashing lights crossing risk index directly or whether the accident prediction formula is recalculated using the formula for crossings with gates in lieu of the formula for crossings with flashing lights. FRA realizes that the two calculations may actually yield significantly different estimates depending on the circumstances. However, to the extent that the direction of the change can vary from crossing to crossing, the aggregate difference is expected to be minimal.

Communities seeking to retain seasonal whistle bans may elect to implement temporary closures. To the extent that communities do implement closures as a result of this rulemaking, the costs of doing so will be lower or comparable to the costs of other measures that are more commonly implemented. Therefore, any costs incurred by communities electing this alternative are already included and overstated in this economic analysis as costs of implementing other safety measures.

Prior to implementing a quiet zone, communities must notify affected railroads, traffic control and law enforcement authorities, state agencies and FRA.

Quiet Zone Development and Application Process

The level of actual quiet zone development and application costs communities will incur will depend on the types of quiet zones that are established or retained, the number of crossings in each, and their CCRIs. This section presents costs associated with the types of quiet zones that FRA believes will be established based on the information that was available at the time this analysis was developed.

Quiet zones created by virtue of having a CCRI that is below the NSRT, or by implementing sufficient SSMs to reduce their CCRIs to a permissible level may be designated without FRA approval. Communities must submit to FRA for approval applications for the creation of other quiet zones. That is, communities using the corridor approach (e.g. implementing ASMs) must submit quiet zone applications to FRA.

For communities having to implement safety measures to reduce their risk levels to permissible levels, it will generally be more cost effective to use the ASM corridor approach than to use the SSM approach (every crossing must be treated). Therefore, most communities will have to submit quiet zone applications to FRA. Some applications will be for QZs comprised of 2 crossings; others for QZs comprised of 50 or more crossings (e.g. large metropolitan areas). FRA does not know with certainty how many communities will submit quiet zone applications. The number of WBJs that have CCRIs above the NSRT and are comprised of more than one crossing is probably a good proxy for the number of quiet zone applications that will be submitted to FRA. Some of the WBJs identified may use SSMs, reducing the number of WBJs that need to apply for approval. FRA expects to spend an average of approximately 15 hours reviewing each quiet zone application. Federal government labor costs will likely be incurred at an average burdened hourly rate of $60 (GS 14 salary plus burden for overhead and fringe benefits).

Employees performing the type of analysis necessary to comply with the requirements of the rule at the local level will probably be senior engineers with some assistance from attorneys and administrative assistants. Commenters from the Chicago area indicate that burdened hourly labor rates for municipal employees in that area range between $60 and $75. Labor rates in the Chicago area are among the highest in the nation and are not representative of labor rates across the nation. This analysis assumes that local government employees' burdened hourly labor rates average $68 in the Chicago area and $60 nationwide, excluding the Chicago area.

FRA estimates that it will take communities an average of 80 labor hours to develop a quiet zone plan. Actual development costs per quiet zone will depend on the number of crossings included in the quiet zone and their risk level, as well as other factors and may significantly differ from quiet zone to quiet zone. Before they can begin the implementation processes, communities will have to analyze the characteristics of each affected grade crossing, consult with the railroad(s) operating over the crossing, get quotes from equipment vendors, evaluate alternative safety measures, and secure funding. Some communities may have to seek approval from city councils and state offices. Finally, the DOT Grade Crossing Inventory form must be updated for every crossing in a quiet zone.

Average quiet zone development and approval cost per quiet zone in the Chicago area is thus $6,340. Similarly, average initial development and approval costs per quiet zone nationwide (excluding Chicago) total $5,700.

Total twenty-year quiet zone development and FRA approval costs are estimated to be $493,923(PV) for the Chicago area and $772,284(PV) for the rest of the nation. Annual cost estimates are presented in Exhibit 6.

Initial Notification, Certification, and Initial Inventory Update

Communities must provide written notice of a quiet zone designation to all railroads operating over the public highway-rail grade crossings within the quiet zone, the highway or traffic control authority and law enforcement authority having control over vehicular traffic at the crossings in the quiet zone, the state agency responsible for highway and road safety, and the FRA Associate Administrator for Safety. Communities must also certify that they have reviewed relevant studies and understand risks and benefits of the quiet zones they establish. Most communities establishing quiet zones are already very familiar with the risks and benefits of doing so. Nevertheless, they may not be aware of all relevant studies and the implications of their results to their particular circumstances. FRA believes that adequate review of relevant studies and examination of the implications for their particular circumstances and written notification to appropriate parties will take an average of about 40 labor hours per quiet zone. Communities with fewer grade crossings in their quiet zones may need less time to notify and certify; those with more crossings may need much more time.

FRA further expects that it will take an FRA staff person about 30 minutes to review and process each notification and certification that is received.

Average compliance cost per community in the Chicago area is thus $2,750. Average initial notification and certification compliance costs per community nationwide (excluding Chicago) is thus $2,430.

In addition, communities that are considering establishing Pre-Rule Quiet Zones must update the DOT Grade Crossing Inventory for each crossing that is being considered for inclusion within 18 months of issuance of the rule and again when establishing the quiet zone. Initial updating of the DOT Grade Crossing Inventory should not take more than one labor hour. Since state departments of transportation maintain a ranking of crossings by degree of hazard in order to plan allocation of funds for crossing safety purposes, States should already have the data that would need to be included in the DOT Grade Crossing Inventory.

Total costs associated with the initial inventory update, notification, and certification requirements are estimated to be $292,106 (PV, 7%) for the Chicago area and $1,775,092 (PV, 7%) for the rest of the nation. Annual cost estimates are presented in Exhibit 6.

Illinois: According to comments from the Chicago Area Transportation Study (CATS), the "Illinois Commerce Commission has excused railroads from routinely sounding their horns at grade crossings that are equipped with automatic warning devices and experienced less than three collisions in the past five years." Therefore, in absence of this rulemaking, Illinois communities wanting to establish quiet zones over crossings not equipped with automatic warning devices would still have to incur costs associated with installing such devices.

CATS comments go on to state that, "according to the FRA inventory, 4,828 grade crossings met these criteria. Throughout the state, 1.9 million people reside within 1/4 mile of a Commerce Commission excused grade crossing; 3.8 million people reside within 2 miles, and 6.6 million live within one mile of a Commerce Commission excused grade crossing. A potential problem exists in that FRA does not currently include the Commerce Commission set of 4,828 grade crossings as currently operating under a ban. This is important in that these crossings are similar to crossings with whistle bans in place, since horns are not currently required to be sounded. Whether or not these crossings are included is critical when evaluating the cost - benefit of the proposed rule. The addition of 3,000 plus grade crossings to the cost side of the cost-benefit analysis is likely to indicate that the costs would exceed the benefits."

Locomotive horns are currently sounded at most of the 4,828 grade crossings that qualify to be excused. FRA has received three requests from Chicago area communities for assistance in establishing quiet zones. This analysis includes costs associated with establishing New Quiet Zones in these communities.

Cost Estimating Methodology: FRA calculated the NSRT and CCRIs for the WBJs identified using the DOT Grade Crossing Inventory data for 1997 through 2001. The following sections present probable cost scenarios that would have resulted if this final rule had been effective in 2001 by relative standing compared to the NSRT and occurrence of relevant collisions. FRA believes that these cost scenarios are representative of actual scenarios that will occur when the rule is implemented. Exhibit 4 presents estimated annual expenditures on safety measure implementations by type of implementation.

6.5.1 Pre-Rule Quiet Zones With CCRIs Below the National Significant Risk Threshold

Chicago Area

There are approximately 25 Whistle Ban Jurisdictions (WBJ) with a total of 57 no-horn grade crossings in the Chicago area that have CCRIs below the NSRT. The crossings are distributed as follows:

Type of Warning Device	Number of Crossings
Automatic Gates & Flashing Lights	22
Flashing Lights	10
Passive Warning Devices	25
Total Crossings	57

Two relevant collisions (i.e. potentially preventable by sounding of the locomotive horn) occurred at these crossings in the 5-year period between 1997 and 2001. No casualties resulted from these collisions. The effect of one collision in the 5 previous years on predicted collisions, as calculated using the FRA Accident Prediction Formulas, is approximately a .045. Given (1) the very low probabilities for collisions at the crossings in the communities that comprise this group and (2) the small magnitude of the effect that the occurrence of a collision would have on predicted collisions, it is unlikely that these communities will see a rise in their CCRIs relative to the NSRT unless there is an increase in highway traffic volumes or other factors that more heavily influence collision probability. This analysis assumes that communities in the Chicago area that currently have CCRIs below the NSRT will retain such relative standing for the next 20 years.

Quiet Zone Establishment Costs: Since the communities in this category may designate quiet zones without seeking FRA approval or adding safety measures, this analysis does not include quiet zone development and approval costs for these 25 WBJs.

Initial updating of the DOT Grade Crossing Inventory for the 57 grade crossings is expected to total $3,622. Notification of affected parties and certification are estimated to total $55,915 for the communities in this group. Total twenty-year costs (PV) for communities in this group are estimated to be $59,537.

Twenty-Six of the 57 crossings in this category would have 20 or fewer severely impacted persons if the locomotive horn were to sound. Since the communities in this category can designate quiet zones without upgrading any crossings, this analysis assumes that communities will take advantage of this and do so. Therefore, no residents should be affected by locomotive horn noise in these communities once this rule is implemented.

Nationwide, Excluding Chicago

There are approximately 277 WBJs with a total of 969 no-horn grade crossings nationwide, excluding the Chicago area that have CCRIs below the NSRT. The crossings are distributed as follows:

Type of Warning Device	Number of Crossings
Automatic Gates & Flashing Lights	290
Flashing Lights	224
WW, Bells, Highway Signals	8
Passive Warning Devices	447
Total Crossings	969

In the 5-year period between 1997and 2001, 45 relevant collisions resulting in 5 injuries and no fatalities occurred in the WBJs in this category. Since the CCRIs of these WBJs remained below the NSRT, despite the occurrence of collisions; it is likely that, despite the occurrence of collisions in the future, the CCRIs for these WBJs will remain below the NSRT. Changes in other factors that affect risk level may increase the CCRIs of some WBJs in this category to levels above the NSRT. However, changes in those same factors, but in the opposite direction, may reduce risk levels of WBJs with CCRIs above NSRT to levels below the NSRT moving these WBJs into this category. Such shifts could occur before communities upgrade crossings or implement safety measures. Furthermore, as exposure levels at gated crossings in general rise, so will the NSRT. This analysis assumes that, to the extent shifts in risk levels relative to the NSRT occur, they will cause moves in both directions and their effects will cancel out overall.

Quiet Zone Establishment Costs: Since these communities may designate quiet zones without seeking FRA approval or adding safety measures, this analysis does not include quiet zone development and approval costs for these 277 WBJs.

Initial updating of the DOT Grade Crossing Inventory for the 969 grade crossings is expected to total $54,336. Notification of affected parties and certification are estimated to total $1,068,419 for the communities in this group. Total twenty-year costs (PV) for communities in this group are estimated to be $1,122,755.

Note that 202 of the 969 crossings in this category would have no impacted persons by the train horn and 291 of the crossings would have 20 or fewer severely impacted persons if the locomotive horn were to sound. Since these crossings will more than likely be included in quiet zones that will be designated without any improvements required, no residents should be impacted by locomotive horn noise once this rule is implemented.

6.5.2 Pre-Rule Quiet Zones With No Relevant Collisions in the Past 5 Years and CCRIs Above the NSRT and Below Twice the NSRT

Chicago

There are 23 WBJs comprised of 61 grade crossings in this category. None of the crossings would have to be upgraded initially. However, it would take the occurrence of only one collision potentially preventable by sounding of the locomotive horn for a community in this group to have to make improvements to one or more crossings to retain the quiet zone (assuming the quiet zone risk index remains between the product of one and two times the NSRT).

As discussed earlier, the DOT Accident Prediction Formulas estimate the probability that a collision will occur at an individual grade crossing in a given year. For each WBJ, the sum of the individual crossings' collision probabilities represents the probability that a collision will occur at some crossing in the WBJ during the year. For purposes of this analysis, FRA is using this probability to estimate the frequency of collisions at WBJs in this category. These frequencies are in turn used to estimate how many WBJs in this category would have to make improvements to one or more crossings to retain their quiet zones in each year of the rule. The tables below summarize this information for the first twenty years of the rule and present costs.

Relevant Collisions that Would Trigger Safety Measure Implementations

Year of Rule	# Crossings in WBJs		Potential Safety Measure Implementations Warranted to Reduce Risk to Permissible Levels				
	ASM	SSM	Add Lights	Add Gates To Lights	Medians	Medians / 4-Q Gates	Photo-En forcement
Year 3							
Year 4	28				5		
Year 5	6					1	
Year 6							
Year 7							
Year 8	5				1		
Year 9							
Year 10							
Year 11							
Year 12							
Year 13							
Year 14							
Year 15	4					2	
Year 16							
Year 17							
Total	43	0	0	0	6	3	0

Cost to Upgrade Existing Whistle-Ban Crossings In the Chicago Area That Are Part of Quiet Zones With No Relevant Collisions in the Past 5 Years And CCRIs Between One and Two Times the NSRT (20 Year PV)

Type of Improvement	Crossings	Installation	Maintenance	Total Cost
Medians	6	$49,997	$16,396	$66,393
Medians OR Four-Quadrant Gates (corridor approach)	3	$79,872	$10,341	$90,211
Total	9	$129,869	$26,737	$156,604

This analysis assumes that, in response to this rule, communities where relevant collisions are expected to occur will take steps to reduce their QZRIs to permissible levels (an amount sufficient to compensate for the effectiveness of the locomotive horn or to meet the NSRT) in the least costly manner. The best effectiveness rate estimate that Westat could provide for the locomotive horn at gated crossings in the Chicago area is 17 percent. A more detailed discussion of the Westat studies appears in the Benefits section of this document.

To reduce QZRI to a permissible level in the least costly manner, when possible, communities will generally improve the crossings with the highest individual risk index with the lowest cost feasible safety measure, as discussed earlier.

To reduce the WBJ CCRIs to permissible levels in 7 WBJs, 6 crossings would likely be treated with 100-foot medians with frangible delineators and 3 crossings would be treated with either median arrangements or four-quadrant gates[5]. Due to the cost differential between medians ($13,000 to $15,000) and four-quadrant gates ($100,000), most communities will try to accommodate medians; however some may find it not feasible.

If a collision that is potentially preventable by sounding a locomotive horn occurs at a no-horn crossing in a community in this category, the quiet zone must be terminated within six months, unless the public authority files with FRA a notice of intent to mitigate within that period. The period before termination can be extended to three years, if the community is pursuing mitigation by preparing in good faith to implement a quiet zone. This analysis assumes that costs incurred to retain quiet zones will be evenly spread among the three years following the occurrence of the relevant collision.

Quiet Zone Establishment Costs:
Even though communities with WBJs in this category would not have to implement additional

[5] Given the way in which grade crossing data appears in the DOT Grade Crossing Inventory, FRA cannot determine whether crossings that have intersections within 75 feet will have sufficient space to accommodate 60-foot medians.

safety measures initially, or ever in some cases, they will probably analyze their quiet zone to determine what could be done if they should have to take action following the occurrence of a potentially preventable collision. Quiet Zone development and approval costs for the 23 WBJs in this category are estimated to total $123,481.

Initial updating of the DOT Grade Crossing Inventory for the 61 grade crossings is estimated to cost $3,877 (PV). Notification of affected parties and certification are estimated to total $51,890 for the WBJs in this group. Total administrative costs for this category are estimated to be $179,248 (PV).

Nationwide, Excluding Chicago

FRA expects that 80 WBJs with a total of 213 whistle-ban crossings in WBJs that have had no relevant collisions in the past five years will establish pre-rule quiet zones. None of the crossings in the WBJs in this category would have to be upgraded initially. Again, it would take the occurrence of only one collision potentially preventable by sounding a locomotive horn for a community to have to make improvements to one or more whistle-ban crossings in order to retain their quiet zone.

As discussed above, for purposes of this analysis, FRA is using the collision probabilities generated by the Accident Prediction Formulas to estimate the frequency of collisions at WBJs in this category. These frequencies are in turn used to estimate how many WBJs will have to make improvements to one or more whistle ban grade crossings to retain their quiet zone in each year of the rule, through year 20. Any triggering events after year 17 would not require implementation of a safety measure until after the 20th year of the rule. The table below presents the predicted triggering collision years and the improvements that could be made to reduce risk to permissible levels.

Relevant Collisions that Would Trigger Safety Measure Implementations

Year of Rule	# Crossings in WBJs		Potential Safety Measure Implementations Warranted to Reduce Risk to Permissible Levels				
	ASM	SSM	Add Lights	Add Gates To Lights	Medians	Medians / 4-Q Gates	Photo-En forcement
Year 3	25			6	2		
Year 4	19				2		
Year 5	21		2		3		
Year 6	10		1		5	1	
Year 7	18		1	2	1	1	
Year 8	9					1	2 sharing
Year 9	6				1	1	
Year 10	4					1	
Year 11	9			1	2		
Year 12	6	1			1	3	
Year 13	6				2		
Year 14	14		2	1		1	2 sharing
Year 15	2		1				
Year 16	3					1	
Year 17	6		2			1	
Total	158	1	9	10	19	11	4

This analysis assumes that, of the WBJs where relevant collisions occur, those where the sounding of the horn at all whistle-ban crossings would severely impact no more than 20 persons or 8 households per corridor will not retain the whistle bans unless the number of affected crossings is large. No such WBJs were identified in this group.

Since communities have three years following the occurrence of a relevant collision to make any improvements, this analysis assumes that costs incurred will be evenly spread among the three years following the occurrence of the relevant collision. Following are estimated implementation costs associated with implementation of the most cost effective safety measures.

Cost to Upgrade Existing Whistle-Ban Crossings Nationwide, Excluding Chicago That Are Part of Quiet Zones With No Relevant Collisions in the Past 5 Years and CCRIs Between One and Two Times the NSRT (PV – 20 Years)

Type of Improvement	Crossings	Installation	Maintenance	Total Cost
Add Lights to Passive Markings	9	$ 368,902	$ 45,678	$ 414,579
Add Gates to Flashing Lights	10	$ 245,153	$ 25,319	$ 270,472
Medians	19	$ 136,808	$ 40,098	$ 176,906
Medians OR Four-Quadrant Gates (SSMs)	1	$ 24,663	$ 2,786	$ 27,449
Medians OR Four-Quadrant Gates (corridor approach)	10	$ 269,660	$ 35,623	$ 305,283
Photo-Enforcement (2 sharing)	4	$ 80,596	$143,908	$ 224,504
Total	53	$1,125,782	$293,412	$1,419,193

Quiet Zone Development Costs: Quiet Zone development and approval costs for the 80 WBJs in this category are estimated to total $386,142.

Initial updating of the DOT Grade Crossing Inventory for the 213 grade crossings is expected to total $11,944 (PV). Notification of affected parties and certification are estimated to total $305,480 for WBJs in this group. Twenty-year administrative costs for establishing and maintaining these quiet zones are expected to total $703,566 (PV).

6.5.3 Pre-Rule Quiet Zones With No Relevant Collisions in the Past 5 Years and CCRIs Above The Product of Two Times the NSRT

<u>Chicago</u>

Thirty-five WBJs comprised of 82 existing no-horn crossings fall into this category. None of the crossings in this group have maximum timetable speeds under 15 mph. This group is generally comprised of commuter rail operations in the Chicago area.

For the whistle bans in this group to be retained, a total of 35 crossings would have to be improved using corridor risk reduction methods. Most communities would have to improve only one crossing to reduce the CCRI to a permissible level under the rule. Following are estimated improvement costs to retain quiet zones in the Chicago area with CCRIs that are above twice the NSRT.

Cost to Upgrade Existing Whistle-Ban Crossings in the Chicago Area That Are Part of Pre-Rule Quiet Zones With No Relevant Collisions in the Past 5 Years And CCRIs Above Twice the NSRT (20-Year PV)

Type of Improvement	Crossings	Installation	Maintenance	Total Cost
Gates with Medians (SSMs)	3	$ 28,062	$9,881	$ 37,943
Gates w/ Medians (corridor approach)	9	$ 84,185	$29,643	$113,828
Medians OR Four-Quadrant Gates (SSMs)	6	$ 274,141	$59,286	$333,427
Medians OR Four-Quadrant Gates (corridor approach)	15	$ 685,354	$148,215	$833,568
Flashing Lights to Gates	2	$ 57,562	$6,587	$64,149
Total	35	$1,129,304	$253,612	$1,382,915

This analysis assumes that only one crossing with potentially no persons severely affected by the sounding of train horns would be terminated as a result of this rule.

Quiet Zone Establishment Costs: Quiet Zone development and approval costs for the 35 WBJs in this category are estimated to total $187,906.

Initial updating of the DOT Grade Crossing Inventory for the 82 grade crossings is estimated to cost $5,211. Notification of affected parties and certification are estimated to total $78,396 for WBJs in this group. Administrative costs are expected to total $211,513(PV).

If their State DOT wholly or partially funds any of the improvements, communities have up to 8 years to make the necessary improvements to reduce their CCRIs to permissible levels. It is very likely that the Illinois DOT will be funding grade crossing improvements in the Chicago area to some degree. Therefore, this analysis assumes that safety measure implementations will be distributed evenly among years 2 through 8 of the final rule.

Ten communities with a total of ten crossings in this category are expected to use SSMs. The remaining communities are expected to use corridor risk reduction methods or install gates.

Nationwide Excluding Chicago

This category includes 14 WBJs comprised of 46 existing whistle-ban crossings.

Communities would probably elect not to include in quiet zones 5 crossings that currently have whistle bans because there would be no persons severely affected by the sounding of train horns. As a result, one WBJ would not become a pre-rule quiet zone.

For the remaining 41 crossings in this category to retain their whistle ban status in the least costly manner, gates would be installed at 3 crossings equipped with flashing lights, medians installed at 7 gated crossings, medians or 4-quadrant gates at 7 crossings, and photo-enforcement (2 crossings sharing equipment) at 2 gated crossings. Costs are detailed in the table below.

Cost to Upgrade Existing Whistle-Ban Crossings Nationwide, Excluding Chicago, That Are Part of Quiet Zones With No Relevant Collisions in the Past 5 Years and Have CCRIs Above Twice the NSRT

Type of Improvement	Crossings	Installation	Maintenance	Total Cost
Gates with Medians (corridor approach)	7	$ 65,477	$ 23,056	$ 88,533
Medians OR Four-Quadrant Gates (SSMs)	3	$137,071	$ 29,643	$ 166,714
Medians OR Four-Quadrant Gates (corridor approach)	4	$182,761	$ 39,524	$ 222,285
Photo-Enforcement (2 sharing)	2	$ 68,355	$196,515	$ 264,870
Lights to Gates (SSMs)	3	$ 67,156	$ 7,685	$ 74,841
Total	19	$520,820	$296,423	$817,243

This analysis assumes that implementation of safety measures will be evenly distributed among years 2 through 8 of the rule as many state DOTs will at least partially fund some of the improvements made.

Sixteen communities with a total of sixteen crossings in this category are expected to use SSMs to establish quiet zones. The remaining communities are expected to use corridor risk reduction methods or install gates at crossings with flashing lights.

Quiet Zone Establishment Costs: Quiet Zone development and approval costs for the 14 WBJs in this category are estimated to total $67,575.

Initial updating of the DOT Grade Crossing Inventory for the 46 grade crossings is expected to cost $2,579. Notification of affected parties and certification are estimated to total $53,862 for WBJs in this group. Total administrative costs $124,016 (PV).

6.5.4 Pre-Rule Quiet Zones With One or More Relevant Collisions in the Past 5 Years and CCRIs Above the NSRT

Chicago Area

Thirty-four WBJs with a total of 183 existing whistle-ban crossings are in this category. The crossings are distributed as follows:

Type of Warning Device	Number of Crossings
Automatic Gates & Flashing Lights	173
Flashing Lights	9
Passive Warning Devices	1
Total Crossings	183

In the 5-year period between 1997 and 2001, 71 relevant collisions resulting in 16 fatalities and 36 injuries occurred in the WBJs in this category. The following table presents estimated compliance costs based on the assumption that communities will implement the most cost-effective safety measures to reduce their CCRIs to permissible levels.

Cost to Upgrade Existing Whistle-Ban Crossings in the Chicago Area

Type of Improvement	Crossings	Installation	Maintenance	Total Cost
Photo-enforcement - 3 sharing	3	$84,546	$211,548	$ 296,093
Install Medians (SSMs)	2	$18,708	$ 6,587	$ 25,295
Install Medians (corridor approach)	14	$130,995	$ 46,111	$ 177,066
Install Medians OR Four-Quadrant Gates (SSMs)	4	$182,761	$ 39,524	$ 222,285
Install Medians OR Four-Quadrant Gates (corridor Approach)	15	$685,354	$148,215	$ 833,568
Add Gates to Flashing Lights	3	$86,344	$ 9,881	$ 96,226
Total	41	$1,188,708	$461,866	$1,650,533

Eight no-horn crossings in this category would have 20 or fewer persons severely affected by the sounding of locomotive horns. All of these crossings could either be included in pre-rule quiet zones at no additional cost or would likely be upgraded because of the combination of high levels of night-time train traffic and having more than 10 persons severely impacted. Train horns are not likely to be sounded at any of these crossings once the rule is implemented.

Quiet Zone Development Costs: Quiet Zone development and approval costs for the 34 WBJs in this category are estimated to total $182,537.

Initial updating of the DOT Grade Crossing Inventory for the 183 grade crossings $11,630 (PV). Notification of affected parties and certification are estimated to total $81,566 for the WBJs in this group. Total administrative costs $275,733 (PV).

As mentioned earlier, the Illinois DOT will likely fund grade crossing improvements in the Chicago area to some degree. Therefore, this analysis assumes that safety measure implementations will be distributed evenly among years two through year eight of the final rule.

Six single-crossing WBJs with a total of six crossings in this category are expected to use SSMs to reduce their CCRIs to permissible levels and establish quiet zones. The remaining communities are expected to use corridor risk reduction methods or have automatic gates installed.

The Chicago Area Transportation Study estimates that 25 percent of whistle ban grade crossings in Illinois will implement photo-enforcement to establish quiet zones and an additional 20 percent will implement programmatic law enforcement and public education and awareness programs. Most communities that use photo-enforcement find that fines arising from violations issued to motorists cover associated annual operating costs. To the extent that photo-enforcement and programmed enforcement are more prevalent in the Chicago area than this analysis assumes, this analysis overstates costs associated with implementing safety measures.

Nationwide, Excluding Chicago

Seventy-five WBJs with a total of 376 existing whistle-ban crossings are in this category. The crossings are distributed as follows:

Type of Warning Device	Number of Crossings
Automatic Gates & Flashing Lights	180
Flashing Lights	105
Passive Warning Devices	91
Total Crossings	376

In the 5-year period between 1997 and 2001, 183 collisions resulting in 9 fatalities and 69 injuries occurred in the WBJs in this category. The following table presents safety measure implementation costs assuming that communities elect to implement the most cost-effective measures.

Cost to Upgrade Crossings Nationwide, Excluding the Chicago Area

Type of Improvement	Crossings	Installation	Maintenance	Total Cost
Photo-Enforcement - 2 sharing	6	$205,066	$589,545	$ 794,611
Photo-enforcement - 3 sharing	3	$ 84,546	$211,548	$ 296,093
Photo-enforcement - 4 sharing	4	$100,734	$231,130	$ 331,865
Install Medians (corridor approach)	29	$271,263	$ 95,516	$ 366,779
Medians OR Four-Quadrant Gates (SSMs)	22	1,005,185	$217,382	$1,222,567
Medians OR Four-Quadrant Gates (corridor approach)	3	$137,071	$ 29,643	$ 166,714
Add Gates to Flashing Lights	32	$690,750	$105,397	$ 796,147
Add Flashing Lights	9	$608,723	$118,572	$ 727,295
Add Flashing Lights and Gates	5	$1,208,813	$194,121	$1,402,934
Total	113	$4,312,151	$1,792,854	$6,105,005

One-hundred-two crossings in this category would have 20 or fewer persons severely affected by the sounding of horns. Of these, 72 should be able to retain their whistle bans as a result of the improvements the communities are expected to make to retain other whistle bans or because the cumulative noise impact of the corridor(s) they belong in would exceed 20 persons. This analysis assumes that the remaining 30 whistle bans will be terminated and six WBJs will not become quiet zones once this rule is implemented.

Quiet Zone Development Costs:
Quiet Zone development and approval costs for the 69 WBJs in this category are estimated to total $333,048.

Initial updating of the DOT Grade Crossing Inventory for the 347 grade crossings should total $19,458 (PV). Notification of affected parties and certification are estimated to total $271,020 for the WBJs in this group. Total administrative costs $623,526 (PV).

It is very likely that certain state DOTs will be funding grade crossing improvements to some degree. Therefore, this analysis assumes that safety measure implementations will be distributed evenly among years two through eight of the final rule.

Three crossings in this category are expected to have SSMs implemented to establish quiet zones. The remaining 68 crossings are expected to have corridor risk reduction methods implemented or have flashing lights or automatic gates installed.

6.5.5 Communities with Whistle Bans Established After October 9, 1996

Some communities passed whistle ban ordinances after October 9, 1996. For purposes of this analysis, the crossings in these communities are considered New Quiet Zones. FRA is aware of 66 crossings where whistle bans were established after October 9, 1996, most of these in Madison, Wisconsin. These crossings are distributed as follows:

Warning Device	CCRI > NSRT	CCRI < NSRT	Total
Gates & Lights	14	3	17
Flashing Lights	38	11	49
Other	0	0	0
Total	52	14	66

In absence of this rule, the communities with these whistle bans would not have to incur any additional costs to retain these bans. It is likely, however, that in anticipation of this rule, these communities have elected to wait and implement safety measures in accordance with this rule. This analysis assumes that communities where these crossings are located will comply with the requirements of the rule for establishing New Quiet Zones.

To meet the requirements of the rule, automatic gates will have to be installed at 49 of these crossings[6]. No SSMs or ASMs would be required at any of the gated crossings. Communities and railroads will only incur costs to install and maintain automatic gates at all crossings that do not already have them. Exhibit 8 presents annual costs associated with installation and maintenance of the gates necessary to retain these recently established whistle bans.

Total twenty-year costs associated with installing gates at crossings already equipped with flashing lights are estimated to total $1,930,277 (PV). These costs are broken down as follows:

	Upgrades	Installation Cost	Annual Maintenance	Total
Above NSRT	38	$1,329,653	$167,296	$1,496,949
Below NSRT	11	$ 384,900	$ 48,428	$ 433,327
Total	49	$1,714,553	$215,724	$1,930,277

Quiet Zone Development Costs: Quiet Zone development and approval costs for eight New

[6] Gates will be installed at 38 crossings in New Quiet Zones with CCRI greater than the NSRT and at 11 crossings in New Quiet Zones with CCRI less than the NSRT.

Quiet Zones are estimated to total $39,890 (PV 7%). This includes costs associated with development of the quiet zones and FRA approval of the quiet zones. Initial notification of affected parties and certification are expected to total $17,006 (PV). Initial updating of the DOT Grade Crossing Inventory for 66 crossings is expected to total $3,701. Estimated administrative costs total $60,596 (PV). Exhibit 6 presents annual cost estimates.

6.5.6 Communities Where Train Horns Are Currently Routinely Sounded

FRA has received numerous requests for guidance from communities desiring to establish New Quiet Zones. In general, communities have elected to wait for issuance of the final rule before proceeding with the actual creation of quiet zones. FRA is specifically aware of intentions to establish quiet zones in the following areas: Olmstead, Olmstead Falls, and Berea, Ohio; Fargo, North Dakota; Moorhead, Minnesota; Salt Lake City, Utah; Placentia, California; and Richardson, Texas. The following communities have expressed an interest to FRA in establishing quiet zones: Farmington, Minnesota; Peoria, Morrison, and Dekalb, Illinois; Stevens Point and Fox Point, Wisconsin; and Lansing, Michigan. FRA is aware of the safety measures that Fargo, North Dakota and Moorhead, Minnesota plan to implement. This analysis assumes that in response to this rulemaking, the other communities will implement a sufficient number of safety measures to reduce their average risk levels to permissible levels. Communities will install mountable barriers with frangible delineators where possible. Where such measures are not feasible, communities will implement photo-enforcement when sharing of equipment is a viable alternative or install four quadrant gates, whichever is less expensive for meeting the requirements for establishing quiet zones. Communities will have to install automatic gates systems with flashing lights and constant warning time at all crossings that do not currently have them.

Although these communities would not have to implement any safety measures in absence of this rule, they probably would have done so to ensure the safety of the crossings. Many communities have contacted FRA regarding ways in which to establish whistle bans without reducing safety levels at crossings. Some of the safety measures that communities are contemplating go beyond what would be required by this rule. Communities that are not informed about the experiences of other communities with safety measures may have questions regarding the effectiveness rates and may spend resources trying to estimate them. In absence of this rule, communities with low risk crossings that do not have lights and gates may not upgrade the crossings as much as this rule is requiring. Specifically, given that the horn is estimated to be 30.9 percent effective at preventing collisions at crossings with flashing lights, that the effectiveness rate of installing gates at these crossings is estimated to be 66 percent (significantly higher than 30.9 percent), and that the upgrade to gates with constant warning time costs about $40,000, it is likely many communities would opt to implement education and awareness programs or photo-enforcement in lieu of the upgrades to compensate for the effectiveness of the horn.

Some communities have expressed a desire to silence locomotive horns, but the railroads that operate through those communities have rejected the notion due to concerns about safety and liability. Many communities along the Southern California Regional Railroad (Metrolink) rail corridors have expressed an interest in silencing locomotive horns. Metrolink operates over 399 at-grade crossings and 253 of these have median barriers of various lengths already in place. Design constraints at 92 crossings prohibit median installations. Metrolink indicates that it would like to implement photo-enforcement at these crossings. Metrolink implemented these safety measures at these crossings where locomotive horns sound today voluntarily and not in response to this rulemaking. Therefore, this analysis does not include costs associated with their implementation. Although the medians in place at many crossings may not be 100-feet long in each direction of approach to the crossings, it is likely that their effectiveness has reduced risk levels at the crossings where they are present. To the extent that most crossings along a quiet zone are treated, the average risk index of the quiet zone (after being adjusted to reflect the increase in risk due to silencing the locomotive horn) will likely be below the national risk index threshold. If not, it is likely that the more limited effectiveness of medians will still be sufficient to compensate for the silencing of locomotive horns. This analysis assumes that quiet zone formation along Metrolink rail corridors will not require the implementation of safety measures beyond those implemented voluntarily. This analysis only includes administrative and signage costs for the establishment of 5 quiet zones each comprised of an average of 5 crossings along Metrolink corridors. As with other assumptions made in order to conduct the analysis of the national level, no determinations as to specific quiet zones are implied. In the past, for instance, FRA has worked with Metrolink and the City of Covina, California, regarding improvements that appeared to be warranted at several crossings in that jurisdiction to support establishments of a quiet zone.

In 1991, Consolidated Rail Corporation (Conrail), one of the largest railroads in North America at the time[7], began ignoring whistle bans that had been enacted by local communities along its rail lines. Other whistle bans ordinances along rail lines of the Norfolk Southern, CSX, Burlington Northern and Santa Fe, Kansas City Southern Railroad, Wisconsin Central, Union Pacific and the former Southern Pacific were also canceled prior to October 9, 1996. FRA believes that communities will establish New Quiet Zones along these corridors.

FRA estimates that communities will consider establishing New Quiet Zones incorporating a total of 811 crossings nationwide (excluding Florida) in the first three years of the rule. Information available to FRA indicates that no persons would be severely impacted at 105 of these crossings and that less than 20 persons are severely impacted by train horn noise at 245 of these crossings. This analysis assumes that communities will establish New Quiet Zones only to the extent that more than 20 persons are severely affected. In addition, communities may not include in New Quiet Zones crossings that would have to be upgraded and have low daytime train traffic volumes and no nighttime train traffic. FRA identified 75 such crossings[8].

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[7] Most of Conrail's railroad assets have since been sold to Norfolk Southern Corporation and CSX Transportation.

[8] Seventy-two of the 75 have an average of 0 trains per day, the other 3 have an average of less than 10 trains per day.

Therefore, this analysis assumes that New Quiet Zones established in the first three years of this rule will be comprised of a total of 376 crossings (exclusive of the 66 crossings that would comprise New Quiet Zones discussed above). These are distributed as follows:

Warning Device	CCRI > NSRT	CCRI < NSRT	Total
Gates & Lights	139	40	179
Flashing Lights	77	33	110
Other	42	45	87
Total	258	118	376

The safety measures that would be required to establish these New Quiet Zones, excluding Moorhead and Fargo, are as follows:

	CCRI > NSRT	CCRI < NSRT	Total
Install Gates & Lights	43	45	88
Install Gates	76	33	109
Install Medians	22	0	22
Medians Or 4-Q Gates	14	0	14
Photo-Enforcement	2	0	2
Total	157	78	235

Exhibit 8 presents annual costs associated with installation and maintenance of safety measures. Twenty-year costs (PV) for these safety measures are as follows:

	CCRI > NSRT	CCRI < NSRT	Total
Install Gates & Lights	$ 6,212,670	$ 6,501,631	$12,714,301
Install Gates	$ 2,993,899	$ 1,299,982	$ 4,293,881
Install Medians	$ 347,040	$ 0	$ 347,040
Medians Or 4-Q Gates	$ 962,578	$ 0	$ 962,578
Photo-Enforcement	$ 336,773	$ 0	$ 336,773
Total	$10,852,960	$ 7,801,613	$18,654,573

Moorhead, Minnesota and Fargo, North Dakota already have plans underway to implement various safety measures to meet or exceed the requirements of this rule. The cost of the project for both communities will be nearly $6.9 million, according to preliminary estimates[9]. The

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9 Moorhead's QZ application includes 12 crossings. They propose to close two crossings and install four-quadrant gates at the remaining ten crossings. The Fargo, ND QZ application (joint with Moorhead) consists of eight crossings one of which is private. They propose to close one crossing, install medians at three crossings, install four-quadrant gates at another three crossings, and install gates at the private industrial crossing. Video cameras will be installed to document the safety of crossings. Quadrant gates and medians will be built and videotaped for another

improvements planned for these quiet zones exceed the requirements of this rule. This rule may therefore result in a cost savings for these two communities.

Quiet Zone Development Costs: Quiet Zone development and approval costs for 99 New Quiet Zones are estimated to total $493,634 (PV 7%). This includes costs associated with development of the quiet zones and FRA approval of the quiet zones. Initial notification of affected parties and certification are expected to total $210,444 (PV). Initial updating of the DOT Grade Crossing Inventory for 401 crossings is expected to total $22,486. Total administrative costs are estimated at $726,564 (PV). Exhibit 6 presents annual cost estimates.

Potential Savings for New Quiet Zones: According to the Office of the Mayor of Salt Lake City, Utah, certain housing projects in Salt Lake City have had difficulty getting financing and tax credit approval because they are in close proximity to a rail line. In some cases, to receive assistance from the U.S. Department Housing and Urban Development, developers must mitigate for train horn noise by installing triple pane windows, central air conditioning, and/or additional insulation. This rule will allow the creation of New Quiet Zones that will reduce the need for noise mitigation and therefore permit the development of residential housing at a lower cost. For many urban areas, the cost of installing flashing lights and automatic gates as well as additional safety measures at crossings may be lower than implementing noise mitigation alternatives.

6.6 Affirmation and Periodic Update of the DOT Grade Crossing Inventory

Every five years, communities which implement quiet zones using SSMs and those that the FRA Administrator has determined do not present a significant risk if horns are not sounded must affirm in writing to FRA and other parties that were initially notified that they continue to conform with the requirements for quiet zones as well as submit to FRA a complete DOT-AAR National Highway-Rail Inventory Form for each crossing in the quiet zone. One of the fields that must be filled out on this form is the Average Annual Daily Traffic (AADT). Local authorities generally estimate this number based on periodic samples taken using counters. Communities update AADT periodically for purposes such as traffic planning or other planning activities. Therefore, FRA does not expect that communities will have to estimate AADT more frequently as a result of this rule.

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prescribed period before the final order is given to “turn the whistles off.” Video-taping for this demonstration project is not required under the final rule.

Communities that elect to establish quiet zones by implementing ASMs (e.g. programmatic education) must establish "before and after" total crossing violation rates for such quiet zones. Every three years, these communities must affirm in writing to FRA and other parties that were initially notified that they continue to conform with the requirements for quiet zones as well submit to FRA a complete DOT-AAR National Highway-Rail Inventory Form for each crossing in the quiet zone.

FRA assumes and NPRM commenters agree that it takes an average of one labor hour to complete an inventory form and process a letter of re-affirmation.

Costs associated with the requirements for updating the inventory and re-affirmation for Pre-Rule Quiet Zones are expected to total $119,028 (PV) for communities in the Chicago area and $224,589 (PV) for communities in the rest of the nation. For New Quiet Zones, the costs are expected to total $87,182 (PV). Exhibit 6 presents annual costs associated with these requirements.

6.7 Annual FRA Update of NSRT and QZRIs

Annually, FRA will (1) recalculate the NSRT as well as the QZRI for each quiet zone, (2) issue a notice in the Federal Register with these indexes, (3) update a website with these indexes, and (4) e-mail the affected communities. FRA anticipates that this effort will take approximately 40 labor hours annually. Federal government labor costs to accomplish this will likely be incurred at an average burdened hourly rate of $60 (GS 14 salary plus burden for overhead and fringe benefits).

Total twenty-year costs associated with this requirement are expected to total $25,426 (PV). Exhibit 6 presents annual costs associated with these requirements.

6.8 Power Out Indicators or Remote Health Monitoring Systems

This rule requires that each public highway-rail grade crossing in a New Quiet Zone be equipped with both flashing lights and automatic gates that control traffic over the crossing. Such warning devices must be equipped with power out indicators capable of indicating to trains approaching a grade crossing equipped with an active warning system whether commercial electric power is activating the warning system at that crossing. The requirement can be met with remote health monitoring of grade crossing warning systems if such systems are equipped to indicate power status.

According to industry sources, the average cost of a remote monitoring system that relies on cell telephone technology is $2,500 (material and labor) to install and $800 to maintain annually (excluding calling costs). This type of system can perform daily checks for up to 10 years. Other systems currently in use rely on automatic train control system radios or satellites.

Power out indicators consist of a simple light bulb, wired to the electrical power circuits that detect whether electrical power is available to properly actuate the warning device. When power is available, the light is continuously lit. The light is located outside the instrument case that houses the control circuitry for the automatic crossing warning devices, and is in plain view of approaching trains. If electrical power is not available to actuate the warning device, the light goes dark. Industry sources indicate that the average installation cost of a power out indicator is about $600 (material and labor). This analysis assumes that annual maintenance costs are approximately $200.

According to the DOT Grade Crossing Inventory, 62,813 crossings nationwide currently have active warning devices. FRA does not have complete information regarding which crossings have remote health monitoring systems or power-out light systems. However, FRA does have information regarding the prevalence of power out indicators on certain Class 1 railroads. This information indicates that approximately 42,206 Class 1 railroad crossings are equipped with active warning devices and 31,334 have either power out indicators or remote health monitoring systems. FRA believes that the proportion of whistle-ban crossings equipped with remote health monitoring or power out systems may be greater than the national average.

The state of Illinois is currently undertaking an effort to equip all crossings that have active warning devices in the state with remote health monitoring systems. Illinois is working with the Class 1 railroads first. As of March 2002, approximately 1,500 systems had been installed on Class 1 railroad crossings.

In general, new active warning device system installations now include either remote health monitoring systems or power out indicators.

This power out requirement only applies to crossings that form part of *New* Quiet Zones. Initially, FRA expects that New Quiet Zones will be mainly comprised of former Conrail, Burlington Northern and Santa Fe, Kansas City Southern Railroad, Wisconsin Central, Union Pacific, CSX, and Norfolk Southern whistle-ban crossings and the newly established whistle-ban crossings in Madison, Wisconsin. Norfolk Southern and CSX purchased most of Conrail assets. These railroads have already equipped approximately 50 percent of their crossings that have automatic warning devices with remote health monitoring systems. In absence of this rule, these railroads would probably continue to install such systems at the remaining crossings with automatic warning devices. However, in response to this rule, these two railroads may have to do so at an expedited rate along some of the former Conrail whistle-ban crossings. This analysis assumes that the incremental installation costs associated with this expedited rate are minimal and are therefore not included in this analysis.

6.9 Private Crossings in Quiet Zones

The final rule requires the evaluation of private crossings within a proposed quiet zone by a diagnostic team to determine whether institution of the quiet zone will significantly increase risk at the private crossing(s).

If a diagnostic team determines that a private crossing could experience a significant increase in risk as a result of quiet zone implementation then (1) the public authority may "adopt" the crossing and include it in its corridor-based risk-reduction program; (2) the crossing may be closed; or (3) safety improvements that address increased risk at that crossing, as evaluated by the diagnostic team would be implemented. FRA expects local and State public authorities to make these determinations in the first instance; FRA's role is to determine whether these authorities have considered the criteria set forth in the appendix and have stated an accurate and reasonable basis for their determinations.

FRA estimates that 17 private crossings could potentially fall within potential New Quiet Zones. In the majority of states, railroads are not currently required to sound locomotive horns at private crossings. Diagnostic team reviews could conclude that certain private crossings need to have safety measures implemented to be included in quiet zones. Private crossing owners would have little incentive to make these improvements. There are three possible outcomes for the communities in which diagnostic teams determine that private crossings must somehow be improved (1) the quiet zone is not formed, (2) the community funds the improvements to be able to establish the quiet zone with the private crossing included, or (3) quiet zones are structured around the private crossing without including it. In the first case, horns would not have to be sounded unless required by State law. In the next two cases, locomotive horns would not be sounded on approach to the private crossing.

FRA identified some private crossings along the Metra system in the greater Chicago area. No collisions have been reported for these crossings in the past twenty years. It is unlikely that diagnostic team reviews will recommend significant improvements to these crossings where train horns do not currently sound. FRA believes that the number of private crossings that are covered by whistle bans today are few in number and the formation of pre-rule quiet zones will not require significant improvement of these crossings.

This analysis assumes that communities proposing to establish quiet zones where there are private crossings will in many cases incur costs associated with diagnostic team reviews. Diagnostic teams are usually composed of representatives form the state, the city, the railroad and a traffic engineer. They may also include, as necessary, representatives from affected school bus services, emergency response agencies, and the FRA. Average labor costs for this effort should not total more than 32 labor hours or approximately $1,920.

Communities that include the private crossings in their quiet zones may also incur costs associated with installing crossbucks, stop signs, and advance warning signs on highway approaches to the crossings. FRA estimates that it will cost approximately $600 per crossing to install all three signs on two approaches. Additional costs for implementing safety measures will be incurred to the extent that diagnostic teams deem necessary. FRA does not collect sufficient information regarding private crossings to estimate how many private crossings would fall in proposed quiet zones, how many may need one or more signs installed, or how many may need safety measures installed.

To the extent that quiet zones are structured around private crossings or that quiet zones are not established as a result of costs associated with making improvements recommended by diagnostic teams, only diagnostic team review costs will be incurred. FRA does not expect private crossing owners to be unduly burdened with the requirement for the diagnostic team review. Communities are expected to fund recommended improvements to the extent that they value silencing the locomotive horns in the entire quiet zone.

6.10 Total Twenty-Year Costs

Total Twenty-Year Costs (PV[10], 7%)

	Nationwide	Chicago	Rest of Nation
Locomotive Horns Sounded			
Maximum Horn Sound Level	$ 2,902,478	Not Applicable	Not Applicable
Relocations Due to Locomotive Horn Noise	$ 1,724,590	$ 47,927	$1,676,663
Pre-Rule Quiet Zones			
Advance Warning Signs	$ 170,493	$ 33,504	$ 136,989
QZs w/ CCRI < NSRT			
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 1,182,292	$ 59,537	$1,122,755
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions			
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 882,814	$ 179,248	$ 703,566
SSMs/ASMs Installation & Maintenance	$ 1,575,797	$ 156,604	$1,419,193
QZs w/ CCRI > 2xNSRT; No Collisions			
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 335,529	$ 211,513	$ 124,016
Install & Maintain Safety Improvements	$ 2,200,158	$1,382,915	$ 817,243
QZs w/ CCRI > NSRT; With Collisions			
QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 899,259	$ 275,733	$ 623,526
Install & Maintain Safety Improvements	$ 7,755,538	$1,650,533	$ 6,105,005
Periodic Affirmation/Inventory Update	**$ 274,066**	**$ 58,426**	**$ 215,640**
TOTAL PRE-RULE QUIET ZONES	**$15,275,946**	**$4,008,013**	**$11,267,933**
	Total	Non-Existing Quiet Zones	Whistle Bans Est. Post 10/9/96
New Quiet Zones			
Advance Warning Signs	$ 42,605	$ 36,832	$ 5,773

[10] The Present Value (PV) of cost and benefit flows is calculated in this analysis. PV provides a way of converting future benefits and costs into equivalent dollars today so that benefit and cost streams that involve different time paths may be compared. The formula used to calculate these flows is: $1/(1+I)^t$ where "I" is the discount rate, and "t" is the year. Per guidance from the Office of Management and Budget, a discount rate of .07 is used in this analysis.

QZ Development, Approval, Certification, Notification, & Initial Inventory Updates	$ 787,160	$ 726,564	$ 60,596
QZ CCRI < NSRT			
Install & Maintain Safety Improvements	$ 8,234,940	$7,801,613	$ 433,327
QZ CCRI > NSRT			
Install & Maintain Safety Improvements	$12,349,909	$10,852,960	$1,496,949
Periodic Affirmation/Inventory Update	**$ 87,182**	**-------**	**-------**
TOTAL NEW QUIET ZONE COSTS	**$21,501,796**	**$19,417,969**	**$1,996,645**
	Federal Railroad Administration		
Annual Update of NSRT/QZRIs and Notification	$25,426		

Total Twenty-Year Costs associated with implementation of this rule are estimated to be $41,430,236 (PV, 20 Years, 7%).

Please note that costs associated with photo-enforcement will likely be recouped almost entirely through the collection of fines arising from violations.

In general there has been a downward trend in collisions at grade crossings nationwide due to the implementation of various private and public safety initiatives. Costs presented in this analysis may be overstated to the extent that such initiatives would lead to the eventual implementation of some of the same or equivalent safety measures that this rule requires for the establishment of quiet zones. In such cases, this rule may be merely accelerating implementation and the rate of expenditures.

7.0 Safety Benefits

The safety benefit of this final rule is the reduction in casualties that result from collisions between trains and highway users at public at-grade highway-rail crossings. Implementation of this rule will ensure that along rail corridors where train horns are not currently routinely sounded (1) locomotive horns are sounded to warn highway users of approaching trains; or (2) rail corridors where train horns do not sound will have a level of risk that is no higher than the average risk level at gated crossings nationwide where locomotive horns are sounded regularly; or (3) the effectiveness of horns is compensated for in rail corridors where train horns do not sound. Implementation of this rule will ensure that along rail corridors where quiet zones are established along corridors where train horns are currently routinely sounded crossings are equipped at least with flashing lights and gates and any other safety measures that may be needed to reach a safety level that is no higher than the average risk level at gated crossings nationwide where locomotive horns are sounded regularly. In addition, when New Quiet Zones are established, motorists will receive minimum levels of warning and safety provided flashing lights and gate systems. Benefits that are not quantified in this analysis include reductions in (1) highway vehicle and railroad property damages, (2) train delays resulting from such collisions and (3) abatements of community disruption where horns are sounded resulting from limiting the duration and level of sound emitted by horns. It is very difficult to quantify the value of "quality of life" and other indirect safety benefits which may result from silencing locomotive horns at locations where they currently sound. Improvements made to crossings in the earlier years of the rule will begin to accrue safety benefits in the earlier years of the rule as well. Those that are made in the later years of the rule will have associated safety benefits realized in the later years of the rule.

7.1 When to Use Locomotive Horns

A whistle board is a sign or a post that coupled with speed information indicates to the locomotive engineer the point at which the locomotive horn should be sounded while approaching a grade crossing. It is a long-standing industry practice to use whistle boards to notify locomotive engineers when to sound the horn as they approach crossings. Most states require that trains sound horns for a quarter mile on approach.

The benefits of sounding the horn for the appropriate amount of time are limited community disruption and sufficient warning to motorists. If the horn is sounded for a longer period than necessary to provide warning to motorists, it is unnecessarily disrupting the community near the crossing for that extra span of time. If the horn is sounded for a shorter period than necessary to provide sufficient warning to motorists, then motorist safety at the crossing is being compromised. Although a manually operated horn will generally be sounded as a train passes through a crossing, it is possible that an automatic horn that is activated too early may stop sounding before the train enters a crossing. In this case, the operator may sound the horn a second time to cover the span of the crossing thus in effect doubling the noise disruption to the community. The requirement for locomotive horns to be sounded at least 15 seconds, but no more than 20 seconds, before they enter crossings, but not more than one-quarter mile (1,320 feet) in advance of a public highway-rail grade crossing will ensure that motorists receive adequate warning of the approach of a train without disturbing the community more than necessary.

Another benefit of sounding locomotive horns at crossings uniformly nationwide is that motorists may become accustomed to the advance warning and learn to expect trains to appear at crossings 15 to 20 seconds after the initial sound of the locomotive horn. If the train is not at the crossing when it is expected, because it is a distance away from the crossing, the motorist may erroneously conclude that the horn is being sounded for another crossing. Conversely, if the locomotive horn is sounded later, then a motorist may not be afforded sufficient time to get through the crossing before the train arrives.

7.2 Maximum Locomotive horn Sound Levels

The benefits of mandating a maximum sound level for the locomotive horn is the mitigation of community noise exposure. Benefits are derived from reducing noise related stress on residents along rail corridors. As stated above, these subjective improvements in the character of day-to-day life in affected areas are difficult to monetize. For those residents that consider moving to avoid horn noise, the noise may be reduced enough to alter their decision point, and thus decease relocation costs. Though not monetized, benefits may be quantified. According to the Final Environmental Impact Statement prepared for this interim final rule, it is estimated that setting a maximum sound level of 110 dB(A) decreases the number of people affected by noise by about 12%. As the horn sounds at most grade crossings, the alleviation of some noise impacts benefits will be widespread. Appendix D contains a more detailed discussion of these benefits.

7.3 Studies of Train Whistle Ban Impacts on Grade Crossing Collision Rates

<u>Florida's Train Whistle Bans</u>

Effective July 1, 1984, Florida authorized local governments to ban the nighttime use of whistles by intrastate trains approaching crossings equipped with flashing lights, bells, gates, and highway signs that warned motorists that train whistles would not be sounded at night. Many local jurisdictions passed whistle ban ordinances.

In August 1990, FRA issued a study of the effect of the Florida train whistle ban. Three control groups were studied. In the first control group, FRA compared collision records for time periods before and during the bans and found that there were almost three times more collisions after the whistle bans were established, a 195 percent increase. In the second control group, FRA found that daytime collision rates remained virtually unchanged for the same highway-rail crossings where the whistle bans were in effect during the nighttime hours. In the third control group, nighttime collisions increased only 23 percent along the same rail line at crossings with no whistle ban. FRA also compared the 1984 through 1989 accident record of the Florida East

Coast Railway Company (FEC), an intrastate carrier that complied with local whistle bans at 511 gated crossings, with that of the parallel rail line of interstate carrier CSX, which was not subject to the whistle ban law at 244 similarly equipped crossings. FRA found that CSX's nighttime collision rate increased by 67 percent, compared to the 195 percent increase experienced by FEC. FRA's data also showed that before the ban, highway vehicles on average, struck the sides of trains at the 37th train car behind the locomotive. After the ban took effect, highway vehicles on average struck the twelfth train car behind the locomotive. This indicated that motor vehicles are more cautious at crossings if a locomotive horn is sounding nearby.

Nationwide Study of Train Whistle Bans

In 1995, FRA began a nationwide effort to identify grade crossings subject to whistle bans and study their collision information. The Association of American Railroads (AAR) surveyed Class 1 railroads and found 2,122 public grade crossings in 27 states excluding Florida subject to whistle bans for some period of time between January 1988 and June 30, 1994. FRA issued a report covering the nationwide study based on the AAR data in 1995. FRA found that 948 collisions occurred at whistle-ban crossings, an average of 84 percent more collisions than at similar crossings with no bans. Sixty-two people died in those collisions and 308 were injured. FRA also noted that average train speed is positively correlated with fatalities.

In 97 percent of the whistle-ban crossing collisions, a warning device was located on the highway vehicle's side of the crossing. This supports the theory that the warning given by the locomotive horn could deter the motorist from entering the crossing. Seventy-two percent of the fatalities occurred while the motorist was moving over the crossing.

FRA found 831 crossings where whistle sounding had at one time been in effect, but where the practice had changed during the period of study. A before and after comparison of collision rates showed an average of 38 percent fewer collisions when whistles were sounded suggesting that whistles had a 0.38 effectiveness rate in reducing collisions.

FRA also rated whistle ban grade crossings according to the FRA Accident Prediction Formulas (APFs)[1], which predict the statistical likelihood of having a collision at a given crossing. These crossings then were grouped by level of risk into ten groups. Non-whistle ban grade crossings were ranked into the same risk level groups. FRA then compared the number of collisions occurring in each of the groups of crossings for the five year period between 1989 and 1993, and found that for nine out of the ten risk groups, the whistle-ban crossings had significantly higher collision rates than the crossings with no whistle bans. On average the risk was 84 percent greater at crossings where horns were silenced. While crossing collisions are infrequent events at individual crossings, the nationwide study, and the experience in Florida, showed they were much more frequent when the horn is not sounded.

[1] The APFs consider the physical characteristics of the crossing, including the number of tracks and highway lanes, types of warning devices, urban or rural location, and whether the roadway is paved. They also consider operational aspects, such as, the number of highway vehicles, and the number, type, time of day, and maximum speed of trains using the crossing.

Updated Analysis of Train Whistle Bans

FRA shared the findings of the nationwide study and this rulemaking with communities where whistle bans were in effect. One result of this outreach was the identification by commenters of 664 additional crossings that were subject to bans, but were not included in the nationwide study. About 95 percent of these crossings were located in the Chicago area. In January 2000, FRA issued an update of the nationwide study of the safety at whistle-ban crossings, expanding it to include the newly identified crossings with whistle bans.

FRA also refined the analysis by subdividing the crossings into three different categories of warning devices (automatic gates with flashing lights; flashing lights or other active devices without gates; and passive devices, such as "Crossbucks" and other signs) and analyzing each category separately. In addition, FRA excluded from the analysis certain collisions where the sounding of the locomotive horn would not have been a deterrent to the collisions. These included cases where there was no driver in the motor vehicle, collisions where the motor vehicle struck the side of the train beyond the fourth locomotive unit (or rail car), and cases where pedestrians were struck. Pedestrians, compared to vehicle operators, have a greater opportunity to see and recognize an approaching train because they can look both ways from the edge of the crossing. They can also stop or reverse their direction more quickly than a motorist if they have second thoughts about crossing safely.

The updated analysis used data for the five-year time period from 1992 through 1996 (the 1995 Nationwide Study used data for 1989 through 1993). For the updated analysis, the collision rate for whistle-ban crossings in each device category was compared to similar crossings in the national inventory using the ten range risk level method used in the original study.

The updated analysis showed that an average of 62 percent more collisions occurred at whistle-ban crossings equipped with gates than at similar crossings across the nation without bans. In developing the NPRM, FRA used this value as the increased risk associated with whistle bans instead of the 84 percent cited in the Nationwide Study of Train Whistle Bans released in 1995.

This updated analysis also indicated that whistle-ban crossings without gates, but equipped with flashing light signals and/or other types of active warning devices, on average, experienced 130 percent more collisions than similar crossings without whistle bans. This finding made it clear that the locomotive horn was highly effective in deterring collisions at crossings equipped with active devices, but without gates. The only exception was in the Chicago area where collisions were 11 percent less frequent. FRA did not have an explanation for this anomaly. One possibility was that approximately one third of the crossings in the city of Chicago that were included in the study were actually closed during some or all of the study period. It was rumored that this was the case, but many continued to be included in DOT Grade Crossing Inventory because they were not reported as closed by local officials nor as abandoned by railroads. Unfortunately there was no way to identify or investigate these crossings in a timely manner for publication of the NPRM in January 2000. Nevertheless, FRA believed this could have contributed to the low collision count for Chicago area crossings without gates.

In order to reduce collision probability at whistle-ban crossings to the collision probability at non-ban crossings, the NPRM proposed that communities implement safety measures that at least meet a standard effectiveness rate of 0.38[2]. This would apply to all states except Florida, where a 1989 FRA study showed that in Florida the whistle had an effectiveness rate of 0.68. FRA assumed that a similar effectiveness rate would be gained by Florida in 1997 as in 1989, although effectiveness rates for train whistles seem to have fallen somewhat over time in the rest of the United States.

Issuance of NPRM and Data Update

Following publication of the NPRM in January 2000 and a series of twelve public hearings thereafter, FRA once again learned from commenters of the existence of more grade crossings with whistle bans. The majority of these crossings were in Wisconsin and Maine. In the case of Wisconsin, FRA became aware of over 400 whistle ban grade crossings that were not included in the *Updated Analysis of Train Whistle Bans*. Over 50 percent of these have only passive warning devices.

FRA remained concerned about the Chicago whistle-ban crossing dataset and began to make efforts to determine whether the information in the DOT Grade Crossing Inventory was correct. Specifically, FRA needed to determine whether any of the crossings reported as active were actually closed. FRA staff made extensive and repeated efforts to obtain updated crossing inventory data from the City of Chicago and the Illinois Department of Transportation (IDOT). IDOT has indicated on several occasions that it is in the process of updating the Illinois Grade Crossing Inventory and will subsequently update the DOT Grade Crossing Inventory as well.

The Chicago Department of Transportation (CDOT) provided FRA with updated information regarding the crossings in the City of Chicago for the period immediately following a grade crossing collision involving a school bus that resulted in several fatalities in Fox River Grove in October 1995. This information revealed that several crossings included in the updated analysis were abandoned or closed. An FRA field survey of 191 crossings in the City of Chicago verified this information. The nationwide whistle ban dataset was updated to reflect information obtained from the CDOT inventory of grade crossings. Because only States and railroads have the authority to update records in the DOT Grade Crossing Inventory, the inventory itself could not be updated to reflect the results of the CDOT site visits. Information regarding whistle-ban crossings in Chicago provided by several railroads that operate in the Chicago area was also included in the revised nationwide whistle ban dataset.

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2 The updated study of locomotive horn effectiveness indicated that the probability of a collision at a gated whistle-ban crossing was 62 % greater than the probability of a collision at a gated crossing where a train sounds the whistle.

FRA revised the whistle-ban crossing dataset for the period 1992 through 1996 to accurately reflect whistle-ban crossings in Wisconsin, Maine, Chicago, and the rest of the nation.

Revision of the Updated Analysis of Train Whistle Bans

In 2000, FRA contracted Westat, Inc., a statistical firm, to (1) revise the 2000 *Updated Analysis of Train Whistle Bans* to reflect more accurate data received post publication of the NPRM, (2) provide an expert opinion regarding FRA's methodology and improve it if necessary, and (3) perform regional studies of the effects of whistle bans in the Chicago area and Wisconsin. FRA was particularly concerned with the effects of whistle bans on crossings with active warning devices in Chicago and passively marked crossings in Wisconsin. Chicago area commenters indicated that gated whistle-ban crossings in Chicago were generally safe and the Wisconsin Railroad Commissioner requested that FRA consider the safety of numerous whistle ban grade crossings in Wisconsin that do not have active warning devices.

Certain crossings were excluded from this study because their level of risk could not be determined or may have changed significantly during the period of study (1992 - 1996). These included (1) grade crossings that were reported as not active in the DOT Grade Crossing Inventory during all or part of the period of study, (2) grade crossings with warning device changes (upgrades/downgrades) reported to the DOT Grade Crossing Inventory during the period of study, (3) grade crossings in Maine that have seasonal whistle bans that are in effect from October 1 to May 1, (4) crossings in Maine that have single-directional whistle bans (eastbound or westbound only), and (4) crossings in Wisconsin at which one railroad does not obey the whistle bans.

Westat made minor modifications to the FRA methodology to yield more statistically significant results. In February 2002, Westat completed the study *Analysis of the Safety Impact of Locomotive Horn Bans at Highway-Rail Grade Crossings.* The study concluded:

> *Nationwide:* Nationwide (excluding Florida), the adverse whistle ban effects are statistically significant at levels well below the conventional significance level of 5%, regardless of warning device class. For all three warning device types, a statistical test for model fit confirmed the validity of the model-based national inferences. All three classifications experienced substantially higher accident rates in whistle ban areas as follows:

Warning Device Class	Percent Difference
Passive	52.6
Flashing Lights	43.2
Gates	44.4

> *Chicago Area:* Since there were very few non-whistle-ban crossings in the Chicago area with passive warning devices or flashing lights, within-Chicago area comparisons for those classes are not reliable. Estimates of locomotive horn effectiveness were not statistically significant at the conventional 5% significance level, with one exception.

The collision rate for gated whistle-ban crossings in the Chicago area was estimated to be 34% higher than for gated crossings nationwide (excluding Florida and the Chicago area) where locomotive horns are sounded. This result was statistically significant at the 1% level.

Wisconsin: Due to the relatively small sample sizes, estimates for effectiveness were not statistically significant at the conventional 5% level, with one exception. The collision rate for passively marked whistle-ban crossings in Wisconsin was 84% higher than for passively marked crossings nationwide (excluding Florida and the Chicago area) where locomotive horns are sounded. However, this evidence was weakened by the fact that the model used to arrive at the estimates did not fit the data well.

<u>Study of Northeastern Illinois Whistle Bans</u>

In 2001, Bader Hafeez and Stephen Laffey submitted to the Transportation Research Board a study of whistle bans in northeastern Illinois entitled *The Effect of Train Whistle Bans and Collisions at Public At-Grade Highway Crossings: An Analysis of the DOT Grade Crossing Accident Inventory.* The statistical methodology used by the authors in this study, the period of study, and the end results of the study differ from that of the FRA whistle ban studies. The Hafeez-Laffey study concludes that whistle bans have no significant effect on collision rates for grade crossings in northeastern Illinois and that such collision rates are more likely a function of human behavior.

FRA contracted Westat to conduct an independent evaluation of the two alternative methodologies for analyzing the effects of whistle bans on grade crossing safety and determine which is more appropriate for such analysis. In 2001, Westat issued the report *Review of a report by B. A. Hafeez and S. C. Laffey entitled 'The Effect of Train Whistle Bans and Collisions at Public At-Grade Highway-Crossings: An Analysis of the DOT Grade Crossing Accident Inventory.'* The Westat report concluded that "Because of its methodological limitations, the study (Bader and Hafeez) did not provide convincing evidence that prohibiting the use of train whistles has no effect on grade crossing accident frequency, and in so far as the study analyzed no data on human behavior, its second conclusion is not based on empirical evidence".

Regarding the methodologies used, Westat concluded that "Since the FRA approach is based on validated statistical models for grade crossing accidents, and the other approach (Haffeez-Laffey) disregarded all factors that account for much of the variation between grade crossings, except for warning device class, the method developed by FRA is better suited to realistically assess the effects of whistle bans on grade crossing accident frequency than the other method examined in this report".

Analysis of the Safety Impact of Train Horn Bans at Highway-Rail Grade Crossings: An Update Using 1997 – 2001 Data

In 2003 after obtaining more current information regarding the status of train horn sounding at crossings in Illinois, FRA again contracted Westat to estimate the impacts of whistle bans nationwide (excluding Florida), in the Chicago area, and in Wisconsin using a more current period of data. The latest information indicates that there are significantly fewer no-horn crossings in the Chicago area than we had thought, and therefore fewer nationwide as well. Unfortunately, Westat was not able to derive statistically significant estimates for the effects of horns at non-gated crossings in the Chicago area using the updated FRA model. Westat refined the modeling techniques and developed new techniques to derive more statistically significant estimates for the effectiveness of locomotive horns nationwide and in the Chicago area. Westat found that, relative to gated crossings nationwide without a ban, the effectiveness rate for the horn at no-whistle gated crossings in the Chicago area was significantly lower.[3] Although Westat's revised model produced a horn effectiveness rate estimate for gated crossings in the Chicago area, it was not statistically significant. Nevertheless, given the need to apply a lower rate to existing no-horn gated crossings in the Chicago area, FRA is applying this distinct effectiveness rate to pre-rule quiet zones in the Chicago area. The table below presents the horn effectiveness rate estimates that Westat calculated and FRA is applying to Pre-Rule Quiet Zones for purposes of this rule along with the levels of statistical significance associated with each one.

Pre-Rule Quiet Zones
Percent Higher w/ Bans (statistical significance level)

Warning Device Class	Nationwide, Excluding Chicago	Chicago Area
Passive	74.9% (99 %)	not meaningful
Flashing Lights	30.9% (92%)	not meaningful
Gates	66.8% (99%)	17.3 (69%)

FRA believes that the difference in effectiveness for gated crossings in Chicago is limited to existing no-horn crossings and would not apply to New Quiet Zone crossings for several reasons. Existing Chicago no-whistle crossings are the result of discretionary selection, i.e., railroads have elected to run silent at some crossings but not others. FRA assumes that railroads have been *less willing* to do this at crossings with known high risk (e.g., near-hit reports, collisions, poor sight distances, difficult roadway geometry). Much of the train traffic involved consists of Metra commuter trains, which are equipped with oscillating lights in addition to ditch lights, a factor that could reduce the value of the train horn (other trains in the area and nationwide are not equipped with oscillating lights). Therefore, the 'Nationwide' effectiveness rates presented in the table above will apply to all New Quiet Zones (including those in the Chicago area).

[3] There were only 21 passively marked crossings and 21 crossings with flashing lights (but no gates) where locomotive horns do not sound in the Chicago area. Statistically significant estimates were not attainable dues to such small sample sizes and very large variability in the data.

Wisconsin: The Wisconsin Railroad Commissioner requested that FRA consider the safety of numerous whistle-ban crossings in Wisconsin that do not have active warning devices. The estimate for passively marked crossings that Westat derived was not statistically significant. FRA is allowing passively marked whistle ban grade crossings that exist as part of Pre-Rule Quiet Zones to remain passively marked as long as the Pre-Rule Quiet Zones they are a part of maintain permissible QZRI levels.

7.4 Advance Warning Signs at Quiet Zone Crossings

FRA cannot assign an effectiveness rate to the warning provided by the advance warning signs at crossings where locomotive horns are not sounded. Nevertheless, there is a clear safety benefit to motorists associated with this requirement. These signs will generally benefit motorists who are not aware that they are about to traverse a crossing where locomotive horns are not sounded. Such motorists, who generally do not drive through the area, will generally approach these crossings and expect to receive the warning of the locomotive horn along with the activation of any automatic warning device present at the crossing. The activation of just the automatic warning device will certainly alert such motorists, but, if a horn is not sounded as well, some may believe it is a false activation. At crossings not equipped with automatic warning devices, the benefit of the advance warning sign will be relied upon more heavily as motorists will not have the additional automatic device to alert them. Such motorists will have to rely on the visual cues they pick up and the sound of the approaching train.

Advance warning signs will be particularly effective at crossings in New Quiet Zones where they will help ensure a safe transition from the sounding of horns to the silencing of horns. Both motorists familiar with the crossings and those not familiar with the crossings will benefit.

All that would be needed to justify the cost of installing advance warning signs at crossings where locomotive horns will not be sounded is the prevention of one or more casualties valued at $211,345 (PV) or more. The prevention of one severe injury in the first year of the rule, valued at $562,500, or two severe injuries prevented in the 20th year of the rule, valued at $290,720 (Present Value of $1,125,000 discounted using an annual rate of 7 percent), would justify the costs incurred. It is reasonable to expect that one or more collisions resulting in a total of one or two severe injuries will be prevented in the next twenty years as drivers unfamiliar with quiet zones successfully traverse grade crossings where horns are not sounded. For a presentation of values associated with the prevention of casualties by level of severity, please refer to *Exhibit 2 - Monetary Values of Preventing Injuries.*

For quiet zones that will be established taking advantage of the exceptions for low risk, the cost associated with installing advance warning signs is relatively low compared to the potential the signs have for preventing one or more accidents over the next twenty years of the rule. For those quiet zones that must have safety measures implemented, it is a small cost in proportion to the cost for implementing the safety measure(s). However, given that high collision risk is a likely prerequisite for implementing safety measures under this rule, warning signs should have a higher rate of effectiveness at crossings in quiet zones with higher risk levels.

7.5 Preventable Grade Crossing Collisions and Resulting Casualties

Whistles provide motorists at or approaching grade crossings information regarding an approaching train's proximity, speed, and direction of travel. A locomotive horn's effectiveness is greatest at the source of sound. Effectiveness is reduced the farther away from the source of sound. This rule is designed to prevent at-grade crossing collisions between trains and highway vehicles with a few exceptions. This rulemaking is not intended to prevent collisions involving pedestrians, collisions where the driver is not in the motor vehicle, or collisions where a highway vehicle strikes the train after the 4^{th} unit of the train (including any locomotives). The effectiveness of sounding of the horn is very limited under such circumstances.

The term injury refers to a broad range of severity, from a small bruise to amputation of limbs. The Abbreviated Injury Scale (AIS) developed by the Association for the Advancement of Automotive Medicine categorizes injuries into six levels of severity. The value of preventing an injury is determined as a portion of the value of preventing a fatality. Clearly, a greater value is associated with prevention of a more severe injury. Per guidance from the Department of Transportation, the value of preventing a fatality is estimated to be $3 million. *Exhibit 2-Monetary Values of Preventing Injuries* presents the six AIS levels and related monetary valuations of preventing casualties.

As discussed earlier, FRA has determined that there is a positive statistically significant correlation between fatalities and train speed. The Regulatory Evaluation of the NPRM rated injuries from collisions that took place at train speeds in excess of 25 mph as an AIS level 5 ($2,287,500) and injuries that resulted from collisions involving trains traveling up to 25 mph as an AIS level 2 ($46,500). FRA did not receive any comments regarding the use of these values for the estimation of safety benefits associated with this rulemaking. Therefore, these AIS levels are used to estimate the safety benefits of the interim final rule.

This rule affords communities establishing quiet zones some discretion in selecting grade crossings for improvement and types of improvements made. Because FRA does not have precise information regarding which crossings will be treated with additional safety measures and what the measures implemented will be, FRA cannot determine which collisions will be prevented as a result of implementing safety measures. However, in estimating the costs associated with the rule, FRA assumed that communities would implement the lowest cost alternatives that meet the requirements of the rule for establishing quiet zones. This analysis estimates the number of fatalities and injuries prevented based on the potential prevention of collisions as a result of implementing the grade crossing improvements presented in the cost section of this analysis and the effectiveness rates of those improvements.

This analysis first assumes that the safety measures will be implemented as presented in the cost section. Next, the five-year (1997 – 2001) collision history of those crossings where the safety measures are implemented is extrapolated to yield the potential pool of preventable collisions and related casualties over a twenty-year period. For pre-rule quiet zones with CCRIs greater than the NSRT and no collisions in the past five years, the pool of preventable collisions and related casualties is estimated as a percentage of the total collisions that are extrapolated for crossings with CCRI greater than NSRT. This methodology is further explained in section 7.6.2 Pre-Rule Quiet Zones with CCRIs Above the NSRT.

7.6 Establishing Quiet Zones

7.6.1 Pre-Rule Quiet Zones With CCRIs Below the NSRT

There are approximately 25 WBJs with a total of 57 whistle ban grade crossings in the Chicago area that have CCRIs below the NSRT. Two relevant collisions (i.e. potentially preventable by sounding the train horn) with no casualties occurred in these WBJs during the five-year period between 1997 and 2001.

Nationwide, excluding the Chicago area, there are 277 WBJs, with a total of 969 whistle-ban crossings, with CCRIs below the NSRT. Forty-five relevant collisions resulting in five injuries and no fatalities occurred in these WBJs between 1997 and 2001.

Given (1) the very low probabilities for collision at the crossings in the communities that comprise this group of WBJs and (2) the small magnitude of the effect of a collision on predicted collisions, it is unlikely that these communities will see a rise in their CCRIs relative to the NSRT unless there is a significant increase in highway traffic volumes or other factors that more heavily influence collision probability. This analysis assumes that communities that currently have CCRIs below the NSRT will retain such standing for the next 20 years.

Changes in other factors that affect risk level may increase the CCRIs of some communities in this category to levels above the NSRT. However, it is also probable that some of those same types of changes, but in the opposite direction, may reduce the risk levels of communities in other categories to levels below the NSRT. These communities may move into this category before any improvements are made to grade crossings. For purposes of estimating costs associated with the rule, this analysis assumes that, to the extent shifts in risk levels relative to the NSRT occur, they will cause moves in both directions and their effects will cancel out overall.

Since FRA does not expect any improvements will be implemented at the crossings in communities with CCRIs below the NSRT as a result of this rulemaking, this analysis does not include any costs or benefits for doing so.

7.6.2 Pre-Rule Quiet Zones With CCRIs Above the NSRT

Chicago Area

There are 327 whistle-ban crossings in WBJs that have CCRIs above the NSRT in the Chicago area. The crossings are distributed as follows:

Type of Warning Device	Number of Crossings
Automatic Gates & Flashing Lights	307
Flashing Lights	19
Passive Warning Devices	1
Total	327

Between 1997 and 2001, 71 relevant collisions occurred at these crossings. These collisions and their resulting casualties are distributed as follows:

Potentially Preventable Collisions at Whistle-Ban Crossings in Chicago Area WBJs With CCRIs Above the NSRT (1997 - 2001)

1997 – 2001	Maximum Train Operating Speed		Total Collisions
	<= 25 mph	> 25 mph	
Automatic Gates & Flashing Lights	8	61	69
Flashing Lights	0	2	2
5-Year Total Collisions	8	63	71

Casualties From Potentially Preventable Collisions at Whistle-Ban Crossings in Chicago Area WBJs With CCRIs Above the NSRT (1997 - 2001)

1997 – 2001	Fatalities: Maximum Train Operating Speed		Injuries: Maximum Train Operating Speed	
	<= 25 mph	>25 mph	<= 25 mph	>25 mph
Automatic Gates & Flashing Lights	0	15	5	29
Flashing Lights	0	1	0	2
5-Year Total	0	16	5	31

Assuming the collision frequency and resulting casualty levels for this group of crossings remains unchanged over the next 20 years, extrapolating this collision data for the next 20 years results in 284 preventable collisions and resulting casualties distributed as follows:

Potentially Preventable Collisions at Whistle-Ban Crossings in Chicago Area WBJs With CCRIs Above the NSRT (20-Year Extrapolation)

	Maximum Train Operating Speed		Total Collisions
	<= 25 mph	> 25 mph	
Automatic Gates & Flashing Lights	32	244	276
Flashing Lights	0	8	8
20-Year Total Collisions	32	252	284

	Fatalities: Maximum Train Operating Speed		Injuries: Maximum Train Operating Speed	
	<= 25 mph	>25 mph	<= 25 mph	>25 mph
Automatic Gates & Flashing Lights	0	60	20	116
Flashing Lights	0	4	0	8
20-Year Total	0	64	20	124

Nationwide, Excluding Chicago

There are 635 whistle-ban crossings nationwide, excluding the Chicago area, that are in WBJs that have CCRIs greater than the NSRT. These are distributed as follows:

Type of Warning Device	Number of Crossings
Automatic Gates & Flashing Lights	369
Flashing Lights	154
Passive Warning Devices	112
Total	635

Between 1997 and 2001, 183 collisions potentially preventable by sounding locomotive horns occurred at these crossings. These collisions and their resulting casualties are distributed as follows:

Potentially Preventable Collisions at Whistle-Ban Crossings Nationwide (Excluding the Chicago Area) That Are Part of WBJs With CCRIs Above the NSRT (1997 - 2001)

1997 – 2001	Maximum Train Operating Speed		Total Collisions
	<= 25 mph	> 25 mph	
Automatic Gates & Flashing Lights	26	62	88
Flashing Lights	30	20	50
Passive Warning Devices	28	17	45
5-Year Total Collisions	84	99	183

Casualties From Potentially Preventable Collisions at Whistle Ban Crossings Nationwide (Excluding Chicago Area) With WBJ CCRIs Above the NSRT (1997 - 2001)

1997 – 2001	Fatalities: Maximum Train Operating Speed		Injuries: Maximum Train Operating Speed	
	<= 25 mph	>25 mph	<= 25 mph	>25 mph
Automatic Gates & Flashing Lights	0	8	6	36
Flashing Lights	0	1	7	10
Passive Warning Devices	0	0	3	7
5-Year Total	0	9	16	53

Assuming the collision frequency at these crossings remains unchanged, extrapolating this data for the next 20 years results in 732 preventable collisions and resulting casualties distributed as follows:

Potentially Preventable Collisions at Whistle-Ban Crossings Nationwide (Excluding the Chicago Area) That Are Part of WBJs With CCRIs Above the NSRT (20-Year Extrapolation)

	Maximum Train Operating Speed		Total Collisions
	<= 25 mph	> 25 mph	
Automatic Gates & Flashing Lights	104	248	352
Flashing Lights	120	80	200
Passive Warning Devices	112	68	180
20-Year Total Collisions	336	396	732

Casualties From Potentially Preventable Collisions at Whistle-Ban Crossings Nationwide (Excluding Chicago Area) With WBJ CCRIs Above the NSRT (20-Year Extrapolation)

	Fatalities: Maximum Train Operating Speed		Injuries: Maximum Train Operating Speed	
	<= 25 mph	>25 mph	<= 25 mph	>25 mph
Automatic Gates & Flashing Lights	0	32	24	144
Flashing Lights	0	4	28	40
Passive Warning Devices	0	0	12	28
20-Year Total	0	36	64	212

Calculation of Expected 20-Year Safety Benefits

Within each warning device category, some whistle-ban crossings may have a significantly greater chance of having the types of collisions that this rule is designed to prevent than others. However, FRA cannot identify these specific crossings using the information and tools available. Therefore, this analysis assumes that within each warning device category, collisions and casualties are distributed equally among whistle-ban crossings[4] with CCRIs greater than the NSRT.

[4] FRA has determined that collision probabilities vary by warning device type.

Although the Accident Prediction Formulas (APF) estimate the collision probability at individual crossings, they do not provide an estimate for the specific subset of *relevant* collisions that this rule is designed to prevent. Furthermore, the accuracy of the APFs is higher when applied to a group of crossings than when it is applied to individual crossings. Therefore, the formulas are more reliable when used to predict the occurrence of a collision in a WBJ (as was done for estimating costs) than when used to predict the occurrence at a particular crossing (as would be done to estimate benefits of improvements which are applied to individual crossings). Because the APFs do not consider certain factors that drive the probability of a relevant collision and their accuracy at the individual crossing level is not as high, this analysis does not use the APF to estimate the level of safety benefits that would result from implementing improvements at individual crossings.

This rule treats WBJs with CCRIs greater than the NSRT and no relevant collisions in the previous five years with leniency because the CCRI is based on the APFs that do not consider all of the factors that influence the probability of the type of collision preventable by the sounding of a locomotive horn. Certain WBJs in this category may have high collision probabilities but lower probabilities for *relevant* collisions. Other WBJs in this category may have very high probabilities for *relevant* collisions. Unfortunately, FRA cannot determine the level of relevant collision risk for crossings in WBJs with CCRI greater than NSRT and no relevant collisions in the past five years. Only time will reveal the standing of these WBJs with regards to relevant collision risk.

For purposes of estimating benefits associated with this rule, this analysis assumes that, within each warning device category, the probability of the occurrence of a relevant collision over the next 20 years is equal among all whistle-ban crossings in WBJs with CCRIs greater than the NSRT. Therefore, within each warning device type group, the relevant collisions expected to occur over the next 20 years are distributed evenly among all of the crossings with CCRIs greater than the NSRT.

It is from the prevention of collisions in this 20-year pool that FRA expects the safety benefits of this rule will be derived. The following steps were taken to estimate how many collisions and related casualties will be prevented and to assign monetary values to these benefits.

1. Implementation of this rule can prevent only those collisions that would occur in absence of this rule at crossings that are improved as a result of this rulemaking. Because not all crossings in each WBJ need to be improved in order to reduce the CCRI to a permissible level, the preventable collisions that are expected to occur at crossings that are not expected to be improved as a result of this rule were removed from the relevant collision pool**.** The number of expected collisions was adjusted to reflect a four percent decline in the number of collisions that have been occurring at whistle ban grade crossings. FRA analyzed relevant collision rates for whistle-ban crossings going back to 1980 and developed a regression model that closely fits these rates. This model was used to

develop relevant collision forecasts for the next twenty years. None of the forecasted annual collision rates indicates a decline of greater than 4 percent per year. Appendix C presents these findings in greater detail.

2. Effectiveness rates were then applied to the collision rates according to the types of improvements that this analysis assumes will be implemented at each crossing (see sections of this analysis addressing costs). This provided an estimate of the number of collisions and related casualties that immediate implementation could prevent.

3. Since implementation of safety measures at grade crossings where horns are not sounded will occur gradually, the reduction in casualties was phased in at the same rate as the costs for implementation of the safety measures. In some cases grade crossing improvements will occur after a potentially preventable collision occurs. Phase in is expected to occur per the following schedule:

Whistle-Ban Crossing Improvements in:	Years of Rule
WBJs with CCRIs greater than 2 times the NSRT	Years 2 - 8
WBJs with CCRIs greater than the NSRT-	
and one or more collisions in the past five years benefits	Years 2 - 8
and less than 2 times NSRT with no collisions in the past 5 years	Years 2 - 19

4. Finally, the values of averting casualties were applied to the expected decreases in casualties resulting from the prevention of collisions. Based on guidance issued by the Department of Transportation, the value of averting a fatality is $3 million. As indicated earlier, this analysis assumes that the type of injury prevented in a collision involving a train travelling at a speed of less than 25 mph is moderate and its prevention is valued at $46,500; the type of injury prevented in a collision involving a train travelling at a speed of 25 mph or greater is critical and its prevention is valued at $2,287,500. (See Exhibit 2 for a discussion of the valuation of the prevention of casualties)

The following sections present the safety benefits expected to accrue over the next twenty years in each of the categories of WBJs with CCRIs greater than the NSRT.

7.6.3 Pre-Rule Quiet Zones With No Relevant Collisions in the Past Five Years and CCRIs Between the Product of One and Two Times the NSRT

Chicago Area

None of the crossings in the WBJs in this category would have to be upgraded initially. However, it would take the occurrence of only one relevant collision (potentially preventable by sounding of the locomotive horn) for a community with a quiet zone in this group to have to improve one or more crossings to retain the quiet zone.

The following table presents the distribution of crossings in WBJs with no relevant collisions in the past five years and CCRIs between the product of one and two times the NSRT. It also presents, for each warning device type, the percentage of all crossings in quiet zones with CCRI greater than NSRT that are in quiet zones that have CCRIs between one and two times the NSRT and no relevant collisions in the past five years. This percentage is used to assign expected collisions to crossings in this category by warning device type.

Existing Whistle-Ban Crossings in the Chicago Area That Are Part of Quiet Zones With No Relevant Collisions in the Past 5 Years and CCRIs Between One and Two Times the NSRT

	Crossings	Percent of QZ w/ CCRI > NSRT
Gates & Flashing Lights	55	18%
Flashing Lights	6	32%
Total Crossings	61	n/a

This analysis assumes that WBJs where the sounding of the horn at all whistle-ban crossings would severely impact no more than 20 persons or eight households would not retain the whistle bans. Two such WBJs are in this category. However, based on the probabilities for collisions estimated by the Accident Prediction Formulas, neither is expected to have a collision in the first twenty years of this rule.

This analysis assumes that throughout the twenty-year period of this analysis, 9 crossings will have safety measures implemented to meet the requirements of this rule for retaining quiet zones. Assuming both a constant collision rate and a four percent annual reduction in collisions at existing whistle-ban crossings in absence of this rule, FRA estimates that twenty-year safety benefits expected to result from the implementation of safety measures at crossings in quiet zones in this category will be as follows:

	Constant Rate	Rate Declining 4% Annually
Collisions Prevented	3	2
Fatalities Prevented	0*	0*
Injuries Prevented	1	1
Value of Casualties Prevented	$2,465,999 (PV)	$1,574,618 (20-Year PV)

* Actual estimates were less than one. This analysis counts whole collisions and casualties prevented. Fractions of collisions and casualties are not counted for purposes of counting these. Nevertheless, for purposes of assigning monetary values to the safety benefits, fractions of collisions and casualties are included.

Nationwide, Excluding Chicago

The following table presents the distribution of crossings in WBJs with no relevant collisions in the past five years and CCRIs between one and two times the NSRT. It also presents, for each warning device type, the percentage of all crossings in quiet zones with CCRI greater than NSRT that are in quiet zones that have CCRIs between the product of one and two times the NSRT and no relevant collisions in the past five years.

Existing Whistle-Ban Crossings Nationwide, Excluding the Chicago Area, That Are Part of Quiet Zones With No Relevant Collisions in the Past Five Years And CCRIs Between the Product of One and Two Times the NSRT

	Total Crossings	Percent of QZ w/ CCRI > NSRT
Gates & Flashing Lights	147	40%
Flashing Lights	46	30%
Passive Warning Devices	20	18%
Total Crossings	213	n/a

This analysis assumes that, of the WBJs where relevant collisions occur, those where the sounding of the horn at all whistle-ban crossings would severely impact no more than 20 persons or 8 households per corridor will not retain the whistle bans unless the number of affected crossings is large. No such WBJs were identified in this group.

This analysis assumes that throughout the twenty-year period of this analysis, 53 crossings will have safety measures implemented to meet the requirements of this rule for retaining quiet zones. Assuming both a constant collision rate and a four percent annual reduction in collisions at existing whistle-ban crossings in absence of this rule, FRA estimates that twenty-year safety benefits expected to result from the implementation of safety measures at crossings in quiet zones in this category will be as follows:

	Constant Rate	Declining Rate 4 % Annually
Collisions Prevented	12	7
Fatalities Prevented	1	0*
Injuries Prevented	5	3
Value of Casualties Prevented	$5,910,012	$3,648,410 (20-Year PV)

*Actual estimates were less than one. This analysis counts whole collisions and casualties prevented. Fractions o collisions and casualties are not counted for purposes of counting these. Nevertheless, for purposes of assigning monetary values to the safety benefits, fractions of collisions and casualties are included.

7.6.4 Pre-Rule Quiet Zones With No Relevant Collisions in the Past Five Years and CCRIs Above Twice the NSRT

Chicago Area

Although the quiet zones in this group initially have a good five-year safety record in terms of relevant collisions, they have very high relative collision risk levels. The high risk levels of these quiet zones are mainly driven by high train operating speeds. Commuter trains in the Chicago area generally operate at speeds well in excess of 50 mph. Also, a collision between a commuter train and a highway vehicle is likely to result in very severe, if not fatal, injuries to the occupants of the highway vehicle. The number of injuries resulting from such collisions is also generally higher because passengers onboard commuter trains can also be injured. Depending on the number of passengers onboard at the time of the collision, the type of highway vehicle involved in the collision, and the speed of the train; the occurrence of a collision at a crossing in one of these quiet zones could result in a high number of serious casualties.

Another factor driving the high CCRIs in this category is the high levels of train traffic through the crossings. In addition to commuter train traffic there is significant freight train traffic.

CCRIs for WBJs in this category are between 30,848 (twice the NSRT) and 124,094 (over eight times the NSRT).

The following table presents the distribution of crossings in WBJs with no relevant collisions in the past five years and CCRIs greater than two times the NSRT. It also presents, for each warning device type, the percentage of all crossings in quiet zones with CCRIs greater than NSRT that are in quiet zones that have CCRIs greater than twice the NSRT and have had no relevant collisions in the past five years.

Existing Whistle-Ban Crossings in Chicago Area That Are Part of Quiet Zones With No Relevant Collisions in the Past Five Years and CCRIs Above Twice the NSRT

	Total Crossings	Percent of QZ w/ CCRI > NSRT
Gates & Flashing Lights	79	26%
Flashing Lights	4	21%
Total Crossings	83	n/a

A total of 35 crossings are expected to be upgraded to comply with the requirements of this rule for the establishment of quiet zones. Assuming a 4 percent annual reduction in collisions at existing whistle-ban crossings in absence of this rule, FRA estimates that twenty-year safety benefits expected to result from the implementation of safety measures at crossings in quiet zones in this category will be as follows:

	Constant Rate	Declining Rate 4% Annually
Collisions Prevented	18	11
Fatalities Prevented	4	2
Injuries Prevented	9	6
Value of Casualties Prevented	$14,164,517 (PV)	$9,676,700 (20-Year PV)

In addition, his analysis assumes that only one whistle ban would be terminated as a result of this rule because no persons would be severely affected by the sounding of train horns. The safety benefits associated with sounding the horn at this crossing are included in section 7.6.6 of this document.

Nationwide, Excluding Chicago

The following table presents the distribution of crossings in WBJs with no relevant collisions in the past five years and CCRIs greater than two times the NSRT. It also presents, for each warning device type, the percentage of all crossings in quiet zones with CCRIs greater than NSRT that are in quiet zones that have CCRIs greater than twice the NSRT and have had no relevant collisions in the past five years.

Existing Whistle-Ban Crossings Nationwide, Excluding Chicago That Are Part of Quiet Zones With No Relevant Collisions in the Past Five Years and CCRIs Above Twice the National Significant Risk Threshold

	Total Crossings	Percent of QZ w/ CCRI > NSRT
Gates & Flashing Lights	42	11%
Flashing Lights	3	2%
Passive Warning Devices	1	1%
Total Crossings	46	n/a

Maximum timetable speeds at these crossings are 30 mph or greater. Train traffic is high along these corridors. Both of these factors drive up the risk levels of these corridors.

Communities would probably elect not to include in quiet zones 5 crossings that currently have whistle bans because there would be no persons severely affected by the sounding of train horns. The safety benefits of sounding locomotive horns at the affected crossings are included in the safety benefits estimated in section 7.6.6 of this document.

Assuming a constant collision rate and a 4 percent annual reduction in collisions at existing whistle-ban crossings in absence of this rule, FRA estimates that twenty-year safety benefits expected to result from the implementation of safety measures at crossings in quiet zones in this category will be as follows:

	Constant Rate	Declining Rate 4% Annually
Collisions Prevented	17	11
Fatalities Prevented	3	2
Injuries Prevented	7	5
Value of Casualties Prevented	$5,499,567	$3,757,111 (20-Year PV)

7.6.5 Pre-Rule Quiet Zones With One or More Relevant Collisions in the Past Five Years and CCRIs Above the NSRT

Chicago Area

The following table presents the distribution of crossings in WBJs with relevant collisions in the past five years and CCRIs greater than the NSRT. It also presents, for each warning device type, the percentage of all crossings in quiet zones with CCRIs greater than NSRT that are in quiet zones that have had relevant collisions in the past five years.

Whistle-Ban Crossings in the Chicago Area That Are Part of Quiet Zones With One or More Relevant Collisions in the Past 5 Years and CCRIs Above the NSRT

	Total Crossings	Percent of QZ w/ CCRI > NSRT
Gates & Flashing Lights	173	56%
Flashing Lights	9	47%
Passive Warning Devices	1	100%
Total Crossings	183	n/a

Eight no-horn crossings in this category would have 20 or fewer persons severely affected by the sounding of locomotive horns. All of these crossings could either be included in pre-rule quiet zones at no additional cost or would likely be upgraded because of the combination of high levels of night-time train traffic and having more than 10 persons severely impacted. Train horns are not likely to be sounded at any of these crossings once the rule is implemented

A total of 41 crossings in this category would have to have safety measures implemented to comply with the requirements for establishing quiet zones. Assuming a constant collision rate and a 4 percent annual reduction in collisions at existing whistle-ban crossings in absence of this rule, FRA estimates that twenty-year safety benefits expected to result from the implementation of safety measures at crossings in quiet zones in this category will be as follows:

	Constant Rate	Declining Rate 4% Annually
Collisions Prevented	21	13
Fatalities Prevented	4	3
Injuries Prevented	10	6
Value of Casualties Prevented	$16,277,752 (PV)	$11,120,388 (20-Year PV)

Nationwide, Excluding Chicago

The following table presents the distribution of crossings in WBJs with relevant collisions in the past five years and CCRIs greater than the NSRT. It also presents, for each warning device type, the percentage of all crossings in quiet zones with CCRIs greater than NSRT that are in quiet zones that have had relevant collisions in the past five years.

Whistle-Ban Crossings Nationwide, Excluding the Chicago Area That Are Part Quiet Zones With One or More Relevant Collisions in the Past Five Years and CCRIs Above the NSRT

	Total Crossings	Percent of QZ w/ CCRI > NSRT
Gates & Flashing Lights	180	49%
Flashing Lights	105	69%
Passive Warning Devices	91	81%
Total Crossings	376	n/a

This analysis assumes that the remaining 30 whistle bans will be terminated and six WBJs will not become quiet zones once this rule is implemented because fewer than 20 persons would be severely impacted by the sounding of horns. The safety benefits of sounding locomotive horns at the affected crossings are included in the safety benefits estimated in the following section of this document.

A total of 113 crossings in this category would have to have safety measures implemented to comply with the requirements for establishing quiet zones. Assuming a constant collision rate and a 4 percent annual reduction in collisions at existing whistle-ban crossings in absence of this rule, FRA estimates that twenty-year safety benefits expected to result from the implementation of safety measures at crossings in quiet zones in this category will be as follows:

	Constant Rate	Declining Rate 4% Annually
Collisions Prevented	27	17
Fatalities Prevented	4	2
Injuries Prevented	12	8
Value of Casualties Prevented	$27,836,627 (PV)	$19,017,005 (20-Year PV)

Exhibit 7 presents annual Pre-Rule Quiet Zone safety benefit estimates.

7.6.6 Communities Where Existing Whistle Bans Will Not be Retained

Some communities that would otherwise retain whistle bans may no longer do so as a result of this implementing this rule. As discussed earlier, this analysis estimates that initially one gated no-horn crossing in the Chicago area and 35 whistle-ban crossings in the rest of the nation will likely not be included in quiet zones as a result of this rulemaking. The crossings nationwide, excluding the Chicago area, are distributed as follows:

Whistle-Ban Crossings Nationwide, Excluding the Chicago Area,
That Are in WBJs With CCRIs Above the NSRT
And That May Not Be Included in New Quiet Zones

	Total Crossings
Gates & Flashing Lights	6
Flashing Lights	8
Passive Warning Devices	21
Total Crossings	35

According to the assumptions used to estimate costs associated with this rule, in years 10 and 14 of the rule, communities with CCRIs greater than the NSRT and no relevant collisions will have collisions that force them to take action to reduce their risk levels, including eliminating from the quiet zone four crossings as follows:

Whistle-Ban Crossings Nationwide, Excluding the Chicago Area, That Are in
WBJs With CCRIs Above the NSRT with No Relevant Collisions

	Total Crossings	Year of Elimination from QZ
Gates & Flashing Lights	1	11
Flashing Lights	2	15
Passive Warning Devices	1	15
Total Crossings	4	n/a

The sounding of locomotive horns at these crossings is expected to result in the avoidance of collisions and resulting casualties. Between 1997 and 2001, relevant collisions at these crossings were distributed as follows:

	Collisions	Injuries	Fatalities
Gates & Flashing Lights	4	8	0
Flashing Lights	7	8	1
Passive Warning Devices	17	12	0
Total	28	28	1

Applying effectiveness rates of the sounding horn to these collisions, extrapolating for twenty-years and assuming sounding of the horn commences in years 3, 11, and 15, depending on when the crossings are eliminated from quiet zones, nationwide benefits are expected to be as follows:

Nationwide (Excluding Chicago)

	Constant Rate	Declining Rate 4% Annually
Collisions Prevented	56	36
Fatalities Prevented	0*	0*
Injuries Prevented	13	8
Value of Casualties Prevented	$8,413,129	$5,810,789

Estimates for the Chicago area are as follows:

Chicago Area

	Constant Rate	Declining Rate 4% Annually
Collisions Prevented	0*	0*
Fatalities Prevented	0*	0*
Injuries Prevented	0*	0*
Value of Casualties Prevented	$424,759	$291,582

* Actual estimates were less than one. This analysis counts whole collisions and casualties prevented. Fractions of collisions and casualties are not counted for purposes of counting these. Nevertheless, for purposes of assigning monetary values to the safety benefits, fractions of collisions and casualties are included.

Exhibit 7 presents the annual safety benefits expected to accrue as a result of whistle ban terminations.

7.6.7 Potential New Quiet Zone Safety Benefits

Communities with Whistle Bans Established After October 9, 1996

New Quiet Zones with CCRI > NSRT: FRA is aware of 66 crossings with whistle bans passed after October 9, 1996. Most of these bans were passed in late 2001. Grade crossing collisions are rare events. During the period between 1997 and 2001, 3 relevant collisions resulting in 2 injuries and one fatality occurred at crossings equipped with flashing lights in WBJs with CCRI greater than the NSRT. Two collisions resulting in no casualties occurred at crossings equipped with gates. To establish New Quiet Zones including all 52 crossings in WBJs with CCRI > NSRT, gates would have to be installed at 38 crossings that currently have flashing lights.

Adjusting for the increase in risk associated with silencing the horns (31%) and extrapolating for the next twenty years results in the occurrence of 15.72 collisions resulting in 10.48 injuries and 5.24 fatalities. Assuming that gate installations are phased in during the first three years of the rule and applying the effectiveness rate of 66 percent for adding gates[5], results in the prevention of 9 collisions resulting in 4 injuries and 2 fatalities. Prevention of these casualties would be valued at $4,709,303 (PV). Assuming a 4 percent declining collision rate for these crossings in absence of this rule would result in the following safety benefits:

Collisions Prevented	6
Fatalities Prevented	1
Injuries Prevented	2
Value of Casualties Prevented	$3,373,878 (20-Year PV)

Exhibit 5 presents annual New Quiet Zone safety benefit estimates.

New Quiet Zones with CCRI < NSRT: Gates would have to be installed at 11 of the 14 crossings in WBJs with CCRI less than the NSRT to establish New Quiet Zones. Between 1997 and 2001, no relevant collisions occurred in any of the WBJs. However, this does not mean that there is no risk for collisions to occur in the future. Given the recent establishment of these quiet zones, it is too soon to tell what the increased risk will translate into in terms of collisions and casualties at these crossings. Given that horns are estimated to be 31 percent effective and upgrades from flashing lights to gates are estimated to be 66 percent effective, it is likely that initially installation of the gates will overcompensate for silencing the horns at these low risk crossings and result in a safer environment than exists today. It is possible that over time, increases in train speed, train traffic, and/or highway vehicle traffic will increase the level of risk at these crossings. This rule will ensure that motorists receive a minimum level of protection against such possible increases in risk by ensuring that the crossings are equipped with at least gates and lights. Therefore, it is possible that installation of gates at these crossings will not be over-compensating for the horn.

Total twenty-year costs associated with establishing these New Quiet Zones by complying with the requirements of this rule are estimated to be approximately $1.6 million. These communities will likely establish quiet zones that permit them to retain these whistle bans to the extent that the value they place on the locomotive horn noise reduction coupled with the value of guaranteeing motorists a certain level of safety meets or exceeds this cost.

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[5] Communities would actually recalculate their CCRI using the APF for gated crossings. FRA is applying this rate as a proxy. FRA does not expect the results to be significantly different.

It is possible that, in response to the issuance of this final rule, some of these communities may decide to terminate the whistle bans. However, given that the communities were aware of the more onerous proposed requirements, it is more likely that they established these whistle bans with the expectation that they would have to incur at least this level of costs.

<u>New Quiet Zones Not Yet Established</u>

Cancelled Whistle Bans: Most of the New Quiet Zones that include crossings where there were once whistle bans could not exist in absence of this rule because the railroads that operate over these corridors ignored whistle ban ordinances when they were in place. Such railroads were opposed to the increased levels of risk to highway users posed by silencing the locomotive horns. With this rule in place, railroads and communities will be able to establish New Quiet Zones that take into account the safety of motor vehicle operators as well as the desire of the community to decrease noise levels.

Both railroads and community residents should benefit from the requirements of the rule for the establishment of New Quiet Zones. Communities will establish New Quiet Zones only to the extent that benefits of silencing locomotive horns and providing motorists with a certain level of safety exceed the costs of doing so.

Those communities that do not establish quiet zones will retain the status quo and not incur any additional costs or benefits attributable to issuance of this interim final rule.

Communities Without Any Whistle Ban Experience: These communities have contacted FRA and sought guidance on how to establish quiet zones in a manner that does not diminish safety levels for motorists using the crossings in the affected corridors. Clearly these communities have an interest in safety and would probably not establish the quiet zones without voluntarily meeting the requirements of the rule for doing so. In absence of this rule, FRA would likely issue guidance on how to establish quiet zones and these communities would likely follow that guidance.

<u>Potential New Quiet Zone Safety Benefits (at crossings where horns currently sound)</u>

The following sections present potential safety benefits that may accrue if communities with an interest in establishing New Quiet Zones do so. They will only accrue to the extent that communities establish New Quiet Zones. Establishment of these quiet zones will indicate that the value communities place on silencing locomotive horns while providing a certain level of safety for motorists at those crossings meets or exceeds the costs of establishing the quiet zones in compliance with the requirements contained in this rule.

The safety benefits presented in the following sections are based on the same locomotive horn effectiveness rates and safety measure effectiveness rates used to calculate pre-rule benefit estimates. The effectiveness rates of locomotive horns and safety measures at particular crossings in New Quiet Zones may be very different. The potential for crossing safety to decline significantly in absence of the locomotive horn sound is driven by different factors that are particular to each crossing. Since FRA does not have sufficient information to establish individual crossing effectiveness rates, and since FRA proceeds from the premise that motorists should be provided some form of unequivocal warning regarding the train's approach, FRA is ensuring that motorists are provided with a certain minimum level of protection at crossings in New Quiet Zones by requiring that all crossings in New Quiet Zones have gates.

CCRIs Greater than NSRT(after adjusting for the loss of the horn): Between 1997 and 2001, 44 relevant collisions resulting in three fatalities and eleven injuries occurred at crossings that are expected to form New Quiet Zones with CCRIs above the NSRT (excluding those whistle bans established post October 9, 1996 which were discussed in the previous section). According to a study of locomotive horn effectiveness, horns have average effectiveness rates of 66.8 percent at gated crossings; 30.9 percent at crossings equipped with flashing lights, but no gates; and 74.9 percent at passively marked crossings.

The following tables present relevant collisions and resulting casualties in potential New Quiet Zones for the five-year period 1997 through 2001, as well as a twenty-year extrapolation of the casualties that adjusts for silencing locomotive horns.

Potentially Preventable Collisions at Potential New Quiet Zone Crossings with CCRI Above the NSRT (1997-2001)

	Maximum Train Operating Speed		Total Collisions
1996 – 2000	<= 25 mph	> 25 mph	
Automatic Gates & Flashing Lights	7	8	15
Flashing Lights	8	10	18
Passive Warning Devices	7	4	11
5-Year Total Collisions	22	22	44

Casualties From Potentially Collisions at Potential New Quiet Zone Crossings with CCRI Above the NSRT (1996-2000)

	Fatalities: Maximum Train Operating Speed		Injuries: Maximum Train Operating Speed	
1996 – 2000	<= 25 mph	>25 mph	<= 25 mph	>25 mph
Automatic Gates & Flashing Lights	1	0	0	5
Flashing Lights	0	1	1	2
Passive Warning Devices	0	1	2	1
5-Year Total	1	2	3	8

Potentially Preventable Collisions at Potential New Quiet Zone Crossings with CCRI Above the NSRT 20-Year Extrapolation and Adjustment for Loss of Locomotive Horn Warning Effectiveness

	Maximum Train Operating Speed		Total Collisions
1996 – 2000	<= 25 mph	> 25 mph	
Automatic Gates & Flashing Lights	11.69	13.36	25.05
Flashing Lights	10.48	13.1	23.58
Passive Warning Devices	12.25	7.0	19.25
5-Year Total Collisions	59.42	58.46	67.88

Casualties From Potentially Preventable Collisions at Potential New Quiet Zone Crossings in Quiet Zones with CCRIs Above the NSRT – 20-Year Extrapolation And Adjustment for Loss of Locomotive Horn Warning Effectiveness[6]

	Fatalities: Maximum Train Operating Speed		Injuries: Maximum Train Operating Speed	
	<= 25 mph	>25 mph	<= 25 mph	>25 mph
Automatic Gates & Flashing Lights	6.68	0	0	33.4
Flashing Lights	0	5.24	5.24	10.48
Passive Warning Devices	0	7	14	7
20-Year Total	6.68	12.24	19.24	50.88

Calculation of Potential 20-Year Safety Benefits for New Quiet Zones with CCRI > NSRT

Safety benefits are estimated using the same methodology as was used for the safety benefits of Pre-Rule Quiet Zones and assuming that safety measure implementations are distributed evenly in the first three years of the rule. Exhibit 5 presents annual estimates.

Estimated total twenty-year safety benefits (including those resulting from the installation of flashing lights and automatic gates at crossings not already equipped with these) that would result from the establishment of New Quiet Zones that include crossings with whistle bans established after October 9, 1996, former whistle-ban crossings, and crossings in communities that have expressed an interest in establishing quiet zones are as follows:

Whistle Bans Established Post Oct. 9, 1996

Scenario	Collisions	Injuries	Fatalities	20-Year NPV
Constant Rate	9	4	2	$ 4,709,303
Declining Rate (4%/yr)	6	2	1	$ 3,373,878

6 For crossings with automatic gates 67%, for crossings equipped with flashing lights 31%, for crossings with no automatic warning devices 75%.

Communities Where Horns Sound Routinely

Scenario	Collisions	Injuries	Fatalities	20-Year NPV
Constant Rate	13	14	2	$25,965,858
Declining Rate (4%/yr)	9	10	1	$18,602,675

Total Potential Safety Benefits of Establishing New Quiet Zones

Total under a constant collision scenario $30,675,161(PV)
Total under a declining collision rate scenario: $21,976,553(PV)

CCRI Less than NSRT (after adjusting for loss of horn): There are 195 crossings in the WBJs in this category. Between 1997 and 2001, four relevant collisions occurred at crossings that could be included in New Quiet Zones with CCRIs below the NSRT. No casualties resulted from these 4 collisions. This is not very surprising given that most of the crossings where bans were once in place have very low train traffic levels. FRA believes that many such former whistle bans will not be included in New Quiet Zones. Specifically, FRA has identified 63 former whistle-ban crossings with average daily train traffic levels of less than one.

The following table presents the relevant collisions in potential New Quiet Zones for the five-year period.

Potentially Preventable Collisions at Potential New Quiet Zone Crossings in Quiet Zones with CCRIs Below the NSRT (1997 – 2001)

	Maximum Train Operating Speed		Total Collisions
	<= 25 mph	> 25 mph	
Automatic Gates & Flashing Lights	1	0	1
Flashing Lights	0	0	0
Passive Warning Devices	1	2	3
20-Year Total Collisions	2	2	4

A twenty-year extrapolation that adjusts for silencing locomotive horns yields a total of 28 collisions. Total twenty-year compliance costs for establishing and maintaining New Quiet Zones comprised of 132 crossings are expected to total $7.5 million. It would take the avoidance of 3 fatalities in the first few years of the rule valued at about $9 million, or up to 9 fatalities in the 20th year of the rule valued at $7.5 million to justify this cost. Given the level of costs compared to the safety levels, communities may decide not to establish quiet zones at crossings with fewer than 5 daily trains, including communities that have recently expressed interest in establishing quiet zones. This would reduce the number of upgrades by 62 (23 gate additions and 39 lights and gates additions) and the number of relevant collisions to one.

Clearly, communities would establish New Quiet Zones including these crossings only to the extent that the value they place on silencing horns (non-safety benefits) is greater than the costs they would have to incur to establish and maintain New Quiet Zones. Given that most of the persons affected by train horn noise have already implemented mitigation measures, the desire to establish quiet zones along former whistle ban corridors may be limited.

<u>Sensitivity Analysis for New Quiet Zones with CCRI Less Than NSRT</u>

Some communities that would like to establish New Quiet Zones may decide to exclude certain crossings or not establish them at all as a result of the costs of complying with this final rule. This may particularly be the case for communities where train horns routinely sound today because (1) residents and/or communities may have taken steps to mitigate the effects of the noise (2) few persons are severely impacted by the sounding of locomotive horns, and (3) many of those who were affected by the noise have already relocated. Communities with grade crossings that have maximum train operating speeds of l5 mph or less may decide that the relief from the duration and sound level requirements in this rule is sufficient.

For purposes of estimating costs and benefits, this analysis excluded crossings where train horn noise severely affects 20 individuals or fewer and where train traffic averages less than one per day.

FRA developed an alternative cost scenario excluding those crossings that have no nighttime train traffic and an average of less than 10 daytime trains. Given the relatively low level of annoyance likely caused by these low levels of train traffic, communities may not include these crossings in New Quiet Zones. To the extent that these crossings are not included, fewer upgrades to flashing lights and gate would be required. The tables below compare the impacts of this alternate scenario with the one assumed in this analysis.

Distribution of Crossings in QZs with CCRI Less Than NSRT

Warning Device	Original Scenario	Alternate Scenario
Gates & Lights	43	22
Flashing Lights	44	23
Passive	45	12
Total	132	57

Upgrades Required to Establish New Quiet Zones

	Original Scenario	Alternate Scenario
Install Gates	44	23
Install Lights and Gates	45	12
Total	89	35

Total Twenty-Year Upgrade Costs
Installation and Maintenance (PV)

	Original Scenario	Alternate Scenario
Install Gates	$1,348,411	$ 704,851
Install Lights and Gates	$6,501,631	$1,733,768
Total	$7,850,042	$2,436,619

Under the alternative scenario considered in this section, persons residing near the crossings that would not be included in New Quiet Zones would continue to be minimally affected by train horn noise and the communities would incur no additional costs. This may seem like a more cost-effective and sensible alternative to many communities. Of the crossings included in the alternative scenario for potential New Quiet Zones with CCRI less than the NSRT, that are not already equipped with both flashing lights and automatic gates, 22 have maximum train operating speeds of 15 mph or less. Residents near these crossings could also benefit from a reduction in noise that results from the sounding of horns for less time on approach. Not including these grade crossings in New Quiet Zones would further reduce costs and should not affect safety levels. Therefore, to the extent that communities exclude some of these crossings in New Quiet Zones, costs and benefits presented in this analysis are overestimated. Under this rule, communities have the discretion to exclude many of these crossings.

7.6.8 Re-affirmation and Updating of the DOT Grade Crossing Inventory

FRA needs to have current information regarding the circumstances that affect the collision risk at crossings in quiet zones for this rule to achieve maximum safety benefits. Periodic update of the DOT Grade Crossing Inventory will ensure that any changes in the factors that affect collision risk are taken into consideration when the accident prediction formulas are used to calculate a quiet zone's CCRI. This will ensure that communities with quiet zones affected by the requirements of this rule, as intended, are not be heavily burdened, and when appropriate reduce their risk levels. Without current information, FRA would possibly have to consider more stringent requirements given the uncertainty of conditions at crossings where locomotive horns are not sounded. Without current information, FRA would not want to put motorists at a greater level of risk than stated by this rule, given that the safety of motorists who drive over crossings is at stake.

Without the requirement to update the inventory periodically, crossings with very high probabilities of having collisions resulting in serious injuries may go untreated and may have collisions that could have been avoided. Communities should also be aware of the current risk levels at their crossings in order to make any improvements they would make in absence of this rule.

Like the periodic updating of the inventory, the periodic affirmation that the supplementary safety measures implemented within the quiet zone continue to conform with the requirements of this rule will ensure that this rulemaking achieves its safety objective.

Changes in the characteristics of the crossings that comprise the quiet zones may require a reevaluation that would not occur in absence of this requirement.

7.6.9 Power-Out Indicators or Remote Health Monitoring

In much the same manner that motorists often rely upon the indications provided by traffic lights as a primary means of determining whether it is safe to traverse a highway intersection, motorists often rely upon the indication provided by highway-rail grade crossing warning devices as the primary means of determining whether it is safe to traverse a highway-rail grade crossing. Safety at crossings equipped with automatic warning devices very much depends upon keeping these devices functioning properly. Automatic warning devices at grade crossings are required to fail in a safe mode. That is, in the case of gated crossings, with gates down, and in the case of other devices with the device signaling a train is approaching. Motorists generally respond by initially heeding the warning. However, once they realize that the system is malfunctioning, they rely on other visual and auditory cues and drive through the grade crossing when they think it is safe to do so. Should a train be approaching at the same time, a collision could occur.

Remote health monitoring devices provide information to a control location. When a problem is reported, a signal maintainer performs the necessary repairs. Depending on the type of problem that is detected, train crews may be notified to protect movements per 49 CFR part 234. Crews may reduce speed and sound the locomotive horn even at whistle-ban crossings.

Power-out light systems provide train crews with a reasonably prompt warning that commercial power is not being provided. The automatic warning device should continue to operate properly as long as the battery back up is charged. Train crews will notify train dispatchers of the situation so that the problem can be addressed before there is an activation failure.

Despite the efforts to maintain the safety and reliability of crossing warning devices, warning device failures do occasionally occur. Such activation failures are very dangerous because motorists who rely on the warning device as the primary indicator of the safety of crossing are given a false sense of security. Activation failures can have potentially fatal consequences when the device provides no warning whatsoever.

FRA recognizes the importance of recording and tracking such failures to analyze their cause and perhaps find ways to prevent or minimize their occurrence. Railroads are required to report all activation failures of highway rail grade crossing automatic warning devices to FRA. The information in these reports indicates there is a trend with implications for this rule.

During the three-year period from 1998 to 2000, FRA compiled 1,786 reports of activation failures involving automatic grade crossing warning devices. During that same three-year time period, 69 grade crossing collisions resulting in 28 injuries and 6 fatalities occurred when automatic warning devices did not issue a warning. The number of collisions attributed to these failures was relatively low.

FRA believes that one reason that so few activation failures result in crossing collisions is that motorists rely on other cues to alert them to the fact that a train is approaching despite the fact that the crossing warning device has not actuated. A logical assumption is that the locomotive horn provides an important auditory cue to alert motorist that a train is approaching when the primary visual cue, the indication provided by the warning device, is false and misleading.

Active warning device activation failures can be very dangerous, particularly without the benefit of a warning from the sound of the locomotive horn. At crossings that are part of a quiet zone, this important auditory cue is not likely to be present, absent a system that notifies the crew of the approaching train that the automatic crossing device is not functioning as intended and is failing in an unsafe manner.

Unfortunately, no device or system has yet been designed that is capable of detecting all automatic warning device malfunctions that are likely to result in a false activation. However, the power-out light device, which has been in use for many years, is capable of detecting the most common cause of automatic grade crossing warning device activation failures and is capable of providing advance warning to the train crew who can then begin slowing the train and sounding the horn before the train arrives at the crossing.

While the loss of electrical power does not account for all activation failures, it is far and away the most common cause of these potentially fatal crossing warning device malfunctions. Between 1998 and 2000, inclusive, 420 activation failures representing or 23.5 percent of the total number of activation failures were caused by loss of electrical power. An additional 154 activation failures were caused by a power surge of lightning that may have also resulted in a loss of electrical power that might have been detected by the presence of a power out indicators. Taken together, as many as one third of all activation failures may have been detected by the presence of power out indicators.

While the information reported to FRA concerning warning device activation failures does not indicate whether the failed devices were equipped with power out indicators, it is very reasonable to assume that a number of the crossings subject to activation failures very likely were equipped with power out indicator which may have played a role in preventing the activation failure from resulting in a collision.

Motorists approaching crossings in New Quiet Zones established under this rule will rely very heavily on the visual cues provided by automatic warning devices (flashing lights and gates) to warn them of approaching trains. In the absence of the auditory cues due to the silenced locomotive horns, it is imperative that these warning devices function properly and safely. An activation failure in a quiet zone crossing could result in a grade crossing collision. Therefore, FRA believes it prudent to require that automatic crossing warning devices located within a quiet zone be equipped with power out indicators or remote health monitoring systems to warn that a power failure has occurred at the crossing so that the problem may be fixed.

7.7 Private Crossings in Quiet Zones

In any given year, approximately 10 percent of the deaths at highway-rail crossings occur at private crossings. Although many private crossings do not present high risk in comparison with active public crossings (e.g., entrances to individual residences; lightly used agricultural crossings), other private crossings may present considerable risk. In some cases, railroads instruct crews to sound the horn at particular private crossings where risk is perceived to be high; in other cases locomotive horns provide effective warning as an accident of geography (i.e., where the private crossing is sandwiched between two nearby public crossings).

Although locomotive horns are not usually sounded at private crossings, the sound from locomotive horns at other crossings may serve as an indication of train activity to motorists approaching private crossings. There may be some safety disbenefits to the extent that quiet zones are created around private crossings and the residual effect of the locomotive horn warning is no longer felt at the private crossings. However, railroads can be presumed to pay some attention to this (to the extent that it is a problem) and railroads may have train crews sound the horn as they approach the private crossings.

7.8 Total Twenty-Year Estimated Safety Benefits

The Regulatory Evaluation prepared for the NPRM presented two safety benefit scenarios; one assumed a constant collision rate and the other a 4% annual decline in collision rate. No comments were received regarding these two collisions rates. FRA has reviewed trends in collision rates for whistle-ban crossings going back to 1980 and determined that these two rates probably bound the range that will be experienced over the twenty-years that this analysis covers. FRA developed a regression model that closely fits the rates since 1980. This model was used to develop relevant collision forecasts for the next twenty years. None of the forecasted annual collision rates indicates a decline of greater than 4 percent per year. Appendix C presents these findings in detail.

The tables that follow present safety benefits under both scenarios.

Total Twenty-Year Safety Benefits Monetized (PV, 7%)
Constant Collision Rate (0% annual decline)

	Nationwide	Chicago	Rest of Nation
Locomotive Horns Sounded			
Maximum Sound Level	---------	Not Quantifiable	---------
Casualties Prevented (Cancellation of W-Bans)	$8,837,888	$424,759	$8,413,129

Pre-Rule Quiet Zones: Value of Injuries and Fatalities Prevented by Implementing Safety Measures

	Nationwide	Chicago	Rest of Nation
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions	$ 8,376,011	$ 2,465,999	$ 5,910,012
QZs w/ CCRI > 2 x NSRT; No Collisions	$19,664,084	$14,164,517	$ 5,499,567
QZs w/ CCRI > NSRT; With Collisions	$44,114,379	$16,277,752	$ 27,836,627
Total	**$72,154,474**	**$32,908,268**	**$ 39,246,206**

New Quiet Zones: Value of Injuries and Fatalities Prevented by Implementing Safety Measures

	Total	Non-Existing Quiet Zones	Whistle Bans Est. Post 10/9/96
CCRI greater than NSRT	$30,675,161	$25,965,858	$ 4,709,303
TOTAL	**$111,667,523**		

Total Twenty-Year Collisions and Casualties Prevented[7]
Constant Collision Rate (0% annual decline)

Nationwide, Including the Chicago Area

Pre-Rule Quiet Zones:	Collisions	Injuries	Fatalities
Cancellation of W-Bans	57	13	1
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions	16	7	2
QZs w/ CCRI > 2 x NSRT; No Collisions	35	17	7
QZs w/ CCRI > NSRT; With Collisions	48	23	8
Pre-Rule Quiet Zone Total	**156**	**60**	**18**
New Quiet Zones:	36	34	8
TOTAL	**192**	**94**	**26**

[7] These estimates represent the sum of forecasted collisions and resulting casualties. These are rarely whole numbers. The totals in the table are only the integer portion of the actual forecasts.

Total Twenty-Year Safety Benefits Monetized (PV, 7%)
Declining Collision Rate (4% annual decline)

	Nationwide	Chicago	Rest of Nation
Locomotive Horns Sounded			
Maximum Sound Level	---------	Not Quantifiable	---------
Casualties Prevented (Cancellation of W-Bans)	$6,102,371	$291,582	$5,810,789

Pre-Rule Quiet Zones: Value of Injuries and Fatalities Prevented by Implementing Safety Measures

	Nationwide	Chicago	Rest of Nation
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions	$ 5,223,028	$ 1,574,618	$ 3,648,410
QZs w/ CCRI > 2 x NSRT; No Collisions	$13,433,811	$ 9,676,700	$ 3,757,111
QZs w/ CCRI > NSRT; With Collisions	$30,137,393	$11,120,388	$19,017,005
Total	**$48,794,232**	**$22,371,706**	**$26,422,526**

New Quiet Zones: Value of Injuries and Fatalities Prevented by Implementing Safety Measures

	Total	Non-Existing Quiet Zones	Whistle Bans Est. Post 10/9/96
CCRI greater than NSRT	$21,976,553	$18,602,675	$ 3,373,878
TOTAL	**$76,873,156**		

Total Twenty-Year Collisions and Casualties Prevented
Constant Collision Rate (0% annual decline)

Nationwide, Including the Chicago Area

	Collisions	Injuries	Fatalities
Pre-Rule Quiet Zones:			
Cancellation of W-Bans	37	8	0
QZs w/ NSRT < CCRI < 2xNSRT; No Collisions	9	4	0
1QZs w/ CCRI > 2 x NSRT; No Collisions	22	11	4
QZs w/ CCRI > NSRT; With Collisions	31	15	5
Pre-Rule Quiet Zone Total	**99**	**38**	**9**
New Quiet Zones:	24	22	4
TOTAL	**123**	**60**	**13**

7.8.1 Uncaptured (Out-Year) Benefits

This analysis includes some compliance costs that will be incurred well beyond the first few years of the rule. Unlike the benefits associated with costs incurred in the early years of the rule, much of the twenty-year stream of benefits associated with these costs is not captured in this analysis. Safety benefits are understated to the extent that many years of safety benefits resulting from safety measures implemented in out-years are not included.

7.9 Damage to Highway Vehicles, Railroad Equipment, and Track

In addition to the prevention of casualties, FRA estimates that, over the next twenty years, this collision prevention will result in a reduction in highway vehicle, railroad equipment, and track damage. For the period between 1997 and 2001, average highway vehicle damage for those relevant collisions that occurred at whistle-ban crossings with CCRI greater than NSRT was $4,371[8]. Railroad equipment and track damage is only reported to FRA when it exceeds $6,700. Eight collisions that occurred at whistle ban crossings with CCRI greater than NSRT occurred between 1997 and 2001. The average damage reported for those eight was $51,444. This analysis assumes that heavy highway vehicles including trucks, truck-trailers, and buses cause average damages of $3,350 (an amount equal to half of the reporting threshold). Between 1997 and 2001, 36 relevant collisions involved these types of heavy highway vehicles. The average damage to rail equipment and track for relevant collisions at whistle ban crossings was $2,095. Applying the average damages to the collisions expected to be prevented by implementing this rule results in a reduction of such damages values at approximately $400,000 (PV). Exhibit 9 presents annual costs by category.

7.10 Unquantified Benefits

Some of the unquantified benefits of this final rule include reductions in freight and passenger train delays, both of which can be very significant when grade crossing collisions occur, and collision investigation efforts. Although these benefits are not quantified in this analysis, their monetary value is significant.

Because such events are rare, FRA has not attempted to estimate the value of avoiding events in which a highway-rail collision results in a derailment, with harm to persons on the train or release of hazardous materials into the community.

Another unquantified benefit of this rule is elimination of some locomotive horn noise disruption to some railroad employees and those who may reside near industrial areas served by railroads. Locomotive horns will no longer have to be sounded at individual highway-rail grade crossings at which the maximum authorized operating speed for that segment of track is 15 miles per hour or less and properly equipped flaggers (as defined in by 49 CFR 234.5, but who for purposes of this rule can also be crew members) provide warning to motorists. This exception is intended to avoid unnecessary noise impacts on railroad personnel working on the ground in very close proximity to the locomotive horn in industrial areas where substantial switching occurs at very low speeds with flaggers providing warning to motorists. This rule will allow engineers, who were probably already exercising some level of discretion as to the duration and sound level of locomotive horn sounding, to stop sounding the horn under these circumstances at no additional cost.

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[8] This average does not include collision reports of $0 highway vehicle damage or those that did not report. FRA believes it is unreasonable to assume that $0 damage would result to a highway vehicle.

8.0 Cost Benefit Comparison

Maximum Horn Sound Levels

The provision for a maximum sound level for the train horn accounts for about $3 million (20-year PV) of the total rule costs. To comply with the provision, the sound level of all existing locomotives horns will need to be tested. The costs result from this testing requirement. The most significant contribution to costs is the labor charge for the railroad's selected testing method, whether the railroad chooses to test the locomotive horn in-house, by using rental equipment, or by contracting out the task. The estimated prices for these testing methods are applied to the number of locomotives to calculate costs. The primary benefit of mandating a maximum sound level is the mitigation of noise related impacts from sounding the train horn. According to the Final Environmental Impact Statement for this Interim Final Rule, FRA estimates that capping the sound level at 110 dB(A) will reduce the number of impacted residents by 12%.

Pre-Rule Quiet Zones

The estimated $15 million (PV) total twenty-year cost associated with compliance with the requirements for the establishment of Pre-Rule Quiet Zones should be justified by over $48 million (PV) in estimated twenty-year safety benefits in the form of casualties avoided. Safety benefits exceed costs for three Pre-Rule Quiet Zone categories with CCRI greater than NSRT (those with relevant collisions in the past five years, those with no relevant collisions in the past five years and CCRIs greater than the product of two times the NSRT, and those with no relevant collisions and CCRIs between one and two times the NSRT) for both the Chicago are and the rest of the nation. For Pre-Rule Quiet Zones with CCRIs less than NSRT, administrative costs totaled slightly over $1 million. No quantifiable safety benefits are expected to result for these quiet zones because no safety improvements would be required. Nevertheless, these costs are justified by the ability to ensure that any increases in risk to levels over the NSRT are detected before they result in serious safety problems.

Cancellation of Existing Whistle Bans

Assuming that some communities decide not to include certain existing whistle-ban crossings in quiet zones due to low train traffic volumes and low numbers of potentially severely impacted persons, this analysis includes relocation and noise mitigation costs totaling about $2 million (20-year PV). The value of the reduction in casualties as a result of sounding train horns at those crossings is expected to total $6 million (20-year PV). Most of the impacts are expected to occur outside of the Chicago area. This rule provides communities with sufficient time to plan in advance for any whistle ban cancellations.

New Quiet Zones

This rule gives individual communities flexibility and discretion regarding the sounding of locomotive horns within their boundaries. Communities establishing New Quiet Zones will have to make highly individualized decisions and trade-offs regarding investments in various strategies to protect the public at grade crossings. FRA does not have the specific information necessary to forecast with precision the decisions communities will make regarding the sounding of locomotive horns at crossings within their boundaries. These decisions will ultimately be made in a political environment with a strong recognition of other competing uses for the financial resources.

Making what it considers to be reasonable assumptions, FRA estimates that it would cost up to approximately $22 million (20-year PV) to establish and maintain New Quiet Zones. However, given the uncertainly as to how many of the potential New Quiet Zones will actually be established, this estimate likely represents an upper bound of potential costs. The associated safety benefits of approximately $22 million (mostly resulting from installation of flashing lights and automatic gate systems at crossings not already equipped with these) justify the overall cost.

About $9 million of the $22 million would be spent on establishing and maintaining New Quiet Zones with CCRIs less than the NSRT. FRA could not quantify the safety benefits that would accrue from the safety improvements made at crossings in these quiet zones because current safety levels are good and there have been no casualties as a result of relevant collisions at these crossings. FRA cannot estimate how many casualties, if any, would result from relevant collisions if the quiet zones were established in absence of this rule. In many cases the quiet zones would not be established at all due to opposition from railroads or other factors that have not allowed communities to do so thus far. This rule does more than require for compensation of the train horn warning. The safety improvements implemented in response to the requirements of this rule would ensure a minimum level of warning and protection for motorists traversing crossings in New Quiet Zones. Since these crossings do not have sufficient, if any, recent experience without train horns sounding, it is not possible to estimate with any level of confidence whether the increase in risk at these crossings once train horns are silenced will result in the occurrence of collisions with casualties. Through the passage of time, other factors, such as train traffic level increases and highway traffic level increases, may also increase risk levels. This rule provides motorists protection in the event that risk increases after New Quiet Zones are established. These safety benefits cannot be quantified and are therefore not included in this analysis. Nevertheless, FRA believes that these benefits would justify the incurring the implementation cost.

This analysis does not quantify the benefit of eliminating community disruption caused by the sounding of train horns. Since this rule is permissive as to the establishment of quiet zones, communities will establish New Quiet Zones to the extent that elimination of the train horn disruption coupled with the safety benefit exceeds the costs of compliance associated with the requirements for establishing New Quiet Zones.

9.0 Alternatives Considered

No FRA Action: This alternative would preserve the status quo: states and municipalities could try to regulate the sounding of locomotive horns while railroads could continue to resist such regulation through litigation and other means. FRA lacks the authority to implement the No-Action Alternative, and adoption of the No-Action Alternative would involve congressional action to reverse its mandate to regulate the use of locomotive horns at highway-rail grade crossings as set forth in 49 USC 20153. FRA rejected seeking repeal of the statutory requirement because it would represent a default by the agency charged with addressing this issue. FRA believes that taking such a course would almost certainly lead to a further reduction in safety over time as State-level officials, many of whom today oppose bans imposed without safety consideration, found the ground cut out from underneath them with the retreat of Federal leadership. In the short term it could further frustrate communities seeking quiet zones that are unable to realize them under existing State laws.

No Exceptions to Sounding the Train Horn: at all public highway-rail grade crossings. It would result in a high level of safety at highway-rail crossings, and the costs of administration would be negligible. However, the great majority of commenters and their elected representatives have urged FRA to provide a means for communities to quiet train horns. Taking this course would probably cause many residents of communities with existing whistle bans to relocate and create unnecessary conflict between commuter rail service and the communities served.

Make The Requirements Contained in the NPRM Final: The Notice of Proposed Rulemaking proposed requiring that trains horns be sounded at all public grade crossings; set a maximum sound level for locomotive horns; and provided an opportunity for any community to establish a quiet zone where all public grade crossings are equipped with gates and lights and data and analysis show that implementation will reduce risk in the quiet zone to sufficiently compensate for the absence of the horn sounding: by implementing one or more SSMs at each crossing; or by implementing a combination of SSMs and ASMs at some or all crossings within a proposed quiet zone with FRA approval. Communities with present whistle bans would have up to three years in which to implement SSMs and ASMs. Crossings with track speeds of 15 mph or less at which train movements are protected by flagmen would not need SSMs.

This option would be unresponsive to those who commented in response to the NPRM. FRA agrees with those who commented that the proposed rule offered insufficient time for implementation. FRA agrees with the tenor of many comments that the proposed rule would have required compensation for loss of the train horn even where risk is very low (or would be projected to be low even after the horn was silenced) when compared to the national average at gated crossings where horns are sounded regularly. The result of maintaining that requirement would have been poor cost-benefit tradeoffs for many communities. Staying with the literal text of the NPRM would not allow the noise reductions associated with the shift from distance- to time-based horn use.

Grandfather All Whistle Bans Existing As Of 10/9/96: This alternative would allow communities that had whistle bans in effect on October 9, 1996 to retain those bans as long as the level of risk does not increase. FRA would essentially be accepting the level of risk the community itself has determined to be acceptable. If a whistle ban community exceeded its risk threshold, it would have three years to implement changes (e.g. install SSMs) sufficient to reduce risk to below its risk threshold. Changes related to use of train horns, including the maximum sound level, could be accommodated within this option.

This option was rejected for various reasons. It would not provide a uniform level of safety across the Nation; it did not afford New Quiet Zones the same exceptions allowed for pre-rule quiet zones, thus undermining uniformity of application and requiring local authorities to expend funds on improvements for which the safety pay-back could not be reasonably assured at the system level. Factors other than silencing the train horn are typically responsible for the growth in calculated risk in the subject communities (e.g., increase in motor vehicle traffic as a result of residential or commercial development in an adjoining jurisdiction; growth in rail traffic). It did not seem sensible to permit excess risk to continue, provided nothing changes in a community, while requiring new increments of risk in other communities to be addressed without regard to whether the current level of risk is excessive.

Grandfather All Whistle Bans Existing As Of 10/9/96 – Combine Collision-Free Exemption With Severity-Weighted Single Threshold: FRA considered allowing communities with whistle bans in effect on October 9, 1996 to retain those for the first 5 years following publication of the interim final rule. Thereafter such communities could retain bans as long as: there have been no collisions within the past 5 calendar years ***or*** risk has not increased above a pre-established threshold calculated using the FRA Accident Prediction Formula (APF) for the past 5 years; ***and*** at least flashing lights and gates have been provided at all such crossings. The option included a severity element in the risk computation for the threshold. A corridor risk index and national threshold would be used, as in the interim final rule. The option provided further flexibility for retaining whistle bans during the transition period as follows: a State Department of Transportation (or other authorized state-level body) could request extended implementation beyond the 5-year period on the basis that the State is assisting local jurisdictions in implementing quiet zones and requires additional time due to funding and/or administrative constraints. The following would apply: each project must be the subject of a filing with FRA (i.e., the rule otherwise applies as revised); actual implementation of initial projects will begin not later than year four; consistent with efficient completion of required work and corridor-related safety considerations, improvements will be implemented at the most hazardous crossings first (where risk reduction opportunities are greatest) and then proceed to less hazardous crossings; no less than 25% of identified excess risk must be abated by the end of year five, 50% by the end of year six, 75% by the end of year seven, and 100% by the end of year eight; and this relief will expire eight years following publication of the interim final rule (seven years from the effective date). If a community exceeded the severity threshold in any annual review thereafter, actions would be taken as necessary to fall back below the threshold within a three-year period or the train horn would be required to sound; or actions sufficient to compensate for the loss of the train horn would have to be taken. Communities establishing New Quiet Zones would be required to follow the standards set forth in the NPRM (and would not be able to take advantage of low baseline risk, even after adjustment for loss of the train horn).

FRA rejected this option principally because it did not afford New Quiet Zones the same exceptions allowed for pre-rule quiet zones, thus undermining uniformity of application and requiring local authorities to expend funds on improvements for which the safety pay-back could not be reasonably assured at the system level. The costs of flashing lights and gates in existing ban areas would be substantial, in some cases prohibitively expensive. Again, in many cases costs would probably not be fully recovered through safety benefits. FRA also concluded that excepting pre-rule quiet zones from the requirement to make safety improvements solely on the basis of no accident history could not be supported as based on sound safety analysis (and opted, instead, for a limited exception based on both accident history and underlying estimated risk).

Require Horns be Sounded Or SSMs Implemented At Highest Risk Crossings: This alternative would have required that train horns be sounded at all grade crossings except those where (1) maximum train speed is 15 m.p.h. or less and flaggers are provided or (2) a whistle ban permitted under the rule is in effect. Existing whistle bans could continue provided high-risk crossings are addressed within three years. New whistle bans could be created only if crossings within them were equipped with gates and lights. No whistle ban could include a grade crossing categorized as high risk, except crossings within existing whistle bans that are remedied within three years. High-risk crossings are those with a collision probability greater than or equal to .05 (i.e., a five percent chance of an accident occurring at that crossing in a year) based on the APF. Where train horns are now sounded, the crossing's collision probability would be increased to account for the absence of the train horn. Within one year of the rule's issuance, any community with an existing whistle ban would have to certify that it has reviewed FRA data on effectiveness of horns, whistle ban effects, and relative merits of SSMs and consulted with affected railroads and state officials about possible safety improvements. Any community imposing a new whistle ban must first provide the same certification. Communities with existing whistle bans would continue to include crossings lacking gates and lights unless and until the crossing has an APF of .05 or more. Once a whistle ban is in effect, any crossing that reaches an APF of .05 would have to implement remedies within two years to retain their bans.

This option was rejected because: it does not directly take into account predicted accident severity, and therefore does not truly consider risk (severity times probability)[1]; it does not permit sufficient flexibility to reduce risk within a quiet zone by dealing with crossings other than ones with the highest collision probability and, therefore, does not adequately take into account the interest of communities with existing whistle bans. The statute addresses all

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[1] The Accident Prediction Formulas were originally developed for purposes that will not in all cases reveal actual risk levels at the individual crossing level. The risk index methodology that FRA developed for purposes of this final rule modifies the accident prediction formula collision probability methodology to include the additional risk posed by not sounding horns by (1) considering the five-year relevant collision history and (2) including severity measures for the predicted casualty probabilities.

crossings, not merely the most hazardous. The option does not focus sufficiently on compensation for loss of the train horn warning (the focus of the law). This crossing-by-crossing based approach could result in a patchwork of whistle-ban areas, adding to burden on locomotive engineers to determine, crossing by crossing, where the horn must be sounded and thus detracting from the engineer's other safety related functions. This option could be more costly per unit of risk reduced because the community is required to take risk reduction at specified crossings rather than where means and need best correspond (e.g., foreclosing the option of putting in medians at two moderate-risk crossings for a total cost of $30,000 rather than installing four-quadrant gates at one higher risk crossing for an incremental cost of $100,000-$128,000, even though the resulting risk reduction could be the same).

Articulated Gates: FRA considered including as an SSM articulated gates that would descend from a single apparatus to block the approach to the crossing in the normal direction of travel and continue to block the exit lanes from the crossing. The State of North Carolina tested articulated gates and indicates in their comments to this rulemaking that they are a maintenance challenge for railroad signal crews. Furthermore, the mechanical design of the articulated gates makes the articulated portion of the gate susceptible to failure of operation. If these problems are resolved satisfactorily, articulated gates may be approved as SSMs in the future.

Nighttime Whistle Bans: Because motor vehicle exposure is greatly reduced at nighttime, FRA also considered allowing nighttime only whistle bans without requiring added safety measures. Different treatment during daylight and nighttime hours would limit community disruption caused by the sounding of locomotive horns during hours at night. Some communities currently have nighttime only locomotive horn bans in place. However, without the use of additional safety measures, FRA fears that a nighttime only ban could lead to motorist confusion and result in collisions. One way of achieving a nighttime only ban under the final rule is to install mechanisms for temporary closures. Communities may also consider other SSMs for achieving nighttime only bans.

Passenger Train Stations: FRA considered allowing whistle bans without requiring additional safety measures at crossings adjacent to passenger train stations with no through train traffic. If train orders limiting speeds entering these crossings to 15 mph are in place, the level of risk at these crossings is likely very similar to that of a crossing with a track speed limit of 15 mph with flaggers that is not equipped with lights and gates.

FRA believes that the low risk level exceptions provided in the rule for establishing quiet zones will properly address such situations.

Alternative Maximum Horn Sound Levels: Finally, FRA considered establishing two alternative maximum horn sound levels 104 dB(A) and 111 dB(A) as well as a third concept. The first is believed to be sufficient in most circumstances to provide adequate warning at crossings using automated warning devices (where the motorist makes a decision while at rest near the crossing, expecting the train to arrive). The second option is believed to be effective under many circumstances at passively signed crossings (where the motor vehicle is in motion at the decision point and the motorist has been provided no contemporaneous reason to expect to see a train). The third concept involved 2 variable maximum sound levels depending on the type of warning device present at the crossing. This concept, however, raises concerns regarding the additional burden placed on the crewmember in charge of sounding the horn and the feasibility where crossings are closely spaced yet not uniformly treated with warning devices. FRA research indicates that a high likelihood of detection will occur when the horn is producing 108dB(A) at the measurement location, 100 feet in front of the locomotive and at 15 feet in height. FRA added a margin to this level to account for variability in the sound level meters and other factors and set the maximum permissible level at 110dB(A).

When to Use Locomotive Horns: FRA is not aware of any crossings in non-positive train control territory where locomotive horns are sounded and there are no whistle boards or other means of notifying locomotive engineers when to commence sounding of the horn, therefore there are only nominal costs associated with informing train crews of this requirement. Any safety benefits that occur as a result would certainly exceed the estimated cost level.

10.0 Conclusions

The benefits in terms of lives saved and injuries prevented are expected to exceed the costs imposed on society by this rule. Even assuming collision rates falling at the most we actually expect is possible the safety benefits alone, exceed the most costly realistic scenario for community safety enhancements.

11.0 Regulatory Flexibility Assessment

The purpose of this assessment is to provide information and further detail on the assessment of the impacts on small entities by the Use of Locomotive Horns at Highway-Rail Grade Crossings Final Rule (49 CFR Part 222). This assessment is also intended to address the issues and concerns outlined in the Regulatory Flexibility Act.[1] Finally, this assessment discusses the provisions that the Federal Railroad Administration (FRA) incorporated into the final rule to minimize any adverse economic impact on small entities and to ensure sufficient outreach to these entities.

This Regulatory Flexibility Assessment (RFA) concludes that (1) small railroads should be minimally impacted by this rule; (2) some small businesses that operate along or nearby rail lines where locomotive horns are not routinely sounded, but that potentially may not after the implementation of this rule, may be moderately impacted; and (3) the most significant impacts on small entities will be on "governmental jurisdictions" of communities. Small railroads will mainly be affected by the requirements for maximum sound levels for locomotive horns and associated testing and certification requirements. FRA estimates that approximately 70 percent of the affected governmental jurisdictions of communities are considered to be small entities by the Small Business Administration (SBA). Many communities will only very minimally be affected by reporting and record keeping requirements of this rule and will be exempt from requirements to implement additional safety measures. Other communities will either:

(1) elect to retain whistle bans currently in place and implement one or more safety measures or
(2) accept locomotive horns will be sounded at crossings where they do not currently do so.

Data available to FRA indicates that this rule may have minimal economic impact on a substantial number of small entities (railroads) and possibly a significant economic impact on a few small entities (government jurisdictions and small businesses). However, there is no indication that this rule will have a significant economic impact on a substantial number of small entities. The SBA did not submit comments to the docket for this rulemaking in response to the Initial Regulatory Flexibility Assessment that accompanied the NPRM. FRA certifies that this rule will not have a significant economic impact on a substantial number of small entities.

[1] 5 U.S.C. 601 et seq...

11.1 Rationale for Choosing Regulatory Action and Problem Statement

The problem considered by this rule is collisions involving motor vehicles and the front ends of trains at highway-rail grade crossings where locomotive horns are not routinely sounded and their resulting casualties. FRA has documented both the increased risk at whistle-ban crossings, and locomotive horn effectiveness. In 1995, a national study using both empirical data and a computer model showed significant increase in the number of collisions on crossings with whistle bans.[2] Train whistles were also shown to have a deterrent effect on motorists attempting to go around lowered gates at highway-rail crossings. An update of this study performed by FRA as well as two subsequent revisions performed for FRA by Westat[3] support these findings.

Locomotive horns are a means to alert motor-vehicle operators that a train is approaching. The locomotive horn also helps to provide operators with information about the approaching train including direction and proximity.

In the United States there are approximately 154,000 public highway-rail grade crossings. Only 62,000 of these crossings are equipped with gates and/or flashing lights. The effectiveness of some of these systems is compromised when motorists fail to heed their warnings, and still proceed through the crossings. At crossings where there are no active warning devices, motorists rely on the locomotive horn in addition to visual cues provided by the headlight, auxiliary alerting lights, and the train itself for information about approaching trains. Under inclement weather conditions, motorists have difficulty seeing approaching trains despite their lights. During the five-year period between 1997 and 2001, 301 collisions that were potentially preventable by sounding locomotive horns occurred at whistle-ban crossings. These collisions resulted in 21 fatalities and 110 non-fatal injuries. This translates into an annual average of 60 collisions, 4 fatalities, and 22 injuries.

The studies performed by Westat for FRA indicate that nationwide (excluding Florida), the adverse whistle ban effects were significant. All three classifications of warning devices experienced substantially higher collision rates in whistle ban areas as follows:

	Percent Difference (Higher)	
Warning Device Class	Nationwide (excluding Chicago)	Chicago Area
Passive	74.9	n/a
Flashing Lights	30.9	n/a
Gates with Flashing Lights	66.8	17.3

This rule requires that a locomotive horn to be sounded while a train is approaching and entering

2 U.S. Department of Transportation, Federal Railroad Administration, *Nationwide Study of Train Whistle Bans*, April 1995.

3 *Analysis of The Safety Impact of Locomotive horn Bans at Highway-Rail Grade Crossings,* March 2002. *Analysis of the Safety Impact of Train Horn Bans at Highway-Rail Grade Crossings: an Update Using 1997-2001 Data,* May 2003.

a public highway-rail crossing. The rule provides for exceptions to this requirement in circumstances in which there is not a significant risk to life or serious personal injury, when the use of the locomotive horn is impractical, when supplementary safety measures fully compensate for the absence of the warning provided by the horn, or where the average quiet zone risk level is at or below the average level at gated crossings where the locomotive horn is regularly sounded.

Some communities believe that the sounding of train whistles at every crossing is excessive and an infringement on community quality of life, and therefore have enacted “whistle bans” that prevent the trains from sounding their whistles entirely, or during particular times (usually at night). FRA is concerned that with the increased risk at grade crossings where train horns are not sounded, or other safety measures are in place, collisions and casualties may increase significantly.

11.2 Legal Authority

This rule is required by law. The 1994 Railroad Safety Reauthorization Act (Public Law 103-440) requires the use of locomotive horns at grade crossings and gives FRA authority to make reasonable exceptions.[4] This law requires the use of locomotive horns at grade crossings, but gives FRA authority to make reasonable exceptions. Congress amended this law on October 9, 1996.[5] The amended law requires the FRA to take into account the interest of communities that have in effect restrictions on the sounding of a locomotive horn at highway-rail crossings. In addition, it requires FRA to work in partnership with affected communities to provide technical assistance and to provide a reasonable amount of time for local communities to install supplementary safety measures and take into account local safety initiatives.

Legal Authority: 29 U.S.C. 20102-20103, 20110-20112, 20114, 20137, 20138, 20143, 20301-20303, 20306, 20701-20703, 21301-20302, 21304, 21306, and 21311; 49 CFR 1.49(c), (g), and (m).

11.3 Small Entities Affected

Communities: Small Governmental Jurisdictions

This Final Rule potentially impacts a greater audience of small entities than most FRA regulations. The potential audience includes many small entities that are classified as “small governmental jurisdictions.” As defined by SBA, this term means governments of cities, counties, towns, townships, villages, school districts, or special districts with a population of less than 50,000.

This rule could impact approximately 260 governmental jurisdictions whose communities

[4] Public Law 103-440.

[5] Public Law 104-264.

currently have either formal or informal whistle bans in place. FRA estimates that approximately 70 percent of these communities are small entities. An estimated 193 small jurisdictional governments may be affected by the implementation of this rule. FRA also estimates that 40 percent of the affected crossings are contained in small communities whose governmental jurisdictions are considered to be small entities.[6] The impact on these governments will vary depending on whether they have to implement safety measures to retain their whistle bans or not and if so, depending on whether they elect to implement such supplementary measures or allow the locomotive horns to be sounded once again. The impacts of these decisions will also vary depending on the number of whistle-ban crossings, the population density of the community neighborhoods that immediately surround the affected grade crossings, and train traffic volume over the affected crossings.

FRA expects the majority of small governmental jurisdictions which have not attempted to institute whistle bans in their communities will not do so in the future. Therefore, this rule should not impact them. A relatively small number of governmental jurisdictions may seek to establish quiet zones if rail traffic increases following railroad mergers or other events. This would increase the number of affected small governmental jurisdictions beyond 193. Communities seeking to establish New Quiet Zones will have fewer and, in many cases, more expensive alternatives available to them for complying with the requirements of this rule than communities with whistle bans that were established prior to October 9, 1996.

This Regulatory Flexibility Assessment may be overstating the impact on small entities that are governmental jurisdictions because "quiet zones" may be located within the boundary of a small community, but may be the legal and responsible entity of another entity. Many roads that are located within the boundaries of a town or other small community actually are the responsibility of a larger community governmental jurisdiction such as a county or state. Thus, the financial burden for some roadway's crossings may be the county, state or possibly even federal government. In response to the NPRM, some communities commented that they needed more time to establish quiet zones. The final rule extends the proposed implementation schedule by a minimum of two years and a maximum of five years.

Small Railroads

The U.S. Small Business Administration (SBA) stipulates in its "Size Standards" that the largest a railroad business firm that is "for-profit" may be and still be classified as a "small entity" is 1,500 employees for "Line-Haul Operating" Railroads, and 500 employees for "Switching and Terminal Establishments."[7] "Small entity," is defined in 5 U.S.C. 601 as a small business

[6] Prior to issuing the NPRM, FRA researched 155 of the affected communities outside of the Chicago area with 1,387 whistle-ban crossings and found that 115 of these communities are governmental jurisdictions that are considered small entities by the SBA definition. These 115 communities contain 597 of the 1,387 whistle-ban crossings.

[7] "Table of Size Standards," U.S. Small Business Administration, January 31, 1996, 13 CFR Part 121.

concern that is independently owned and operated, and is not dominant in its field of operation. FRA considers railroads that meet the line haulage revenue requirements of a Class III railroad as "small entities". For other entities, the same dollar limit on revenues is established to determine whether a railroad shipper or contractor is a small entity.[8] FRA used this alternative definition in the NPRM to identify small railroads affected by this rulemaking and requested comment on the appropriateness of doing so. No comments were received. Therefore, FRA is using this alternative definition of "small entity" to identify small railroads affected by this final rule.

Given this interim definition of small entity it is difficult to determine exactly how many of the estimated 685 railroads that operate in the United States are considered small entities.[9] Nationwide, 45 to 50 railroads provide approximately 90 percent or more of the industry's employment; own almost 90 percent of the track; and operate over 90 percent of the ton-miles. Included in this group are passenger railroads that provide well over 95 percent of the passenger miles. FRA believes that these 45 to 50 railroads are not small entities. Therefore, FRA estimates that approximately 640 railroads that may be affected by this rule are small entities.

Intercity passenger and commuter railroads are not considered small entities by SBA definition because they are owned by governmental jurisdictions or transit authorities that serve populations of well over 50,000.

Most the existing whistle bans cover rail lines that are owned by railroads that are not considered small entities. FRA is aware of fewer that 10 Class III railroads that operate over crossings that are subject to local whistle bans.

The standards for maximum locomotive horn sound levels and related horn testing and certification will affect small railroads. FRA has incorporated alternative testing standards to allow small railroads with limited physical space to perform tests with relative ease.

Small Businesses

It is not feasible for FRA to survey or determine how many small businesses may be affected by the implementation of this rule. FRA is aware of concerns advanced by owners and operators of hotels, motels and some other establishments as a result of numerous town meetings and other

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[8] As defined by the Interstate Commerce Commission (ICC) - now the Surface Transportation Board (S.B.), all "switching and terminal" railroads are classified as Class III, regardless of their operating revenue.

[9] Approximately 685 railroads report accident/incident data and statistics to the FRA.

outreach sessions in which FRA has participated during development of this rule. Such concerns were taken into consideration in development of the final rule. The increase in flexibility and implementation schedule provided by the final rule addresses those concerns.

This rule may also affect small businesses that might set-up shop in an area that borders or is nearby a rail corridor that formerly had a whistle ban in effect prior to this rulemaking process. For these potentially affected small entities, the existence of an established "quiet zone" could or could not be a factor in their decision to open for business in such a location. FRA requested comments on potential impacts on such future small businesses in the NPRM, but did not receive any.

11.4 Reporting, Record keeping, and Other Compliance Requirements

When a state or local government designates a quiet zone, it is required to provide notice of such designation to all operating railroads over the crossings within the quiet zone, the highway or traffic control authority or law enforcement authority that has control over vehicular traffic at the crossings within the quiet zone, the state agency responsible for highway and road safety, and FRA. In addition, the quiet zone that is established will not take effect until an accurate and complete U.S. DOT Grade Crossing Inventory Form is provided to FRA. Updates to the inventory are also required every 3 to 5 years thereafter.

One alternative option for complying with this rule is allowing locomotive horns to be sounded. This alternative imposes no direct costs on governmental jurisdictions. Other alternatives which will likely be implemented include installation of medians at gated crossings at estimated costs between $13,000 and $15,000; installation of four-quadrant gate systems at an estimated cost of $100,000 plus annual maintenance costs of $2,500 -$5,000; photo enforcement at estimated costs between $28,000-$65,500, plus annual maintenance costs between $6,600-$24,000; and programmed enforcement programs estimated to cost between $20,000 and $25,000 initially and $4,600 annually thereafter.

Finally, FRA has not limited compliance alternatives to the lists provided in Appendix A or Appendix B of the final rule. Other safety measures may be implemented if their analysis demonstrates that the number of motorists that violate the crossing is equivalent or less than that when locomotive horns are sounded. FRA intends to rely on the creativity of communities to formulate solutions that will work for them.

11.5 Impacts

FRA expects that the costs of this rulemaking will be incurred predominantly by communities with whistle bans in place, in some cases, with state government funding. As noted above, FRA estimates that 70 percent of the approximately 265 jurisdictional governments of communities that have whistle bans in place are considered to be small entities. For these small entities the impacts will vary. Some communities will have to comply with only minimal reporting requirements to retain whistle bans. Some communities that would be required to implement supplementary measures in order to retain whistle bans may elect not to do so and will be minimally impacted if at all.

For small governmental jurisdictions that elect to implement additional safety measures to retain or establish quiet zones, the impact will vary according to the measures they implement. One of the less expensive safety measures that a community may implement is photo enforcement at an estimated initial cost of $28,000 - $65,500 and an annual cost of $6,600 - 24,000 per crossing, depending on how many crossings share equipment. Communities may lower overall costs by installing boxes at all crossings and rotating cameras among up to 4 crossings. Communities that have implemented photo-enforcement indicate that most of the annual cost is directly offset by revenue generated by the collection of fines arising from violations. Other lower cost options for gated crossings are frangible delineators on mountable curbs or barrier curbs at estimated costs between $13,000 and $15,000 per crossing. Some lower cost options, such as one-way streets with gates and temporary and permanent closures are not viable alternatives for many crossings. Other quiet zone options can be more expensive. Such options include four-quadrant gate systems, programmed enforcement, and grade separation. Maintenance and upkeep for automated warning devices are the responsibility of the pertinent railroad, per *49 CFR part 234*.

One supplementary safety measure that could prove to be a very viable alternative to the governmental jurisdiction of a small community is "programmed enforcement" aimed at reducing the number of motorists violations at railroad crossings by changing behavior. Such activities may involve developing departmental policies on railroad safety, training law enforcement officers in enforcing safety regulations, monitoring crossings and issuing citations, as well as collecting data on program effectiveness. Information collected from municipalities with programs already in place indicates that revenues from such programs exceed costs.[10]
The impact of establishing supplementary safety measures could eventually be felt by governmental jurisdictions of communities where rail traffic increases due to railroad mergers or a commuter railroad start-up.

Small railroads will be affected under the provision establishing a maximum train horn sound level. They will have to test and potentially adjust their locomotive horns to comply with the maximum sound level of 110 dB(A). As such, they will incur costs for performing the horn volume test and making any needed adjustments to the horn. Since small railroads own fewer locomotives, they will need to perform much fewer tests than larger railroads, and will incur lower total costs associated with this requirement.

Under current regulations (49 CFR 234), railroads are required to maintain automated warning devices, such as gates and lights at grade crossings. To the extent that communities choose to install devices that have higher maintenance costs than existing devices, there will be increased

[10] This is based on information collected from several municipalities in Illinois and Los Angeles.

maintenance costs to the railroad. For example, maintenance costs for a standard system of 2 automatic gates and flashing lights device are considerably lower than for a four-quadrant gate arrangement with flashing lights.

When proposing new rules or changes in current regulations FRA is usually concerned with any potential impact on tourist railroads. These are passenger railroads that operate scenic, excursion and dinner train operations. Almost all of these are considered to be small entities. FRA is not aware of any whistle bans in place on lines that are operated on or owned by tourist operators. Most people find the sound of steam whistles on these operations to be more enjoyable and nostalgic, and therefore the noise from these operations if it were to exist is less likely to be seen as noise pollution. Nevertheless, these railroads may be affected by the standards for maximum sound levels for locomotive horns and will be affected by locomotive horn certification and testing requirements. FRA has provided for alternative testing requirements for locomotive horns that tourist railroads may find better suited for their operations.

FRA has crafted an exception from the requirement to sound the horn for any tourist railroad operating off the general system at speeds not to exceed 15 mph. This exception will allow tourist trains to run silent where state law allows.

Forty-nine CFR Part 229 covers locomotives "other than steam." FRA is not amending 49 CFR Part 230, the Steam Locomotive Inspection and Maintenance Standards, which does contain a requirement for an audible warning device meeting the 96 dB(A) standard. The only steam locomotives in service are historic locomotives used for tourist and excursion service. The great majority of these locomotives are owned and operated by small businesses or non-profit museums. If used on the general system or by a railroad that operates greater than 15 miles per hour, their audible warning devices will be required to be sounded at highway-rail crossings. Given the generally less frequent use of these locomotives, their historic characteristics, community acceptance of the steam whistle, and the cost that would be involved, FRA sees no reason to require that they be tested for compliance with maximum horn volume applicable to other locomotives.

For small businesses that are located along or near a rail line that currently have a whistle ban, the impacts will vary. As noted prior, FRA does not know how many such small businesses will be impacted. Obviously the concern and the impact will be the noise from the locomotive horns at crossings were locomotive horns are not currently sounded. FRA estimates that approximately 90 percent of the communities that currently have whistle bans will retain them either because they will not have to implement additional safety measures to do so or because they will implement the necessary measures. Thus, very few small businesses should be impacted.

Among these businesses the impact will vary. The impact will be minimal for small businesses, other than hotels, operating along rail lines where the whistle ban was only in effect during night-time hours. For small businesses located along or near a rail line that formerly operated a whistle ban during day-time hours the impact will vary according to the number of crossings with whistle bans in place and daily train traffic levels through those crossings, as well as the distance of the commercial property from the rail line and the extent to which structures are effectively sound insulated.

In summation, since FRA does not know exactly how each community will elect to proceed on the future of its existing whistle ban(s), it cannot estimate or determine the actual impact of this rule on small entities. Nevertheless, FRA is confident that a substantial number of small entities will not be significantly impacted by this rule. In any event, FRA has incorporated into this final rule a wide range of options intended to mitigate any impacts consistent with the statutory mandate to address safety at highway-rail crossings.

11.6 Alternative Treatment for Small Entities

Congress has ensured that all communities that might be adversely affected by this rule be provided adequate time to initiate changes. The law requires that this Final Rule not be effective for 365 days.

In addition, FRA is allowing whistle bans established before October 9, 1996 to continue for a period of five years from issuance of the rule, if the community files a detailed plan for establishing a quiet zone with the FRA Associate Administrator for Safety within three years. Some communities may have an additional three years beyond the five years if, in addition to filing of the detailed plan within three years, the State provides to the Associate Administrator: a comprehensive State-wide implementation plan and funding commitment for implementing improvements and within the first four years of the rule at least one improvement is initiated within the state. In effect, the final rule adds a minimum of 2 years and maximum of 5 years to the implementation schedule proposed in the NPRM. FRA expects that many small communities will take advantage of the extended implementation periods.

FRA has provided numerous alternatives for establishing quiet zones in Appendixes A, & B of the Final Rule. These alternatives vary in cost impact and expected effectiveness. In addition, Appendix C lists which scenarios do not require supplementary safety measures. Communities may also apply for permission to use systems that are not listed in the Appendixes. If such systems are found to be sufficient then they will be added to the appropriate appendix.

FRA has also incorporated alternative testing standards to allow small railroads with limited physical space to perform tests.

11.7 Outreach to Small Entities

After issuing its Nationwide Study of Train Whistle Bans in 1995, FRA went to great lengths to reach out to communities. FRA directly wrote to each community that was known to have a whistle ban in affect at the time and offered to visit the community and discuss the increased risk associated with whistle bans and provisions of the Swift Act. The agency's Regional Grade Crossing Managers followed-up with additional community meetings. During this same time period FRA also provided the same information to associations that represented cities and counties.

At the NPRM stage of this rulemaking, FRA provided outreach to potentially affected small entities in several ways. First, FRA specifically addressed its concern for the affected small entities in the NPRM. The preamble of the NPRM noted issues and areas on which the agency needed further input. Second, FRA notified Congressional representatives whose districts would potentially be impacted by the proposed rule. Third, FRA held 12 public hearings nationwide following publication of the NPRM. Many of these were held in or near locations where small entities that are governmental jurisdictions that have a population of less than 50,000.

FRA has been working with over a dozen communities to plan the necessary supplementary safety measures for the establishment of quiet zones. About half of these communities have populations less than 50,000 and are therefore considered small governmental jurisdictions.

FRA has answered hundreds of letters from citizens, community officials, and members of Congress on issues related to this rulemaking. In developing the Final Rule, the agency also considered close to 3,000 comments that were submitted to the docket for this rulemaking in response to the NPRM. Some of these comments addressed issues of concern to small entities. In response to comments, FRA added a considerable amount of flexibility to the rule and extended the implementation schedule by a minimum of two years and a maximum of five years.

FRA will once again notify Congressional representatives whose districts could potentially be impacted by this final rule when it is issued. The agency's eight Regional Grade Crossing Managers and eight Assistant Regional Grade Crossing Managers that worked with the potentially affected communities and railroads during this rulemaking will continue to do so through the implementation stage.

11.8 Conclusion

This is essentially a safety rule that minimizes the potential negative impacts of a Congressional mandate to blow train whistles and horns at highway-rail grade crossings. It contains provisions for exceptions for many small communities and it gives communities that are affected sufficient flexibility to limit the impact of the locomotive horns within their jurisdictions. However, this rule will be responsible for varying amounts of impact on some of the potentially affected small entities, no matter how the outcome for each whistle ban is determined. That is, if a community elects to simply follow the mandate and allow locomotive horns to sound at crossings where a whistle ban is now in place, there will be a noise impact to any potential small business that exists along that route. If a community elects to implement supplementary safety measures that are necessary to establish a quiet zone, then the local government jurisdiction will be impacted by the cost of such programs or systems. At a minimum, such communities will be burdened with administrative costs. It is important to note that the impacts discussed in this assessment are inherent in the requirements of the law, which allows recognition of supplementary safety measures provided by traffic control and law enforcement authorities of the affected communities.

APPENDIX A: EFFECTS OF SOUDING LOCOMOTIVE HORNS ON PROPERTY VALUES

Research shows that residential property markets are influenced by a variety of factors including structural features of the property, local fiscal conditions, and neighborhood characteristics. Hedonic housing price models treat a property as a bundle of characteristics, with each individual characteristic generating an influence on the price of the property. For example, additional structural characteristics such as bathrooms, bedrooms, interior or exterior square footage increase the value of residential properties. Likewise, neighborhood characteristics are expected to influence property prices. For example, homes that are in relatively close proximity to noxious activities such as hazardous waste sites, incinerators, etc. have been shown to have lower values, other things equal.

A carefully designed hedonic model can be used to implicitly value locational attributes that have no explicit market price. Deriving market signals of these prices is especially useful when attempting to address concerns of property owners, especially those related to phenomena that are highly localized and subjective. Instead of relying on what homeowners believe will be the influence of a change in a locational attribute such as the lifting of a whistle ban, this influence could be statistically measured. Past hedonic studies that derive actual measures of locational influences have generated a number of important insights.

- Proximity to local disamenities, such as crime and congestion, and proximity to noxious activity, such as incinerator activity, do lower property values.
- The property value influence of undesirable activities is highly localized and appears to decay relatively quickly with distance from the activities.
- Property impacts frequently decline over time, as highly sensitive homeowners relocate away from the activity, and are replaced by homeowners who are less concerned with the activity.

Hedonic housing price techniques can be used to analyze the effects of lifting train whistle bans. To apply such techniques, various factors related to the sounding of locomotive horns at crossings must be controlled. These include proximity of the home to the tracks, proximity to an intersection, frequency of train traffic, time of day in which whistles are blown, and dBA level of the whistle.

The effects of the sounding of locomotive horns on property values have been studied recently in response to the Federal Railroad Administration Use of Locomotive Horns at Highway-Rail Grade Crossings rulemaking. Initial results are available. Unfortunately these results are not conclusive. FRA is aware of two studies issued in 2000. David E. Clark performed one for the FRA and Schwieterman and Baden of the Chaddick Institute performed the other. According to Clark, the study performed for FRA was “just a first step in understanding how train whistles influence local property values.” Schwieterman and Baden of the Chaddick Institute emphasize that their “report is a preliminary assessment of a complex issue. Some of our findings are speculative in nature.” Those who have studied the issue agree that further study is needed to reach a better understanding of the true effects of locomotive horn sounding on property values.

David E. Clark, Associate Professor of Economics, Marquette University and Argonne National Laboratory, Decision and Information Sciences Division performed a study for FRA entitled *Ignoring Whistle Bans and Residential Property Values: An Hedonic Housing Price Analysis*. In 1991, Consolidated Rail Corporation (Conrail), one of the largest railroads in North America at the time[12], began ignoring whistle bans that had been enacted by local communities along its rail lines. Clark studied the effects of this action on property values in three counties (two in Ohio and one in Massachusetts) where Conrail began sounding locomotive horns. The counties were selected based on the presence of Conrail service, whistle bans ignored by Conrail, and availability of relevant real estate data. Train traffic levels in these communities were moderate to low during the period of study. Some lines carry less than ten trains per day. Middlesex County, Massachusetts was the only community with more than 50 daily trains. Because more precise information regarding train traffic for these communities for the period of study was not available, Clark did not consider train traffic levels in his study. Other characteristics influencing sale prices of residences were controlled for in the study.

Originally, the Clark study included only the two counties in Ohio. When FRA developed the Environmental Impact Statement and Regulatory Evaluation of the NPRM, preliminary results were available for Butler and Trumbull Counties in Ohio. The results were mixed and in some cases not statistically significant[13]. According to the author, "These findings provide only weak evidence of negative impacts on residential property markets resulting from the policy action taken by Conrail in October 1991." The study found that having an additional rail line within a quarter mile decreased property values in Butler County by 2.1 percent and in Trumbull County by 2.8 percent. Being within a half mile of a Conrail crossing (while locomotive horns were being sounded) decreased property values in Butler County by 6.2 percent and in Trumbull County by 17.4 percent. The decrease in property values in Trumbull County was temporary and disappeared completely in three to four years. Being within a half mile of a non-Conrail crossing with a whistle ban decreased property values in Butler County by 7.8 percent and in Trumbull County by 8.4 percent. In Butler County, there is weak evidence that property values were 4.5 percent higher at the outer edge of the audible noise range for locomotive horn sounding after Conrail began ignoring whistle bans.

Given the lack of precision and mixed nature of the initial results, Clark made recommendations for further study. Among other things, he recommended (1) studying a wider geographic area to remove any regional effects that may not have been accounted for and (2) getting more precise geocoding to eliminate some of the bias introduced by using the zip+4 centroid instead of precise

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[12] Most of Conrail's railroad assets have since been sold to Norfolk Southern Corporation and CSX Transportation.

[13] Statistical significance for purposes of this study is established at the generally accepted 95 percent confidence interval.

street addresses. On January 31, 2000, a final version of the study incorporated these two recommendations. The study included the Middlesex County, Massachusetts and used street level geocoding.

The final study used hedonic pricing techniques and a linear regression model to analyze data for more than 21,000 single-family residential home sales between 1987 and 1997 in the three communities and found:

- In Trumbull County, Ohio, the decision to ignore the whistle ban had no statistically significant influence on residential housing prices.

- In Middlesex County, Massachusetts, the decision to ignore the whistle ban had no statistically significant influence on residential housing prices. Note that there is a significant level of commuter rail traffic and stations very near crossings in Middlesex County. Property values near commuter rail stations are usually higher due to the added convenience for those who use the service. Since commuter rail service hours usually do not overlap with the core sleep hours, residents may not be as disturbed by the sounding of commuter locomotive horns. The commuter rail station effect may have counterbalanced the effect of the locomotive horn on property values near crossings or otherwise significantly affected the findings for Middlesex County.

- In Butler County, Ohio, the decision to ignore the whistle ban had a statistically significant influence on residential housing prices. Between 1/4 mile and ½ mile of Conrail crossings, there was a 6.7 percent reduction in sale prices immediately following the Conrail action. However, property values in this area increased annually by 2.4 percent[14], implying that the detrimental influence may have been eliminated less than three years later. On net, five years after the horns began to sound, the premium for a location an additional 100 feet from the crossing was approximately 0.4 percent (or a total of 9.7 percent difference between a location directly adjacent to the crossing and a distance of 2,320[15] feet from the crossing).

- The study concludes that there is little indication that the decision by Conrail to ignore whistle bans had any permanent and appreciable influence on the housing values in the three communities analyzed.

Clark offers two explanations for the lack of effect on property values. First, those buying property within the audible range of a highway-rail grade crossing likely consider the possibility that train whistles may be sounded at the crossing in the future. When Conrail began ignoring the whistle bans, their suspicions were confirmed. Second, the Conrail action generated dynamic changes in

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[14] This increase uses time trend variables to take into account general real estate trends in the area.

[15] The audible range for a locomotive horn sound is approximately 2,320 feet.

the composition of residents that served to mitigate the initial impact of the action. Residents most sensitive to the sounding of locomotive horns moved away and were replaced with those less sensitive to such sounding.

Clark also cautions that the findings of the study are not representative for communities with greater train activity or with different regional characteristics. Annoyance levels should increase with train activity. Furthermore, in moderate climates, residents are more likely to spend more time outdoors and be more affected by the sounding of horns. Clark's study also did not distinguish between day and nighttime train traffic levels which may greatly influence the degree of disturbance caused by locomotive horn sounding and therefore the effect on property values.

The Chaddick Institute study, *Alternatives to the Whistle: The Role of Public Education and Enforcement in Promoting Highway-Rail Grade Safety in Metropolitan Chicago*[16], evaluates the probable costs of the noise generated by locomotive horns at grade crossings in the Chicago area[17] from implementation of the rule as proposed in the NPRM. The study's "results show that the region would experience significant losses in property value from sounding of horns at grade crossings currently subject to whistle bans. If budget constraints prevent the creation of quiet zones in an appreciable number of communities, the losses would likely be in the range of $616 million to $1.0 billion." The study also concludes that "Even if property values do not fall, homeowners that are forced to move away may incur other real economic costs."

This study also estimates the effects of noise pollution on property values using a hedonic analysis. Schwieterman and Baden pick up on Clark's scenario of noise-sensitive people moving away from crossings and the need to sell their homes, possibly at a discount. It also examines six studies of highway and airport related noise pollution property damage which estimate property value losses per decibel. Applying the average property value loss per decibel to homes in the Chicago area between one-fourth and one-half mile from the crossings would mean that property values would decline by $8,100 to $13,200 (per residence); those within one-fourth mile would decline by $11,500 to $17,500 (per residence).

For the reasons discussed below, it is not likely that the overall costs associated with sounding locomotive horns at crossings in the Chicago area where they do not currently sound will be as high as the Chaddick Institute study concludes.

Dataset for Chicago has changed: The Chaddick Institute study was based on information regarding at-grade crossings in Chicago that was available at that time. Unfortunately, the data for the City of Chicago crossings available to Schwieterman and Baden was not current. The Chaddick Institute based its analysis on a dataset prepared by the Chicago Area Transportation Study, which in turn was based in large part on the DOT Grade Crossing Inventory. The mean age

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[16] Joseph P. Schwieterman, PH.D. and Brett Baden, Chaddick Institute For Metropolitan Development, De Paul University, Working Paper 09-00, September 25, 2000.

[17] The Chicago area encompasses Cook, Du Page, Kane, Lake, Mc Henry, and Will counties.

of the inventory in January 2000 was 11 years and the median 13 years. According to the data used, train horns were not being sounded at 780 grade crossings in the Chicago area. The DOT inventory did not reflect entire line segment abandonments or other at-grade crossing eliminations in the City of Chicago. Since then, FRA has identified over 100 whistle ban grade crossing abandonments, closings, or changes to over- or under-passes in the City of Chicago. Since many of the crossings that were included in the Chaddick Institute study are not active at-grade crossings now, fewer residents in the City of Chicago may be potentially affected by the sounding of locomotive horns than was estimated in the study.

Credit for implementation of safety measures made prior to rule: The final rule allows certain formal or informal whistle bans that were in place as of October 9, 1996 to continue without any changes. Pre-Rule Quiet Zones that have severity weighed risk indexes that fall below a national threshold (established by taking the national average risk index for gated crossings without whistle bans) may continue for as long as their risk indexes remain within the permissible range. Pre-Rule Quiet Zones that had no collisions potentially preventable by sounding the locomotive horn in the previous five years and have average risk indexes below twice the national threshold may also continue for as long as they meet these criteria. Since such exemptions were not contained in the NPRM, their impacts were not considered in the Chaddick Institute's study. Many communities in the Chicago area will be able to take advantage of these exemptions. In total, approximately 285 crossings are expected to be included in Chicago area quiet zones that would not require additional safety measures under the final rule. Fewer crossings and residents should be affected by this rulemaking than the Chaddick Institute study estimates.

Costs of Photo Enforcement: The Chaddick Institute's study estimates that many communities will not be able to afford implementation of photo-enforcement at crossings. The Chaddick Institute estimates that photo-enforcement systems cost an average of $200,000 to $300,000 per crossing. However, these cost estimates are based on the assumption that crossings will not share cameras. Both the NPRM and the final rule permit up to four crossings to share cameras. FRA estimates that sharing equipment can cut per crossings costs by approximately two thirds. According to the Chaddick Institute study, costs could drop to $80,000 per crossing if cameras and other hardware are shared. The authors also indicate that a reasonable target for the Chicago area would be to implement photo-enforcement at 25 or more crossings over the next three years. Eventually, if communities find that photo-enforcement is paying for itself, they may certainly choose to increase the active camera to crossing ratio so they can issue more violations and earn higher revenues to offset costs.

Sharing cameras certainly makes photo-enforcement a more viable option. Considering the reduced costs associated with such sharing, it is likely that more crossings will be equipped with photo-enforcement equipment than the Chaddick Institute estimated. This should further reduce the number of affected residents affected by locomotive horns and losses associated with decreasing property values due to locomotive horns sounding.

Use of Median Strips: The Chaddick Institute also bases its cost estimates on the proposed requirements that median strips used as SSMs to be a minimum of 60 feet in length. However both the NPRM and the final rule also permit localities to file for alternative standards. FRA will consider shorter lengths for those crossings where it would be impractical to have 60-foot long medians. Therefore, it is likely that more communities will add medians to retain quiet zones than the Chaddick Institute assumed and fewer residents will be affected by the sound of horns.

Additional Time for Implementation: The final rule allows more time for implementation of safety measures than was proposed in the NPRM. The NPRM had a 3-year implementation period, the final rule allows communities with existing whistle bans up to 8 years for implementation. More time for implementation will give communities more time to evaluate SSMs and ASMs and secure the funding needed to implement the safety measures required to retain whistle bans. This will probably result in fewer communities actually opting to have locomotive horns sounded at crossings where they have been silent for years.

Funding Available for Certain Upgrades: Certain communities may not be able to afford the safety improvements required to retain whistle bans. State and Federal program funds are available to assist these communities under certain circumstances. The Transportation Equity Act for the 21st Century (TEA-21) provides funding flexibility that may be used to some extent to pay for some or all of the costs for communities that cannot afford the entire cost.

While Congress provided no specific authorization of funds for the creation of quiet zones, highway safety infrastructure improvements are eligible for a variety of Federal Highway Administration administered Surface Transportation Program (STP) and National Highway System (NHS) funds. Eligible projects may qualify for funds under Sections 130 and152 of the STP, as well as the Optional Safety Category of funds associated with those programs. Determinations about which projects could receive funds are usually made by State Departments of Transportation or Public Utility Commissions, which must base decisions about the same on an objective analysis of the relative safety risks associated with each public highway-rail crossing in accordance with 23 CFR Part 924. Therefore, the use of Section 130 funds for the purpose of creating quiet zones would be appropriate only if the safety gains associated with the improvements would justify the project's priority ranking compared to other competing highway-rail crossing improvement projects.

STP funding beyond the 10 percent safety set-aside may also be employed at the discretion of the state without regard to the priority ranking system required for the safety set-aside programs. The same would be true of National Highway System (NHS) funds for those crossings which remain on the NHS. Elimination of at-grade crossings on the NHS is specifically enumerated as a specific goal under the 1994 U.S. DOT Action Plan for Rail-Highway Grade Crossing Safety. Use of Federal-aid funds for these projects would be based on need, and the availability of funds as determined by individual states. While infrastructure safety improvements for Supplemental

Safety Measures will generally be eligible for federal funding, states have the ultimate authority to determine whether such funds will be made available.

The availability of other funding sources for certain upgrades may allow more communities to retain their whistle bans than estimated by the Chaddick Institute. Again, fewer residents should be affected than the Chaddick Institute estimated.

Transferability of Airport and Highway Hedonic Property Value Studies' Results to Grade Crossings: The types of noise experienced by residents near highways and airports can be different from that experienced by residents near highway-rail grade crossings. Highways and airports where noise is an issue have higher daily volumes of motor vehicle and aircraft traffic than grade crossings with whistle bans. The noise produced by locomotive horns at crossings is also generally more intermittent than that produced at airports and highways.

The effect of highways and airports on nearby property values can also be very different than that of highway-rail at-grade crossings on nearby property values. For instance, airports are a source of employment for residents in the community. Although airport employees may not desire to reside in properties immediately adjacent to airports, they probably want to reside relatively close by. Few highway users desire to reside in properties immediately adjacent to highways, however many probably want to reside close enough to have easy access to highways. Such situations may greatly influence the magnitude of difference between property values of residences immediately adjacent to highways and airports compared to property values of residences that are still very close to highways and airports yet not adjacent. Since there generally is no incentive to residing near highway-rail at-grade crossings (unless there happens to be a commuter rail station nearby) the difference in property values between residences immediately adjacent to grade crossings and those a little further away is probably not as great.

Studies of airport and highway noise compare property values of residences adjacent to source of noise to property values of residences that are near but not adjacent to the source of noise. To isolate the effect of the noise itself, the effect of the incentive for residing nearby, versus adjacent to, should be removed from the studies of airport and highway noise. Given the differences in (1) types of noise produced by highway vehicles and aircraft versus locomotive horns and (2) effects of highways and airports on nearby property values versus effects of grade crossings on property values, FRA believes that results from hedonic studies of airport and highway noises on property values are not directly transferable to locomotive horn noise effects on property values.

APPENDIX B: APPROVED SAFETY MEASURES

Supplementary Safety Measures

Temporary Closure of a Public Highway-Rail Grade Crossing

This option requires closing the crossing to highway and pedestrian traffic during whistle ban periods.

Costs: The Chicago Area Transportation Study (CATS) estimates that it costs approximately $2,000 plus routine maintenance to temporarily close a crossing. Temporary closures usually require actual activation and deactivation of the closure mechanism in person. Unless the closure is seasonal or for a prolonged period of time, an authorized person must normally be available on a routine basis to open and close the crossing. Law enforcement officers or other authorized city personnel would have to incorporate this activity, which could occur up to four times daily to accommodate rush hour traffic, into their daily routine. Communities seeking other than seasonal whistle bans will probably elect to implement other SSMs.

Effectiveness: According to comments received from the Northwest Municipal Conference (NWMC), temporary closures may add to safety risk at other crossings as they divert highway traffic to nearby crossings that may not be as well protected. The NPRM assumed that 60 of 1978 grade crossings would be closed for some part of the day. The effectiveness rate associated with this SSM is 1.0. However, traffic must be distributed among adjacent crossings or grade separations for the purpose of estimating risk following the imposition of a whistle ban. Communities that will be closing crossings at the outer-bounds of quiet zones should consider any potential increases in risk to motorists who are diverted to crossings with higher risk levels that are not part of the quiet zone.

Permanent Closure of a Public Highway-Rail Grade Crossing

This option requires closing the crossing to highway and pedestrian traffic permanently. Communities that will be closing crossings at the outer-bounds of quiet zones should consider any potential increases in risk to motorists who are diverted to crossings with higher risk levels whether they are not part of the quiet zone or not.

Costs: CATS estimates that it costs approximately $5,000 to permanently close a grade crossing. Railroads usually provide some funding voluntarily to assist in the permanent closing crossings. Realistically, however, FRA does not expect very many communities to close crossings solely in response to this rule. When deciding whether to permanently close crossings, communities consider various other factors which carry more weight (e.g. the rerouting of highway vehicle traffic).

Effectiveness: The effectiveness rate associated with this SSM is 1.0.

Four-Quadrant Gate System

Typical crossing gate systems today have two gates on a two-way street. One gate is located on each side of the track(s), blocking traffic in the right lane(s) approaching the crossing. The opposing lanes are typically not blocked, which sometimes tempts motorists to drive onto the opposing lane and proceed around the gate and through the crossing. In a four-quadrant gate system, a sufficient number of gates are installed to fully block highway traffic from entering the crossing when the gates are lowered (median barrier optional) including at least one gate for each direction of traffic on each approach. When the gates are fully lowered, the gap between the ends of the gates must be less than two feet if there is no median between the lanes. If there is a median or channelization devices are installed, the gap between the gate and the median or channelization device must be within one foot. Four-quadrant gate systems will likely be installed at crossings with high levels of traffic.

Costs: Information available to FRA indicates that it costs an average of about $280,000 to install a four-quadrant gate system including constant warning time circuitry at a passively marked crossing and an average of approximately $100,000 to install 2 additional gates at a crossing already equipped with two-quadrant gates. Although some communities will elect to upgrade two-quadrant crossings to four-quadrant crossings, it is not likely that communities will install four-quadrant gate systems at crossings that do not already have gates.

For all gate installations, FRA is requiring constant warning time (CWT) devices to activate the gates to ensure that activation occurs at the same amount of time prior to the arrival of a train irrespective of speed. This should avoid long unnecessary waits at crossings that have very slow moving trains and discourage motorists from attempting to drive around gates to beat trains. FRA estimates that the additional cost for CWT devices is approximately $20,000 when gates are initially being installed and $40,000 when added to a flashing lights system that does not already accommodate the circuitry.

FRA is not requiring vehicle detection systems that are intended to keep exit gates up while vehicles remain in the crossing. Some communities where crossings and intersections are located in close proximity to one another may install these where necessary to prevent highway vehicles from becoming trapped in crossings as a result of long queues. Communities in the Chicago area would probably have to include vehicle detection systems as part of some of the four-quadrant gate systems. According to information regarding recent installations in the Chicago and St. Louis areas, it costs about $28,000 to install a standard six-loop configuration vehicle detection system at a crossing consisting of four highway lanes and two tracks.

Under current regulations (49 CFR 234), railroads are required to maintain automated warning devices, such as gates and lights at grade crossings. To the extent that, in response to this rule, communities install devices that have higher maintenance costs than existing devices, there will be increased maintenance costs to the railroad. The additional cost for maintaining a four-quadrant gate system over a two-quadrant gate system is $2,500 per annum.

Effectiveness: The effectiveness of four-quadrant gates will vary depending on whether or not vehicle presence detection systems and medians are also installed. Vehicle presence detection systems which keep exit gates up longer may encourage motorists to follow violators through crossings using the oncoming traffic=s exit gate opening in a steady stream, defeating the intended warning. Some four-quadrant gate systems must include vehicle presence detection systems, especially in metropolitan areas where traffic signals may be in close proximity of grade crossings. Medians increase the efficiency of four-quadrant gates because they discourage the violation minded driver. Since vehicle presence detectors add expense and reduce the effectiveness of four-quadrant gate systems, they will likely only be installed to the extent the risk of having motor vehicles inadvertently caught in the middle of crossings is a concern.

Gates with Non-Mountable Medians or Mountable Medians with Channelization Devices

Opposing traffic lanes on both highway approaches to the crossing must be separated by either: (1) medians bounded by non-mountable curbs designed to discourage a motor vehicle from leaving the roadway (curb is 6 to 9 inches high), or (2) medians bounded by mountable curbs designed to permit a motor vehicle to leave a roadway when required (curb is 4 to 6 inches with a rounded top) if equipped with channelization devices (at least 2.5 feet high and no more than 7 feet apart). Such medians must extend at least 100 feet from the gate, unless there is an intersection within that distance. If so, the median or channelization devices must extend at least 60 feet from the gate. The gap between the lowered gate and the median or channelization devices must be one foot or less. As in other installations, “break-away” or frangible channelization devices must be monitored frequently, and broken elements replaced.

Costs: The regulatory evaluation of the NPRM presented an estimated installation cost of $11,070 for mountable medians with frangible delineators 100 feet on either side. CATS presented a cost of $15,000 in its comments to the NPRM. Ten crossings in the North Carolina Sealed Corridor were treated with traffic channelization devices between 1997 and 2000 at an average cost of $10,000 per crossing. To reflect more current levels of cost associated with such installations, this analysis uses an average cost per installation of $13,000.

Annual maintenance costs are approximately $500 for mountable medians with frangible delineators.

DuPage County, Illinois submitted a preliminary cost estimate of $15,000 for the installation of a two-foot concrete median on each approach to a crossing.

CATS also presented a $120,000 cost of installing a two-foot wide mountable permanent concrete barrier. Installation of such a barrier would require expansion of the roadway and relocation of ravel lanes. Because installation of either detachable or permanent median barriers would suffice to meet the reduction in risk at affected crossings, communities will likely install the less expensive medians with channelization devices.

Feasibility: Although installation of gates with mountable median curbs and frangible delineators is the lowest cost SSM, installation will not be feasible at every crossing that requires an upgrade since they must extend for at least 60 feet on each approach. The Southern California Regional Rail Authority (Metrolink) operates over 399 at-grade crossings and 253 of these have median barriers in place. However, according Metrolink comments, design constraints at 92 crossings prohibit median installations.

One commenter indicated that snowplowing makes implementation of lower cost medians with frangible delineators in certain parts of the country infeasible because snowplows would destroy the delineators. FRA consulted with communities that use delineators to separate traffic flows and experience heavy snow. Such communities indicate that snowplow operators are trained to properly plow around delineators and have been doing so successfully for several years.

Effectiveness: This alternative safety measure is the most cost-effective for affected crossings where there are no intersections within 60 feet. At a crossing in North Carolina, 60-foot long channelization devices reduced violations by 77 percent during a 22-month period. FRA estimates that mountable curbs with channelization devices have an effectiveness rate of 0.75 (adjusted for novelty effect) and non-mountable curbs have an effectiveness rate of 0.80. In Spokane County, Washington, the Washington State Public Utilities Commission and the FRA worked together to test the effectiveness of non-mountable medians as a substitute for the use of locomotive horns. Results of this testing support the effectiveness rates cited in the NPRM.

<u>One Way Street With Gate(s)</u>

Gate(s) must be installed so that all approaching highway lanes to the public are completely blocked. There are two ways to accomplish this. Two gates can be used or one gate of extended length. If one gate is used, the arm must extend to within one foot of the far edge of the pavement and the edge of the road opposite the gate mechanism must have a barrier curb extending to and around the nearest intersection for at least 100 feet. If two gates are used, the gap between the gates when they are down must not exceed two feet. If the highway approach is equipped with a median, the lowered gates should reach to within one foot of the median. FRA is also requiring that newly installed gates systems be equipped with constant warning time systems.

Costs: In the case of pairing one-way streets that already have two-quadrant gates, the implementation cost is only for the relocation for one gate per crossing so that both gates are on the approaching side of the crossing. No additional gates should be required. FRA estimates it will cost approximately $35,000 to relocate one gate system. No incremental maintenance costs should be incurred as the number of gates at the crossing will not change.

Feasibility: At existing two-lane one-way streets, a long-arm gate could be installed or two gates could be used. In many areas it would be impractical to install long-arm gates because the additional length of the gate can greatly reduce the arms tolerance to strong winds. The additional weight of the longer arm can also present a challenge for standard motors used in normal arm length gate systems.

Although it is possible that communities will pair multi-lane one-way streets, it is not very likely that they will do so solely in response to this rule. Commenters from the Chicago area indicate that one way street designations in downtown areas have contributed to the failure of local business districts and are therefore do not make good business sense. One-way streets may limit access to businesses and therefore reduce sale volumes. Therefore this may be an uncommon alternative that is applied mainly in rural or largely residential and industrial areas.

Effectiveness: FRA does not have sufficient information regarding the effectiveness rate for one-way streets with gates. FRA conservatively estimates it will be about 0.82.

Alternate Safety Measures

<u>Photo-Enforcement</u>

Photo-enforcement systems involve the use of high-resolution cameras to photograph motorists who disobey traffic signals and provide one or more photographs of the vehicle, its license plate, and the driver's face as the basis for issuing a citation. Superimposed onto each photograph are the date, time and location of the violation, as well as the speed of the violating vehicle and the number of seconds of elapsed time since the red flashing lights were activated. FRA is requiring that state law authorize use of photographic evidence both to bring charges against a vehicle owner and sustain the burden of proof that a traffic law violation has occurred.

FRA is further requiring that (1) equipment be actually operating at each location at least 25% of each calendar quarter, (2) baseline violation rates are determined, and (3) violations be monitored for the next two calendar quarters, every other quarter until the crossing has five years of collision history with locomotive horns not sounding, and every fourth quarter thereafter.

Costs: The FRA, FHWA, and FTA funded an evaluation of the effectiveness of photo enforcement at the Southern California Regional Rail Authority (Metrolink) Pasadena Blue Line crossings. Initial costs were as follows:

High-resolution camera:	$50,000
Bulletproof cabinet and 12-foot pole:	4,500
Installation of pole, cabinet, and inductive roadway loops:	11,000
Total	$65,500

Annual costs for film processing (view film and issue tickets) were $24,000. In 1998, a digital video ticketing system was placed in service at a crossing in Salisbury, North Carolina at a cost of $55,000.

According to comments received from Du Page County, based on review of the Wood Dale, Illinois and future Naperville, Illinois demonstration projects and input from other entities, installation of one set of video detection equipment at one crossing can cost $100,000 and $7,500 annually to operate. For application to multiple crossings in a community individual crossing costs would decrease to 25% for installation due to equipment sharing and operating costs to $3,000 for each additional crossing.

For purposes of analysis, FRA is using an estimated initial cost of $65,500 for single crossing photo-enforcement programs and annual costs of $24,000. Communities may offset these costs by revenue generated from citation collection.

Since FRA is requiring that equipment be actually operating at each location for only 25 % of each calendar quarter, communities will probably rotate cameras between two to four crossings leaving dummy boxes in place at crossings without live equipment. Motorists will not know when they are actually being filmed, and very high levels of compliance may be achieved at significantly reduced cost. Assuming a ratio of one camera per every two crossings. Costs are distributed as follows:

Initial Costs	
High-resolution camera (1)	$50,000
Bulletproof cabinet and 12 foot pole (2 sets)	9,000
Installation of pole, cabinet, and inductive roadway loops (2)	22,000
Total for 2 crossings	$81,000
Total per crossing	$40,500

Similarly, for 3 and 4 crossings sharing equipment, the initial cost per crossing is about $32,167 and $28,000 respectively.

Annual Costs		
Film processing (view film and issue tickets)		$24,000
Rotate camera		800
Total for 2 crossings	$24,800	
Total per crossing	$12,400	

Similarly, for three and four crossings sharing equipment, annual costs per crossing are about $8,533 and $6,600, respectively.

The cabinet, pole, and inductive roadway loop maintenance is included in the annual maintenance costs.

Effectiveness: Before photo-enforcement, Naperville, Illinois documented over 340 motorist violations (going around the lowered gates five seconds after the lights started flashing) in 30 days. One year after photo-enforcement began, violations fell to 30 per month.

The Metrolink blue line photo-enforcement program was applied to an urban light rail environment and was combined with a public education and programmed enforcement effort. Two crossings were equipped with cameras. The first was at Van Nuys Boulevard, a busy arterial with 22,000 average daily motor vehicle trips, 28 daily weekday trains, and 8 daily weekend trains. The other was Goodwin Street, a residential street with 4,600 average daily motor vehicle trips, 76 daily weekday trains, and 18 weekend trains. The residential nature of this location lead Metrolink to believe the novelty effect would occur and violation rates would drop over time. Violation rates at Goodwin Street were low, so after 6 months, their cameras were moved to Chestnut Avenue, a feeder/collector street in Santa Ana with 7,000 average daily motor vehicles, 72 daily weekday trains and 22 weekend trains.

Violations were recorded at seven seconds after initiation of the warning devices at crossings. Two pictures are taken 1.1 seconds apart to determine that the vehicle was moving and calculate its speed. The cameras were rotated at Goodwin Street and Chestnut Avenue every three days from eastbound to westbound. The Metropolitan Transit Authority has a violation to conviction rate of 41 percent. Many times photos are not sufficiently clear and some vehicles do not have front license plates. During the project none of the cameras malfunctioned and relocation of the camera took only a few minutes. After the first month benchmark period, there was significant media coverage of the project.

At Van Nuys Boulevard, the number of average monthly trains increased from 596 to 660 between the benchmark period and the last month of the study period. Average monthly motor vehicle traffic declined from 670,000 to 624,000. The number of monthly violations also increased from 23 to 43. Violations per 100 trains increased from 4.4 to 6.0. At Goodwin Street eastbound the level of train traffic remained constant at 1,810 trains per month, average motor vehicle traffic decreased from 82,595 to 56,776, and violations increased from 6 in the benchmark month to 10 in the last month of the study. Violations per 100 trains increased from 0.33 to 0.55. At Goodwin Street westbound, the average number of monthly motor vehicles increased from 33,254 to 49,735. Train traffic levels remained constant. Violations increased from 4 monthly to 13 in the last month. Violations per 100 trains increased from 0.22 to 0.72 At Chestnut Avenue eastbound, the motor vehicle and train traffic levels remained constant while monthly violations decreased from 21 to 20. At Chestnut Avenue westbound, train traffic levels were unchanged and motor vehicle counts fell from 332,081 to 122,658. The number of monthly violations decreased from 29 in the first month to 14 in the last probably due to the reduction in motor vehicle traffic.

During the initial benchmark period (one month), the sites averaged 0.5 daily violations. At the end of the enforcement period, the sites averaged 0.46 daily violations. Violations decreased by 8 percent. According to Metrolink, 96.5% of the violations occurred before twelve seconds it takes a gate to come down completely. Metrolink concluded that most motorists are racing against gates and not trains. When comparing their results to those of other communities' experiences with photo-enforcement, Metrolink also concludes that the distance of 40 miles between the two locations where photo-enforcement was tested probably led to the lower effectiveness rates. If the crossings had been closer together they probably would have been more effective because motorists would have been more likely to expect photo-enforcement activity at crossings in the vicinity and altered their driving behavior at crossings.

The Los Angeles photo-enforcement demonstration project showed that a carefully administered and well-publicized program of photo-enforcement reduced violation rates by 92 percent and collisions by 72 percent. Thus, the ratio of 72:92 or 0.7826 is the rate to be used to adjust reduced violation rates to estimate reductions in collisions for law enforcement and education/awareness options. Unfortunately, education and legal sanctions may lack effectiveness for several highway users. Therefore, at crossings with law enforcement and education/awareness options, violations must be reduced at least 49 percent (0.4852) in order to realize a 38 percent reduction in the risk of a collision.

Feasibility: Large-scale adoption of photo enforcement in Illinois, however, will require substantial outside funding as well as approval of the Illinois General Assembly. FRA believes that given the success experienced by photo-enforcement testing in Illinois shows that such systems can be implemented successfully. Therefore the General Assembly will probably soon approve the use of such systems. According to comments from the Chicago area, "Wood Dale has refined its photo enforcement system to account for complications associated with relying on evidence obtained from remote systems. As a result, Wood Dale's judicial success rate now reportedly exceeds 80 percent - a rate rivaling (and perhaps exceeding) the success of communities throughout the state who rely solely on conventional methods of enforcement." Furthermore, "The experience of Wood Dale testifies to the enormous potential of using video surveillance to abet enforcement. The city expects to issue more than 800 citations this year a number that will likely result in as many judgments against motorists as its single crossing than in the rest of the state combined." Wood Dale has been able to produce acceptable photographs of both the driver and the license plates, and to match vehicular information with other necessary data, to issue citations to about 40 percent of motorists who commit serious violations.

<u>Public Education and Awareness</u>

Public education and awareness programs are directed at motorists, pedestrians, and residents near the crossing to emphasize the risks associated with grade crossings and applicable requirements of state and local traffic laws at those crossings.

Educational programs may be and are often combined with enforcement programs. Police departments usually precede enforcement activities with educational efforts to increase awareness of railroad crossing dangers, to inform the public of the laws against violating railroad safety devices and of the departments' intention to enforce railroad crossing laws. Some activities to make people conscious of railroad safety are distributing informational pamphlets at crossings, display booths, posting the penalty for ignoring railroad crossing safety devices, and coordinating with local media to publicize the program. As part of the awareness campaign, officers or other trained personnel (such as Operation Lifesaver volunteers) may present safety information at public places, such as malls, schools or libraries.

FRA believes that to implement a fully effective education and awareness program, a community would have to spend approximately $5,000 annually in materials. Labor associated with disseminating information is usually voluntary, but not always.

Effectiveness: As discussed in the section presenting costs associated with photo-enforcement, crossings with law enforcement and education/awareness options, violations must be reduced at least 49 percent (0.4852) in order to realize a 38 percent reduction in the risk of a collision.

DuPage County, Illinois comments indicate that the minimum violation rate reduction of 49% requirement for approval of enforcement and public awareness options is unfair to areas that have already implemented such efforts. A violation fine of $500, or 50 hours of community service for violating a railroad grade-crossing device was passed by Illinois in 1997. Their effectiveness is already being experienced. FRA believes that the effectiveness of such programs will be reflected in their actual past five-year relevant collision record. Well implemented programs should result in effectiveness levels that result in Quiet Zone Risk Indexes that are permissible under this rule without the addition of SSMs.

<u>Programmed Enforcement</u>

Programmed enforcement includes community and law enforcement programs with systematic and measurable crossing monitoring and traffic law enforcement activities aimed at reducing the number of motorists violating railroad crossing devices by changing their behavior. Enforcement activities may involve developing departmental policies on railroad safety, training officers in enforcing safety regulations, monitoring crossings and issuing citations, as well as collecting data on program effectiveness. Programmed enforcement may be implemented in conjunction with public education and awareness programs.

Costs: In 1997, FRA collected information from several municipalities on the costs of law enforcement programs and the revenues generated by such programs. FRA has updated those costs as follows:

Monitoring Costs

Number of Hours the Crossing was Monitored, Per Year:

1) Los Angeles	2080 or Full-Time
2) Berwyn, Brookfield, Elmurst, LaGrange, Riverside, Western Springs - all in Illinois.	104 or 5% of Full-Time

The number of hours provided by the Elmhurst, IL Police Department is also used as an estimate for the other listed Illinois communities. The monitoring effort in Los Angeles was full-time.

Number of Officers Assigned to Monitor Crossings:

1) Los Angeles	10
2) Berwyn, Brookfield, Elmurst, LaGrange, Riverside, Western Springs - all in Illinois.	11

Elmhurst data is used as an estimate for the other Illinois communities. Los Angeles data is from the MTA report cited above.

Annual Monitoring Cost @ $80,000 average annual burdened salary per officer

1) Los Angeles	$800,000
2) Berwyn, Brookfield, Elmurst, LaGrange, Riverside, Western Springs - all in Illinois	$ 4,000

Number of Grade Crossings

1) Los Angeles	28
2) Berwyn, IL	8
3) Brookfield, IL	3
4) Elmhurst, IL	16
5) LaGrange, IL	12
6) Riverside, IL	9
7) Western Springs, IL	4
Total:	80

Annual Monitoring Cost per Crossing

1) Los Angeles	$28,571
2) Berwyn, IL	$ 500
3) Brookfield, IL	$ 1,333
4) Elmhurst, IL	$ 250
5) LaGrange, IL	$ 333
6) Riverside, IL	$ 444
7) Western Springs, IL	$ 1,000
Average annual monitoring costs per crossing:	$ 4,633

Training Costs

Operation Lifesaver Training

1) Tuition	$	0
2) Materials	$	40
3) Average Length of Course, in Hours		14
4) Opportunity Cost of Course, in Terms of Officers's Salary @ $38.46 per Hour	$	538
5) Total Financial and Opportunity Cost per Officer	$	578

Information from Operation Lifesaver, except officer salary information which is calculated from "I" above. Operation Lifesaver training courses are flexible and adaptable to local conditions. The data above are an average for a course recommended for training officers to enforce violators of railroad crossing safety devices and educate people on railroad safety issues.

Departmental/Municipal Training

1) Estimated Number of Hours		4
2) Opportunity Cost @ $38.46 per Hour per Officer	$	154

A consideration of the time needed to review and discuss the railroad grade crossing enforcement policy of the department with officers.

Annual Training Cost per Crossing

1) Number of Operation Lifesaver Trained Officers in the 6 Illinois Communities	11
2) Total Departmental/Municipal Training Costs @ $154 per Officer	$ 1,694
3) Total Operation Lifesaver Training Costs @ $578 per Officer	$ 6,358
4) Total Training Costs	$ 8,052
5) Number of Grade Crossings in the 6 Illinois Communities	52
6) Average Training Cost per Crossing	$ 155

Based on the Illinois communities of Berwyn, Brookfield, Elmurst, LaGrange, Riverside, and Western Springs.

The average cost per crossing per year is $4,633.

Revenues: Violations will likely decrease somewhat over time as drivers become more aware of crossing laws, however FRA does not expect violations to decrease rapidly or cease to exist.[11] Revenue is dependent on the fine structure as well, Illinois has implemented a $500 fine for crossing violations. Each municipality that provided information to FRA has greater revenues than the cost of the program.

Ticket Revenues From Grade Crossing Violations

Number of Tickets Issued Annually

1) Los Angeles	15,736
2) Berwyn, IL	24
3) Brookfield, IL	7
4) Elmhurst, IL	83
5) LaGrange, IL	72
6) Riverside, IL	73
7) Western Springs, IL	42

Los Angeles tickets calculated from data in the MTA report, p. 3, and rounded to the nearest integer. Number of tickets for all Illinois communities except Elmhurst is from the West Central Municipal Conference (WCMC). Elmhurst, IL data is from the Elmhurst Police Department.

Annual Ticket Revenue @ $104 Fine collected per Ticket for Los Angeles and $200 Fine collected per Ticket for Illinois Communities

1) Los Angeles	$1,636,498
2) Berwyn, IL	$ 4,800
3) Brookfield, IL	$ 1,400
4) Elmhurst, IL	$ 16,600
5) LaGrange, IL	$ 14,400
6) Riverside, IL	$ 14,600
7) Western Springs, IL	$ 8,400

[11] A program that generates the feeling that crossing violations are socially unacceptable, similar to drunk driving campaigns, would be more likely to have a dramatic effect.

Annual Ticket Revenue per Crossing

1) Los Angeles	$	58,446
2) Berwyn, IL	$	600
3) Brookfield, IL	$	467
4) Elmhurst, IL	$	1,038
5) LaGrange, IL	$	1,200
6) Riverside, IL	$	1,622
7) Western Springs, IL	$	2,100

Average annual revenue per crossing is $9,353.

Effectiveness: See previous section addressing effectiveness of Public Education and Awareness.

Determination of Baseline Violation Rate and Semi-Annual Verification –

Photo-enforcement, programmed enforcement, and public education and awareness require establishment of baseline violation rates (number of violations/train movements). The baseline monitoring period must be a minimum of 4 weeks if conducted without public notice or media coverage and 16 weeks if conducted with public notice or media coverage. Once a baseline has been established, photo-enforcement may begin and violation rates must be monitored for the next 6 months. While the quiet zone has less than five years of collision history with locomotive horns not sounding, semi-annual analysis verifying the last quarters violation rates remain at or below the levels established prior to initiation of the program must be performed. Thereafter, analysis will required every fourth quarter. If the violation rate is ever greater than 49 percent below the baseline rate, procedures for dealing with unacceptable effectiveness rates must be followed. For purposes of this analysis, FRA is assuming that it will cost communities approximately $7,000 to establish a baseline, $3,000 annually to monitor violation rates until there is five years of collision history for the crossing, and $1,500 annually subsequently. If the level of effort is maintained, the effectiveness should be as well. FRA's monitoring via annual comparisons of the individual risk indexes to the NSRT should detect any significant decreases in the effectiveness of the programs.

Site Specific Costs

Actual site-specific costs may vary significantly from those presented in this document. Labor rates vary greatly within the various locations affected by this rulemaking. Crossing specific characteristics will also influence the actual cost of implementing safety measures.

Wayside Horns

FRA is allowing the use of wayside horns, which are placed at crossings and directed at oncoming motorists. Wayside horns are activated by the same track circuits used to detect the train's approach for purposes of other automated warning devices at the crossing. Use of wayside horns in lieu of train-mounted horns reduces net community noise impacts. Although wayside horns do not provide motorists with information about the proximity, speed, and direction of approaching trains, demonstrations have thus far indicated that they may be as effective as train horns. This interim final rule permits their use as a one-for-one substitution at individual crossings either within or outside of quiet zones.

Effectiveness: Upon satisfactory results from a human factors study on automatic wayside horns, FRA will issue a finding of its effectiveness rate.

APPENDIX C: MODELING INCIDENTS AT "WHISTLE-BAN" CROSSINGS

Introduction

The Federal Railroad Administration has developed models to forecast incidents at grade crossings to support the analysis of this rule.

Purpose

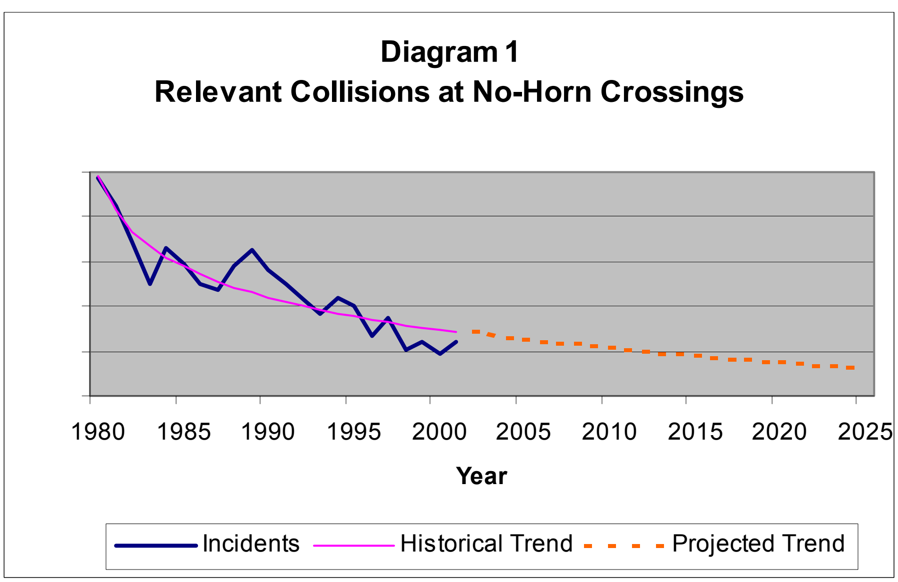
The purpose of the models is to support the economic analysis of the interim final rule. To assess the benefit of the rule, the economic analysis needs to forecast how incidents at grade crossings will behave in the future without the rule. The grade crossings of interest are those where train horns are not sounded (no-horn crossings).

Key Assumptions

1. There is an underlying process of safety improvement at grade crossings and that this process will continue in the future even in the absence of a train horn rule.
2. This process can be adequately characterized by linear regression.
3. Crossings where the train horn is currently sounded will be unaffected by the rule with one exception. The exception is for crossings nominated to become no-horn crossings. These will be affected by the rule.

Approach

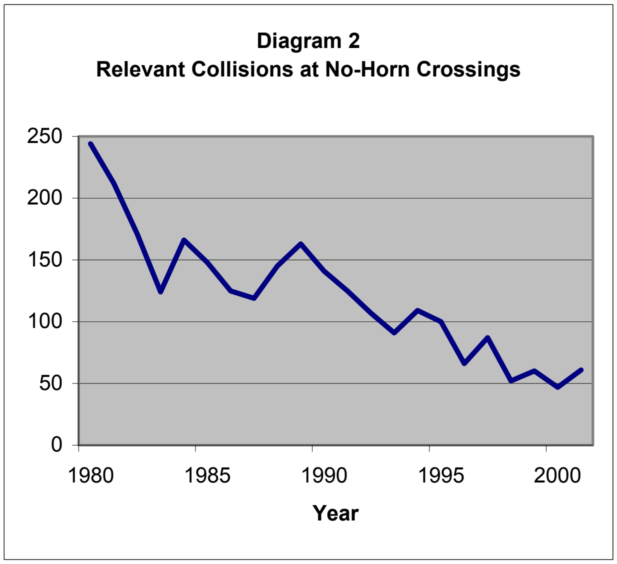
Diagram 1 is a notional illustration of how crossings affected by the rule would behave under the above assumptions, if the rule is not adopted. Note the historic trend simply continues. The analysis will present a model projecting the trend for no-horn crossings, based on historical incidents.



Model for No-Horn Crossings

Table 1: Incidents at No-Horn Crossings	
Year	**Incidents**
1980	244
1981	212
1982	171
1983	124
1984	166
1985	148
1986	125
1987	119
1988	145
1989	163
1990	141
1991	125
1992	107
1993	91
1994	109
1995	100
1996	66
1997	87
1998	52
1999	60
2000	47
2001	61

Table 1 presents the incident counts for 1,979 no-horn crossings. Note the declining trend in incidents. The analysis assumes an underlying process of safety improvements and this decline will continue even in the absence of a train horn rule. Linear regression is used to model this trend. Diagram 2 presents a graph of this data. It is clear from this graph, the trend is non-linear and the yearly declines are occurring in smaller and smaller increments.



Using only years as an explanatory variable, the following model was fit to the data:

Incidents = 246 - 56.7 * ln(Year-1979)

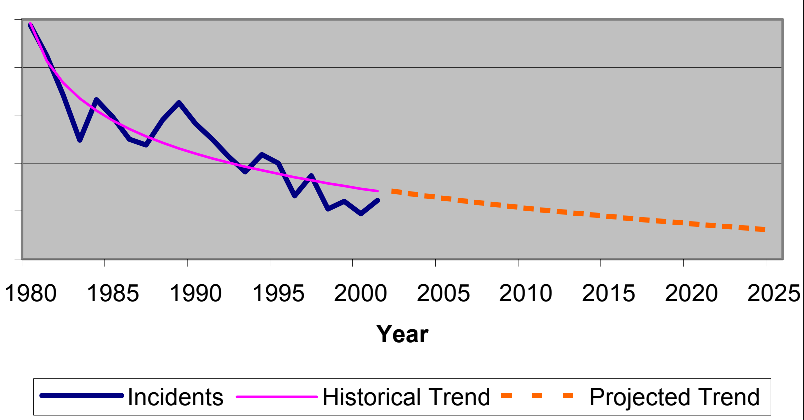
Key statistics: F – 98.82; R^2 - .832; CV – 17.8%. These are good results given only one variable was used in the regression to account for the variability in the data.

This analysis assumes the trend represented by the model will continue until 2025 even in the absence of a train horn rule. Table 2 shows estimates produced by the model and Diagram 3 shows a graph.

Table 2: Estimated Incidents at No-Horn Crossings

Year	Actual Incidents	Estimated Incidents	Annual % Change for Estimated Incidents	Year	Estimated Incidents	Annual % Change for Estimated Incidents
1980	244	246		2002	68	-3.5%
1981	212	207	-16.0%	2003	66	-3.5%
1982	171	184	-11.1%	2004	63	-3.5%
1983	124	167	-8.9%	2005	61	-3.5%
1984	166	155	-7.6%	2006	59	-3.5%
1985	148	144	-6.7%	2007	57	-3.5%
1986	125	136	-6.1%	2008	55	-3.5%
1987	119	128	-5.6%	2009	53	-3.5%
1988	145	121	-5.2%	2010	51	-3.5%
1989	163	115	-4.9%	2011	49	-3.5%
1990	141	110	-4.7%	2012	48	-3.5%
1991	125	105	-4.5%	2013	46	-3.5%
1992	107	101	-4.3%	2014	44	-3.6%
1993	91	96	-4.2%	2015	43	-3.6%
1994	109	92	-4.1%	2016	41	-3.6%
1995	100	89	-4.0%	2017	40	-3.7%
1996	66	85	-3.9%	2018	38	-3.7%
1997	87	82	-3.8%	2019	37	-3.8%
1998	52	79	-3.7%	2020	35	-3.8%
1999	60	76	-3.7%	2021	34	-3.9%
2000	47	73	-3.6%	2022	33	-3.9%
2001	61	71	-3.6%	2023	31	-4.0%
				2024	30	-4.1%
				2025	29	-4.1%

Diagram 3
Relevant Collisions at No-Horn Crossings
Estimate: 246 - 56.7 * ln(Year-1979)



APPENDIX D Supplemental Analysis for Maximum Sound Level Provision

Introduction

The locomotive horn rule has several provisions. One distinct provision is the mandating of a maximum volume for the train horn. This section separately evaluates the impacts from the maximum volume level section of the locomotive train horn rule ("Rule")[1].

Regulatory Approach: Maximum Sound Level for the Audible Warning Device

Analysis performed by the John A. Volpe National Transportation Systems Center ("Volpe") indicated that a volume of 108 dB(A) should typically be sufficient to warn motorists at passively signed highway-rail crossings. The selected sound level provides for a 95% likelihood of detection of the train horn, assuming average train and motor vehicle speeds. FRA is setting a maximum train horn sound level of 110 dB(A), to allow for error in the measuring instrument, and differences in field conditions between the test location and the location where FRA might verify the sound level. To measure the train horn's sound level, the Rule specifies a Class 2 (same as a Type 2) sound level meter (SLM). The time allotted for testing the existing set of locomotives is five years, and new locomotives should comply upon manufacture. FRA is also modifying the procedure used to measure the train horn volume. [2]

<u>Volpe's Horn Model</u>

The maximum horn level designated in the Rule was selected with the assistance of a train horn model developed by Volpe. The model determines the optimal horn volume under the constraints of providing a high probability of detection of the horn , and minimizing noise impacts to the community. As the sound level provision is based on Volpe's model, a brief description of the model follows.[3]
The underlying theory behind the horn model is Signal Detection Theory (SDT). Described in terms of SDT, sounding the train horn provides a signal to the driver, above and beyond the general level of ambient noise. A horn outputting a higher level of sound energy translates into a stronger signal, versus a horn providing a lower level of sound energy. A stronger signal is more distinguishable from ambient background noises, and is more likely to be recognized by the motorist in comparison to a weaker signal.

The horn model incorporates several factors that affect the motorists' capability to hear the train horn. The model draws upon empirical research that measured the strength of the horn signal. It also uses prior research that determined the signal loss caused by the insulating effects of the automobile (known as insertion loss), and that estimated the internal ambient noise in the

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[1] *Guidelines to Standardize Measures of Costs and Benefits and the Format of Accounting Statements*, Office of Management and Budget (OMB), March 2000 p. 4. OMB guidelines recommend describing the costs and benefits of distinct provisions separately.

[2] Refer to the Interim Final Rule, *Use of Locomotive Horns at Highway-Rail Grade Crossings*, FRA, for a formal description of the maximum train horn volume regulation and the testing procedure.

[3] Refer to the report, *Determination of a Sound Level for Railroad Horn Regulatory Compliance*, by the John A. Volpe Transportation Systems Center, September 2002, for detailed discussion of the horn model and SDT.

vehicle. This data helps determine the likelihood that a horn sounding will be heard by the driver inside the vehicle. An adjustment is also made to account for the angle between the locomotive and the motor vehicle.

Testing Procedure

The provision establishing the train horn sound limit also changes the procedure used to test horns for compliance. To verify that horns are in compliance, train horns on existing and new locomotives will have to be tested. As many of the costs of the sound limit result from the required testing procedure, the relevant parts of the procedure are described below. (Refer to the Rule for more detailed information about the testing procedure).

The testing procedure specifies particular test conditions. The locomotive horn should be measured for compliance from a distance 100 feet away in front of the locomotive. To overcome the shadow effect, the testing microphone should be mounted fifteen feet high, rather than the previously required height of four feet. It is assumed that a remote testing microphone will be placed upon a tripod or other fixture, with a cable connecting the microphone on the tripod to the SLM. For sound level readings, the train horn is sounded for 20 seconds, and the SLM is used to take a reading every second. The energy average of these 20, one-second readings is calculated or read directly from an integrating-averaging SLM.[4] This procedure, or sounding event, is repeated six times. Each sounding event should be adjusted according to the instrument's calibration error. The arithmetic average for these six sounding events is then calculated to determine compliance with the train horn sound level limits.

Other specified conditions concern the test site and environmental conditions during the test. The test site needs to be free of large reflective surfaces, including buildings, adjacent rail cars, and hills, for a distance of 400 feet in front, and 200 feet to the sides, of the locomotive. Note that the clear area extends beyond the testing microphone. No objects or testing personnel should be in the sound path between the locomotive and the microphone. As weather conditions can affect sound level measurements, the temperature should range between 36 to 95 degrees Fahrenheit (2 to 35 degrees Celsius), relative humidity should be between 20% to 95%, and windspeed should be less than 12 mph.

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[4]The formula for calculating the energy average of the 20, one-second readings is:

$$L_{Aeq,\,20s} = 10 \log_{10} \left[\left(\sum_{i=1}^{20} 10^{L_{Aeqi}/10} \right) / 20 \right]$$

The testing system used to measure the train horn volume consists of a Class 2 SLM, the fifteen foot high tripod or other fixture to mount the testing microphone, a cord from the microphone to the SLM, a microphone windscreen to block unwanted sound, and an acoustic calibrator for field calibrations of the SLM. As the microphone will be high above eye level, and connected via cable to the SLM which can be read on the ground, a SLM that can accept a remote microphone is needed. Per most manufacturers' recommendations, it is expected that the SLM will be calibrated by the manufacturer or other equivalent facility every year.

FRA is requiring that several elements of the sound test be recorded to show compliance with the sound level provision of the Rule. An existing regulation, 49 CFR 210.31 requires the recording of the test location, type of test, test date, and decibel sound level reading for any locomotive noise emissions tests. These items and other information the railroad may deem necessary to satisfactorily demonstrate compliance should be noted.

<u>New Locomotives</u>
For new locomotives, the manufacturer can test the horn volume and make adjustments in the manufacturing process to comply with the train horn volume limits. It should be easier to test and adjust horns when the locomotives are made than when the locomotives are in service. Both locomotive and horn manufacturers already have most of the equipment necessary for testing the locomotive horns. They may need, however, the fifteen feet high mount for the remote microphone, and the cable to connect the microphone to the SLM. Manufacturers can reduce their burden by testing one type of locomotive-train horn combination, and applying the results to all locomotive-train horn combinations of a similar kind.

<u>Existing Locomotives</u>
It is assumed that the least-cost method of testing existing locomotive horns would be to test them at the time of the locomotives' regularly scheduled, periodic inspections. Performing the sound level test when the locomotive is due for servicing would minimize disruption to railroad operations. It also seems reasonable that a locomotive will pass through an inspection facility specifically selected by the railroad for this purpose (e.g., because the location has a suitable "free field" testing area) at least once in the five year period allocated for testing existing locomotives.

Alternatives

<u>Baseline</u>
The baseline for the maximum sound level provision is the no-action alternative. The baseline represents the continuation of the status quo, with no mandated maximum sound level for the train horn. The required minimum sound level would continue. The measurement distance, which results in lower decibel readings than actual because of the shadow effect, would still exist. The pressures that lead to a conflict between community tranquility and grade crossing safety in some communities (discussed in the "Need" section) will also continue. Under the baseline, it is assumed that future conditions will mimic these past conditions.

Even under baseline conditions, changes will occur in the railroad operating environment. The use of electronically controlled train horns may increase. These horns, in which the engineer has less discretion over sounding the horn, will likely sound at higher volumes than traditional horns. Future regulations will also change the operating environment. FRA's upcoming rule on locomotive cab working conditions (noise) will establish new standards for sound levels inside the cab. The refined standards will reinforce the predominant position for the horn in the center of the locomotive (behind the cab). This position reduces the horn's sound intrusion into the cab.

The no-action approach will provide benefits associated with sounding the horn at current sound levels, and possibly louder sound levels that may occur in the future. Louder horns provide increased warning to the motorist, more easily overcoming the ambient noise and insertion loss of the motor vehicle. A more effective warning would potentially decrease the number of grade crossing collisions and increase public safety.

Placing no limit on the horn volume also incurs some disadvantages. To some residents, train horn soundings become an annoyance. A Volpe report states that annoyance can result from disturbance of conversations, sleep, and general peace and quiet caused by the unwanted sound of the train horn. These same effects were described by some commenters to the NPRM. When train horn noise interrupts conversation, the conversation participants compensate by increasing their own speech volume, increasing stress on the speaker and listener. Noise may also interfere with other audible activities as well, such as listening to music. Sleep disruption is of concern because it may lead to fatigue. In general, noise raises the stress level of those subject to the noise. Although some residents may become accustomed to the noise over time and those especially sensitive will move to avoid the noise, annoyance remains as a cost of noise. It should be noted that much of the research on noise impacts relates to aircraft noise, which is different in nature than rail noise.[5]

<u>Directionality Requirement</u>

In the NPRM, FRA had proposed that the volume of the horn to the side of the locomotive should not exceed the volume in front of the locomotive. FRA had proposed this requirement to limit the community's exposure to the noise caused by the horn. FRA received comments that this mandate would involve moving the horns. Most horns are currently center-mounted on the locomotive, behind the cab. In this location, other rooftop equipment such as fans deflect the sound to the side of the locomotive. Testing done by Volpe showed that moving the horn forward would reduce the sound levels to the side of the locomotive. FRA has also learned of recent research by Transport Canada indicating that forward, cab-mounted horns provide a stronger warning signal than center-mounted horns. Moving the horn, however, would also cause two negative effects. First, it would mean relocating some of the equipment that provides air pressure to the horn, costing about $1,250. The horn would also compete for space with other equipment on the roof over the cab crew. Second, locations closer to the cab would increase the sound level inside the locomotive cab. Horns had been moved back of the cab to reduce the intrusion of the horn into the cab, moving them forward would partly defeat this purpose. Although the crew compartments of new locomotives are better insulated against noise, moving the horn forward would still incrementally increase the sound pressure in the cab. Furthermore, the previous FRA testing procedure may have made it appear that the sound to the side of the

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[5] *General Health Effects of Transportation Noise*, John A. Volpe Transportation Systems Center, June 2002.

locomotive was louder than in front. This testing procedure showed a lower volume on testing equipment because of the shadow effect. Accounting for the shadow effect, the sound level to the side may not in fact be greater than the sound in front of the locomotive. The new specified testing height of fifteen feet will prevent the shadow effect from influencing the sound level measurement. In response to these considerations, FRA is no longer including the directionality requirement in the interim final rule, however, further study may be needed in light of the Canadian research.

Shrouding

One way to reduce the sound of the train horn is to construct a physical barrier, or shroud around the train horn. A shroud could also help to channel the sound to the front of the locomotive, reducing the sound exposure of residents adjacent to the tracks. A shroud would essentially consist of a metal piece secured to the locomotive.

Shrouds are generally not used in the industry and thus there is little empirical data upon which to base regulatory guidance. The BNSF railroad tried a baffling system. They found that the welding used to attach the baffles weakened in field use and the baffles broke off of the locomotive.[6] Separately, a shroud may result in more noise inside the locomotive cab. When the train horn is sounded, the shroud may also vibrate. If the shroud is mounted directly to the locomotive, the vibration of the shroud may lead to vibrations being transmitted to the locomotive cab as noise. Unless the shroud is mounted to isolate potential vibrations (as the horn is), a shroud may trade reduced horn sound to residents for more noise to locomotive employees. Also, due to the nature of sound waves, low-pitched sound waves are more difficult to block than high-frequency sound waves. The amplitude of the low-frequency sound waves produced from the horn is about two feet high. To effectively block these low-frequency sound waves, the shroud material would have to be quite large, adding weight and cost. Using a large shroud, however, may potentially become a site for debris to collect. In addition, commenters at the locomotive horn technical conference noted that there is limited clearance available on top of the locomotive, limiting the height of a shroud or baffle to only one foot. The cost for installing a shroud is estimated at between $1,000 and $1,400[7], a mount to isolate the shroud would increase this cost.

Sampling

FRA is requiring that all locomotive horns be tested for compliance with the maximum train horn volume provision. A less stringent alternative would test only a portion of all existing

[6] *Technical Conference on Locomotive Train Horns*, transcript of meeting held at FRA, May 2000, p. 141-143, (docket number FRA-1999-6439-2240).

[7] Association of American Railroads (AAR) letter to FRA, subject: Cost Survey, dated July 27, 2001.

locomotive horns. Such an option could potentially decrease costs but also reduce benefits, because among the horns not tested, there may be some that exceed the maximum volume limit.

Testing a sample of train horns may have logistical problems and not provide the overall level of desired noise reduction. Horns vary by manufacturer, age, condition, mounting location, sound frequency, type of locomotive, available air pressure, and other factors. A representative sample of a diverse population of horns could be difficult and costly to obtain. Fewer locomotive horns would need testing, but there will exist costs to develop a sampling plan and draw the sample. A sampling approach also provides a less egalitarian distribution of benefits. It will not provide for all horns to comply. Testing a sample will subject some communities to higher levels of train horn noise than others, because the horns that affect some communities will remain unchecked. Thus, some communities will receive less relief than others without any objective basis for the differential treatment. Moreover, if a community feels that the train horn noise is excessive at its crossings, the community may petition the FRA and elected representatives to test the train horns for compliance. If a community realizes that it was not part of the original sample, and it feels that the noise from horns is excessive, it is in the community's self-interest to request testing of the locomotives that pass through the community. In such a scenario, the number of additional tests performed as a result of such requests may counter the reduced initial costs of testing a sample. As a result of implementation concerns and to ensure that as many people as possible benefit, FRA is proposing testing a census rather than a sample of existing train horns. FRA is allocating an extended period of time, five years, to provide increased flexibility in complying with the maximum sound level limit.

A consequence of testing either a sample of horns or all horns is that some horns will sound outside the mandated volume range. These horns will need adjustments to comply. Adjustments may involve changing the air pressure or perhaps the metering orifice that controls the flow of air to the horn. These modifications will require additional time beyond the actual horn volume test to complete. Adjustments to the horn should be easier to perform if the locomotives are tested at their regular inspection times, as anticipated.

<u>Variable Amplitude Horn</u>

In the NPRM, one option that was discussed to reduce the amount of train horn noise was a horn that could sound at a range of volumes. Volpe guidance had suggested a horn volume of 111 db(A) for passively protected crossings and 104 dB(A) for actively protected crossings[8]. The rationale was that the warning provided by the train horn was even more critical at crossings with only passive warning systems, where a motorist may not expect a train, versus crossings with active warning devices. A stronger signal would give the motorist approaching a passively protected crossing more time to slow down and stop. FRA's concern with this alternative is the increased responsibility placed on the engineer to sound the horn at the proper volume. Using a variable horn may especially prove confusing at locations where crossings are close together, yet have different warning devices. Indeed, in this situation, the sound energy of a louder horn may carry over to nearby crossings, diminishing the benefits of sounding at a lower decibel level at those (actively protected) crossings. The existence of quiet zones or speed restrictions on the track may also complicate matters for the engineer. If the engineer is overburdened, it may cause a tendency to sound the horn at the higher volume consistently because it is easier to

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[8]Passive warning devices are signs such as crossbucks and stop signs. Examples of active warning device types are gates, flashing lights, and wig wags.

do so. As these concerns continue, and there is sparse empirical data regarding the use of variable horns, FRA is not pursuing this alternative at this time.[9] (According to ballpark estimates from the AAR, a variable amplitude horn would cost between $1,000 and $3,800.)

Front/Rear Selectable Horn

Another alternative to limit the amount of train horn noise in the community is to use a front/rear selectable horn. A single cluster of horns, with some chimes facing front and some facing rear could be used, or two separate horns could be installed (AAR prefers two horns). In this proposal, if the locomotive is traveling forward, only the forward facing horn or chimes would sound, and vice versa if the locomotive is moving in reverse. The direction of the reverser or other switch would determine whether the front or rear horn sounds. As with the proposal for the variable amplitude horn, the responsibility to correctly sound the horn lies with the engineer, and FRA has similar concerns about overburdening the engineer, especially in an emergency situation. Installing two horns may also require some work on the air supply system, such as adding another air hose, or a switch directing air pressure to the horn to be sounded. Further work may be needed to mount a second horn, as the horn would compete for space with antennas, air conditioning system, and other roof top equipment. AAR estimates for new installations range from $3,100 to $3,300, and for equipping existing locomotives vary from $1,200 to $2,300.

Benefit-Cost Analysis: Maximum Sound Level

Costs of Regulatory Approach

The costs of setting a maximum train horn sound limit reflect the amount of incremental resources required to satisfy the regulatory requirements. Without the regulation, these resources could of course provide benefits in other uses.

The majority of costs associated with this provision are labor costs caused by the requirement to test all existing locomotive horns. FRA is also modifying the test procedure previously specified for the minimum sound level requirement in order to eliminate the shadow effect. The new testing procedure will raise incremental costs. To determine labor costs, the analysis first estimates labor rates for a test and then multiplies these by the number of horns that require testing. To more accurately estimate costs, the analysis accounts for three different parties to conduct the locomotive horn testing. A railroad may perform the tests by, (1) using its own employees and equipment, (2) using its employees but renting equipment, or (3) contracting out the job (i.e. renting both employees and equipment). The prices of these methods differ. Depending on the testing costs faced by each railroad, and other factors such as convenience, one

[9]FRA is aware of a Canadian study in progress in which a lower volume is used for routine sounding of the horn and a higher volume for emergencies. Similar concerns apply to this option, the onus is placed on the engineer to sound the horn properly. In an emergency situation, when both the train and the motor vehicle may be traveling at high speed, the engineer may not have enough time to react and sound the horn at full volume.

method may be preferred over another. The cost estimate is also sensitive to the fact that larger railroads may partake of each method differently than smaller railroads, because of the greater number of tests required of larger railroads, and estimates costs by railroad class.

Some locomotive horns will exceed the decibel limit. These non-compliant horns will require adjustment and retesting, incurring additional costs. Horns may require retesting for other reasons as well. Routine maintenance and replacement of the horn (with an in-kind model) should not ordinarily trigger a horn test, but if the maintenance could cause a difference in the sound level, such as a change in the air supply system, the horn should be retested. Finally, scheduled major maintenance, like a rebuild, will require retesting of the train horn.

The number of horn sound level tests performed as a result of this rule will increase significantly from the amount of tests previously conducted. It is probable that more sound level meters will be purchased for assistance in carrying out this testing within the five-year period. Consequently, costs are estimated for additional meters and their yearly calibration. For those railroads who might test their horns by renting meters, rather than buying them, costs are assigned as well. Costs are also allocated for new equipment needed to take measurements at a height of fifteen feet, as opposed to the earlier testing height of four feet. This additional equipment consists of a tripod or other fixture to mount the remote microphone, and a cable to connect the remote microphone to the sound level meter. Together with labor costs, these incremental equipment costs describe the consequences of the maximum train horn volume provision.

<u>Labor Rates</u>

The actual sound level test is relatively simple. The Volpe Center estimates that a test would take ten minutes to set-up, ten minutes to calibrate the SLM, five minutes to take measurements, and ten minutes to break down the equipment, for a total of 35 minutes (0.58 hours). Moreover, time is allocated for one person to record results, make adjustments, and other various tasks for an additional 25 minutes. One to two people should be sufficient to conduct the test. The costs for two people are allocated for a conservative estimate. The testing team may consist of a noise specialist, such as an industrial hygienist, and an assistant. The assistant would be needed for the actual test, but not necessarily to write-up results. Thus, less time is allocated for the assistant.

The most cost-effective time to test the locomotive horn should be during the locomotives' regular inspection/maintenance cycle. It is assumed that a locomotive's periodic inspection is carefully scheduled to minimize the time that the locomotive is out of service. It follows that horn tests also will be carefully scheduled for locomotives brought in for service or inspection. The areas around inspection facilities or surrounding test track should also provide convenient test sites. FRA realizes, however, that occasionally field conditions may cause delays. A test may not go as planned because the locomotive may not be at the test site when scheduled, equipment failures, or other unforeseen conditions. For cost estimating purposes, this scenario is defined as a "field situation". When the test proceeds as scheduled, the test is termed a "scheduled situation". The total labor rate is estimated as a weighted average of the field and scheduled situations, with the field situation assumed to occur 15% of the time.

It is expected that railroads conduct horn tests in three possible ways. For railroads that perform the test using their own employees and sound testing equipment ("In-House"), if the field situation occurs, it is assumed that employees will be reassigned to other tasks while waiting. One-half hour, however, is added to the test time to allow for lost time due to receiving instructions, traveling to another site, storing equipment, and the like. Costs for the In-House testing option are:[10]

Labor Rate for Conducting Sound Level Test In-House

	Person 1			Person 2			
Situation	Wage Rate	Hours	Total 1	Wage Rate	Hours	Total 2	Total
Scheduled	$34	1	$34	$30	0.58	$18	$52
Field	$34	1.5	$51	$30	1.08	$33	$84
Weighted Average Cost (Scheduled 85% and Field 15%)							$56.45

Smaller railroads that have fewer locomotive horns to test and who perform less noise emission testing in general may not own sound level equipment. Another available option for conducting horn tests is to rent SLM's. Because this option may be used by employees less familiar and proficient with sound level equipment, more time is allocated for the test (an additional one-half hour) to provide increased flexibility.

Labor Rate for Conducting Sound Level Test Using Rental Equipment

	Person 1			Person 2			
Situation	Wage Rate	Hours	Total 1	Wage Rate	Hours	Total 2	Total
Scheduled	$34	1.5	$51	$30	0.58	$18	$69
Field	$34	2	$68	$30	1.08	$33	$101
Weighted Average Cost (Scheduled 85% and Field 15%)							$73.52

Railroads may also employ contractors to perform the tests. This option may be used extensively by railroads with small numbers of locomotives, for whom simply contracting out the horn testing job may be easier than training employees and purchasing (or even renting) equipment. Larger railroads may use contractors as a convenient option too. It is assumed that the contractor would meet the locomotive at the test site, as it comes in for its regularly scheduled inspection. In the case of a delay (the field situation), contractors may be kept waiting. Under the In-House and Rental SLM test methods, it was stated that railroad employees would likely be reassigned to other tasks in case of a field situation. The railroad may not be able to reassign a contractor. Thus, instead of an additional one-half hour, one hour is allocated for delays in testing. If the delay is excessive, it seems reasonable that the railroad will communicate and coordinate with the contractor to reduce the time he or she is kept idle, in order to minimize the costs of the contractor. As in the rates for testing by the other two methods, the field situation is estimated to happen only 15% of the time. Railroads carefully schedule

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[10]See Exhibit 1 for compensation table. Person 1 is costed at the "Professional and administrative" burdened rate, while Person 2 (assistant) is costed at the "Maintenance of way and stores" rate.

servicing of their locomotives to minimize the out-of-service time of their revenue-earning capital equipment, and minimize testing personnel costs.

Labor Rate for Conducting Sound Level Test Using Contractors

	One or Two Persons (Contractor's Choice)		
Situation	Wage Rate	Hours	Total
Scheduled	$100	1	$100
Field	$100	2	$200
Weighted Average Cost (Scheduled 85% and Field 15%)			$115.00

In summary the labor rates are:

Summary of Labor Rates for Conducting a Horn Sound Level Test

Testing Method	Weighted Average Cost (Labor)
In-House	$56.45
Rental SLM	$73.52
Contractor	$115.00

Who-Does-What

An assumption is made as to the degree the different classes of railroads use the three available methods to test horns (In-House, Rental, and Contractor). To better model actual operating conditions, it is reasoned that differing sizes of railroads will use the methods selectively based on their needs, in order to comply with the volume regulation. These percentages are descriptively termed "Who-Does-What" assumptions.

To help establish these percentages, the approximate indifference points between the three methods are estimated. In this case, indifference points are the number of tests that provide equal satisfaction for the railroad. Note that any one testing method provides the same service for the railroad as any other, that is, each method is just as good as the other in testing the train horn volume. The primary factor that differentiates one method from another is its relative cost, other factors that may affect the railroad's choice of testing method are collectively termed "convenience". For example, in-house personnel may not be available to perform the test, time may be required to learn the equipment, or planning for the test may be costly. In these circumstances, a railroad may choose the Rental or Contractor method instead of testing In-House. Given the railroad's limited resources, a cheaper method will be preferred to a more expensive one; a more convenient method will be preferred over a less convenient one.

As cost determines selection of a testing method, the total costs for the testing types are calculated. The labor rates presented provide a portion of the total prices. The cost of required materials is also needed. While equipment costs are presented later, they are included here in simpler terms for estimation purposes. Railroads are already mandated to perform noise testing, therefore costs are allocated only for the purchase of incremental SLM's, to meet the regulatory burden of testing existing locomotives in five years. Each SLM and related equipment is estimated to cost $2,118. To maintain these SLM's, they must be calibrated yearly. The Net Present Value (NPV) of calibration costs for five years, at $249 per year and discounted at 7%, equals $1,021. The SLM and calibration costs combined are $3,139. For Class I railroads, it is assumed two additional meters will be purchased, for a parts cost per railroad of (2 x $3,139) = $6,278. For Class II and III's, with an average of 4.17 locomotives per railroad, only 1 SLM is assigned.[11] Total labor costs are determined by multiplying the labor cost per test by the number of total locomotives, representing the total number of tests the railroad has to perform. Using the In-House method as a baseline, the following costs face Class 1, II, and III railroads:

Total In-House Costs for Estimating Who-Does-What Assumptions

Railroad	Number of Locomotives	Total Labor Costs (@ $56.45 per test)	Equipment Costs	Total Costs
Union Pacific (UP)	6854	$386,908	$6,278	$393,186
Burlington Northern and Santa Fe (BNSF)	4862	$274,460	$6,278	$280,738
Norfolk Southern (NS)	3455	$195,035	$6,278	$201,313
CSX Transportation (CSX)	3360	$189,672	$6,278	$195,950
Kansas City Southern (KC)	482	$27,209	$6,278	$33,487
Soo Line (Soo)	327	$18,459	$6,278	$24,737
Illinois Central (IC)	296	$16,709	$6,278	$22,987
Grand Trunk Western (GTW)	109	$6,153	$6,278	$12,431
Average Class II and III	4	$233	$3,139	$3,372

Using UP as an example, note that its total costs are $393,186. These costs represent the cost for performing all of its 6,854 tests In-House. To compare this way of testing to the Rental method, one needs to determine the number of Rental tests that can be conducted for the same cost. The cost per Rental test is $73.52 for labor and $60.00 for equipment (the rental fee per day), for a total price of $133.52 per test. At this price, ($393,186 ÷ $133.52) = 2,945 Rental tests could be

[11] Class II and II railroads combined total 2500 locomotives. Previous FRA estimates for the number of Class II and III railroads are 647, while AAR provides a figure of 552 for regional and local railroads (*Railroad Facts: 2001 Edition*, p. 3). The analysis uses an average of (647 + 552) ÷ 2 = 600 railroads. The average locomotives per railroad are therefore (2500 ÷ 600) = 4.17 locomotives.

performed for a cost equivalent to the In-House cost; 2,945 is the indifference point between the Rental and In-House methods. As the railroad can perform many more tests for the same cost with the In-House option, it would prefer this method versus the Rental option. For UP, for any number of tests over 2,945, it is cost-efficient to do the tests In-House. A similar analysis could be conducted for the Contractor option, using the Contractor price of $115.00 per test. Recognizing that the Contractor price does not significantly differ from the Rental price, one can expect similar results. The railroad will tend to use the In-House method. Even if the parts cost was doubled, (for example if the railroad purchased more SLMs) the railroad would prefer to use thee In-House method, because the parts cost is a small component of the total cost. The indifference points for all the Class 1 Railroads and the average Class II and II railroad are presented below:

Indifference Points for In-House versus Rental

Railroad	Number of Locomotives	Rental Indifference Point: No. of Tests	Difference: No. of Loco's and Rental	Likely Method Based on Cost
Union Pacific (UP)	6854	2945	3909	In-House
Burlington Northern and Santa Fe (BNSF)	4862	2103	2759	In-House
Norfolk Southern (NS)	3455	1508	1947	In-House
CSX Transportation (CSX)	3360	1468	1892	In-House
Kansas City Southern (KC)	482	251	231	In-House
Soo Line (Soo)	327	185	142	In-House
Illinois Central (IC)	296	172	124	In-House
Grand Trunk Western (GTW)	109	93	16	In-House/Rental
Average Class II and III	4	25	-21	Rental

Sorting the table in descending order highlights the association between the number of locomotives and the margin by which In-House is favored over Rental (the Difference column). As the number of locomotives decreases, the margin becomes smaller. The cost of the SLM's is being spread over fewer tests, raising the incremental cost of each test. Note that for the GTW Railroad, the likely method is denoted as In-House or Rental. Given that the costs provided are estimates, there may be enough variance in the estimates to make Rental the preferred testing method for GTW.

To establish the Who-Does-What assumptions, the analysis considers the indifference points above, and convenience factors. The indifference points indicate that most Class I railroads will tend toward using the In-House method, while Class II and II's will use another method. Only a very small percentage of Class I's, about one-half of one percent[12], possibly will use an alternative method. Through informal conversations with a FRA noise specialist, however, FRA has knowledge that a Class I railroad does use the Contract option. FRA does not know the extent of horn testing that is contracted, only that it does occur. For this railroad and others, convenience must also affect their decision of testing method. To account for Class I railroads

[12] Out of 19745 locomotives, 109, or (109 ÷ 19745) = .0055 may use the Rental method.

using other methods, a nominal amount of 5% each is assigned for the Rental and Contract types of testing. As some Class I's use the Contract option, it seems reasonable that some Class II and III's have sufficient numbers of locomotives to make the In-House method cost-effective. FRA similarly estimates that 10% of Class II and III locomotive horns are tested In-House. It is further expected that Amtrak and commuter railroads will follow Class I testing patterns. The distribution of testing methods is assumed to be:

Who-Does-What Assumptions: Percent of Locomotives by Testing Method

RR Class	In-House	Rental	Contractor
Class I	90%	5%	5%
Class II & III	10%	45%	45%
Amtrak & Commuter	90%	5%	5%

Number of Locomotives

Having estimated labor rates for a single test, the analysis determines the total number of locomotive horns that need testing. FRA is allowing five years for the testing of *existing* locomotives (thus one-fifth of the fleet will be tested each year). The table below lists the numbers of locomotives that need testing:

Number of Locomotives to Test per Year for Five Years

RR Class	Number of Total Locomotives	Number of Loco's To Test Per Year
Class I	19,745[13]	3,949
Class II & III	2,500	500
Amtrak & Commuter	985	197
Total	23,230	4,646

Thus, about 4,650 locomotives should be scheduled for horn tests each year for five years.

It should be noted that shared transit operations (light rail) must abide by the mandate to sound the horn, but are not subject to the maximum train horn volume provision. Therefore no testing costs are attributed for these operations.

Existing Locomotive Horn Test Costs

With estimated labor rates for a single test, a count of existing locomotives, and assumptions

[13]FRA estimate based on the *AAR Railroad Equipment Report 2002*, p. 70.

about the use of the three testing methods, the costs to test the existing fleet may be calculated as follows:

Costs to Test Existing Locomotives

Rule Year	Apply Who-Does-What Rates: Number of Locomotives by Test Method			Apply Labor Rates			Total Costs
	Contractor	In-House	Rental	Contractor	In-House	Rental	
1	432	3,781	432	$49,715	$213,462	$31,783	$294,959
2	432	3,781	432	$49,715	$213,462	$31,783	$294,959
3	432	3,781	432	$49,715	$213,462	$31,783	$294,959
4	432	3,781	432	$49,715	$213,462	$31,783	$294,959
5	432	3,781	432	$49,715	$213,462	$31,783	$294,959
6 . . . 20	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
Total Nominal Cost							$1,474,797
Total NPV Cost							$1,209,392

The “Number of Locomotives by Test Method” are the Who-Does-What assumptions multiplied by the number of locomotives to test that were presented earlier, and then summed by class. For example, the number of locomotives tested by contractors is found by multiplying the Class I contractor rate by the number of Class I locomotives, plus the Class II and III contractor percentages multiplied by the number of Class II and III locomotives, and finally adding the Amtrak and Commuter contractor percentage multiplied by the count of those locomotives. Hence, (0.05 x 3949) + (0.45 x 500) + (0.05 x 197) = 432 locomotive horn tests which are expected to be contracted out. To calculate costs, these locomotives are multiplied by the appropriate single-test labor cost (e.g. 432 locomotives x $115 labor cost per test = $49,715). The In-House and Rental costs are found similarly. The NPV cost is the nominal costs discounted at 7%, per DOT guidance. Note that the cost schedule for years six through twenty of the rule are abbreviated because the values are the same for those years. The values are zero because the rule mandates testing of existing locomotives horns to be completed in five years. This analysis, however, presents twenty-year costs anyway, in order that reviewing agencies and the public may compare this rule to other rules which are typically analyzed in a twenty-year framework.

Non-Compliant Locomotive Costs

Some community residents commented to FRA that they felt the train horns were too loud. Although most horns are sounded at lower levels, the maximum horns can sound ranges between 114 to 115 decibels, by design. It is reasonable, therefore, to expect that some horns will exceed the regulatory maximum of 110 dB(A). This analysis estimates that 30% of horns will not comply with the maximum volume limit. The estimate is based on the number of sound measurements that exceeded 110 dB(A) in a site-specific survey conducted for the Draft Environmental Impact Statement (DEIS).[14] Horns that exceed the maximum limit will require adjustment and then retesting to determine compliance. Consequently, a cost is allocated for the time spent to adjust the non-compliant horns. It is estimated that the adjustment will take approximately one-half hour. The labor rate for an employee in the "Maintenance of equipment and stores"[15] category, burdened by 40%, is used to calculate costs. (Costs for parts that may be needed are accounted for later in the analysis, under Non-Compliant Locomotives - Parts Costs.)

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[14]*Technical Supplement to the Draft Environmental Impact Statement of the Proposed Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings*, FRA, December 1999, p. 10. Measurements are in Table 2-3: Sound Exposure Levels in dBA at Grade Crossings - Normalized to 100 Feet from Track Centerline

[15]See Exhibit 1: Railroad Employee Compensation. The labor rate used is $30 per hour.

Labor Costs to Adjust Horns that Exceed the Maximum Volume Limit

Rule Year	Number of Non-Compliant Horns, @ 30%			Total Labor Cost
	Class I	Class II & III	Amtrak & Commuter	
1	1,201	152	60	$21,190
2	1,201	152	60	$21,190
3	1,201	152	60	$21,190
4	1,201	152	60	$21,190
5	1,201	152	60	$21,190
6 . . . 20	0	0	0	$0
	0	0	0	$0
	0	0	0	$0
Total Nominal Cost				$105,948
Total NPV Cost				$86,881

Similar to calculations for estimating the costs to test the existing locomotive fleet, the labor rates and Who-Does-What assumptions are applied to the 30% of non-compliant horns, yielding costs for retesting these horns after they are adjusted. These costs are presented below.

Costs to Retest Locomotives with Non-Compliant Horns

Rule Year	Apply Who-Does-What Rates: No. of Locomotives to Retest, by Test Method			Apply Labor Rates			Total Costs
	Contractor	In-House	Rental	Contractor	In-House	Rental	
1	131	1150	131	$15,116	$64,904	$9,664	$89,684
2	131	1150	131	$15,116	$64,904	$9,664	$89,684
3	131	1150	131	$15,116	$64,904	$9,664	$89,684
4	131	1150	131	$15,116	$64,904	$9,664	$89,684
5	131	1150	131	$15,116	$64,904	$9,664	$89,684
6 . . . 20	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
Total Nominal Cost							$448,418
Total NPV Cost							$367,720

Thus, the NPV cost to retest horns exceeding the maximum sound provision is estimated at $367,720.

<u>Retesting Horns Due to Major Service</u>

Other conditions may also necessitate retesting of the locomotive horn. After many years of use, a railroad may perform major maintenance on its locomotives. Such major maintenance will likely involve sufficient mechanical changes to warrant retesting of the horn's sound level, particularly if the air supply system is serviced or changed. Information gathered from meetings of the Railroad Safety Advisory Committee (RSAC), Event Recorder Working Group, indicates that locomotives undergo major servicing (variously referred to as "overhaul" or "rebuild") about every fifteen years. Thus a locomotive purchased in 1990 will be scheduled for major service in 2004 (counting 1990 as year one). This service interval, and the number of new locomotives acquired are used to produce the schedule of locomotives that will need retesting.

By way of further explanation, the 609 locomotives that were purchased in 1989 would be scheduled for major maintenance in 2003 (year one of the rule), on average. These 609 locomotives represent 3.08 % of the 19,745 total units in service in year one of the rule. This percentage was multiplied by the number of Class II and III, and Amtrak and Commuter units in service to estimate the number of locomotives scheduled for major maintenance for these railroad classes. The Class I percentage was used as an approximation because historical data such as that was available for Class I's (the number of new locomotives purchased by year, and the number of units in service) were not available for Class II and III, and Amtrak and Commuter railroads. Thus, for Class II and III, there are 3.08% x 2500 = 77 locomotives due for major service in year one; for Amtrak and Commuter there are 3.08% x 985 = 30 units due. Note also that the number of Class I units due for service stays constant at 607 for years 14 to 20 of the analysis. New locomotive purchase data was available until 2001 (corresponding to being scheduled for severe maintenance in rule year 13), for later rule years the average from 1987 to 2001 was substituted. As many factors can affect the number of locomotives added to or retired from the Class I fleet (such as the replacement rate and sales to Class II and III's), the number of Class I locomotives in service is held constant at 19,745.

Locomotives Expected to Undergo Major Maintenance

Rule Year	No. of Total Class I Loco's	Major Maintenance as a Percent of Class I Loco's	Year Purchased	No. of Loco's Due for Major Maintenance		
				Class I	Class II & III (No. of Total Loco's = 2500)	Amtrak & Commuter (No. of Total Loco's = 985)
1	19,745	3.08%	1989	609	77	30
2	19,745	2.68%	1990	530	67	26
3	19,745	2.39%	1991	472	60	24
4	19,745	1.63%	1992	321	41	16
5	19,745	2.55%	1993	504	64	25
6	19,745	4.16%	1994	821	104	41
7	19,745	4.70%	1995	928	117	46
8	19,745	3.85%	1996	761	96	38
9	19,745	3.76%	1997	743	94	37
10	19,745	4.50%	1998	889	113	44
11	19,745	3.59%	1999	709	90	35
12	19,745	3.24%	2000	640	81	32
13	19,745	3.60%	2001	710	90	35
14	19,745	3.08%	2002	607	77	30
15	19,745	3.08%	2003	607	77	30
16	19,745	3.08%	2004	607	77	30
17	19,745	3.08%	2005	607	77	30
18	19,745	3.08%	2006	607	77	30
19	19,745	3.08%	2007	607	77	30
20	19,745	3.08%	2008	607	77	30

Under baseline conditions, one might expect railroads or maintenance shops to test the train horn for see if it meets the minimum sound level. Mandated in 49 CFR 229.129 "Audible warning device", is a minimum sound level of 96 dB(A) at 100 feet in front of the locomotive, measured at four feet above the track with a Type 2 SLM. If these same measurements could also be used to determine compliance with the stipulated maximum volume, then there would be no new costs attributable to retesting the locomotives that are significantly serviced. The new maximum train horn volume provision, however, requires a different testing procedure than the previous regulation. Testing at the 100 feet distance, fifteen feet high, will take slightly more time to set-up and break up equipment. In addition, taking measurements for the six, twenty-second sound events is a new method which will require additional time. As a result of these departures from the previous regulation, the analysis accounts for retesting costs after major maintenance.

To estimate these costs, the labor rates for conducting a horn sound level test, and the Who-Does-What assumptions are applied to the number of locomotives scheduled for major service (from the above table). The calculations are similar to those done in the Existing Locomotive Horn Test Costs section. The following table presents the results.

Costs to Retest Locomotives that Undergo Major Maintenance

Rule Year	Apply Who-Does-What Rates: No. of Locomotives to Retest, by Test Method			Apply Labor Rates			Total Costs
	Contractor	In-House	Rental	Contractor	In-House	Rental	
1	67	583	67	$7,667	$32,919	$4,901	$45,488
2	58	508	58	$6,672	$28,649	$4,266	$39,587
3	52	452	52	$5,942	$25,514	$3,799	$35,255
4	35	307	35	$4,041	$17,352	$2,584	$23,976
5	55	483	55	$6,345	$27,244	$4,056	$37,645
6	90	786	90	$10,336	$44,379	$6,608	$61,322
7	102	889	102	$11,683	$50,163	$7,469	$69,314
8	83	729	83	$9,580	$41,136	$6,125	$56,814
9	81	711	81	$9,354	$40,163	$5,980	$55,496
10	97	851	97	$11,192	$48,055	$7,155	$66,401
11	78	679	78	$8,926	$38,325	$5,706	$52,957
12	70	613	70	$8,057	$34,595	$5,151	$47,803
13	78	680	78	$8,938	$38,379	$5,714	$53,031
14	66	582	66	$7,647	$32,833	$4,889	$45,368
15	66	582	66	$7,647	$32,833	$4,889	$45,368
16	66	582	66	$7,647	$32,833	$4,889	$45,368
17	66	582	66	$7,647	$32,833	$4,889	$45,368
18	66	582	66	$7,647	$32,833	$4,889	$45,368
19	66	582	66	$7,647	$32,833	$4,889	$45,368
20	66	582	66	$7,647	$32,833	$4,889	$45,368
Total Nominal Cost							$962,692
Total NPV Cost							$501,899

Total discounted costs over the twenty-year period of analysis are estimated at $501,899

Retesting Horns Due to Minor Maintenance

In addition to major maintenance, the railroad may perform routine servicing of the horn. Most often, routine maintenance will consist of simply cleaning the horn of dirt and debris, but it may also involve replacing worn parts, or replacing the entire horn unit.[16] The amount of maintenance required could vary by geographic area, climate conditions, horn usage, and other factors. For most routine maintenance, the air supply system is not changed. If parts or the whole unit are replaced, they are usually replaced with the same model, thus requiring no change in valves or fittings. With no changes to the air supply, valves, or fittings, routine servicing should not alter the sound level. In most cases, the horn would not have to be retested. The analysis, however, allows for a small number of random instances when maintenance that affects the horn volume will be required. It is assumed that routine maintenance will necessitate horn retesting at the rate of 1% per year. At this rate, the set of affected locomotives will consist of 197 Class I, 25 Class II and III, and about 10 Amtrak and Commuter locomotives. The previously estimated labor costs per horn test, and the Who-Does-What percentages are employed to calculate retesting costs.

[16] *Technical Conference on Locomotive Train Horns*, transcript of meeting held at FRA, May 2000, p. 101-102, (docket number FRA-1999-6439-2240). Participants stated that the life expectancy of Nathan horns is about twelve years, while Leslie horns last from five to six years.

Costs to Retest Locomotives After Minor Maintenance

Rule Year	Apply Who-Does-What Rates: No. of Locomotives to Retest, by Test Method			Apply Labor Rates			Total Costs
	Contractor	In-House	Rental	Contractor	In-House	Rental	
1	22	189	22	$2,486	$10,673	$1,589	$14,748
2	22	189	22	$2,486	$10,673	$1,589	$14,748
3	22	189	22	$2,486	$10,673	$1,589	$14,748
4	22	189	22	$2,486	$10,673	$1,589	$14,748
5	22	189	22	$2,486	$10,673	$1,589	$14,748
6 . . . 20	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
Total Nominal Cost							$294,959
Total NPV Cost							$156,240

Total discounted costs for retests resulting from routine maintenance are calculated as $156,240.

<u>Administrative and Planning Costs</u>

Labor costs calculated thus far have estimated costs for the existing inventory of locomotives. New additions to the fleet will also incur costs as a result of the maximum volume regulation. Costs for new locomotives, however, should be minimal because both horn and locomotive manufacturers can make adjustments to the horn at the time of manufacture. Once a particular horn-locomotive combination is tested and adjusted to within the regulated volume limits, other like combinations need not be tested, reducing compliance costs. Manufacturers and railroads, however, may experience administrative and logistic costs to become familiar with the regulation and implement it. Manufacturers need to determine how the rule applies to their particular manufacturing processes. According to the proposed testing scenario, locomotives will be tested as they come in for their periodic inspections. Railroads will incur planning costs associated with identifying and scheduling locomotives for testing. Larger railroads with greater numbers of locomotives will likely spend more resources in planning than smaller railroads. Larger railroads are therefore assumed to represent the majority of these costs.

To determine administrative and planning costs, the cost of the time needed for one railroad or manufacturer to implement the sound level provision is applied to the set of manufacturers and railroads. The regulatory evaluation for the Quiet Zone sections of the rule allocated 40 hours for a community to form a Quiet Zone plan. This estimate is used as the basis for allocating planning costs. Reasoning that planning for implementation of the horn volume limits should be easier than Quiet Zone planning, one-half the time (20 hours) is designated for this purpose. For an estimate of the number of railroads and manufacturers affected, the sum of the number of railroad manufacturers, horn manufacturers, Class I railroads, Amtrak, regional railroads[17], and a small number of other railroads - totaling 54 affected entities - is used. For this group, it is likely that an industrial hygienist or other employee familiar with sound testing will administer and plan for the regulation; they are costed at the "Professional & administrative" burdened wage rate of $34 per hour. Total costs for new locomotives are presented in the following table.

Administrative and Planning Costs to Implement Regulation

Rule Year	Number of Manufacturers & Railroads	Hours to Plan & Administer	Total Hours	Hourly Wage Rate	Total Cost
1	54	20	1080	$34	$36,871

It is assumed that companies will read and plan for the ways in which the regulation affects them when the regulation is published. The total costs are therefore first costs, accounted for in year one of the rule.

<u>New Meters</u>
Turning to the equipment costs of the regulation, given the requirement to test the existing locomotive horns in five years, the number of tests conducted per year will increase from previous years. The need to perform more tests can be expected to create demand for additional SLM's. Railroads currently do possess some Type 2 meters and other sound testing equipment (such as dosimeters), because they conduct other types of environmental noise testing, as well as mandated testing for the minimum horn volume. They may, however, need incrementally more meters for compliance within the five-year time frame.

In addition, some railroads will need meters that can accept a remote microphone. Under the old testing procedure, the SLM could be read directly because the testing height was four feet. In contrast, the revised procedure specifies a testing height of fifteen feet, too high to be read

[17] *Railroad Facts*: *2001 Edition*, Association of American Railroads, October 2001, p. 3. AAR's definition of regional railroads is used.

directly from a SLM. Thus, the testing microphone will be attached remotely on the high testing fixture, and connected to the SLM with a cable, allowing the SLM to be read at eye level.

To estimate the incremental cost of new meters, first the Who-Does-What percentages are used to aid in determining the number of new meters needed, and then this number is multiplied by the cost per SLM to arrive at total costs. To determine the number of new meters, it is assumed that those railroads that perform more in-house testing will be the same ones expressing a greater need for additional SLM's. For example, assuming 90% of Class I's will conduct the horn tests in-house, then 0.90 x 8 = 7.2 Class I railroads will purchase additional SLM's. Two incremental meters are appropriated per Class I railroad, for a total of 14 new meters. For Class II and III railroads, with smaller numbers of locomotives to test on average, one meter per railroad may be sufficient. These railroads are expected to perform 10% of their horn tests in-house, and are allocated 60 meters. An earlier FRA report estimated 17 Commuter railroads, resulting in 18 Amtrak and Commuter railroads[18]. This group is assumed to follow Class I patterns, 32 SLM's are estimated for these railroads. The sum total is 106 incremental meters. These estimates are likely to contain much variability, since FRA lacks data on the numbers and types of SLM's currently in use. The analysis makes an adjustment for the information deficit, and to account for some railroads that may not have meters that can accept a remote microphone. The 106 SLM estimate is increased by 15% for a grand total of 122 SLM's. As the horn testing occurs over five years, the need for these meters is also expected to occur over the same five years. The second factor, the cost for the SLM, represents an average of several brands of meters. The average SLM cost of $2,118 includes not only the price of the SLM, but also the windscreen, tripod, remote microphone cable, and field calibrator. The price is applied to the number of meters to produce the cost schedule shown below.

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[18] *Qualifications for Locomotive Engineers* (Regulatory Impact Analysis), June 1999, p.7.

New Meter Costs

Rule Year	Cost of Meter	Number of New Meters	Total Costs
1	$2,118	24	$51,677
2	$2,118	24	$51,677
3	$2,118	24	$51,677
4	$2,118	24	$51,677
5	$2,118	24	$51,677
6 . . . 20	$0	0	$0
	$0	0	$0
	$0	0	$0
Total Nominal Cost			$258,383
Total NPV Cost			$211,884

Total discounted costs are about $212,000 for 122 new meters over the testing period.

<u>New Meters: Replacement Costs</u>
Meters are durable goods that last a relatively long time if properly maintained. Meters can last ten to fifteen years and longer. They are more likely to be replaced because of technological advancements available in newer meters rather than because of a malfunction.

After the initial testing of locomotive horns to determine compliance with the maximum train horn limit, the number of tests that need to be performed will decrease substantially. Thus, the need for additional meters will also lessen as the burden from the regulation decreases. It is assumed that railroads will replace their meters as necessary, about every ten to fifteen years, but there will be no incremental need for replacement meters as a result of this regulation. Replacement costs are therefore $0.

<u>New Meters: Calibration Costs</u>
Part of the maintenance for SLM's is a yearly calibration by the meter manufacturer or other party that can certify the SLM. This calibration was also required in the code establishing the minimum horn volume. As more SLM's will reasonably be needed to test horns governed by the new maximum volume provision, a calibration cost is included for these additional SLM's. The discussion above estimated that 122 new meters will be required to meet the burden of testing the existing fleet in five years. Therefore, full calibration costs are also allocated for five years. Railroads calibrate their existing SLM's, and it is assumed that these meters will suffice for train horn testing after five years. An allowance is made, however, for retesting horns because of major and routine maintenance. Thus, a portion of the calibration costs - equal to the proportion of major and routine maintenance retests - is accounted for in rule years six through twenty. The following table calculates the percent of retests, and the following table uses this percentage with the average annual calibration cost of $249 per meter to find total calibration costs.

Retests as a Percent of Locomotives

Rule Year	Total Locomotives	Major Maintenance Retests	Routine Maintenance Retests	All Maintenance Retests as a % of Total Locomotives
1	23,230	716	232	4%
2	23,230	624	232	4%
3	23,230	555	232	3%
4	23,230	378	232	3%
5	23,230	593	232	4%
6	23,230	966	232	5%
7	23,230	1,092	232	6%
8	23,230	895	232	5%
9	23,230	874	232	5%
10	23,230	1,046	232	6%
11	23,230	834	232	5%
12	23,230	753	232	4%
13	23,230	835	232	5%
14 . . . 20	23,230	715	232	4%
	23,230	715	232	4%
	23,230	715	232	4%

In the table above, “Total Locomotives” is the sum of the locomotives in Class I, Class II and III, and Amtrak railroads.

Calibration Costs

Rule Year	New Meters	Meters to Calibrate	Maintenance Retests as a % of Total Loco's	Annual Calibration Costs per Meter	Total Costs
1	24	24		$249	$6,067
2	24	49		$249	$12,135
3	24	73		$249	$18,202
4	24	98		$249	$24,269
5	24	122		$249	$30,337
6		122	5%	$249	$1,565
7		122	6%	$249	$1,729
8		122	5%	$249	$1,473
9		122	5%	$249	$1,445
10		122	6%	$249	$1,669
11		122	5%	$249	$1,393
12		122	4%	$249	$1,287
13		122	5%	$249	$1,394
14 . . . 20		122	4%	$249	$1,237
		122	4%	$249	$1,237
		122	4%	$249	$1,237
Total Nominal Cost					$111,620
Total NPV Cost					$80,460

For simplicity, it is assumed that the incremental meters are purchased at the beginning of the year and sent in for calibration at the end of the year. Again, note that only a portion of the calibration costs is accounted for after year five, corresponding to the reduced burden of the regulation. Total discounted costs for calibrating meters used to test the existing fleet and perform retests are estimated at about $80,000.

<u>Additional Equipment: Tripod and Remote Microphone Cable Costs</u>
The maximum horn volume provision prescribes a new testing height of fifteen feet to overcome the shadow effect. In order to measure sound energy from this height, railroads, locomotive

manufacturers, horn producers, and other testing entities will need to purchase new tripods (or other fixtures) for mounting the meters' remote microphones. They will also need a long cable to connect the microphone to the SLM.

To calculate costs for these additional components, the number of new tripods and cables is multiplied by their combined cost. To begin to estimate the amount of additional equipment, each of the major railroad and horn manufacturers are allocated two sets of components, for a total of eight sets.[19] Railroads are assigned equipment according to the Who-Does-What assumptions (using the In-House percentages), as described in the "New Meters" discussion.[20] Thus, (8+106) = 114 sets of equipment are estimated for manufacturers and railroads. Other parties, such as contractors, that use SLM's may also need the new equipment. As FRA does not have information on the number of contractors, and to allow for entities that may purchase additional tripods and cables, an adjustment of 15% is added to the estimate, for a total of 131 sets. The cost of a tripod is about $108 each, and a cable averages $162, resulting in a combined cost of $270. The cost of the meters is scheduled over the same five year time period that most of the benefits are expected. The total costs for 131 pairs are illustrated in the following table.

Additional Equipment Costs: Tripods and Remote Microphone Cables

Rule Year	Cost for Tripod & Cable Pair	Number of New Tripods & Cables	Total Costs
1	$270	26	$7,069
2	$270	26	$7,069
3	$270	26	$7,069
4	$270	26	$7,069
5	$270	26	$7,069
6	$0	0	$0
.	$0	0	$0
. 20	$0	0	$0
Total Nominal Cost			$35,345
Total NPV Cost			$28,984

The total discounted cost for additional equipment necessary to conduct sound level measurements from fifteen feet high is approximately $29,000.

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[19]Railroad manufacturers are General Electric and General Motors Electro Motive Division (EMD), and horn suppliers are Nathan and Leslie.

[20] The railroads that will perform tests In-House are calculated by: 0.90 X 8 Class I railroads = 7 railroads; for Class II and III, 0.10 X 600 railroads = 60 railroads; and for Amtrak and Commuters, 0.90 X 18 railroads = 16 railroads. Each of the Class I, Amtrak, and Commuter railroads are assumed to purchase two sets of equipment, while the Class II and III railroads are assigned one set of equipment. Thus, the total sets of new equipment for the railroads is found by: (7 railroads X 2 sets) + (60 railroads X 1 set) + (16 railroads X 2 sets) = 106 sets.

Companies that provide SLM's for rental will also require the tripods and cables. Rental companies usually provide a kit that includes all of the needed accessories. Their customers will expect them to stock the proper mounting fixtures and wires. Some or all of this cost will likely be passed on consumers. To estimate an incremental cost for Rental SLM's because of the new equipment, the equipment cost is divided by its expected life of 10 years. Thus, $270 distributed over 10 years equates to a cost of $27 per year. The more times the equipment is rented out during a year, the lower will be the unit cost for the extra equipment. As FRA does not have data on the frequency of SLM rentals, a nominal cost of $10 is added to the cost of SLM rental. An average cost to rent an SLM for one day is about $50, with the additional equipment the estimated cost rises to $60 per day. Rental costs are accounted separately below.

Non-Compliant Locomotives (Parts Costs)
Train horns that exceed the maximum horn volume will need adjustment to reduce their sound level. Labor costs for this adjustment were accounted for previously in the analysis. In addition to labor costs, railroads may also incur costs for parts to bring the horn into compliance. If changing the air pressure does not succeed in reducing the horn volume, the metering orifice of the horn, or another air pressure valve, may need to be changed. The cost for such parts is minimal, about $10 per part. Using the earlier non-compliance rate of 30%, the total cost is calculated by multiplying the number of non-compliant horns by the parts cost, as displayed in the following table.

Parts Cost to Adjust Non-Compliant Train Horns

Rule Year	Number of Non-Compliant Horns, @30%			Cost per Part	Total Costs
	Class I	Class II & III	Amtrak & Commuter		
1	1,201	152	60	$10	$14,126
2	1,201	152	60	$10	$14,126
3	1,201	152	60	$10	$14,126
4	1,201	152	60	$10	$14,126
5	1,201	152	60	$10	$14,126
6 . . . 20	0	0	0	$0	$0
	0	0	0	$0	$0
	0	0	0	$0	$0
Total Nominal Cost					$70,632
Total NPV Cost					$57,921

Over the five year testing period, the total discounted costs for parts needed to adjust non-compliant horns is about $58,000.

Rental Costs

Some railroads will rent SLM's to measure the volume of their locomotive horns. In formulating the Who-Does-What percentages, it was noted that renting SLM's may be a convenient option for those smaller railroads with fewer locomotives. These railroads have less horn tests to conduct, and may not find it cost-effective to own a SLM. Larger railroads may also rent SLM's occasionally. To estimate the number of horn tests conducted using rental equipment, the Who-

Does-What Rental rate is applied to the sum of existing locomotives, locomotives that undergo major service, and those that are routinely serviced.[21] This calculation yields the number of rental SLM tests. To assess the total parts costs, these tests are multiplied by the average cost to rent a SLM, about $50 per day plus $10 for additional tripods and cables required by the regulation to test the horn at a height of 15 feet. The results of these calculations are presented in the following table.

Number and Costs of Horn Tests Conducted Using Rental Sound Level Meters[22]

Rule Year	Number of Rental SLM Horn Tests			Cost per Rental Day	Total Costs
	Class I	Class II & III	Amtrak & Commuter		
1	238	271	12	$60	$31,235
2	234	266	12	$60	$30,716
3	231	263	12	$60	$30,335
4	223	255	11	$60	$29,343
5	233	265	12	$60	$30,545
6	51	58	3	$60	$6,689
7	56	64	3	$60	$7,392
8	48	55	2	$60	$6,295
9	47	54	2	$60	$6,177
10	54	62	3	$60	$7,136
11	45	52	2	$60	$5,954
12	42	48	2	$60	$5,501
13	45	52	2	$60	$5,960
14 . . . 20	40	46	2	$60	$5,286
	40	46	2	$60	$5,286
	40	46	2	$60	$5,286
Total Nominal Cost					$240,285
Total NPV Cost					$164,226

[21]The number of tests for existing locomotives as shown in the tables that present major service, and routine maintenance tests.

[22]The number of horn tests have been rounded to the nearest integer for ease in presentation, the actual figures were used in calculations.

Total discounted costs for rental SLM tests are estimated at about $164,000. This estimate is conservative because it assumes only one test is conducted per day. If multiple horn tests can be scheduled for the same day, the number of days that the SLM is rented will decrease, reducing costs. A conservative appraisal is used to permit more flexibility for railroads in scheduling horn tests.

Summary of Costs

Before estimating benefits, the identified costs of the rule are summarized. Much of the resources expended as a result of this regulation will be for testing existing locomotives, and retesting locomotives because of major maintenance, routine service, and non-compliant horns. To model these costs, the labor rates for three different methods to conduct horn tests were approximated. Horns may be tested by the railroad itself, by contractors, or by the railroad using rental equipment. Noting that dissimilar sized railroads may find it advantageous to use the three testing methods in different amounts, assumptions were made as to which classes of railroads will use what methods. New locomotives will face much lower costs, as horn adjustments are easier to make in the manufacturing process than in the field. Costs are assigned, however, for implementing the new regulation.

The maximum volume provision will also result in incremental equipment costs for railroads and other stakeholders that perform sound level testing of locomotive horns. Although railroads and others who perform tests currently have SLM's, they will likely need to acquire additional meters to meet the burden of testing all locomotives in five years. Some will also need to buy meters than can accept a remote microphone. The analysis estimates that 122 new meters will be required. Calibration costs are also designated for these meters, with only a portion of costs allocated after five years, reflecting the reduced testing burden. All testing entities will need to purchase tripods (or some other testing fixture) to mount the remote microphone at the new testing height of fifteen feet. A cable to connect the remote microphone to the SLM is also necessary. Of course, if a horn exceeds the maximum volume standard, it will need to be adjusted and retested. Costs to adjust non-compliant horns were calculated using a non-compliance rate of 30%, and estimated separately for labor required to make the change and the cost of parts. One of the possible ways for a railroad to test it's locomotive horns is by renting a SLM. This method will especially appeal to smaller railroads with fewer locomotives, for whom renting may be a cost-effective option. Rental costs are determined by multiplying the average SLM rental cost of $60 per day by the number of locomotives that will be tested in this way (estimated using the Who-Does-What assumptions). The table below itemizes the costs from this provision.

Summary of Costs

Cost Description	Total NPV Cost
Existing Locomotive Horn Tests	$1,209,392
Non-Compliant Locomotives (Adjustment)	$86,881
Non-Compliant Locomotives (Retests)	$367,720
Retesting Horns Due to Major Service	$501,899
Retesting Horns Due to Minor Maintenance	$156,240
Administrative and Planning	$36,871
New Meters	$211,884
New Meters: Calibration	$80,460
Additional Equipment: Tripod & Remote Microphone Cable	$28,984
Non-Compliant Locomotives (Parts)	$57,921
Rental SLM	$164,226
Total NPV Costs	$2,902,478

Total discounted costs are estimated at about $3 million for the upper sound level limit on the locomotive horn.

Benefits of Regulatory Approach

Noise Effects

Train horns that are perceived as being too loud reduce the quality of life in communities where the horn sounds. Residents view this unwanted sound as noise. Noise, in turn, leads to annoyance. Annoyance represents the irritation residents experience when noise intrudes in their sleep, conversations, recreational activities, and general comfort. It has the effect of increasing stress for those affected.[23] The Schultz curve, described in the DEIS (Figure 3-8), relates sound levels to the percent of people that are annoyed at those levels. The curve is steeper at higher decibels, indicating that a small increase in sound energy leads to much more annoyance. Conversely, a small decrease in the upper decibel range should have a marked effect on reducing the level of annoyance.

[23] *General Health Effects of Transportation Noise*, John A. Volpe Transportation Systems Center, June 2002, pp. 3 - 4, 11.

Quantified Noise Mitigation Benefits

The maximum horn volume provision reduces community noise exposure by limiting the sound energy of the horn. Benefits are derived from reducing the annoyance of residents, and described in improved quality-of-life terms (i.e. the noise effects described above are reduced). The provision mitigates noise in several ways. Most obviously, in areas where the horn currently sounds, the volume of the horn is lessened. Moreover, the provision benefits communities where the horn has not sounded before and who do not wish to establish Quiet Zones. Setting a maximum sound limit mitigates for changes in the railroad operating environment also. As previously discussed under "Need", some railroads are using electronic horns. These horns may be sounded louder than traditional horns. The maximum volume limit serves to limit potential increased noise from electronic horns as the use of this technology may increase. Previously, FRA commissioned a hedonic property value study to aid in measuring the effects of noise. In this methodology, noise is treated as a negative quality of a property among many qualities that determine its market price. As a result of this preliminary study, FRA is accounting for relocation costs for those residents who may be so annoyed that they move to a different location. Under the maximum volume provision, however, the sound level of the horn may be reduced just enough for some residents to alter their decision to move, lowering total relocation costs. Thus, placing a cap on the horn volume will mitigate direct noise impacts from present and future horn use.

The benefits from this element of the rule are not monetized. The type of subjective, improved quality-of-life advantages gained by placing a limit on the horn volume are difficult to measure, quantify, or assign ownership rights to. These benefits are generally not traded in the marketplace like traditional goods and services. Furthermore, while research is available regarding airplane noise, very little research exists about train noise, particularly a warning signal like train horns. Although not monetized, the benefits can be quantified. The DEIS used a horn model to examine the noise effects of various rule proposals on community residents. The FEIS provides updated estimates, and finds that a maximum sound level of 110 dB(A) reduces the number of affected residents by 1,151,000 people, or about 12% in comparison to baseline conditions.[24] Note also that the benefits are widespread, occurring at most of the approximately 150,000 grade crossings where the horns sounds. Only at the relatively small number of Quiet Zone crossings will the maximum horn volume rule not have an effect. These benefits are expected to occur over the same five year time period allotted to test existing horns, as horns that are found to exceed the volume limit are adjusted for compliance. Benefits will continue beyond five years because new locomotive horns (on new locomotive purchases and replacement horns) will sound within the regulated volume range upon manufacture. A primary advantage of the maximum train horn provision is its contribution to the overall benefits to the rule and mitigation of sounding the train horn.

Statement of Costs and Benefits

The need to enforce a limit on the train volume arises from present and future conditions that would increase noise impacts for people living near train tracks. Train traffic has been rising, and there may exist a trend toward higher train horn volumes. With more construction near train tracks, the significance of the horns' positive and negative effects becomes more important.

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[24] *Final Environmental Impact Statement: Final Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings.*

Congressional intent also directs FRA to provide noise relief for communities. This regulation mitigates the noise impacts of the train horn, while continuing it's use as an effective safety device. In addition, the regulation modifies the sound level testing procedure to account for the shadow effect, yielding more accurate measurements.

FRA considered several options to reduce the horn's noise impacts. The proposal to lower noise radiating to the sides of the locomotive, in comparison to sound levels in front of the locomotive, used frontal measurements that were artificially low because of the shadow effect, as AAR reported. Furthermore, moving the horn forward may reduce noise to the side, but would also raise noise levels inside the locomotive cab. The shrouding option would block sound at the source. One railroad's test in field conditions, however, showed problems with reliability as the shrouds broke loose. Also, shrouds may not effectively block large amplitude, low frequency sound waves. A sampling approach to testing existing horns would reduce costs in the short run, but costs would increase as more communities might request that the trains in their geographic area be tested, because their horns were excessively loud. Given the high degree of variation in the population of train horns, drawing a random, representative sample would be difficult. Finally, proposals to equip locomotives with horns that can sound at two different volumes, or sound only in the direction of travel, seem promising. The logistics of implementing the proposals are uncertain, however, and there is little empirical evidence supporting their use. With both of these options, FRA is also concerned about adding to the responsibilities of the engineer. Given the disadvantages associated with each of the above alternatives, they were not considered further in the analysis.

The costs for the selected proposal of setting a maximum sound level limit for the train horn were summarized previously. The majority of costs will result from the requirement to test existing locomotive horns. Other major cost contributors are retesting costs and rental SLM costs. Costs for additional equipment needed to gather sound data from a height of fifteen feet, and complete testing within five years are also assigned. The analysis estimates that total discounted costs over the 20-year period of analysis are $2,902,478 for the maximum horn level provision. As the benefits were not monetized, a benefit cost ratio cannot be calculated. The provision is expected to relieve noise impacts to about 12% of the affected population, and cover a significant area as benefits would occur at public grade crossings nationally.

EXHIBIT 3

Whistle Bans That will Not Be Retained : Relocation Costs

Chicago Area	Whistle Ban Cancellations	Expected Relocations	Cost
Year 1	0	0.00	$0
Year 2	0	0.00	$0
Year 3	0	0.00	$0
Year 4	1	3.00	$62,823
Year 5	0	0.00	$0
Year 6	0	0.00	$0
Year 7	0	0.00	$0
Year 8	0	0.00	$0
Year 9	0	0.00	$0
Year 10	0	0.00	$0
Year 11	0	0.00	$0
Year 12	0	0.00	$0
Year 13	0	0.00	$0
Year 14	0	0.00	$0
Year 15	0	0.00	$0
Year 16	0	0.00	$0
Year 17	0	0.00	$0
Year 18	0	0.00	$0
Year 19	0	0.00	$0
Year 20	0	0.00	$0
NPV - 20	1	3.00	$47,927

Nationwide, Excluding Chicago	Whistle Ban Cancellations	Expected Relocations	Cost
Year 1	0	0.00	$0
Year 2	0	0.00	$0
Year 3	0	0.00	$0
Year 4	35	105.00	$2,076,270
Year 5	0	0.00	$0
Year 6	0	0.00	$0
Year 7	0	0.00	$0
Year 8	0	0.00	$0
Year 9	0	0.00	$0
Year 10	0	0.00	$0
Year 11	1	3.00	$59,322
Year 12	0	0.00	$0
Year 13	0	0.00	$0
Year 14	0	0.00	$0
Year 15	3	9.00	$177,966
Year 16	0	0.00	$0
Year 17	0	0.00	$0
Year 18	0	0.00	$0
Year 19	0	0.00	$0
Year 20	0	0.00	$0
NPV - 20	39	117.00	$1,676,663

EXHIBIT 4

Pre-Rule Quiet Zone Crossing Safety Measures Costs

Flashing Lights to Automatic Gates CHICAGO AREA				
	Number of Installations	Cost of Installations	Annual Maintenance	Total
Year 1	0.0	$0	$0	$0
Year 2	0.7	$28,571	$0	$28,571
Year 3	0.7	$28,571	$357	$28,929
Year 4	0.7	$28,571	$714	$29,286
Year 5	0.7	$28,571	$1,071	$29,643
Year 6	0.7	$28,571	$1,429	$30,000
Year 7	0.7	$28,571	$1,786	$30,357
Year 8	0.7	$28,571	$2,143	$30,714
Year 9	0.0	$0	$2,500	$2,500
Year 10	0.0	$0	$2,500	$2,500
Year 11	0.0	$0	$2,500	$2,500
Year 12	0.0	$0	$2,500	$2,500
Year 13	0.0	$0	$2,500	$2,500
Year 14	0.0	$0	$2,500	$2,500
Year 15	0.0	$0	$2,500	$2,500
Year 16	0.0	$0	$2,500	$2,500
Year 17	0.0	$0	$2,500	$2,500
Year 18	0.0	$0	$2,500	$2,500
Year 19	0.0	$0	$2,500	$2,500
Year 20	0.0	$0	$2,500	$2,500
NPV 20	5	$143,906	$16,468	$160,375

Mountable Curbs w/ Frangible Delineators CHICAGO AREA				
	Number of Installations	Installation and Baseline	Annual Maintenance	Total
Year 1	0.0	$0	$0	
Year 2	4.0	$52,000	$0	$52,0
Year 3	4.0	$52,000	$2,000	$54,0
Year 4	4.0	$52,000	$4,000	$56,0
Year 5	5.7	$73,667	$6,000	$79,6
Year 6	5.7	$73,667	$8,833	$82,5
Year 7	5.7	$73,667	$11,667	$85,3
Year 8	4.0	$52,000	$14,500	$66,5
Year 9	0.3	$4,333	$16,500	$20,8
Year 10	0.3	$4,333	$16,667	$21,0
Year 11	0.3	$4,333	$16,833	$21,1
Year 12	0.0	$0	$17,000	$17,0
Year 13	0.0	$0	$17,000	$17,0
Year 14	0.0	$0	$17,000	$17,0
Year 15	0.0	$0	$17,000	$17,0
Year 16	0.0	$0	$17,000	$17,0
Year 17	0.0	$0	$17,000	$17,0
Year 18	0.0	$0	$17,000	$17,0
Year 19	0.0	$0	$17,000	$17,0
Year 20	0.0	$0	$17,000	$17,0
NPV 20	34	$311,906	$108,618	$420,5

Photo-Enforcement: 3 Crossings Sharing Camera
CHICAGO AREA

	Number of Installations	Installation and Baseline	Annual Maintenance	Total
Year 1	0.0	$0	$0	$0
Year 2	0.4	$16,786	$0	$16,786
Year 3	0.4	$16,786	$4,943	$21,729
Year 4	0.4	$16,786	$9,885	$26,671
Year 5	0.4	$16,786	$14,828	$31,614
Year 6	0.4	$16,786	$19,771	$36,557
Year 7	0.4	$16,786	$24,714	$41,499
Year 8	0.4	$16,786	$29,013	$45,799
Year 9	0.0	$0	$33,313	$33,313
Year 10	0.0	$0	$32,670	$32,670
Year 11	0.0	$0	$32,028	$32,028
Year 12	0.0	$0	$31,385	$31,385
Year 13	0.0	$0	$30,742	$30,742
Year 14	0.0	$0	$30,099	$30,099
Year 15	0.0	$0	$30,099	$30,099
Year 16	0.0	$0	$30,099	$30,099
Year 17	0.0	$0	$30,099	$30,099
Year 18	0.0	$0	$30,099	$30,099
Year 19	0.0	$0	$30,099	$30,099
Year 20	0.0	$0	$30,099	$30,099
NPV 20	3.0	$84,546	$211,548	$296,093

Pre-Rule Quiet Zone Crossing Safety Measures Costs
Chicago Area

Medians OR Four-Quadrant Gates
CHICAGO AREA

	Number of Installations	Cost of Installations	Annual Maintenance	Total Annual Cost
Year 1	0.0	$0	$0	$0
Year 2	5.7	$362,857	$0	$362,857
Year 3	5.7	$362,857	$8,571	$371,429
Year 4	5.7	$362,857	$17,143	$380,000
Year 5	5.7	$362,857	$25,714	$388,571
Year 6	6.0	$384,024	$34,286	$418,310
Year 7	6.0	$384,024	$43,357	$427,381
Year 8	6.0	$384,024	$52,429	$436,452
Year 9	0.0	$0	$61,500	$61,500
Year 10	0.0	$0	$61,500	$61,500
Year 11	0.0	$0	$61,500	$61,500
Year 12	0.0	$0	$61,500	$61,500
Year 13	0.0	$0	$61,500	$61,500
Year 14	0.0	$0	$61,500	$61,500
Year 15	0.0	$0	$61,500	$61,500
Year 16	0.7	$42,333	$61,500	$103,833
Year 17	0.7	$42,333	$62,500	$104,833
Year 18	0.7	$42,333	$63,500	$105,833
Year 19	0.0	$0	$64,500	$64,500
Year 20	0.0	$0	$64,500	$64,500
NPV 20	43	$1,907,481	$405,580	$2,313,060

Pre-Rule Quiet Zone Crossing Safety Measures Costs

	Passive Devices to Flashing Lights NATION (Excluding Chicago Area)			
	Number of Installations	Cost of Installations	Annual Maintenance	Total Annual Cost
Year 1	0.00	$0	$0	$0
Year 2	1.3	$120,857	$0	$120,857
Year 3	1.3	$120,857	$2,571	$123,429
Year 4	1.3	$120,857	$5,143	$126,000
Year 5	1.3	$120,857	$7,714	$128,571
Year 6	2.0	$183,524	$10,286	$193,810
Year 7	2.3	$214,857	$14,190	$229,048
Year 8	2.6	$246,190	$18,762	$264,952
Year 9	0.67	$62,667	$24,000	$86,667
Year 10	0.33	$31,333	$25,333	$56,667
Year 11	0.00	$0	$26,000	$26,000
Year 12	0.00	$0	$26,000	$26,000
Year 13	0.00	$0	$26,000	$26,000
Year 14	0.00	$0	$26,000	$26,000
Year 15	0.67	$62,667	$26,000	$88,667
Year 16	1.00	$94,000	$27,333	$121,333
Year 17	1.00	$94,000	$29,333	$123,333
Year 18	1.00	$94,000	$31,333	$125,333
Year 19	0.67	$62,667	$33,333	$96,000
Year 20	0.67	$62,667	$34,667	$97,333
NPV 20	18.00	$977,625	$164,249	$1,141,874

Pre-Rule Quiet Zone Crossing Safety Measures Costs

	Flashing Lights to Automatic Gates NATION (Excluding Chicago Area)			
	Number of Installations	Cost of Installations	Annual Maintenance	Total
Year 1	0.0	$0	$0	
Year 2	5.0	$200,000	$0	$200,0
Year 3	5.0	$200,000	$2,500	$202,5
Year 4	7.0	$280,000	$5,000	$285,0
Year 5	7.0	$280,000	$8,500	$288,5
Year 6	7.0	$280,000	$12,000	$292,0
Year 7	5.0	$200,000	$15,500	$215,5
Year 8	5.7	$226,667	$18,000	$244,6
Year 9	0.7	$26,667	$20,833	$47,5
Year 10	0.7	$26,667	$21,167	$47,8
Year 11	0.0	$0	$21,500	$21,5
Year 12	0.3	$13,333	$21,500	$34,8
Year 13	0.3	$13,333	$21,667	$35,0
Year 14	0.3	$13,333	$21,833	$35,1
Year 15	0.3	$13,333	$22,000	$35,3
Year 16	0.3	$13,333	$22,167	$35,5
Year 17	0.3	$13,333	$22,333	$35,6
Year 18	0.0	$0	$22,500	$22,5
Year 19	0.0	$0	$22,500	$22,5
Year 20	0.0	$0	$22,500	$22,5
NPV 20	45	$1,252,497	$140,597	$1,393,0

Pre-Rule Quiet Zone Crossing Safety Measures Costs

	Mountable Curbs w/ Frangible Delineators NATION (Excluding Chicago Area)			
	Number of Installations	Installation and Baseline	Annual Maintenance	Total
Year 1	0.0	$0	$0	$0
Year 2	5.1	$66,857	$0	$66,857
Year 3	5.1	$66,857	$2,571	$69,429
Year 4	5.8	$75,524	$5,143	$80,667
Year 5	6.5	$84,190	$8,048	$92,238
Year 6	7.5	$97,190	$11,286	$108,476
Year 7	8.5	$110,190	$15,024	$125,214
Year 8	8.1	$105,857	$19,262	$125,119
Year 9	2.0	$26,000	$23,333	$49,333
Year 10	0.7	$8,667	$24,333	$33,000
Year 11	0.3	$4,333	$24,667	$29,000
Year 12	1.0	$13,000	$24,833	$37,833
Year 13	1.3	$17,333	$25,333	$42,667
Year 14	1.3	$17,333	$26,000	$43,333
Year 15	1.0	$13,000	$26,667	$39,667
Year 16	0.7	$8,667	$27,167	$35,833
Year 17	0.0	$0	$27,500	$27,500
Year 18	0.0	$0	$27,500	$27,500
Year 19	0.0	$0	$27,500	$27,500
Year 20	0.0	$0	$27,500	$27,500
NPV 20	55	$473,549	$158,670	$632,218

	Medians OR Four-Quadrant Gates NATION (Excluding Chicago Area)			
	Number of Installations	Cost of Installations	Annual Maintenance	Total Ann Cost
Year 1	0.0	$0	$0	
Year 2	4.6	$290,286	$0	$290,2
Year 3	4.6	$290,286	$6,857	$297,1
Year 4	4.6	$290,286	$13,714	$304,0
Year 5	4.6	$290,286	$20,571	$310,8
Year 6	4.6	$290,286	$27,429	$317,7
Year 7	4.9	$311,452	$34,286	$345,7
Year 8	5.2	$332,619	$41,643	$374,2
Year 9	1.0	$63,500	$49,500	$113,0
Year 10	1.0	$63,500	$51,000	$114,5
Year 11	1.0	$63,500	$52,500	$116,0
Year 12	0.7	$42,333	$54,000	$96,3
Year 13	1.3	$84,667	$55,000	$139,6
Year 14	1.0	$63,500	$57,000	$120,5
Year 15	1.3	$84,667	$58,500	$143,1
Year 16	0.3	$21,167	$60,500	$81,6
Year 17	0.7	$42,333	$61,000	$103,3
Year 18	0.7	$42,333	$62,000	$104,3
Year 19	0.7	$42,333	$63,000	$105,3
Year 20	0.3	$21,167	$64,000	$85,1
NPV 20	43	$1,756,411	$354,600	$2,111,0

EXHIBIT 4

Pre-Rule Quiet Zone Crossing Safety Measures Costs

Photo-Enforcement: 2 Crossings Sharing Camera NATION (Excluding Chicago Area)				
	Number of Installations	Installation and Baseline	Annual Maintenance	Total
Year 1	0.0	$0	$0	$0
Year 2	1.1	$54,286	$0	$54,286
Year 3	1.1	$54,286	$0	$54,286
Year 4	1.1	$54,286	$35,200	$89,486
Year 5	1.1	$54,286	$52,800	$107,086
Year 6	1.1	$54,286	$70,400	$124,686
Year 7	1.1	$54,286	$88,000	$142,286
Year 8	1.1	$54,286	$103,886	$158,171
Year 9	0.7	$31,667	$119,771	$151,438
Year 10	0.7	$31,667	$130,038	$161,705
Year 11	0.7	$31,667	$140,305	$171,971
Year 12	0.0	$0	$150,571	$150,571
Year 13	0.0	$0	$150,571	$150,571
Year 14	0.0	$0	$150,571	$150,571
Year 15	0.7	$31,667	$151,286	$182,952
Year 16	0.7	$31,667	$162,267	$193,933
Year 17	0.7	$31,667	$172,533	$204,200
Year 18	0.0	$0	$183,800	$183,800
Year 19	0.0	$0	$184,800	$184,800
Year 20	0.0	$0	$184,800	$184,800
NPV 20	12.0	$354,018	$929,968	$1,283,986

Photo-Enforcement: 3 Crossings Sharing Camera NATION (Excluding Chicago Area)				
	Number of Installations	Installation and Baseline	Annual Maintenance	Total
Year 1	0.0	$0	$0	
Year 2	0.4	$16,786	$0	$16
Year 3	0.4	$16,786	$4,943	$21
Year 4	0.4	$16,786	$9,885	$26
Year 5	0.4	$16,786	$14,828	$31
Year 6	0.4	$16,786	$19,771	$36
Year 7	0.4	$16,786	$24,714	$41
Year 8	0.4	$16,786	$29,013	$45
Year 9	0.0	$0	$33,313	$33
Year 10	0.0	$0	$32,670	$32
Year 11	0.0	$0	$32,028	$32
Year 12	0.0	$0	$31,385	$31
Year 13	0.0	$0	$30,742	$30
Year 14	0.0	$0	$30,099	$30
Year 15	0.0	$0	$30,099	$30
Year 16	0.0	$0	$30,099	$30
Year 17	0.0	$0	$30,099	$30
Year 18	0.0	$0	$30,099	$30
Year 19	0.0	$0	$30,099	$30
Year 20	0.0	$0	$30,099	$30
NPV 20	3.0	$84,546	$211,548	$296,

Pre-Rule Quiet Zone Crossing Safety Measures Costs

Photo-Enforcement: 4 Crossings Sharing Camera
NATION (Excluding Chicago Area)

	Number of Installations	Cost of Installations	Annual Maintenance	Total
Year 1	0.0	$0	$0	$0
Year 2	0.6	$20,000	$0	$20,000
Year 3	0.6	$20,000	$5,486	$25,486
Year 4	0.6	$20,000	$10,971	$30,971
Year 5	0.6	$20,000	$16,457	$36,457
Year 6	0.6	$20,000	$21,943	$41,943
Year 7	0.6	$20,000	$27,429	$47,429
Year 8	0.6	$20,000	$32,057	$52,057
Year 9	0.0	$0	$36,686	$36,686
Year 10	0.0	$0	$35,829	$35,829
Year 11	0.0	$0	$34,971	$34,971
Year 12	0.0	$0	$34,114	$34,114
Year 13	0.0	$0	$33,257	$33,257
Year 14	0.0	$0	$32,400	$32,400
Year 15	0.0	$0	$32,400	$32,400
Year 16	0.0	$0	$32,400	$32,400
Year 17	0.0	$0	$32,400	$32,400
Year 18	0.0	$0	$32,400	$32,400
Year 19	0.0	$0	$32,400	$32,400
Year 20	0.0	$0	$32,400	$32,400
NPV 20	4.0	$100,734	$231,130	$331,865

Add Flashing Lights and Gates to Passive Crossings
NATION (Excluding Chicago Area)

	Number of Installations	Installation and Baseline	Annual Maintenance	Total
Year 1	0.0	$0	$0	
Year 2	1.7	$240,000	$0	$240,
Year 3	1.7	$240,000	$0	$240,
Year 4	1.7	$240,000	$8,571	$248,
Year 5	1.7	$240,000	$12,857	$252,
Year 6	1.7	$240,000	$17,143	$257,
Year 7	1.7	$240,000	$21,429	$261,
Year 8	1.7	$240,000	$25,714	$265,
Year 9	0.0	$0	$30,000	$30,
Year 10	0.0	$0	$30,000	$30,
Year 11	0.0	$0	$30,000	$30,
Year 12	0.0	$0	$30,000	$30,
Year 13	0.0	$0	$30,000	$30,
Year 14	0.0	$0	$30,000	$30,
Year 15	0.0	$0	$30,000	$30,
Year 16	0.0	$0	$30,000	$30,
Year 17	0.0	$0	$30,000	$30,
Year 18	0.0	$0	$30,000	$30,
Year 19	0.0	$0	$30,000	$30,
Year 20	0.0	$0	$30,000	$30,
NPV 20	5.0	$1,208,813	$194,121	$1,402,

EXHIBIT 5

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
CONSTANT COLLISION RATE

Communities Where Train Horns Are Routinely Sounded

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Injuries	Fewer Fatalities	Fewer Collisions
Year 1	0	$0	$0	Year 1	0	0.00	0.00
Year 2	$743,800	$239,192	$982,992	Year 2	0.56	0.08	0.51
Year 3	$1,487,599	$478,385	$1,965,984	Year 3	1.12	0.16	1.01
Year 4	$2,231,399	$717,577	$2,948,976	Year 4	1.68	0.24	1.52
Year 5	$2,231,399	$717,577	$2,948,976	Year 5	1.68	0.24	1.52
Year 6	$2,231,399	$717,577	$2,948,976	Year 6	1.68	0.24	1.52
Year 7	$2,231,399	$717,577	$2,948,976	Year 7	1.68	0.24	1.52
Year 8	$2,231,399	$717,577	$2,948,976	Year 8	1.68	0.24	1.52
Year 9	$2,231,399	$717,577	$2,948,976	Year 9	1.68	0.24	1.52
Year 10	$2,231,399	$717,577	$2,948,976	Year 10	1.68	0.24	1.52
Year 11	$2,231,399	$717,577	$2,948,976	Year 11	1.68	0.24	1.52
Year 12	$2,231,399	$717,577	$2,948,976	Year 12	1.68	0.24	1.52
Year 13	$2,231,399	$717,577	$2,948,976	Year 13	1.68	0.24	1.52
Year 14	$2,231,399	$717,577	$2,948,976	Year 14	1.68	0.24	1.52
Year 15	$2,231,399	$717,577	$2,948,976	Year 15	1.68	0.24	1.52
Year 16	$2,231,399	$717,577	$2,948,976	Year 16	1.68	0.24	1.52
Year 17	$2,231,399	$717,577	$2,948,976	Year 17	1.68	0.24	1.52
Year 18	$2,231,399	$717,577	$2,948,976	Year 18	1.68	0.24	1.52
Year 19	$2,231,399	$717,577	$2,948,976	Year 19	1.68	0.24	1.52
Year 20	$2,231,399	$717,577	$2,948,976	Year 20	1.68	0.24	1.52
NPV - 20	$19,647,561	$6,318,297	$25,965,858	Total	30.30	4.31	27.37

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
DECLINING COLLISION RATE: 4% Annually

Communities in the Process of Establishing QZs

	Value of Reduction in: Injuries	Fatalities	Total			Fewer Injuries	Fewer Fatalities	Fewer Collisions
Year 1	$0	$0	$0	1.00	Year 1	-	-	-
Year 2	$714,048	$229,625	$943,672	0.96	Year 2	0.54	0.08	0.49
Year 3	$1,370,971	$440,879	$1,811,851	0.92	Year 3	1.03	0.15	0.93
Year 4	$1,974,199	$634,866	$2,609,065	0.88	Year 4	1.49	0.21	1.35
Year 5	$1,895,231	$609,472	$2,504,702	0.85	Year 5	1.43	0.20	1.29
Year 6	$1,819,422	$585,093	$2,404,514	0.82	Year 6	1.37	0.20	1.24
Year 7	$1,746,645	$561,689	$2,308,334	0.78	Year 7	1.32	0.19	1.19
Year 8	$1,676,779	$539,221	$2,216,000	0.75	Year 8	1.26	0.18	1.14
Year 9	$1,609,708	$517,653	$2,127,360	0.72	Year 9	1.21	0.17	1.10
Year 10	$1,545,319	$496,946	$2,042,266	0.69	Year 10	1.17	0.17	1.05
Year 11	$1,483,507	$477,069	$1,960,575	0.66	Year 11	1.12	0.16	1.01
Year 12	$1,424,166	$457,986	$1,882,152	0.64	Year 12	1.07	0.15	0.97
Year 13	$1,367,200	$439,666	$1,806,866	0.61	Year 13	1.03	0.15	0.93
Year 14	$1,312,512	$422,080	$1,734,592	0.59	Year 14	0.99	0.14	0.89
Year 15	$1,260,011	$405,197	$1,665,208	0.56	Year 15	0.95	0.14	0.86
Year 16	$1,209,611	$388,989	$1,598,600	0.54	Year 16	0.91	0.13	0.82
Year 17	$1,161,226	$373,429	$1,534,656	0.52	Year 17	0.88	0.12	0.79
Year 18	$1,114,777	$358,492	$1,473,269	0.50	Year 18	0.84	0.12	0.76
Year 19	$1,070,186	$344,152	$1,414,339	0.48	Year 19	0.81	0.11	0.73
Year 20	$1,027,379	$330,386	$1,357,765	0.46	Year 20	0.78	0.11	0.70
NPV - 20	$14,076,069	$4,526,606	$18,602,675		Total	20.20	2.87	18.25

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
CONSTANT COLLISION RATE

Communities Where Whistle Bans Were Established Post 10-9-96

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Injuries	Fewer Fatalities	Fewer Collisions
Year 1	0	$0	$0	Year 1	0	0.00	0.00
Year 2	$5,361	$172,920	$178,281	Year 2	0.08	0.04	0.18
Year 3	$10,721	$345,840	$356,561	Year 3	0.15	0.08	0.35
Year 4	$16,082	$518,760	$534,842	Year 4	0.23	0.11	0.53
Year 5	$16,082	$518,760	$534,842	Year 5	0.23	0.11	0.53
Year 6	$16,082	$518,760	$534,842	Year 6	0.23	0.11	0.53
Year 7	$16,082	$518,760	$534,842	Year 7	0.23	0.11	0.53
Year 8	$16,082	$518,760	$534,842	Year 8	0.23	0.11	0.53
Year 9	$16,082	$518,760	$534,842	Year 9	0.23	0.11	0.53
Year 10	$16,082	$518,760	$534,842	Year 10	0.23	0.11	0.53
Year 11	$16,082	$518,760	$534,842	Year 11	0.23	0.11	0.53
Year 12	$16,082	$518,760	$534,842	Year 12	0.23	0.11	0.53
Year 13	$16,082	$518,760	$534,842	Year 13	0.23	0.11	0.53
Year 14	$16,082	$518,760	$534,842	Year 14	0.23	0.11	0.53
Year 15	$16,082	$518,760	$534,842	Year 15	0.23	0.11	0.53
Year 16	$16,082	$518,760	$534,842	Year 16	0.23	0.11	0.53
Year 17	$16,082	$518,760	$534,842	Year 17	0.23	0.11	0.53
Year 18	$16,082	$518,760	$534,842	Year 18	0.23	0.11	0.53
Year 19	$16,082	$518,760	$534,842	Year 19	0.23	0.11	0.53
Year 20	$16,082	$518,760	$534,842	Year 20	0.23	0.11	0.53
NPV - 20	$141,599	$4,567,704	$4,709,303	Total	4.11	2.05	9.45

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
DECLINING COLLISION RATE: 4% Annually

Communities Where Whistle Bans Were Established Post 10-9-96

	Value of Reduction in: Injuries	Fatalities	Total			Fewer Injuries	Fewer Fatalities	Fewer Collisions
Year 1	$0	$0	$0	1.00	Year 1	-	-	-
Year 2	$5,146	$166,003	$171,149	0.96	Year 2	0.07	0.04	0.17
Year 3	$9,881	$318,726	$328,607	0.92	Year 3	0.14	0.07	0.32
Year 4	$14,228	$458,966	$473,194	0.88	Year 4	0.20	0.10	0.46
Year 5	$13,659	$440,607	$454,266	0.85	Year 5	0.19	0.10	0.45
Year 6	$13,112	$422,983	$436,095	0.82	Year 6	0.19	0.09	0.43
Year 7	$12,588	$406,063	$418,651	0.78	Year 7	0.18	0.09	0.41
Year 8	$12,084	$389,821	$401,905	0.75	Year 8	0.17	0.09	0.39
Year 9	$11,601	$374,228	$385,829	0.72	Year 9	0.16	0.08	0.38
Year 10	$11,137	$359,259	$370,396	0.69	Year 10	0.16	0.08	0.36
Year 11	$10,692	$344,889	$355,580	0.66	Year 11	0.15	0.08	0.35
Year 12	$10,264	$331,093	$341,357	0.64	Year 12	0.15	0.07	0.34
Year 13	$9,853	$317,849	$327,703	0.61	Year 13	0.14	0.07	0.32
Year 14	$9,459	$305,135	$314,595	0.59	Year 14	0.13	0.07	0.31
Year 15	$9,081	$292,930	$302,011	0.56	Year 15	0.13	0.06	0.30
Year 16	$8,718	$281,213	$289,930	0.54	Year 16	0.12	0.06	0.28
Year 17	$8,369	$269,964	$278,333	0.52	Year 17	0.12	0.06	0.27
Year 18	$8,034	$259,166	$267,200	0.50	Year 18	0.11	0.06	0.26
Year 19	$7,713	$248,799	$256,512	0.48	Year 19	0.11	0.05	0.25
Year 20	$7,404	$238,847	$246,251	0.46	Year 20	0.11	0.05	0.24
NPV - 20	$101,445	$3,272,432	$3,373,878		Total	2.74	1.37	6.30

EXHIBIT 5

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
CONSTANT COLLISION RATE

Communities Where Train Horns Are Routinely Sounded

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Injuries	Fewer Fatalities	Fewer Collisions
Year 1	0	$0	$0	Year 1	0	0.00	0.00
Year 2	$743,800	$239,192	$982,992	Year 2	0.56	0.08	0.51
Year 3	$1,487,599	$478,385	$1,965,984	Year 3	1.12	0.16	1.01
Year 4	$2,231,399	$717,577	$2,948,976	Year 4	1.68	0.24	1.52
Year 5	$2,231,399	$717,577	$2,948,976	Year 5	1.68	0.24	1.52
Year 6	$2,231,399	$717,577	$2,948,976	Year 6	1.68	0.24	1.52
Year 7	$2,231,399	$717,577	$2,948,976	Year 7	1.68	0.24	1.52
Year 8	$2,231,399	$717,577	$2,948,976	Year 8	1.68	0.24	1.52
Year 9	$2,231,399	$717,577	$2,948,976	Year 9	1.68	0.24	1.52
Year 10	$2,231,399	$717,577	$2,948,976	Year 10	1.68	0.24	1.52
Year 11	$2,231,399	$717,577	$2,948,976	Year 11	1.68	0.24	1.52
Year 12	$2,231,399	$717,577	$2,948,976	Year 12	1.68	0.24	1.52
Year 13	$2,231,399	$717,577	$2,948,976	Year 13	1.68	0.24	1.52
Year 14	$2,231,399	$717,577	$2,948,976	Year 14	1.68	0.24	1.52
Year 15	$2,231,399	$717,577	$2,948,976	Year 15	1.68	0.24	1.52
Year 16	$2,231,399	$717,577	$2,948,976	Year 16	1.68	0.24	1.52
Year 17	$2,231,399	$717,577	$2,948,976	Year 17	1.68	0.24	1.52
Year 18	$2,231,399	$717,577	$2,948,976	Year 18	1.68	0.24	1.52
Year 19	$2,231,399	$717,577	$2,948,976	Year 19	1.68	0.24	1.52
Year 20	$2,231,399	$717,577	$2,948,976	Year 20	1.68	0.24	1.52
NPV - 20	$19,647,561	$6,318,297	$25,965,858	Total	30.30	4.31	27.37

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
DECLINING COLLISION RATE: 4% Annually

Communities in the Process of Establishing QZs

	Value of Reduction in:					Fewer	Fewer	Fewer
	Injuries	Fatalities	Total			Injuries	Fatalities	Collisions
Year 1	$0	$0	$0	1.00	Year 1	-	-	-
Year 2	$714,048	$229,625	$943,672	0.96	Year 2	0.54	0.08	0.49
Year 3	$1,370,971	$440,879	$1,811,851	0.92	Year 3	1.03	0.15	0.93
Year 4	$1,974,199	$634,866	$2,609,065	0.88	Year 4	1.49	0.21	1.35
Year 5	$1,895,231	$609,472	$2,504,702	0.85	Year 5	1.43	0.20	1.29
Year 6	$1,819,422	$585,093	$2,404,514	0.82	Year 6	1.37	0.20	1.24
Year 7	$1,746,645	$561,689	$2,308,334	0.78	Year 7	1.32	0.19	1.19
Year 8	$1,676,779	$539,221	$2,216,000	0.75	Year 8	1.26	0.18	1.14
Year 9	$1,609,708	$517,653	$2,127,360	0.72	Year 9	1.21	0.17	1.10
Year 10	$1,545,319	$496,946	$2,042,266	0.69	Year 10	1.17	0.17	1.05
Year 11	$1,483,507	$477,069	$1,960,575	0.66	Year 11	1.12	0.16	1.01
Year 12	$1,424,166	$457,986	$1,882,152	0.64	Year 12	1.07	0.15	0.97
Year 13	$1,367,200	$439,666	$1,806,866	0.61	Year 13	1.03	0.15	0.93
Year 14	$1,312,512	$422,080	$1,734,592	0.59	Year 14	0.99	0.14	0.89
Year 15	$1,260,011	$405,197	$1,665,208	0.56	Year 15	0.95	0.14	0.86
Year 16	$1,209,611	$388,989	$1,598,600	0.54	Year 16	0.91	0.13	0.82
Year 17	$1,161,226	$373,429	$1,534,656	0.52	Year 17	0.88	0.12	0.79
Year 18	$1,114,777	$358,492	$1,473,269	0.50	Year 18	0.84	0.12	0.76
Year 19	$1,070,186	$344,152	$1,414,339	0.48	Year 19	0.81	0.11	0.73
Year 20	$1,027,379	$330,386	$1,357,765	0.46	Year 20	0.78	0.11	0.70
NPV - 20	$14,076,069	$4,526,606	$18,602,675		Total	20.20	2.87	18.25

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
CONSTANT COLLISION RATE

Communities Where Whistle Bans Were Established Post 10-9-96							
	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Injuries	Fatalities	Collisions
Year 1	0	$0	$0	Year 1	0	0.00	0.00
Year 2	$5,361	$172,920	$178,281	Year 2	0.08	0.04	0.18
Year 3	$10,721	$345,840	$356,561	Year 3	0.15	0.08	0.35
Year 4	$16,082	$518,760	$534,842	Year 4	0.23	0.11	0.53
Year 5	$16,082	$518,760	$534,842	Year 5	0.23	0.11	0.53
Year 6	$16,082	$518,760	$534,842	Year 6	0.23	0.11	0.53
Year 7	$16,082	$518,760	$534,842	Year 7	0.23	0.11	0.53
Year 8	$16,082	$518,760	$534,842	Year 8	0.23	0.11	0.53
Year 9	$16,082	$518,760	$534,842	Year 9	0.23	0.11	0.53
Year 10	$16,082	$518,760	$534,842	Year 10	0.23	0.11	0.53
Year 11	$16,082	$518,760	$534,842	Year 11	0.23	0.11	0.53
Year 12	$16,082	$518,760	$534,842	Year 12	0.23	0.11	0.53
Year 13	$16,082	$518,760	$534,842	Year 13	0.23	0.11	0.53
Year 14	$16,082	$518,760	$534,842	Year 14	0.23	0.11	0.53
Year 15	$16,082	$518,760	$534,842	Year 15	0.23	0.11	0.53
Year 16	$16,082	$518,760	$534,842	Year 16	0.23	0.11	0.53
Year 17	$16,082	$518,760	$534,842	Year 17	0.23	0.11	0.53
Year 18	$16,082	$518,760	$534,842	Year 18	0.23	0.11	0.53
Year 19	$16,082	$518,760	$534,842	Year 19	0.23	0.11	0.53
Year 20	$16,082	$518,760	$534,842	Year 20	0.23	0.11	0.53
NPV - 20	$141,599	$4,567,704	$4,709,303	Total	4.11	2.05	9.45

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
DECLINING COLLISION RATE: 4% Annually

Communities Where Whistle Bans Were Established Post 10-9-96

	Value of Reduction in: Injuries	Fatalities	Total			Fewer Injuries	Fewer Fatalities	Fewer Collisions
Year 1	$0	$0	$0	1.00	Year 1	-	-	-
Year 2	$5,146	$166,003	$171,149	0.96	Year 2	0.07	0.04	0.17
Year 3	$9,881	$318,726	$328,607	0.92	Year 3	0.14	0.07	0.32
Year 4	$14,228	$458,966	$473,194	0.88	Year 4	0.20	0.10	0.46
Year 5	$13,659	$440,607	$454,266	0.85	Year 5	0.19	0.10	0.45
Year 6	$13,112	$422,983	$436,095	0.82	Year 6	0.19	0.09	0.43
Year 7	$12,588	$406,063	$418,651	0.78	Year 7	0.18	0.09	0.41
Year 8	$12,084	$389,821	$401,905	0.75	Year 8	0.17	0.09	0.39
Year 9	$11,601	$374,228	$385,829	0.72	Year 9	0.16	0.08	0.38
Year 10	$11,137	$359,259	$370,396	0.69	Year 10	0.16	0.08	0.36
Year 11	$10,692	$344,889	$355,580	0.66	Year 11	0.15	0.08	0.35
Year 12	$10,264	$331,093	$341,357	0.64	Year 12	0.15	0.07	0.34
Year 13	$9,853	$317,849	$327,703	0.61	Year 13	0.14	0.07	0.32
Year 14	$9,459	$305,135	$314,595	0.59	Year 14	0.13	0.07	0.31
Year 15	$9,081	$292,930	$302,011	0.56	Year 15	0.13	0.06	0.30
Year 16	$8,718	$281,213	$289,930	0.54	Year 16	0.12	0.06	0.28
Year 17	$8,369	$269,964	$278,333	0.52	Year 17	0.12	0.06	0.27
Year 18	$8,034	$259,166	$267,200	0.50	Year 18	0.11	0.06	0.26
Year 19	$7,713	$248,799	$256,512	0.48	Year 19	0.11	0.05	0.25
Year 20	$7,404	$238,847	$246,251	0.46	Year 20	0.11	0.05	0.24
NPV - 20	$101,445	$3,272,432	$3,373,878		Total	2.74	1.37	6.30

Pre-Rule Quiet Zones -
Costs for Periodic Re-Certification and Update of Grade Crossing Inventory

Chicago Area

	SSMs	ASMs	Cost
Year 1	0	0	$0
Year 2	0	0	$0
Year 3	0	0	$0
Year 4	0	0	$0
Year 5	0	0	$0
Year 6	0	357	$24,276
Year 7	0	0	$0
Year 8	26	0	$1,768
Year 9	0	357	$24,276
Year 10	0	0	$0
Year 11	0	0	$0
Year 12	0	357	$24,276
Year 13	26	0	$1,768
Year 14	0	0	$0
Year 15	0	357	$24,276
Year 16	0	0	$0
Year 17	0	0	$0
Year 18	26	357	$26,044
Year 19	0	0	$0
Year 20	0	0	$0
NPV - 20	n/a	n/a	$58,426

Nationwide, Excluding Chicago

	SSMs	ASMs	Cost
Year 1	0	0	$0
Year 2	0	0	$0
Year 3	0	0	$0
Year 4	0	0	$0
Year 5	0	0	$0
Year 6	0	1539	$92,340
Year 7	0	0	$0
Year 8	27	0	$1,620
Year 9	0	1539	$92,340
Year 10	0	0	$0
Year 11	0	0	$0
Year 12	0	1539	$92,340
Year 13	27	0	$1,620
Year 14	0	0	$0
Year 15	0	1539	$92,340
Year 16	0	0	$0
Year 17	0	0	$0
Year 18	27	1539	$93,960
Year 19	0	0	$0
Year 20	0	0	$0
NPV - 20	n/a	n/a	$215,640

All New Quiet Zones -
Costs of Periodic Re-certification and Update of
Grade Crossing Inventory

	Number of Crossings	Update Inventory Certification
Year 1	0	$ -
Year 2	0	$ -
Year 3	467	$ 28,020
Year 4	0	$ -
Year 5	0	$ -
Year 6	467	$ 27,540
Year 7	0	$ -
Year 8	8	$ 480
Year 9	467	$ 27,540
Year 10	0	$ -
Year 11	0	$ -
Year 12	467	$ 27,540
Year 13	8	$ 480
Year 14	0	$ -
Year 15	467	$ 27,540
Year 16	0	$ -
Year 17	0	$ -
Year 18	475	$ 28,020
Year 19	0	$ -
Year 20	0	$ -
NPV - 20	n/a	$ 87,182

Federal Government Costs for Annual Update of NSRT and QZSIs
and Notification of Affected Communities

	FRA Update & Notification
Year 1	$2,400
Year 2	$2,400
Year 3	$2,400
Year 4	$2,400
Year 5	$2,400
Year 6	$2,400
Year 7	$2,400
Year 8	$2,400
Year 9	$2,400
Year 10	$2,400
Year 11	$2,400
Year 12	$2,400
Year 13	$2,400
Year 14	$2,400
Year 15	$2,400
Year 16	$2,400
Year 17	$2,400
Year 18	$2,400
Year 19	$2,400
Year 20	$2,400
NPV - 20	$25,426

Initial Cost to Update Grade Crossing Inventory, Develop QZ, Notify Affected Entities, Certify Understanding of Risk, and FRA Approval: Pre-Rule Quiet Zones in Chicago Area

	Initial Update of Inventory	Notification, Update Inventory, Certification	QZ Development FRA Approval
Year 1	$0	$0	$0
Year 2	$26,044	$49,685	$145,820
Year 3	$0	$49,685	$145,820
Year 4	$0	$49,685	$145,820
Year 5	$0	$49,685	$145,820
Year 6	$0	$49,685	$0
Year 7	$0	$49,685	$0
Year 8	$0	$49,685	$0
Year 9	$0	$0	$0
Year 10	$0	$0	$0
Year 11	$0	$0	$0
Year 12	$0	$0	$0
Year 13	$0	$0	$0
Year 14	$0	$0	$0
Year 15	$0	$0	$0
Year 16	$0	$0	$0
Year 17	$0	$0	$0
Year 18	$0	$0	$0
Year 19	$0	$0	$0
Year 20	$0	$0	$0
NPV - 20	$24,340	$267,766	$493,923

Initial Cost to Update Grade Crossing Inventory, Develop QZ, Notify Affected Entities, Certify Understanding of Risk, and FRA Approval: Pre-Rule Quiet Zones Nationwide (Excluding Chicago)

	Initial Update of Inventory	Notification, Update Inventory, Certification	QZ Development FRA Approval
Year 1	$0	$0	$0
Year 2	$93,960	$313,080	$228,000
Year 3	$0	$313,080	$228,000
Year 4	$0	$313,080	$228,000
Year 5	$0	$313,080	$228,000
Year 6	$0	$313,080	$0
Year 7	$0	$313,080	$0
Year 8	$0	$313,080	$0
Year 9	$0	$0	$0
Year 10	$0	$0	$0
Year 11	$0	$0	$0
Year 12	$0	$0	$0
Year 13	$0	$0	$0
Year 14	$0	$0	$0
Year 15	$0	$0	$0
Year 16	$0	$0	$0
Year 17	$0	$0	$0
Year 18	$0	$0	$0
Year 19	$0	$0	$0
Year 20	$0	$0	$0
NPV - 20	$87,813	$1,687,279	$772,284

Initial Cost to Update Grade Crossing Inventory, Develop QZ, Notify Affected Entities, Certify Understanding of Risk, and FRA Approval: New Quiet Zones (Non Existing W-Bans)

	Initial Update of Inventory	Notification and Certification	QZ Development FRA Approval
Year 1	$0	$0	$0
Year 2	$24,060	$80,190	$188,100
Year 3	$0	$80,190	$188,100
Year 4	$0	$80,190	$188,100
Year 5	$0	$0	$0
Year 6	$0	$0	$0
Year 7	$0	$0	$0
Year 8	$0	$0	$0
Year 9	$0	$0	$0
Year 10	$0	$0	$0
Year 11	$0	$0	$0
Year 12	$0	$0	$0
Year 13	$0	$0	$0
Year 14	$0	$0	$0
Year 15	$0	$0	$0
Year 16	$0	$0	$0
Year 17	$0	$0	$0
Year 18	$0	$0	$0
Year 19	$0	$0	$0
Year 20	$0	$0	$0
NPV - 20	$22,486	$210,444	$493,634

Initial Cost to Update Grade Crossing Inventory, Develop QZ, Notify Affected Entities, Certify Understanding of Risk, and FRA Approval: New Quiet Zones (Established post 10/9/96)

	Initial Update of Inventory	Notification and Certification	QZ Development FRA Approval
Year 1	$0	$0	$0
Year 2	$3,960	$6,480	$15,200
Year 3	$0	$6,480	$15,200
Year 4	$0	$6,480	$15,200
Year 5	$0	$0	$0
Year 6	$0	$0	$0
Year 7	$0	$0	$0
Year 8	$0	$0	$0
Year 9	$0	$0	$0
Year 10	$0	$0	$0
Year 11	$0	$0	$0
Year 12	$0	$0	$0
Year 13	$0	$0	$0
Year 14	$0	$0	$0
Year 15	$0	$0	$0
Year 16	$0	$0	$0
Year 17	$0	$0	$0
Year 18	$0	$0	$0
Year 19	$0	$0	$0
Year 20	$0	$0	$0
NPV - 20	$3,701	$17,006	$39,890

Pre-Rule Quiet Zone Anticipated Safety Benefits
CONSTANT COLLISION RATE

Termination of Whistle Bans

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Collisions	Fewer Injuries	Fewer Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$0	$0	$0	Year 2	-	-	-
Year 3	$0	$0	$0	Year 3	-	-	-
Year 4	$33,069	$7,439	$40,508	Year 4	0.03	0.01	0.00
Year 5	$33,069	$14,878	$47,947	Year 5	0.03	0.01	0.00
Year 6	$33,069	$22,317	$55,386	Year 6	0.03	0.02	0.01
Year 7	$33,069	$22,317	$55,386	Year 7	0.03	0.02	0.01
Year 8	$33,069	$22,317	$55,386	Year 8	0.03	0.02	0.01
Year 9	$33,069	$22,317	$55,386	Year 9	0.03	0.02	0.01
Year 10	$33,069	$22,317	$55,386	Year 10	0.03	0.02	0.01
Year 11	$33,069	$22,317	$55,386	Year 11	0.03	0.02	0.01
Year 12	$33,069	$22,317	$55,386	Year 12	0.03	0.02	0.01
Year 13	$33,069	$22,317	$55,386	Year 13	0.03	0.02	0.01
Year 14	$33,069	$22,317	$55,386	Year 14	0.03	0.02	0.01
Year 15	$33,069	$22,317	$55,386	Year 15	0.03	0.02	0.01
Year 16	$33,069	$22,317	$55,386	Year 16	0.03	0.02	0.01
Year 17	$33,069	$22,317	$55,386	Year 17	0.03	0.02	0.01
Year 18	$33,069	$22,317	$55,386	Year 18	0.03	0.02	0.01
Year 19	$33,069	$22,317	$55,386	Year 19	0.03	0.02	0.01
Year 20	$33,069	$22,317	$55,386	Year 20	0.03	0.02	0.01
NPV - 20	$263,551	$161,208	$424,759	Total	0.56	0.27	0.12

Pre-Rule Quiet Zone Anticipated Safety Benefits
Assuming a declining collision rate of 4% annually.

Termination of Whistle Bans							
	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total	4% decline	Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	$1	-	-	-
Year 2	$0	$0	$0	$0.96	-	-	-
Year 3	$0	$0	$0	$0.92	-	-	-
Year 4	$29,257	$6,582	$35,839	$0.88	0.03	0.00	0.00
Year 5	$28,087	$12,637	$40,724	$0.85	0.03	0.01	0.00
Year 6	$26,964	$18,197	$45,161	$0.82	0.03	0.01	0.01
Year 7	$25,885	$17,469	$43,354	$0.78	0.03	0.01	0.01
Year 8	$24,850	$16,770	$41,620	$0.75	0.02	0.01	0.01
Year 9	$23,856	$16,099	$39,955	$0.72	0.02	0.01	0.01
Year 10	$22,902	$15,455	$38,357	$0.69	0.02	0.01	0.01
Year 11	$21,985	$14,837	$36,823	$0.66	0.02	0.01	0.00
Year 12	$21,106	$14,244	$35,350	$0.64	0.02	0.01	0.00
Year 13	$20,262	$13,674	$33,936	$0.61	0.02	0.01	0.00
Year 14	$19,451	$13,127	$32,578	$0.59	0.02	0.01	0.00
Year 15	$18,673	$12,602	$31,275	$0.56	0.02	0.01	0.00
Year 16	$17,926	$12,098	$30,024	$0.54	0.02	0.01	0.00
Year 17	$17,209	$11,614	$28,823	$0.52	0.02	0.01	0.00
Year 18	$16,521	$11,149	$27,670	$0.50	0.02	0.01	0.00
Year 19	$15,860	$10,703	$26,564	$0.48	0.02	0.01	0.00
Year 20	$15,226	$10,275	$25,501	$0.46	0.02	0.01	0.00
NPV - 20	$182,778	$108,804	$291,582		0.37	0.17	0.08

EXHIBIT
7 Chicago Area

Pre-Rule Quiet Zone Anticipated Safety Benefits
CONSTANT COLLISION RATE

Quiet Zones with Corridor Crossing Severity Index Greater Than the National Significant Risk Threshold and One or More Collisions in 5 Years

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Collisions	Fewer Injuries	Fewer Fatalities
Year 1	0	0	$0	Year 1	-	-	-
Year 2	$190,052	$128,196	$318,248	Year 2	0.19	0.10	0.04
Year 3	$380,105	$256,392	$636,497	Year 3	0.38	0.19	0.09
Year 4	$570,157	$384,588	$954,745	Year 4	0.57	0.29	0.13
Year 5	$760,210	$512,784	$1,272,994	Year 5	0.76	0.38	0.17
Year 6	$950,262	$640,980	$1,591,242	Year 6	0.94	0.48	0.21
Year 7	$1,140,315	$769,176	$1,909,490	Year 7	1.13	0.58	0.26
Year 8	$1,330,367	$897,372	$2,227,739	Year 8	1.32	0.67	0.30
Year 9	$1,330,367	$897,372	$2,227,739	Year 9	1.32	0.67	0.30
Year 10	$1,330,367	$897,372	$2,227,739	Year 10	1.32	0.67	0.30
Year 11	$1,330,367	$897,372	$2,227,739	Year 11	1.32	0.67	0.30
Year 12	$1,330,367	$897,372	$2,227,739	Year 12	1.32	0.67	0.30
Year 13	$1,330,367	$897,372	$2,227,739	Year 13	1.32	0.67	0.30
Year 14	$1,330,367	$897,372	$2,227,739	Year 14	1.32	0.67	0.30
Year 15	$1,330,367	$897,372	$2,227,739	Year 15	1.32	0.67	0.30
Year 16	$1,330,367	$897,372	$2,227,739	Year 16	1.32	0.67	0.30
Year 17	$1,330,367	$897,372	$2,227,739	Year 17	1.32	0.67	0.30
Year 18	$1,330,367	$897,372	$2,227,739	Year 18	1.32	0.67	0.30
Year 19	$1,330,367	$897,372	$2,227,739	Year 19	1.32	0.67	0.30
Year 20	$1,330,367	$897,372	$2,227,739	Year 20	1.32	0.67	0.30
NPV - 20	$9,720,792	$6,556,959	$16,277,752	Total	21.15	10.76	4.79

Assuming a declining collision rate of 4% annually.
Pre-Rule Quiet Zone Anticipated Safety Benefits
Quiet Zones with Corridor Crossing Seveity Index Greater Than the
National Significant Risk Threshold and One or More Collisions in 5 Years

	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$182,450	$123,068	$305,518	Year 2	0.18	0.09	0.04
Year 3	$350,305	$236,291	$586,595	Year 3	0.35	0.18	0.08
Year 4	$504,439	$340,259	$844,697	Year 4	0.50	0.25	0.11
Year 5	$645,682	$435,531	$1,081,213	Year 5	0.64	0.33	0.15
Year 6	$774,818	$522,637	$1,297,455	Year 6	0.77	0.39	0.17
Year 7	$892,590	$602,078	$1,494,668	Year 7	0.89	0.45	0.20
Year 8	$999,701	$674,328	$1,674,029	Year 8	0.99	0.51	0.22
Year 9	$959,713	$647,355	$1,607,067	Year 9	0.95	0.49	0.22
Year 10	$921,324	$621,460	$1,542,785	Year 10	0.92	0.47	0.21
Year 11	$884,471	$596,602	$1,481,073	Year 11	0.88	0.45	0.20
Year 12	$849,093	$572,738	$1,421,830	Year 12	0.84	0.43	0.19
Year 13	$815,129	$549,828	$1,364,957	Year 13	0.81	0.41	0.18
Year 14	$782,524	$527,835	$1,310,359	Year 14	0.78	0.40	0.18
Year 15	$751,223	$506,722	$1,257,945	Year 15	0.75	0.38	0.17
Year 16	$721,174	$486,453	$1,207,627	Year 16	0.72	0.36	0.16
Year 17	$692,327	$466,995	$1,159,322	Year 17	0.69	0.35	0.16
Year 18	$664,634	$448,315	$1,112,949	Year 18	0.66	0.34	0.15
Year 19	$638,048	$430,382	$1,068,431	Year 19	0.63	0.32	0.14
Year 20	$612,527	$413,167	$1,025,694	Year 20	0.61	0.31	0.14
NPV - 20	$6,640,904	$4,479,484	$11,120,388	Total	13.55	6.90	3.07

Pre-Rule Quiet Zone Anticipated Safety Benefits
CONSTANT COLLISION RATE

Corridor Crossing Seveity Index Greater Than Two Times the National Significant Risk Threshold and No Collisions in 5 Years

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Collisions	Fewer Injuries	Fewer Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$165,346	$111,587	$276,932	Year 2	0.17	0.08	0.04
Year 3	$330,691	$223,173	$553,865	Year 3	0.33	0.17	0.07
Year 4	$496,037	$334,760	$830,797	Year 4	0.50	0.25	0.11
Year 5	$661,383	$446,346	$1,107,729	Year 5	0.66	0.34	0.15
Year 6	$826,728	$557,933	$1,384,661	Year 6	0.83	0.42	0.19
Year 7	$992,074	$669,519	$1,661,594	Year 7	1.00	0.50	0.22
Year 8	$1,157,420	$781,106	$1,938,526	Year 8	1.16	0.59	0.26
Year 9	$1,157,420	$781,106	$1,938,526	Year 9	1.16	0.59	0.26
Year 10	$1,157,420	$781,106	$1,938,526	Year 10	1.16	0.59	0.26
Year 11	$1,157,420	$781,106	$1,938,526	Year 11	1.16	0.59	0.26
Year 12	$1,157,420	$781,106	$1,938,526	Year 12	1.16	0.59	0.26
Year 13	$1,157,420	$781,106	$1,938,526	Year 13	1.16	0.59	0.26
Year 14	$1,157,420	$781,106	$1,938,526	Year 14	1.16	0.59	0.26
Year 15	$1,157,420	$781,106	$1,938,526	Year 15	1.16	0.59	0.26
Year 16	$1,157,420	$781,106	$1,938,526	Year 16	1.16	0.59	0.26
Year 17	$1,157,420	$781,106	$1,938,526	Year 17	1.16	0.59	0.26
Year 18	$1,157,420	$781,106	$1,938,526	Year 18	1.16	0.59	0.26
Year 19	$1,157,420	$781,106	$1,938,526	Year 19	1.16	0.59	0.26
Year 20	$1,157,420	$781,106	$1,938,526	Year 20	1.16	0.59	0.26
NPV - 20	$8,457,092	$5,707,424	$14,164,517	Total	18.59	9.38	4.17

EXHIBIT 7 Chicago Area
Pre-Rule Quiet Zone Anticipated Safety Benefits
Assuming a declining collision rate of 4% annually.

Corridor Crossing Severity Index Greater Than Two Times the National Significant Risk Threshold and No Collisions in 5 Years

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Collisions	Fewer Injuries	Fewer Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$158,732	$107,123	$265,855	Year 2	0.16	0.08	0.04
Year 3	$304,765	$205,676	$510,442	Year 3	0.31	0.15	0.07
Year 4	$438,862	$296,174	$735,036	Year 4	0.44	0.22	0.10
Year 5	$561,743	$379,103	$940,846	Year 5	0.56	0.28	0.13
Year 6	$674,092	$454,923	$1,129,015	Year 6	0.68	0.34	0.15
Year 7	$776,554	$524,072	$1,300,625	Year 7	0.78	0.39	0.17
Year 8	$869,740	$586,960	$1,456,700	Year 8	0.87	0.44	0.20
Year 9	$834,951	$563,482	$1,398,432	Year 9	0.84	0.42	0.19
Year 10	$801,553	$540,942	$1,342,495	Year 10	0.80	0.41	0.18
Year 11	$769,490	$519,305	$1,288,795	Year 11	0.77	0.39	0.17
Year 12	$738,711	$498,533	$1,237,243	Year 12	0.74	0.37	0.17
Year 13	$709,162	$478,591	$1,187,754	Year 13	0.71	0.36	0.16
Year 14	$680,796	$459,448	$1,140,244	Year 14	0.68	0.34	0.15
Year 15	$653,564	$441,070	$1,094,634	Year 15	0.66	0.33	0.15
Year 16	$627,421	$423,427	$1,050,848	Year 16	0.63	0.32	0.14
Year 17	$602,325	$406,490	$1,008,814	Year 17	0.60	0.31	0.14
Year 18	$578,232	$390,230	$968,462	Year 18	0.58	0.29	0.13
Year 19	$555,102	$374,621	$929,723	Year 19	0.56	0.28	0.12
Year 20	$532,898	$359,636	$892,535	Year 20	0.53	0.27	0.12
NPV - 20	$5,777,588	$3,899,112	$9,676,700	Total	11.91	6.01	2.67

Chicago Area

Pre-Rule Quiet Zone Anticipated Safety Benefits
CONSTANT COLLISION RATE

Corridor Crossing Seveity Index Greater Between One and Two Times the National Significant Risk Threshold and No Collisions in 5 Years

	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$0	$0	$0	Year 2	-	-	-
Year 3	$0	$0	$0	Year 3	-	-	-
Year 4	$0	$0	$0	Year 4	-	-	-
Year 5	$54,752	$37,011	$91,764	Year 5	0.06	0.03	0.01
Year 6	$120,455	$81,425	$201,880	Year 6	0.12	0.06	0.03
Year 7	$186,157	$125,839	$311,996	Year 7	0.19	0.10	0.04
Year 8	$197,108	$133,241	$330,349	Year 8	0.20	0.10	0.04
Year 9	$208,058	$140,643	$348,702	Year 9	0.22	0.11	0.05
Year 10	$219,009	$148,046	$367,054	Year 10	0.23	0.11	0.05
Year 11	$229,959	$155,448	$385,407	Year 11	0.24	0.12	0.05
Year 12	$229,959	$155,448	$385,407	Year 12	0.24	0.12	0.05
Year 13	$229,959	$155,448	$385,407	Year 13	0.24	0.12	0.05
Year 14	$229,959	$155,448	$385,407	Year 14	0.24	0.12	0.05
Year 15	$229,959	$155,448	$385,407	Year 15	0.24	0.12	0.05
Year 16	$251,860	$170,252	$422,113	Year 16	0.26	0.13	0.06
Year 17	$273,761	$185,057	$458,818	Year 17	0.28	0.14	0.06
Year 18	$295,662	$199,862	$495,523	Year 18	0.31	0.15	0.07
Year 19	$295,662	$199,862	$495,523	Year 19	0.31	0.15	0.07
Year 20	$295,662	$199,862	$495,523	Year 20	0.31	0.15	0.07
NPV - 20	$1,471,377	$994,622	$2,465,999	Total	3.68	1.81	0.80

EXHIBIT 7 Chicago Area

Pre-Rule Quiet Zone Anticipated Safety Benefits

Assuming a declining collision rate of 4% annually.

Corridor Crossing Seveity Index Greater Between One and Two Times the National Significant Risk Threshold and No Collisions in 5 Years

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Collisions	Fewer Injuries	Fewer Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$0	$0	$0	Year 2	-	-	-
Year 3	$0	$0	$0	Year 3	-	-	-
Year 4	$0	$0	$0	Year 4	-	-	-
Year 5	$46,504	$31,436	$77,939	Year 5	0.05	0.02	0.01
Year 6	$98,216	$66,392	$164,607	Year 6	0.10	0.05	0.02
Year 7	$145,716	$98,501	$244,217	Year 7	0.15	0.07	0.03
Year 8	$148,116	$100,124	$248,240	Year 8	0.15	0.08	0.03
Year 9	$150,091	$101,459	$251,550	Year 9	0.16	0.08	0.03
Year 10	$151,671	$102,527	$254,198	Year 10	0.16	0.08	0.03
Year 11	$152,884	$103,347	$256,231	Year 11	0.16	0.08	0.03
Year 12	$146,769	$99,213	$245,982	Year 12	0.15	0.07	0.03
Year 13	$140,898	$95,244	$236,143	Year 13	0.15	0.07	0.03
Year 14	$135,262	$91,435	$226,697	Year 14	0.14	0.07	0.03
Year 15	$129,852	$87,777	$217,629	Year 15	0.13	0.07	0.03
Year 16	$136,530	$92,292	$228,821	Year 16	0.14	0.07	0.03
Year 17	$142,466	$96,304	$238,770	Year 17	0.15	0.07	0.03
Year 18	$147,709	$99,848	$247,557	Year 18	0.15	0.08	0.03
Year 19	$141,800	$95,854	$237,655	Year 19	0.15	0.07	0.03
Year 20	$136,128	$92,020	$228,149	Year 20	0.14	0.07	0.03
NPV - 20	$939,521	$635,097	$1,574,618	Total	2.23	1.10	0.48

Pre-Rule Quiet Zone Anticipated Safety Benefits
CONSTANT COLLISION RATE

Termination of Whistle Bans								
	Value of Reduction in:					Fewer	Fewer	Fewer
	Injuries	Fatalities	Total	cancellations		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	0	Year 1	-	-	-
Year 2	$0	$0	$0	0	Year 2	-	-	-
Year 3	$0	$0	$0	0	Year 3	-	-	-
Year 4	$883,280	$148,320	$1,031,600	8	Year 4	3.23	0.76	0.05
Year 5	$883,280	$148,320	$1,031,600	0	Year 5	3.23	0.76	0.05
Year 6	$883,280	$148,320	$1,031,600	0	Year 6	3.23	0.76	0.05
Year 7	$883,280	$148,320	$1,031,600	3	Year 7	3.23	0.76	0.05
Year 8	$883,280	$148,320	$1,031,600	0	Year 8	3.23	0.76	0.05
Year 9	$883,280	$148,320	$1,031,600	0	Year 9	3.23	0.76	0.05
Year 10	$883,280	$148,320	$1,031,600	0	Year 10	3.23	0.76	0.05
Year 11	$927,827	$148,320	$1,076,147	0	Year 11	3.31	0.80	0.05
Year 12	$927,827	$148,320	$1,076,147	0	Year 12	3.31	0.80	0.05
Year 13	$927,827	$148,320	$1,076,147	3	Year 13	3.31	0.80	0.05
Year 14	$927,827	$148,320	$1,076,147	0	Year 14	3.31	0.80	0.05
Year 15	$980,513	$185,400	$1,165,913	2	Year 15	3.51	0.84	0.06
Year 16	$927,827	$148,320	$1,076,147	0	Year 16	3.51	0.84	0.06
Year 17	$927,827	$148,320	$1,076,147	0	Year 17	3.51	0.84	0.06
Year 18	$927,827	$148,320	$1,076,147	0	Year 18	3.51	0.84	0.06
Year 19	$927,827	$148,320	$1,076,147	0	Year 19	3.51	0.84	0.06
Year 20	$927,827	$148,320	$1,076,147	0	Year 20	3.51	0.84	0.06
NPV - 20	$7,217,624	$1,195,505	$8,413,129	16	Total	56.97	13.52	0.91

Assuming a declining collision rate of 4% annually.

Termination of Whistle Bans							
	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$0	$0	$0	Year 2	-	-	-
Year 3	$0	$0	$0	Year 3	-	-	-
Year 4	$781,470	$131,224	$912,694	Year 4	2.86	0.67	0.04
Year 5	$750,211	$125,975	$876,186	Year 5	2.75	0.64	0.04
Year 6	$720,203	$120,936	$841,139	Year 6	2.64	0.62	0.04
Year 7	$691,395	$116,099	$807,493	Year 7	2.53	0.59	0.04
Year 8	$663,739	$111,455	$775,194	Year 8	2.43	0.57	0.04
Year 9	$637,189	$106,997	$744,186	Year 9	2.33	0.55	0.04
Year 10	$611,702	$102,717	$714,418	Year 10	2.24	0.52	0.03
Year 11	$616,849	$98,608	$715,457	Year 11	2.20	0.53	0.03
Year 12	$592,175	$94,664	$686,839	Year 12	2.11	0.51	0.03
Year 13	$568,488	$90,877	$659,365	Year 13	2.03	0.49	0.03
Year 14	$545,749	$87,242	$632,991	Year 14	1.95	0.47	0.03
Year 15	$553,670	$104,690	$658,360	Year 15	1.98	0.47	0.03
Year 16	$502,962	$80,402	$583,364	Year 16	1.90	0.46	0.03
Year 17	$482,844	$77,186	$560,030	Year 17	1.83	0.44	0.03
Year 18	$463,530	$74,099	$537,629	Year 18	1.76	0.42	0.03
Year 19	$444,989	$71,135	$516,123	Year 19	1.69	0.40	0.03
Year 20	$427,189	$68,289	$495,479	Year 20	1.62	0.39	0.03
NPV - 20	$4,983,414	$827,376	$5,810,789	Total	36.85	8.73	0.59

CONSTANT COLLISION RATE
Pre-Rule Quiet Zone Anticipated Safety Benefits

Corridor Crossing Seveity Index Greater Than
National Significant Risk Threshold and Relevant Collisions

	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$441,681	$102,556	$544,237	Year 2	0.64	0.25	0.03
Year 3	$883,362	$205,113	$1,088,475	Year 3	0.80	0.33	0.07
Year 4	$1,325,043	$307,669	$1,632,712	Year 4	0.97	0.42	0.11
Year 5	$1,766,724	$410,226	$2,176,950	Year 5	1.13	0.50	0.15
Year 6	$2,208,405	$512,782	$2,721,187	Year 6	1.30	0.58	0.18
Year 7	$2,650,085	$615,339	$3,265,424	Year 7	1.46	0.67	0.22
Year 8	$3,091,766	$717,895	$3,809,662	Year 8	1.63	0.75	0.26
Year 9	$3,091,766	$717,895	$3,809,662	Year 9	1.63	0.75	0.26
Year 10	$3,091,766	$717,895	$3,809,662	Year 10	1.63	0.75	0.26
Year 11	$3,091,766	$717,895	$3,809,662	Year 11	1.63	0.75	0.26
Year 12	$3,091,766	$717,895	$3,809,662	Year 12	1.63	0.75	0.26
Year 13	$3,091,766	$717,895	$3,809,662	Year 13	1.63	0.75	0.26
Year 14	$3,091,766	$717,895	$3,809,662	Year 14	1.63	0.75	0.26
Year 15	$3,091,766	$717,895	$3,809,662	Year 15	1.63	0.75	0.26
Year 16	$3,091,766	$717,895	$3,809,662	Year 16	1.63	0.75	0.26
Year 17	$3,091,766	$717,895	$3,809,662	Year 17	1.63	0.75	0.26
Year 18	$3,091,766	$717,895	$3,809,662	Year 18	1.63	0.75	0.26
Year 19	$3,091,766	$717,895	$3,809,662	Year 19	1.63	0.75	0.26
Year 20	$3,091,766	$717,895	$3,809,662	Year 20	1.63	0.75	0.26
NPV - 20	$22,591,072	$5,245,554	$27,836,627	Total	27.50	12.53	4.11

Assuming a declining collision rate of 4% annually.
Pre-Rule Quiet Zone Anticipated Safety Benefits
Corridor Crossing Seveity Index Greater Than
National Significant Risk Threshold and Relevant Collisions

	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$424,014	$98,454	$522,468	Year 2	0.61	0.24	0.03
Year 3	$814,106	$189,032	$1,003,138	Year 3	0.74	0.31	0.07
Year 4	$1,172,313	$272,206	$1,444,519	Year 4	0.86	0.37	0.10
Year 5	$1,500,561	$348,424	$1,848,985	Year 5	0.96	0.43	0.12
Year 6	$1,800,673	$418,109	$2,218,782	Year 6	1.06	0.48	0.15
Year 7	$2,074,375	$481,661	$2,556,036	Year 7	1.15	0.52	0.17
Year 8	$2,323,300	$539,461	$2,862,761	Year 8	1.23	0.56	0.19
Year 9	$2,230,368	$517,882	$2,748,250	Year 9	1.18	0.54	0.19
Year 10	$2,141,153	$497,167	$2,638,320	Year 10	1.13	0.52	0.18
Year 11	$2,055,507	$477,280	$2,532,788	Year 11	1.08	0.50	0.17
Year 12	$1,973,287	$458,189	$2,431,476	Year 12	1.04	0.48	0.16
Year 13	$1,894,355	$439,862	$2,334,217	Year 13	1.00	0.46	0.16
Year 14	$1,818,581	$422,267	$2,240,848	Year 14	0.96	0.44	0.15
Year 15	$1,745,838	$405,376	$2,151,214	Year 15	0.92	0.42	0.15
Year 16	$1,676,004	$389,161	$2,065,166	Year 16	0.88	0.41	0.14
Year 17	$1,608,964	$373,595	$1,982,559	Year 17	0.85	0.39	0.13
Year 18	$1,544,606	$358,651	$1,903,257	Year 18	0.81	0.38	0.13
Year 19	$1,482,821	$344,305	$1,827,127	Year 19	0.78	0.36	0.12
Year 20	$1,423,509	$330,533	$1,754,041	Year 20	0.75	0.35	0.12
NPV - 20	$15,433,427	$3,583,578	$19,017,005	Total	17.99	8.16	2.63

CONSTANT COLLISION RATE
Pre-Rule Quiet Zone Anticipated Safety Benefits

Corridor Crossing Seveity Index Greater Than Two Times the National Significant Risk Threshold and No Relevant Collisions in 5 Years

	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$84,386	$23,137	$107,523	Year 2	0.10	0.01	0.01
Year 3	$168,772	$46,274	$215,045	Year 3	0.27	0.09	0.04
Year 4	$253,158	$69,411	$322,568	Year 4	0.43	0.18	0.08
Year 5	$337,543	$92,548	$430,091	Year 5	0.60	0.26	0.12
Year 6	$421,929	$115,684	$537,614	Year 6	0.76	0.34	0.16
Year 7	$506,315	$138,821	$645,136	Year 7	0.93	0.43	0.19
Year 8	$590,701	$161,958	$752,659	Year 8	1.09	0.51	0.23
Year 9	$590,701	$161,958	$752,659	Year 9	1.09	0.51	0.23
Year 10	$590,701	$161,958	$752,659	Year 10	1.09	0.51	0.23
Year 11	$590,701	$161,958	$752,659	Year 11	1.09	0.51	0.23
Year 12	$590,701	$161,958	$752,659	Year 12	1.09	0.51	0.23
Year 13	$590,701	$161,958	$752,659	Year 13	1.09	0.51	0.23
Year 14	$590,701	$161,958	$752,659	Year 14	1.09	0.51	0.23
Year 15	$590,701	$161,958	$752,659	Year 15	1.09	0.51	0.23
Year 16	$590,701	$161,958	$752,659	Year 16	1.09	0.51	0.23
Year 17	$590,701	$161,958	$752,659	Year 17	1.09	0.51	0.23
Year 18	$590,701	$161,958	$752,659	Year 18	1.09	0.51	0.23
Year 19	$590,701	$161,958	$752,659	Year 19	1.09	0.51	0.23
Year 20	$590,701	$161,958	$752,659	Year 20	1.09	0.51	0.23
NPV - 20	$4,316,163	$1,183,404	$5,499,567	Total	17.32	7.94	3.61

Assuming a declining collision rate of 4% annually.
Pre-Rule Quiet Zone Anticipated Safety Benefits
Corridor Crossing Seveity Index Greater Than Two Times the
National Significant Risk Threshold and No Relevant Collisions in 5 Years

	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$81,010	$22,211	$103,222	Year 2	0.10	0.01	0.01
Year 3	$155,540	$42,646	$198,186	Year 3	0.24	0.08	0.04
Year 4	$223,978	$61,410	$285,388	Year 4	0.38	0.16	0.07
Year 5	$286,691	$78,605	$365,296	Year 5	0.51	0.22	0.10
Year 6	$344,030	$94,326	$438,355	Year 6	0.62	0.28	0.13
Year 7	$396,322	$108,663	$504,986	Year 7	0.73	0.33	0.15
Year 8	$443,881	$121,703	$565,584	Year 8	0.82	0.38	0.17
Year 9	$426,125	$116,835	$542,960	Year 9	0.79	0.37	0.17
Year 10	$409,080	$112,162	$521,242	Year 10	0.76	0.35	0.16
Year 11	$392,717	$107,675	$500,392	Year 11	0.73	0.34	0.15
Year 12	$377,009	$103,368	$480,377	Year 12	0.70	0.33	0.15
Year 13	$361,928	$99,233	$461,162	Year 13	0.67	0.31	0.14
Year 14	$347,451	$95,264	$442,715	Year 14	0.64	0.30	0.14
Year 15	$333,553	$91,453	$425,007	Year 15	0.62	0.29	0.13
Year 16	$320,211	$87,795	$408,006	Year 16	0.59	0.28	0.13
Year 17	$307,402	$84,284	$391,686	Year 17	0.57	0.27	0.12
Year 18	$295,106	$80,912	$376,019	Year 18	0.55	0.25	0.12
Year 19	$283,302	$77,676	$360,978	Year 19	0.53	0.24	0.11
Year 20	$271,970	$74,569	$346,539	Year 20	0.50	0.23	0.11
NPV - 20	$2,948,651	$808,460	$3,757,111	Total	11.05	5.03	2.29

Natiowide (Excluding the Chicago Area)

Pre-Rule Quiet Zone Anticipated Safety Benefits
CONSTANT COLLISION RATE

Corridor Crossing Seveity Index Greater Between One and Two Times the National Significant Risk Threshold and No Collisions in 5 Years

	Value of Reduction in:				Fewer	Fewer	Fewer
	Injuries	Fatalities	Total		Collisions	Injuries	Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$0	$0	$0	Year 2	-	-	-
Year 3	$0	$0	$0	Year 3	-	-	-
Year 4	$ 56,666	$ 16,459	$73,125	Year 4	0.06	0.03	0.01
Year 5	$ 127,499	$ 37,033	$164,532	Year 5	0.14	0.06	0.01
Year 6	$ 233,748	$ 67,893	$301,641	Year 6	0.25	0.12	0.02
Year 7	$ 332,914	$ 96,696	$429,610	Year 7	0.35	0.17	0.03
Year 8	$ 453,329	$ 131,672	$585,001	Year 8	0.48	0.23	0.04
Year 9	$ 559,578	$ 162,532	$722,111	Year 9	0.60	0.28	0.05
Year 10	$ 630,411	$ 183,106	$813,517	Year 10	0.67	0.32	0.06
Year 11	$ 672,911	$ 195,450	$868,361	Year 11	0.72	0.34	0.07
Year 12	$ 715,410	$ 207,794	$923,205	Year 12	0.76	0.36	0.07
Year 13	$ 772,076	$ 224,253	$996,330	Year 13	0.82	0.39	0.07
Year 14	$ 835,826	$ 242,770	$1,078,596	Year 14	0.89	0.42	0.08
Year 15	$ 920,825	$ 267,458	$1,188,283	Year 15	0.98	0.47	0.09
Year 16	$ 984,575	$ 285,975	$1,270,549	Year 16	1.05	0.50	0.10
Year 17	$1,041,241	$ 302,434	$1,343,674	Year 17	1.11	0.53	0.10
Year 18	$1,076,657	$ 312,720	$1,389,377	Year 18	1.15	0.55	0.10
Year 19	$1,104,990	$ 320,950	$1,425,940	Year 19	1.18	0.56	0.11
Year 20	$1,126,240	$ 327,122	$1,453,362	Year 20	1.20	0.57	0.11
NPV - 20	$4,579,789	$ 1,330,222	$5,910,012	Total	12.40	5.92	1.13

Pre-Rule Quiet Zone Anticipated Safety Benefits
Assuming a declining collision rate of 4% annually.

Corridor Crossing Seveity Index Greater Between One and Two Times the National Significant Risk Threshold and No Collisions in 5 Years

	Value of Reduction in: Injuries	Fatalities	Total		Fewer Collisions	Fewer Injuries	Fewer Fatalities
Year 1	$0	$0	$0	Year 1	-	-	-
Year 2	$0	$0	$0	Year 2	-	-	-
Year 3	$0	$0	$0	Year 3	-	-	-
Year 4	$50,135	$14,562	$64,696	Year 4	0.05	0.03	0.00
Year 5	$108,291	$31,454	$139,744	Year 5	0.12	0.06	0.01
Year 6	$190,592	$55,358	$245,950	Year 6	0.20	0.10	0.02
Year 7	$260,591	$75,690	$336,281	Year 7	0.28	0.13	0.03
Year 8	$340,653	$98,944	$439,598	Year 8	0.36	0.17	0.03
Year 9	$403,674	$117,249	$520,923	Year 9	0.43	0.21	0.04
Year 10	$436,581	$126,807	$563,388	Year 10	0.46	0.22	0.04
Year 11	$447,373	$129,942	$577,315	Year 11	0.48	0.23	0.04
Year 12	$456,603	$132,623	$589,226	Year 12	0.49	0.23	0.04
Year 13	$473,059	$137,402	$610,461	Year 13	0.50	0.24	0.05
Year 14	$491,634	$142,797	$634,431	Year 14	0.52	0.25	0.05
Year 15	$519,965	$151,027	$670,992	Year 15	0.55	0.26	0.05
Year 16	$533,724	$155,023	$688,747	Year 16	0.57	0.27	0.05
Year 17	$541,865	$157,387	$699,252	Year 17	0.58	0.28	0.05
Year 18	$537,884	$156,231	$694,115	Year 18	0.57	0.27	0.05
Year 19	$529,957	$153,929	$683,886	Year 19	0.56	0.27	0.05
Year 20	$518,543	$150,613	$669,156	Year 20	0.55	0.26	0.05
NPV - 20	$2,827,228	$821,182	$3,648,410	Total	7.29	3.48	0.66

New Quiet Zone Crossing Improvement Costs
New Quiet Zones Not Yet Established

	Installation of Flashing Lights and Gates			
	Number of Installations	Cost of Installations	Annual Maintenance	Total Annual Cost
Year 1	29.3	$4,106,667	$0	$4,106,667
Year 2	29.3	$4,106,667	$73,333	$4,180,000
Year 3	29.3	$4,106,667	$146,667	$4,253,333
Year 4	0.0	$0	$220,000	$220,000
Year 5	0.0	$0	$220,000	$220,000
Year 6	0.0	$0	$220,000	$220,000
Year 7	0.0	$0	$220,000	$220,000
Year 8	0.0	$0	$220,000	$220,000
Year 9	0.0	$0	$220,000	$220,000
Year 10	0.0	$0	$220,000	$220,000
Year 11	0.0	$0	$220,000	$220,000
Year 12	0.0	$0	$220,000	$220,000
Year 13	0.0	$0	$220,000	$220,000
Year 14	0.0	$0	$220,000	$220,000
Year 15	0.0	$0	$220,000	$220,000
Year 16	0.0	$0	$220,000	$220,000
Year 17	0.0	$0	$220,000	$220,000
Year 18	0.0	$0	$220,000	$220,000
Year 19	0.0	$0	$220,000	$220,000
Year 20	0.0	$0	$220,000	$220,000
NPV 20	88.0	$10,777,191	$1,937,109	$12,714,301

New Quiet Zone Crossing Improvement Costs
New Quiet Zones Not Yet Established

Adding Gates to Flashing Lights

	Number of Installations	Cost of Installations	Annual Maintenance	Total Annual Cost
Year 1	36.3	$1,453,333	$0	$1,453,333
Year 2	36.3	$1,453,333	$18,167	$1,471,500
Year 3	36.3	$1,453,333	$36,333	$1,489,667
Year 4	0.0	$0	$54,500	$54,500
Year 5	0.0	$0	$54,500	$54,500
Year 6	0.0	$0	$54,500	$54,500
Year 7	0.0	$0	$54,500	$54,500
Year 8	0.0	$0	$54,500	$54,500
Year 9	0.0	$0	$54,500	$54,500
Year 10	0.0	$0	$54,500	$54,500
Year 11	0.0	$0	$54,500	$54,500
Year 12	0.0	$0	$54,500	$54,500
Year 13	0.0	$0	$54,500	$54,500
Year 14	0.0	$0	$54,500	$54,500
Year 15	0.0	$0	$54,500	$54,500
Year 16	0.0	$0	$54,500	$54,500
Year 17	0.0	$0	$54,500	$54,500
Year 18	0.0	$0	$54,500	$54,500
Year 19	0.0	$0	$54,500	$54,500
Year 20	0.0	$0	$54,500	$54,500
NPV 20	109	$3,814,006	$479,875	$4,293,881

New Quiet Zone Crossing Improvement Costs
New Quiet Zones Not Yet Established

Mountable Curbs w/ Frangible Delineators				
	Number of Installations	Cost of Installations	Annual Maintenance	Total Annual Cost
Year 1	7.3	$95,333	$0	$95,333
Year 2	7.3	$95,333	$3,667	$99,000
Year 3	7.3	$95,333	$7,333	$102,667
Year 4	0.0	$0	$11,000	$11,000
Year 5	0.0	$0	$11,000	$11,000
Year 6	0.0	$0	$11,000	$11,000
Year 7	0.0	$0	$11,000	$11,000
Year 8	0.0	$0	$11,000	$11,000
Year 9	0.0	$0	$11,000	$11,000
Year 10	0.0	$0	$11,000	$11,000
Year 11	0.0	$0	$11,000	$11,000
Year 12	0.0	$0	$11,000	$11,000
Year 13	0.0	$0	$11,000	$11,000
Year 14	0.0	$0	$11,000	$11,000
Year 15	0.0	$0	$11,000	$11,000
Year 16	0.0	$0	$11,000	$11,000
Year 17	0.0	$0	$11,000	$11,000
Year 18	0.0	$0	$11,000	$11,000
Year 19	0.0	$0	$11,000	$11,000
Year 20	0.0	$0	$11,000	$11,000
NPV 20	22	$250,185	$96,855	$347,040

New Quiet Zone Crossing Improvement Costs
New Quiet Zones Not yet Established

Photo-Enforcement

	Number of Installations	Installations and Baseline	Annual Maintenance	Total Annual Cost
Year 1	0.7	$31,667	$0	$31,667
Year 2	0.7	$31,667	$10,267	$41,933
Year 3	0.7	$31,667	$20,533	$52,200
Year 4	0.0	$0	$30,800	$30,800
Year 5	0.0	$0	$30,800	$30,800
Year 6	0.0	$0	$29,800	$29,800
Year 7	0.0	$0	$28,800	$28,800
Year 8	0.0	$0	$27,800	$27,800
Year 9	0.0	$0	$27,800	$27,800
Year 10	0.0	$0	$27,800	$27,800
Year 11	0.0	$0	$27,800	$27,800
Year 12	0.0	$0	$27,800	$27,800
Year 13	0.0	$0	$27,800	$27,800
Year 14	0.0	$0	$27,800	$27,800
Year 15	0.0	$0	$27,800	$27,800
Year 16	0.0	$0	$27,800	$27,800
Year 17	0.0	$0	$27,800	$27,800
Year 18	0.0	$0	$27,800	$27,800
Year 19	0.0	$0	$27,800	$27,800
Year 20	0.0	$0	$27,800	$27,800
NPV 20	2.0	$83,103	$253,669	$336,773

New Quiet Zone Crossing Improvement Costs
New Quiet Zones Not yet Established

Medians OR Four-Quadrant Gates

	Number of Installations	Installations and Baseline	Annual Maintenance	Total Annual Cost
Year 1	4.7	$296,333	$0	$296,333
Year 2	4.7	$296,333	$7,000	$303,333
Year 3	4.7	$296,333	$14,000	$310,333
Year 4	0.0	$0	$21,000	$21,000
Year 5	0.0	$0	$21,000	$21,000
Year 6	0.0	$0	$21,000	$21,000
Year 7	0.0	$0	$21,000	$21,000
Year 8	0.0	$0	$21,000	$21,000
Year 9	0.0	$0	$21,000	$21,000
Year 10	0.0	$0	$21,000	$21,000
Year 11	0.0	$0	$21,000	$21,000
Year 12	0.0	$0	$21,000	$21,000
Year 13	0.0	$0	$21,000	$21,000
Year 14	0.0	$0	$21,000	$21,000
Year 15	0.0	$0	$21,000	$21,000
Year 16	0.0	$0	$21,000	$21,000
Year 17	0.0	$0	$21,000	$21,000
Year 18	0.0	$0	$21,000	$21,000
Year 19	0.0	$0	$21,000	$21,000
Year 20	0.0	$0	$21,000	$21,000
NPV 20	14.0	$777,672	$184,906	$962,578

New Quiet Zone Crossing Improvement Costs
New Quiet Zones Established Post October 9, 1996

Adding Gates to Flashing Lights

	Number of Installations	Cost of Installations	Annual Maintenance	Total Annual Cost
Year 1	16.3	$653,333	$0	$653,333
Year 2	16.3	$653,333	$8,167	$661,500
Year 3	16.3	$653,333	$16,333	$669,667
Year 4	0.0	$0	$24,500	$24,500
Year 5	0.0	$0	$24,500	$24,500
Year 6	0.0	$0	$24,500	$24,500
Year 7	0.0	$0	$24,500	$24,500
Year 8	0.0	$0	$24,500	$24,500
Year 9	0.0	$0	$24,500	$24,500
Year 10	0.0	$0	$24,500	$24,500
Year 11	0.0	$0	$24,500	$24,500
Year 12	0.0	$0	$24,500	$24,500
Year 13	0.0	$0	$24,500	$24,500
Year 14	0.0	$0	$24,500	$24,500
Year 15	0.0	$0	$24,500	$24,500
Year 16	0.0	$0	$24,500	$24,500
Year 17	0.0	$0	$24,500	$24,500
Year 18	0.0	$0	$24,500	$24,500
Year 19	0.0	$0	$24,500	$24,500
Year 20	0.0	$0	$24,500	$24,500
NPV 20	49	$1,714,553	$215,724	$1,930,277

Natiowide (Including the Chicago Area)

Pre-Rule Quiet Zone Other Anticipated Benefits
CONSTANT COLLISION RATE

	Highway Veh. Damage	Rail Equip. & Track Damage	Total
Year 1	$ -	$ -	$ -
Year 2	$ 4,760	$ 2,282	$ 7,042
Year 3	$ 7,762	$ 3,720	$ 11,482
Year 4	$ 25,312	$ 12,132	$ 37,444
Year 5	$ 28,891	$ 13,847	$ 42,738
Year 6	$ 32,685	$ 15,666	$ 48,350
Year 7	$ 36,445	$ 17,468	$ 53,913
Year 8	$ 40,057	$ 19,199	$ 59,256
Year 9	$ 40,601	$ 19,460	$ 60,061
Year 10	$ 40,980	$ 19,642	$ 60,622
Year 11	$ 41,561	$ 19,920	$ 61,482
Year 12	$ 41,759	$ 20,015	$ 61,774
Year 13	$ 42,023	$ 20,141	$ 62,165
Year 14	$ 42,320	$ 20,284	$ 62,604
Year 15	$ 43,600	$ 20,897	$ 64,497
Year 16	$ 43,996	$ 21,087	$ 65,083
Year 17	$ 44,359	$ 21,261	$ 65,620
Year 18	$ 44,623	$ 21,387	$ 66,010
Year 19	$ 44,755	$ 21,451	$ 66,205
Year 20	$ 44,854	$ 21,498	$ 66,352
NPV - 20	$ 315,162	$ 151,056	$ 466,218

Pre-Rule Quiet Zone Other Anticipated Benefits
Assuming a declining collision rate of 4% annually.
Natiowide (<u>Including</u> the Chicago Area)

	Highway Veh. Damage	Rail Equip. & Track Damage	Total
Year 1	$ -	$ -	$ -
Year 2	$ 4,570	$ 2,190	$ 6,760
Year 3	$ 7,153	$ 3,428	$ 10,582
Year 4	$ 22,394	$ 10,734	$ 33,128
Year 5	$ 24,539	$ 11,761	$ 36,300
Year 6	$ 26,650	$ 12,773	$ 39,423
Year 7	$ 28,528	$ 13,673	$ 42,201
Year 8	$ 30,101	$ 14,427	$ 44,528
Year 9	$ 29,289	$ 14,038	$ 43,327
Year 10	$ 28,380	$ 13,603	$ 41,983
Year 11	$ 27,631	$ 13,244	$ 40,875
Year 12	$ 26,652	$ 12,774	$ 39,427
Year 13	$ 25,748	$ 12,341	$ 38,089
Year 14	$ 24,893	$ 11,931	$ 36,823
Year 15	$ 24,620	$ 11,800	$ 36,420
Year 16	$ 23,849	$ 11,431	$ 35,280
Year 17	$ 23,084	$ 11,064	$ 34,149
Year 18	$ 22,293	$ 10,685	$ 32,978
Year 19	$ 21,464	$ 10,288	$ 31,752
Year 20	$ 20,651	$ 9,898	$ 30,550
NPV - 20	$ 215,289	$ 103,187	$ 318,476

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
CONSTANT COLLISION RATE

	Highway Veh. Damage	Rail Equip. & Track Damage	Total
Year 1	$0	$0	$0
Year 2	$2,980	$1,428	$4,409
Year 3	$5,960	$2,857	$8,817
Year 4	$8,941	$4,285	$13,226
Year 5	$8,941	$4,285	$13,226
Year 6	$8,941	$4,285	$13,226
Year 7	$8,941	$4,285	$13,226
Year 8	$8,941	$4,285	$13,226
Year 9	$8,941	$4,285	$13,226
Year 10	$8,941	$4,285	$13,226
Year 11	$8,941	$4,285	$13,226
Year 12	$8,941	$4,285	$13,226
Year 13	$8,941	$4,285	$13,226
Year 14	$8,941	$4,285	$13,226
Year 15	$8,941	$4,285	$13,226
Year 16	$8,941	$4,285	$13,226
Year 17	$8,941	$4,285	$13,226
Year 18	$8,941	$4,285	$13,226
Year 19	$8,941	$4,285	$13,226
Year 20	$8,941	$4,285	$13,226
NPV - 20	$78,722	$37,731	$116,453

New Quiet Zone Safety Benefits

Corridor Crossing Severity Indexes Greater Than the National Severity Risk Index
DECLINING COLLISION RATE: 4% Annually

	Highway Veh. Damage	Rail Equip. & Track Damage	Total
Year 1	$0	$0	$0
Year 2	$2,861	$1,371	$4,232
Year 3	$5,493	$2,633	$8,126
Year 4	$7,910	$3,791	$11,701
Year 5	$7,594	$3,640	$11,233
Year 6	$7,290	$3,494	$10,784
Year 7	$6,998	$3,354	$10,353
Year 8	$6,718	$3,220	$9,938
Year 9	$6,450	$3,091	$9,541
Year 10	$6,192	$2,968	$9,159
Year 11	$5,944	$2,849	$8,793
Year 12	$5,706	$2,735	$8,441
Year 13	$5,478	$2,626	$8,104
Year 14	$5,259	$2,521	$7,779
Year 15	$5,048	$2,420	$7,468
Year 16	$4,847	$2,323	$7,169
Year 17	$4,653	$2,230	$6,883
Year 18	$4,467	$2,141	$6,607
Year 19	$4,288	$2,055	$6,343
Year 20	$4,116	$1,973	$6,089
NPV - 20	$56,399	$27,032	$83,430