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

Florida's Train Whistle Bans

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.

Study of Northeastern Illinois Whistle Bans

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 4th 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)

	Maximum Train Operating Speed		
1997 – 2001	<= 25 mph	> 25 mph	Total Collisions
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)

	Fatalities: Maximum Train Operating Speed		Injuries: Maximum Train Operating Speed	
1997 – 2001	<= 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.

[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.

New Quiet Zones Not Yet Established

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.

Potential New Quiet Zone Safety Benefits (at crossings where horns currently sound)

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		
1996 – 2000	<= 25 mph	> 25 mph	Total Collisions
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)

1996 – 2000	Fatalities: Maximum Train Operating Speed		Injuries: Maximum Train Operating Speed	
	<= 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

1996 – 2000	Maximum Train Operating Speed		Total Collisions
	<= 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.

Sensitivity Analysis for New Quiet Zones with CCRI Less Than NSRT

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		
Pre-Rule Quiet Zones:	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**
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.

[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.