



U.S. Department  
Of Transportation  
Federal Railroad  
Administration

# Research Results

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## North Carolina Department of Transportation's "Sealed Corridor" Assessment—Phase IV

### SUMMARY

By 2010, the fatality rate will be 52 percent lower on the North Carolina Sealed Corridor, if both public and private crossings are assigned crossing consolidation, closures, crossbucks, flashing lights and gates, signals, locking gates, signs, or pavement markings. The Federal Railroad Administration's Office of Research and Development has tasked the Research and Innovative Technology Administration's John A. Volpe National Transportation Systems Center to document the further success of the Sealed Corridor project through Phase IV—the implementation of safety strategies at private crossings. The Sealed Corridor is the section of the designated Southeast High Speed Rail corridor that runs through North Carolina as shown in Figure 1. The Sealed Corridor program aims at improving or consolidating every highway-rail grade crossing, public and private, along the Charlotte to Raleigh rail route in North Carolina. The initial assessment of this high-speed rail corridor was published in 2001 [1]. An updated assessment compared the results from a partial Phase I implementation to the results of completing Phases I, II, and III, all of which consisted of improvements or consolidation of public crossings [2].



This study consists of assessing the results of the North Carolina Department of Transportation's Sealed Corridor, Private Crossing Safety Initiative program. The research on the Sealed Corridor assesses the progress made at the 44 private crossings that have been treated with improved warning devices or have been closed, between Charlotte and Raleigh, from March 1990 through September 2008. Two approaches are used to describe benefits in terms of lives saved:

1. Analysis of fatal crashes to derive lives saved, and
2. Prediction of lives saved based on the reduction of risk at the treated crossings.

Both methods estimate that more than 1.5 lives were saved as a result of the 44 improvements implemented through September 2008. Analysis also shows that the resulting reduction in accidents due to the crossing improvements is sustainable through the year 2010, when anticipated exposure and train speeds along the corridor will be increased.

Figure 1. Southeast High Speed



## BACKGROUND

High-speed passenger rail service is being encouraged in the United States as evidenced by legislation such as the Intermodal Surface Transportation Efficiency Act of 1991, the Swift Rail Development Act of 1994, the Transportation Equity Act for the 21st Century, the Rail Safety Improvement Act of 2008, and the Passenger Rail Investment and Improvement Act of 2008. Eleven high-speed rail passenger service corridors have been designated in the United States, and high-speed rail operations on these corridors could eventually result in train speeds above 110 mph.

To address the greater risks associated with higher train speeds, the Federal Railroad Administration (FRA) has developed safety guidelines at these crossings. FRA Guidelines call for the following actions:

- Eliminate all redundant or unnecessary crossings,
- Protect rail movement with full-width barriers capable of absorbing the impact of highway vehicles at crossings that have train operating speeds between 111 and 125 mph, and
- Close or grade separate all crossings with train speeds above 125 mph.

## RESEARCH OBJECTIVES

The main research objectives of this study were:

- To determine the number of lives saved, from 1990 through September 2008, along the North Carolina Department of Transportation's (NCDOT) Sealed Corridor.
- To determine whether planned treatments for Phase IV of the Sealed Corridor private crossings provide a sustainable crash reduction condition through 2010, when train speeds should reach 110 mph.

## RESEARCH METHODS

The intent of this research was to assess the progress on private crossings that have been treated with improved warning devices or have been closed on the Sealed Corridor. Treatments implemented on the corridor include

crossing consolidation, closures, crossbucks, flashing lights and gates, signals, locking gates, signs, and pavement markings.

Progress was measured in terms of safety benefits, using crash data up through December 2008. Safety benefits were developed through the use of two techniques:

1. Fatal crash analysis estimate of lives saved, and
2. Modified United States Department of Transportation (USDOT) accident prediction formula (APF), prediction of lives saved based on the reduction of risk at those treated crossings.

In the fatal crash analysis, the crossing environment was not considered and only fatal crashes were used. This baseline crash information for the period of 1985 through 2008 was obtained from the FRA Railroad Accident Incident Reporting System database and was supplemented by NCDOT collision reports. Historical fatality data for 5 years before treatment were used to get an average of fatalities per year in the pretreatment condition. The pretreatment condition and lives saved under the post treatment condition through December 2008 were also estimated using fatal crashes from 1985 through 2008. The pre- and post-treatment conditions were compared with estimate the lives saved.

In the modified USDOT APF, adjustments to train speed, annual average daily traffic (AADT), train movements, and warning device changes were considered. All fatal and nonfatal collisions were used for the crash data.

The model estimated a 5-year pre- and post-treatment period for warning device effectiveness calculations. Populated year-by-year input variables from FRA inventory data were used in the model or extrapolated from NCDOT records. The model calculated the effect of the 5-year actual incident history for prediction of future incidents. A 2-percent per year growth in AADT and train frequency was assumed in the model after the year 2008. All treatments were assumed completed by 2009, and train speeds were increased to 110 mph for 2010 only.



Further predictions for the risk reduction sustainability were completed by determining future reduction in risk for the total Phase IV corridor through 2010, when train speeds along the corridor are projected to achieve 110 mph and all crossings would be treated and/or closed. The condition of the corridor in 2008 was projected for 2010 after application of modest growth factors.

### FINDINGS AND CONCLUSIONS

The implementation of the North Carolina Sealed Corridor initiative is a demonstration of nonstandard corridor highway-railroad grade crossing improvements. These techniques can serve as a basis for assessing the potential impact of similar programs in other corridors, high-speed rail or not.

The fatal crash analysis estimated potential of about 1.5 lives saved through December 2008, as shown in Table 1.

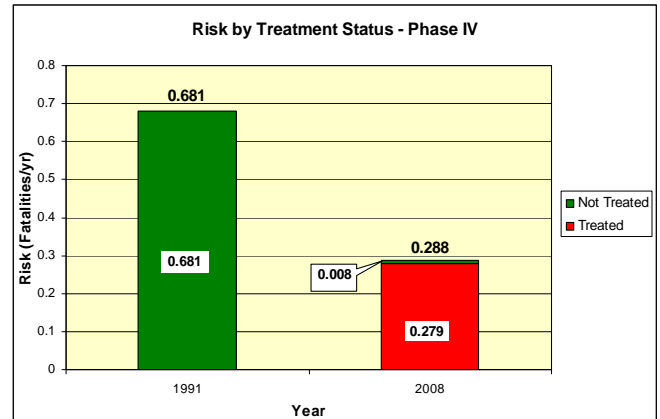
**Table 1. Fatal Crash Analysis of Lives Saved results for Phase IV—Private Crossings**

Crossing Name	Pretreatment Fatalities/Months	Posttreatment Fatalities/Months	Lives Saved
8400 Old Concord Rd	1 / 193	0 / 30	0.155
Byrdsville Rd	1 / 142	0 / 82	0.577
IP Merryhue Farms	1 / 193	0 / 30	0.155
NW Tree & Stone	1 / 154	0 / 94	0.610
<b>Total Lives</b>	<b>4</b>	<b>0</b>	<b>1.499</b>

The modified USDOT APF estimated that the private crossing improvements implemented through September 2008 are reducing fatalities by approximately 0.39 each year. The APF predicted half more lives saved compared with the Fatal Crash Analysis results. This may be because of the fact that the APF contains more variables, and addresses the crossing environment risk.

Figure 2 compares the risk for highway occupants along the 46 private crossings between 1991, before they were treated, and

2008, after 44 out of the 46 were treated. As shown, the fatality risk in 1991 was 0.681 fatalities per year, whereas in 2008, it was reduced to 0.288 fatalities per year. The risk of fatality was decreased by a substantial 57.7 percent. The entire corridor risk, had all of the improvements been completed by 2008, would have been reduced by an additional 1.3 percent.

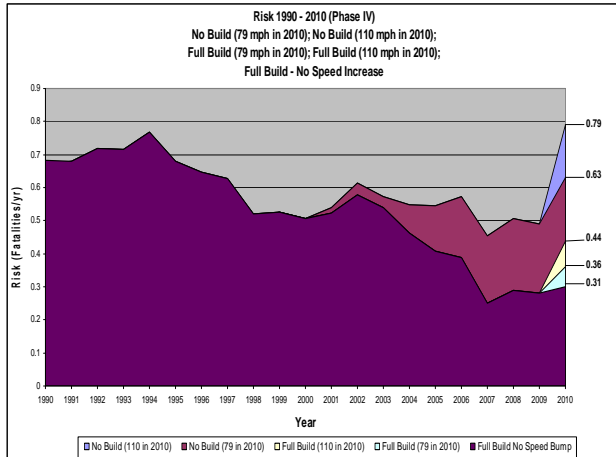


**Figure 2. Corridor Risk for Phases IV—Private Crossings**

To estimate future incident reduction rates and to estimate that the reduction result was sustainable, the Modified USDOT APF was used to ensure increases in train and vehicle exposure occurring over time were considered in the analysis. By 2010, as shown in Figure 3, the fatality rate resulting from full implementation on the entire Sealed Corridor private crossing initiative would be 44 percent lower than if no implementation was executed and speed increased to 110 mph. Further analysis indicates the fatality rate would be 42.8 percent lower if the speed increased to 79 mph only in 2010 and 40.4 percent lower with no increase in speed in 2010.

Discussions with NCDOT rail staff indicate train speeds will only increase to 79 mph. Therefore, roughly 43 percent of the risk would be eliminated.

(See Figure 3 on following page)



**Figure 3. Risk Reduction through 2010 for Phase IV—Private Crossings**

By 2010, the fatality rate resulting from full implementation of the entire Sealed Corridor Phases I through IV on both public and private crossings would be 52 percent lower than if no implementation was executed and speed increased to 110 mph. Further analysis indicates the fatality rate would be 50.9 percent lower if the speed increased to 79 mph only in 2010, and 46 percent lower with no increase in speed in 2010.

This risk assessment, therefore, illustrates that the treatments and all public and private crossing enhancements made in the Sealed Corridor program have resulted in additional benefit in terms of lives saved through 2010 and will save even more lives in the future.

## REFERENCES

- [1] *North Carolina "Sealed Corridor" Phase I: U.S. DOT Assessment Report.* Report to Congress. Carroll, A. August 2001.
- [2] *North Carolina "Sealed Corridor" Phase I, II, and III: U.S. DOT Assessment Report.* Bien-Aime, P. January 2008.
- [3] *North Carolina "Sealed Corridor" Phase IV: U.S. DOT Assessment Report.* Bien-Aime, P. August 2009.

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**KEYWORDS:** Sealed Corridor, private grade crossing, grade crossing improvements, safety benefits

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