U.S. Department
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Research Results

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Research Results

NC DOT "Sealed Corridor" Assessment Phase I, II, and III

SUMMARY

The Federal Railroad Administration's (FRA) Office of Research and Development (R&D) tasked the Research and Innovative Technology Administration's (RITA) John A. Volpe National Transportation Systems Center (Volpe Center) to document the further success of the "Sealed Corridor" project through Phases I, II and III. The "Sealed Corridor" is the section of the designated Southeast High Speed Rail (SEHSR) 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 HSR corridor as mandated by Congress was published in 2001. FRA's intent in completing this updated assessment is to compare the results from a partial Phase I implementation to the results of completing Phases I, II and III.

This study consisted of assessing the results of the North Carolina's "Sealed Corridor" program. The research on the "Sealed Corridor" assesses the progress made at the 189 crossings that have been treated with improved warning devices or closed between Charlotte and Raleigh, from March 1995 through September 2004. Two approaches are used to describe benefits in terms of "lives saved":

1. Fatal crash analysis to derive "lives saved," and

2. Prediction of "lives saved" based on the reduction of risk at the treated crossings.

Both methods estimate that over 10 lives are saved as a result of the 189 improvements implemented through December 2004. 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 Corridor

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, and the Transportation Equity Act for the 21st Century. 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, 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 where train operating speeds are between 111 and 125 mph; and
- Close or grade separate all crossings where trains travel at speeds above 125 mph.

RESEARCH OBJECTIVES

- Determine "lives saved," from 1995 through December 2004, along the North Carolina Department of Transportation (NCDOT) "Sealed Corridor."
- Determine if planned treatments for Phase I, II and III of the "Sealed Corridor" 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 crossings that have been treated with improved warning devices or closed on the "Sealed Corridor." Treatments implemented on the corridor include: crossing consolidation, grade separations, photo enforcement, four-quadrant gate systems, long-arm gate systems, channelization devices, signs, pavement markings, and crossing health monitoring systems.

Progress was measured in terms of safety benefits, using crash data up through December 2004. 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 was obtained from FRA Railroad Accident Incident Reporting System database from 1987 through December 2004, NCDOT collision reports, and newspaper articles. Historical fatalities data for fives years prior to treatment were used to get an average fatalities per year. Pre-treatment condition and "lives saved" under the post-treatment condition through December 2004 were also estimated using fatal crashes from 1987 through 2004. The pre and post treatment conditions were compared to 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 non-fatal 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 both FRA Inventory and NCDOT inventory data were used in the model. 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 were assumed in the model after the year 2004, all treatments were assumed completed by 2008, 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 I, II, and III corridor through 2010, when train speeds along the corridor are projected to achieve 110 mph and all crossings would have been treated and/or

closed. The condition of the corridor in 2004 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. This technique 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 19.7 potential "lives saved" through December 2004 (table 1).

Table 1. Summary of "Lives Saved" Analysis results by Warning Device Type.

Phase I, II and III	Pre-Treatment		Post-Treatment		
Warning Device Improvement	Fatalities	Ave Time Frame (Months)	Fatalities	Ave Time Frame (Months)	Analysis of "Lives Saved"
Closure Subtotal	15	142	0	68	8.727
4-Quadrant Gate Subtotal	14	139	2	49	6.013
Long Gate Subtotal	16	135	1	36	4.012
Median Barrier Subtotal	3	157	0	51	0.988
Totals	48		3		19.74

The Modified USDOT APF estimated that the improvements implemented through 2004 are reducing fatalities by approximately two each year or about ten "lives saved" over 5 years. The APF predicted nine fewer lives saved compared to the Fatal Crash Analysis results. This may be due to the fact that the APF contains more variables, and addresses the crossing environment risk.

Comparing the change of risk to highway occupants (Figure 2) along the "Sealed Corridor" from 1991 (208 crossings) to 2004 for the 189 treated, and 19 untreated crossings, the risk of fatality is decreased by a substantial 50.9 percent. The entire corridor risk, had it been completed by 2004, would have been reduced by an additional 6.4 percent.

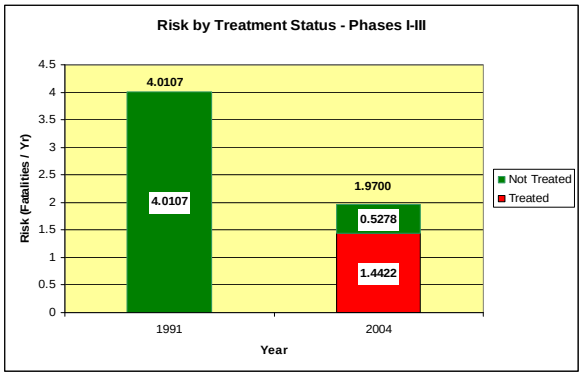

Figure 2. Corridor Risk for Phases I, II, and III

In order 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 over time were considered in the analysis. The resulting analysis estimated that the fatality rate resulting from full implementation of the entire "Sealed Corridor" would be 2.49 By 2010 (figure 3), which is approximately 53 percent lower than the estimated fatality rate of 5.30 if no implementation was executed and speed increased to 110 mph. Further analysis indicated the fatality rate associated with full implementation would be 51.9 percent lower if the speed increased to only 79 mph in 2010 (i.e., 2.31 fatalities per year), and 46.7 percent lower with no increase in speed in 2010 (i.e., 1.73 fatalities per year).

Discussions with NCDOT Rail Staff indicate train speeds will only increase to 79 mph. Therefore, approximately 52 percent of the risk would be eliminated.

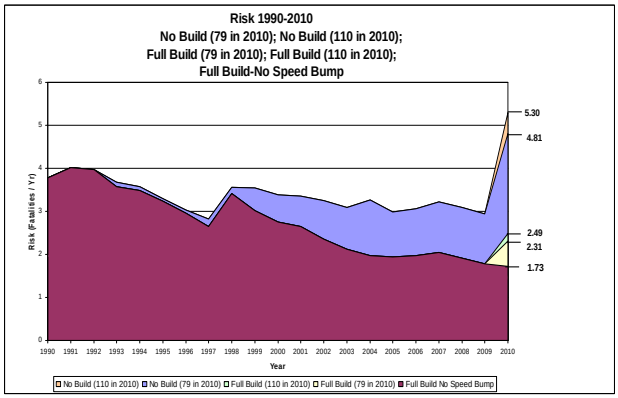

Figure 3. Risk Reduction through 2010 for Phases I, II, and III.

REFERENCES

[1] *North Carolina "Sealed Corridor" Phase I: U.S. DOT Assessment Report.* Report to Congress. Carroll, A. August 2001.

[1] *North Carolina "Sealed Corridor" Phase I, II, and III: U.S. DOT Assessment Report.* Bien-Aime, P. January 2008.

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