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SUMMARY

The Public Education and Enforcement Research Study (PEERS) was a collaborative effort between the U.S. Department of Transportation (DOT) Federal Railroad Administration (FRA), the Illinois Commerce Commission (ICC), and several local communities in the State of Illinois. The purpose of the project was to promote safety at highway-rail grade crossings by preventing and reducing incidents, injuries, and fatalities. The role of the John A. Volpe National Transportation Systems Center (Volpe Center) was to monitor and evaluate highway-rail intersections in selected Illinois communities, using video data collection, while public education and enforcement campaigns were conducted.

In 2003, ICC bestowed a grant on the community of Arlington Heights to establish an enhanced crossing safety education and enforcement program. The community conducted and sustained education and enforcement activities over the course of 12 months. Some activities were passive, including safety inserts with utility bills, radio and television public service announcements, poster campaigns, and train station public address announcements. Other initiatives were proactive and involved representatives from local law enforcement and the community. These included participation in the Officer on the Train programs, sponsored by Operation Lifesaver, Inc.; an increase in Operation Lifesaver presentations throughout the community; and police education and enforcement presence at the crossings, as shown in Figure 1.



Figure 1. Law Enforcement at an Arlington Heights Crossing

The Volpe Center designed and installed a remote video data collection system at three highway-rail intersections in Arlington Heights, IL. The effectiveness of the education and enforcement programs was determined by analysis of the number of motorists and pedestrians that violated the crossing active warning devices during three project phases: pre-test, test, and post-test. The pre-test phase occurred during the 2 months before the education and enforcement programs began. The test phase was 12 months long; during this time, the education and enforcement plans were enacted. The final 2 months of the study were a post-test measurement of motorist and pedestrian violations. This information was used to measure the effects of the education and enforcement programs.

The conclusions for the PEERS project were that overall highway-user behavior improved during the study, and pedestrians, especially commuters, were the most affected by the PEERS programs. Education and enforcement reduced the motor vehicle violation rate between 0 percent to 35 percent (12 percent average) and the pedestrian violation rate by 25 percent to 80 percent (58 percent average).



BACKGROUND

The Federal Railroad Safety Authorization Act of 1994 (Public Law 103-440, November 2, 1994) required that every train approaching a highway-rail grade crossing sound the locomotive horn. In 2000, FRA announced the Notice of Proposed Rule Making on the Use of Locomotive Horns at Highway-Rail Grade Crossings. The rule proposed guidelines and objective criteria to allow communities to silence train horns at grade crossings. Under the Final Rule on the Use of Locomotive Horns at Highway-Rail Grade Crossings, published in 2005, to establish a quiet zone a community must reduce its Quiet Zone Risk Index (QZRI). QZRI is a measure of average risk for all crossings in a proposed quiet zone, taking into consideration the increased risk posed by the absence of train horns and any decrease in risk attributable to the addition of supplemental safety measures, such that QZRI does not exceed the crossing risk when the horn is sounded or that QZRI does not exceed the average national risk for gated, public crossings where train horns are sounded. This inspired a desire to evaluate low-cost safety measures to reduce the risk of grade crossing collisions and fatalities. Non-engineering alternative safety measures (ASM), including programmed enforcement and public education and awareness, can be used in establishing a quiet zone to lower the quiet zone risk index. Each community must demonstrate and validate the effectiveness of the ASM with a documented violation rate reduction.

The 1994 DOT Grade Crossing Action Plan and the 2004 Secretary's Action Plan on Highway-Rail Crossing Safety and Trespass Prevention identified education and enforcement as key actions in reducing grade crossing incidents, injuries, and fatalities. The effect of education and enforcement programs on highway-user behavior, until this point, was largely unknown. The Volpe Center, within PEERS, evaluated the effectiveness of education and enforcement programs as an ASM at active grade crossings in Illinois.

The majority of highway-rail grade crossing collisions are caused by highway-user error. This error includes both errors in judgment and misunderstandings of the meaning of crossing warning devices. Education and enforcement safety programs are employed to inform highway-users that it is illegal and dangerous to disobey applicable traffic safety laws and crossing warning

devices; highway-users are provided with information to help them make better decisions. One benefit of crossing safety education and enforcement programs is that the whole community becomes involved in safety. It elevates crossing safety as a priority for law enforcement, local government officials, motorists, pedestrians, and commuters. Communities can make a difference in behavior at highway-rail grade crossings without incurring significant costs.

RESEARCH OBJECTIVES

- Monitor highway-rail grade crossings in Illinois as education and enforcement campaigns are conducted in order to provide FRA with research data that supports the development of education and enforcement effectiveness measures to be used in current and future rulemaking activities.
- Determine whether sufficient data could be collected from a field operational test to provide significant and meaningful results about the relative effectiveness of education and enforcement activities.
- Conduct a field operational test to determine whether community education efforts and/or enforcement activities were successful in reducing violations at the subject highway-rail grade crossings by 50 percent.

RESEARCH METHODS

The PEERS project was considered to be a success if one of two goals was met. The first goal was for the research to produce meaningful, valid, and reliable results. The amount of data collected must be sufficient to infer the effectiveness of the treatments. The second goal was for the PEERS program to be effective in changing behavior around highway-rail grade crossings. FRA Office of Safety considered the programs successful if the violations were reduced by 50 percent over the course of the study.

To establish the effectiveness of the education and enforcement programs, it was desired that the results of this project be transferable. A large sample size was essential to assure that the results of PEERS could be replicated under similar circumstances. A sufficient sample size also gives confidence in the analysis and results.



The effectiveness of the enhanced education and enforcement programs was analyzed by comparing the frequency of violations in each study period. Previous studies have correlated reductions in violations at grade crossings to reductions in incidents; therefore, violations were used as a surrogate for incidents. During the study, video images of the crossing were collected anytime that the crossing warning devices were activated. The video equipment was connected to the track circuitry so that the video images were time-stamped upon circuit activation. The reduction in violations from the pre-test period to the post-test period was used as a measure of the program success.

The violation data was evaluated three ways: by type of violation, by mode of travel, and by highway-rail grade crossing. This resulted in more information about the crossing users and what types of behavior were most affected by the PEERS programs.

Categorizing the data by type of violation is useful in determining what types of risky behavior were observed and changed during the enhanced education and enforcement initiatives. The three types of violations represented a different degree of highway-user risk, as shown in Figure 2. A type I violation occurred when a violator traversed the crossing while the lights were flashing but before the gate descended. A type II violation occurred when a violator traversed the crossing during gate descent or ascent. A type III violation occurred when a violator traversed the grade crossing after the gates were fully deployed. Type III violations were the most risky and type I the least.

Motorists and pedestrians behave differently at highway-rail grade crossings. During the course of this study, pedestrians were found more likely to disobey a fully deployed gate than motorists. In addition, motorists have a tendency to be impatient and violate the warning devices as they are deactivated.

Each of the three crossings in this study, Arlington Heights Road, Evergreen Avenue, and Dunton Avenue, has different demographic and traffic characteristics. Arlington Heights Road carries primarily motor vehicle traffic and has a busy highway-highway intersection immediately to the north. Evergreen Avenue also carries primarily motor vehicle traffic, although not as heavy as



Figure 2. (From Top) Type I, II, and III Violations

Arlington Heights Road. Dunton Avenue has an adjacent commuter rail station and is therefore bustling with pedestrian activity, especially during the morning and evening rush hours. Because of these differences, it was beneficial to separate the data by crossing and analyze the corresponding violation rate reductions.



FINDINGS AND CONCLUSIONS

Before the start of data collection, the predicted number of train events at the 3 crossings in Arlington Heights was 76,300. This approximate sample size was sufficient to believe that enough data would be collected to lend confidence to the results. Over the course of the project, 60,942 train events and 120,234 violations were reviewed and analyzed. The results obtained from this data can be replicated in other environments under similar circumstances. These findings satisfied the intention to produce meaningful results that are transferable and could be replicated under similar circumstances.

As shown in Table 1, overall highway-user violations at the highway-rail grade crossings were reduced 30.92 percent. This does indicate some change in behavior, it but did not meet the FRA goal of a 50 percent reduction. As the data was analyzed, however, it was clear that certain highway-users and behaviors were more affected by the PEERS programs.

A minimal increase in the type I violation rate was observed. (A type I violation is the first indication that a train is approaching the crossing.) The violators nearing the crossing may not be able to stop safely or feel they have enough time to safely traverse the crossing. The type I violation could be a less conscious decision to violate the warning devices; this behavior is less affected by the PEERS programs. The most risky, type III violations, were reduced 71.4 percent. Pedestrians were decidedly more affected than motorists.

Table 1. Change in Violations

Type of Violation	Percent Change in Violations*
Type I Violations	15.2%
Type II Violations	-23.0%
Type III Violations	-71.4%

*From the pre-test to the post-test period. A - indicates a reduction.

The crossing environment and characteristics were important in whether the PEERS programs were successful in changing highway-user

behavior. The only crossing that saw a considerable (50 percent or greater) reduction in violations was Dunton Avenue. At Dunton Avenue, pedestrians committed 65 percent of the violations. Dunton Avenue also has an adjacent commuter rail station, and most of those pedestrians are commuter rail passengers. Type III pedestrian violations at Dunton Avenue were reduced 76.3 percent over the course of the study. Pedestrians appeared the most affected by the education and enforcement efforts.

The positive results observed in the urban community of Arlington Heights, IL, prompted a comparison evaluation of data collected in the rural community of Macomb, IL. The comparison study, to be published separately, will describe the effectiveness of education and enforcement programs in a variety of crossing environments.

REFERENCES

[1] *Safety of Highway-Rail Grade Crossings: Public Education and Enforcement Research Study*. Sposato, S; Bien-Aime, P; Chaudhary, M. Final Report. December 2006. DOT/FRA/ORD-06/27. DOT-VNTSC-FRA-06-03.

CONTACTS

Thomas Dorset
Federal Railroad Administration
Office of Research and Development
1120 Vermont Avenue NW-Mail Stop 20
Washington, DC 20590
Tel: (202) 493-6362 Fax: (202) 493-6330
E-mail: Thomas.Dorset@dot.gov

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