JERSEY DOT'S Tech Brief

"Turning Problems into Solution"

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Think Jersey DOT

Railroad Crossing Safety

FHWA-NJ-2010-011 December 2010

The Problem?

There are more than 1600 highway-rail grade crossings in New Jersey. To maintain and improve grade crossing safety is an enormous challenge that will take the combined efforts of railroads, public safety officials and the general public. The daily inspection, maintenance, and improvement of these critical areas around railroad crossings rest on the shoulders of a selected group of railroad engineers and safety officers in the New Jersey Department of Transportation (NJDOT). Are there any optimum approaches to effectively identify potential hazards at various crossing locations and correct them? What are the best approaches to enhance motorist safety at all railroad crossings?

The Response !!!

To achieve the safety improvement goal at railroad crossings, NJDOT commissioned New Jersey Institute of Technology (NJIT) to develop an optimal and effective approach to identify vegetation blockage of the sight distances at the highway-railroad crossings. This project consisted of a peer survey among state Departments of Transportations (DOT) and a development of potential solutions in coordination with NJDOT staff and Research Project Selection and Implementation Panel (RPSIP).

Research Objectives

The purpose of this research is to improve motorist safety at railroad crossings through an optimal approach to identify vegetation blockage of the sight distances at the highway-railroad crossings. The project team worked with the railroad engineers to explore solutions in identifying potential hazards at various locations and select the best innovative approach for corrective action. In order to produce a practical, implementable solution, the research team strived to accomplish the following objectives:

1. Review existing literature to identify potential solutions or best practices implemented by others.

2. Survey peers among state Departments of Transportations (DOT), railroad associations, and other related parties to acquire existing practices and potential solutions in the developing stages

3. Evaluate current operations of the Railroad Engineering and Safety Division in NJDOT to establish the baseline for implementing potential solutions.

4. Coordinate with NJDOT staff and Research Project Selection and Implementation Panel (RPSIP) to select the optimal approach among various potential solutions to identify vegetation blockage of the clearance triangle at railroad crossings.

5. Demonstrate the practicality and implementability of the recommended solution by applying the process to selected locations.

Project Tasks

- Review existing literatures
- Conduct survey of peer state DOTs and other agencies
- Evaluate current operations
- Select an optimum approach
- Demonstrate the practicality and implementability of the proposed solutions.

Main Findings

Focusing on public vehicular crossings, the survey responses revealed that less than one fifth of the highway and railroad crossings are grade separated, which leaves the majority of the crossings, 83 percent, at grade. About 40 percent of the total at grade crossings are actively controlled by gates while the rest of the 60 percent are passively controlled, using cross bucks, stops signs, yield signs and other devices.

The usage and effectiveness of the passive control devices vary across all survey responses as shown in Figure 1. As expected, only a few agencies use law enforcement personnel and flag waving railroad personnel at a few selected crossing locations and usually for particular occasions, the two categories were rated to be most effective. Of the agencies that have such practices, 57% score the flagman and law enforcement officer the highest, averaging 4.0 and 3.9 out of 5, resepctively. It is not surprising that it is most effecive when a real person is at the location but it is also very expensive and not used for daily operations.

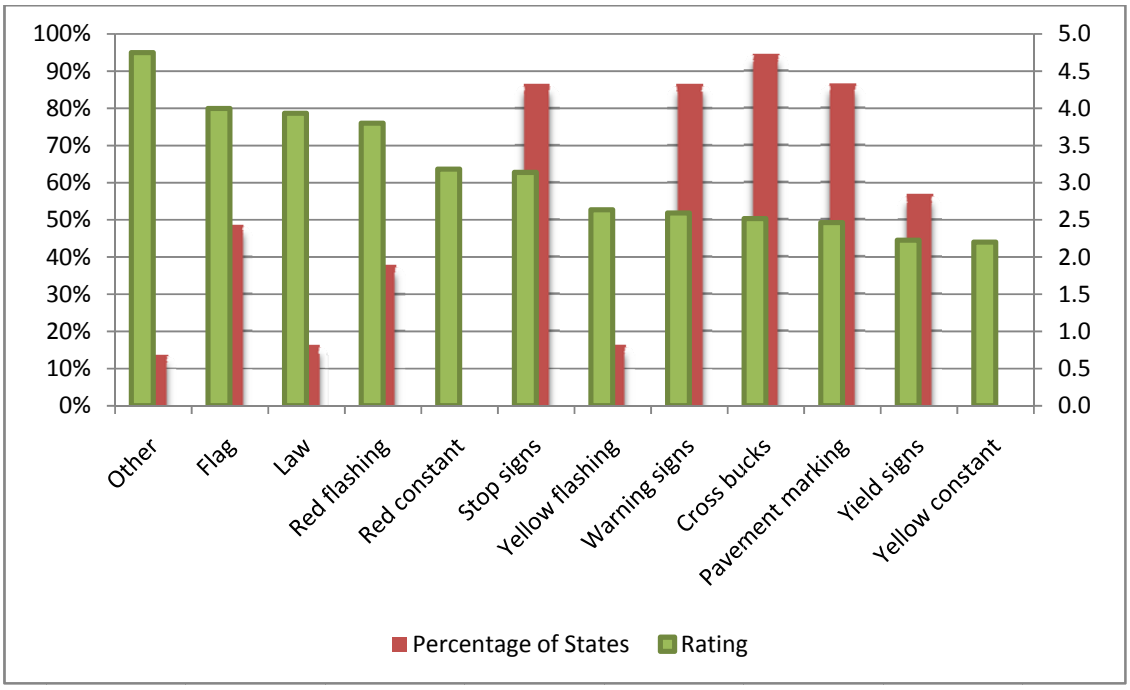

Figure 1. Various Passive Controls Used and Their Ratings

As the work loads mount, the inspection cycle can get very long. As depicted in Figure 2, among all responding states, only a small portion, 15%, are able to complete the inspection cycle within one year. Slightly more than one quarter of them, 27%, can complete the inspection cycle within one to two years and another quarter of the states run the cycle more than five years. The highest portion of the inspection cycle is between three to four years.

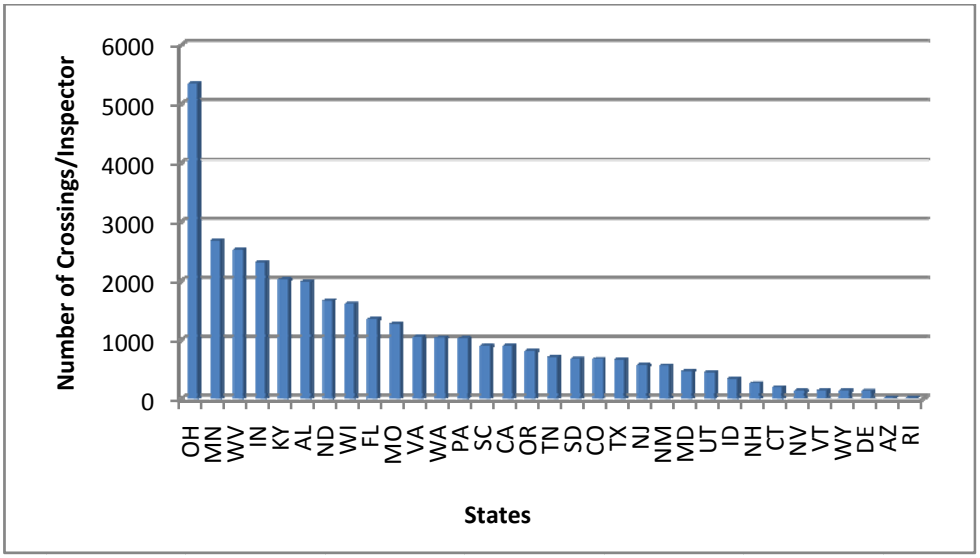

Figure 2. Average Load for Each Inspector

Among all the survey respondents, about two thirds of the states, 64%, have an overall rating system for each crossing while the rest the one-third do not. The general principle for overall ratings of the crossings may be categorized into the following groups:

- Simple rating based on surface conditions;
- Direct applications of FRA formula or hazard index;
- Stated modified procedures based on the FRA formula;
- Evaluation of particular studies.

In terms of the identification of best practices used by other peer agencies in maintaining the sight distance triangle, especially clearing the vegetation blockage at crossing locations, two states, Indiana and Wisconsin, use fixed numbers. More than half of the state agencies estimate the stopping sight distance using the operating speed and the geometry of the crossings as shown in Figure 3. After examining the rest of the “other” category, researchers found that most of the agencies belong to the same category that “estimates using operation and geometric characteristics” as by the Railroad/Highway Grade Crossing handbook. The MUTCD formula and Hazard Index models all use the general principles of stop sight distances based on speed and geometry.

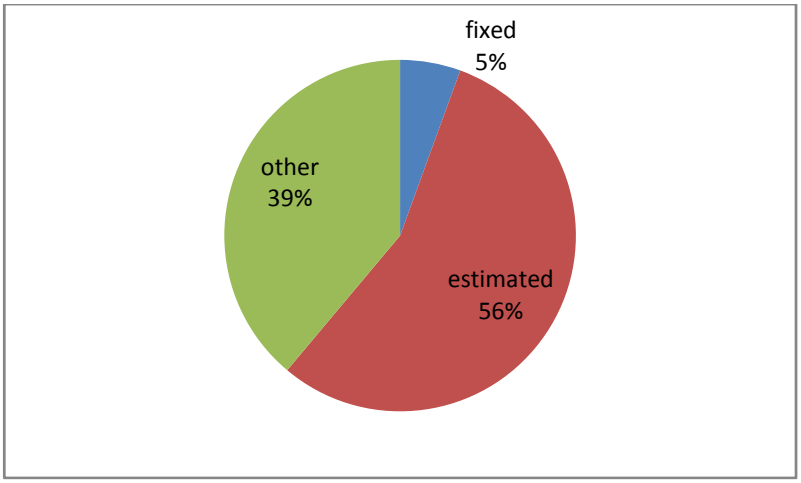

Figure 3. How stopping sight distance was determined{ *TC "**Figure 20. How stopping sight distance was determined**" \f F \l "1"* ***}***

As for the effectiveness of the practices used by various agencies, conventional survey approaches and measuring with rollers were rated the highest, an average 4.4 and 4.2 out of 5 and Google mapping the lowest, 2 out of 5, as depicted in Figure 4.

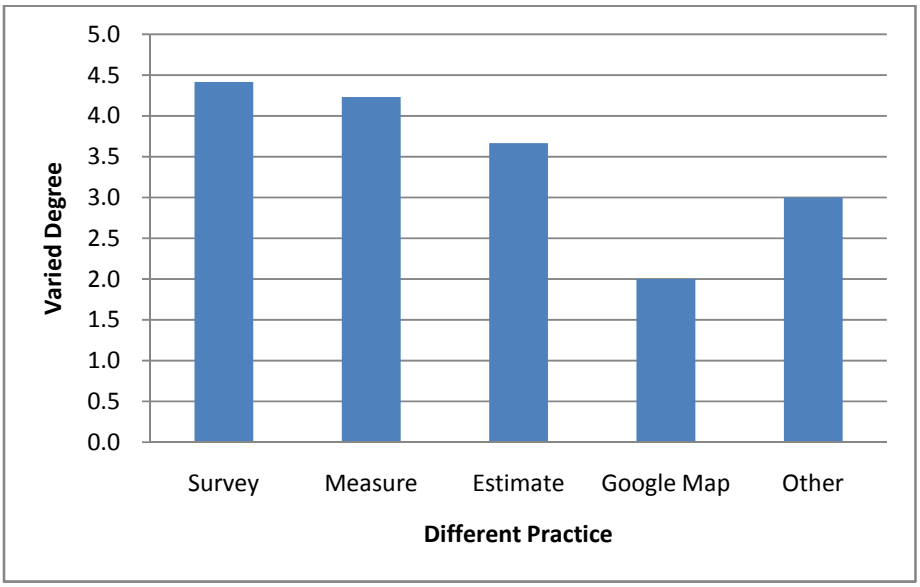

Figure 4. Effectiveness of various approaches

Proposed Vegetation Clearance Identification Approach

The survey results indicated no consensus or commonly accepted practices. After considering all of these modern technologies and conventional survey techniques in identifying vegetation blockage, the research team developed a two step process, which is a combination of photogrammetric and survey approaches.

The proposed approach combines both web mapping applications and the conventional survey approach. The procedures accomplished via Google Earth /Bing Map help inspectors eliminate a large number of crossings from the vegetation blocakge concerns so higher priority may be placed on these locations that need immediate attention. The conventional survey step should be executed on site to confirm if vegetation blocks the visibility triangle. A simple geometric template and marking procedure has been developed to instruct reponsible parties to trim and clear the blockages accordingly.

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A final report is available online at
http://www.state.nj.us/transportation/research/research.html

If you would like a copy of the full report, please FAX the NJDOT, Division of Research and Technology, Technology Transfer Group at (609) 530-3722 or send an e-mail to Research.Division@dot.state.nj.us and ask for:

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