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Study on drivers' behavior at various warning sign at Rail-Highway Grade Crossings (RHGC)

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Abstract

Safeguarding grade crossings between rail lines and roads has been a long-standing issue for railroads and motorists alike. This research examines the effectiveness of several passive warning sign systems installed at certain railroad-highway grade crossings in India. Due of its long-standing and substantial risk to public safety, drivers' STOP behaviour was the main focus of our investigation. This research was conducted on the road to see how motorists responded to varied warnings at nine grade crossings. We do a statistical analysis and comparison of the amount of time it takes for large trucks, school buses, and other vehicles to come to a complete stop at crossings with poor and excellent sight distance on their approaches. Road tests revealed that the great majority of motorists ignored the STOP signs posted at grade crossings. It was shown that a much larger proportion of cars came to a full stop at crossings with inadequate sight distance compared to those at approaches with sufficient sight distance. For years, there has been contentious debate about whether or not the STOP sign should be used at passive grade crossings. This article provides a synopsis of the many arguments for and against their application. In light of these scant findings, the authors recommend waiting to install STOP signs at grade crossings until more engineering studies can be performed to ascertain the visual distance.

Keywords; *Railroad Highway Grade Crossings; drivers' behavior; passive warning sign*

Introduction

On average, there is a collision at a railroad-highway grade crossing somewhere in the United States every 90 minutes. According to the Association of Railroads, annual losses due to car-train crashes total about $1 billion **(Highway-Rail Grade Crossing Safety 2006).** The accident data from 2003–2004 to 2011–12 demonstrates the trend of decreasing accidents on Indian railroads. The graph shown

below makes the trend quite evident. Despite the fact that the number of train kilometres is increasing annually due to traffic, accidents on Indian railways are trending downward. The upgrade of the track and rolling stock, as well as the replacement of outdated assets, all contributed to an increase in safety. Indian Railways saw 0.14 accidents per million train kilometres (APTKM) in 2011–12. The graph depicts the APKTKM's downward trend over the previous fifty years **(Indian Government's Ministry of Railways, February 2012)**

The absence of train-activated warning equipment at a grade crossing is referred to as a "passive grade crossing," and it consists of just a series of signs such as "STOP," "CROSSBUCK," and "YIELD" **(Jannat, et al 2018).** People often believe 67% percent of all grade crossing deaths occur at crossings that are not operational because they are located on low-traffic routes and would be too costly to modify. One easy approach to improve security is to install STOP or YIELD signs. Given that the STOP sign's effectiveness is contingent on drivers stopping their cars (which is sometimes used as a surrogate for safety), its continued usage has been hotly contested. The Association of Railroads supported this study to learn more about how drivers respond to different passive grade crossing situations, including how often they stop when instructed to do so by a STOP sign has been the subject of dispute for some time now **(Hanowski, et al 2017).**

Objective

To determine thedrivers' behavior at various warning signat specific rail-road grade crossings.

Methodology

With input from the Association of Railroads, nine grade crossings were selected to receive different warning systems. Because of safety concerns, almost all of the locations were located along railroad lines that ran adjacent to a state highway. Nine rail –road grade crossings used in this study randomly across the country.

Number of grade crossings	Signage
4	Only CROSSBUCK
2	CROSSBUCK and STOP
2	CROSSBUCK and YIELD
1	Only YIELD
1	Only STOP

Two were active grade crossings with a STOP sign, while two were passive grade crossings. The DOT was particularly interested in drivers' replies concerning the frequency with which they obeyed the STOP sign and whether or not they seemed to stop at the YIELD or CROSSBUCK signs. Each STOP sign and the lone YIELD sign were placed on their own poles **(Singh, 2020).**

Results

Overall, 4,318 vehicles crossed the nine grade crossings that were studied. There were a total of 4,318 cars counted, with 4,088 being driven during the day and 230 being driven at night. Three thousand two hundred and ninety-eight percent (3,269) of the vehicles did not come to a complete stop; nine percent (398) performed a rolling stop; and fifteen percent (651), stopped but kept moving. Seventy-six percent (3,104) of the vehicles did not stop at all during the day; nine percent (372); fifteen percent (612); and nine percent (372). Only 11% (26) of the vehicles came to a complete stop, 17% (39) made a rolling stop, and 72% (165) never stop. At grade crossings, 2% more cars only stop at night than during the day. There is a 4% increase in the number of cars that don't stop at grade crossings.

It is crucial to understand how big truck drivers and drivers of school buses respond to various indicators at grade crossings. School bus drivers are obligated by law to come to a complete stop at all grade crossings regardless of the situation. Children ride in school buses, thus it is unacceptable to endanger their lives at grade crossings. Due to their size, heavy trucks have considerably different viewing angles, sight distances, and turning capabilities than other types of vehicles. In addition, huge vehicles may carry dangerous goods or combustible objects that, if drivers don't exercise caution during grade crossings, might result in catastrophic catastrophes. Every grade crossing requires large vehicles carrying certain cargo to come to a complete stop.

Table 1 demonstrates that whereas 78% of drivers of other vehicles (n=3,160) did not stop at any grade crossings, 81% of heavy vehicle drivers (n=98) and 11% of public vehicle drivers (n=1) not. The drivers of at least 10% (12) of heavy-duty trucks, 11% (1) of buses, and 15% (638) of all other vehicles came to a full stop at all grade crossings. Of the 78% of school buses, 7 came to a complete stop, but just 9% of the heavy trucks (11) and 7% of the other vehicles (390) did the same. Despite their not being enough buses to draw firm conclusions, the fact that one bus didn't stop and another executed a rolling stop should raise red flags.

Table 1 Findings at All Grade Crossings for School Buses, Heavy Trucks, and Other Vehicles

Day	No. of Heavy Trucks	%	No. of School Buses	%	No. of Other Vehicles	%
Full STOP	9	9	7	78	364	7
Rolling STOP	11	11	1	11	590	15
No STOP	80	80	1	11	3025	78
Total	**100**	**100**	**9**	**100**	**3,979**	**100**
Night	**No. of Heavy Trucks**	**%**	**No. of School Buses**	**%**	**No. of Other Vehicles**	**%**
Full STOP	2	10	0	0	26	12
Rolling STOP	1	5	0	0	48	23
No STOP	18	85	0	0	135	65
Total	**21**	**100**	**0**	**0**	**209**	**100**
Day + Night Combined	**No. of Heavy Trucks**	**%**	**No. of School Buses**	**%**	**No. of Other Vehicles**	**%**
Full STOP	11	9	7	78	390	7
Rolling STOP	12	10	1	11	638	15
No STOP	98	81	1	11	3,160	78
Total	**121**	**100**	**9**	**100**	**4,188**	**100**

Conclusions

As a result of the limited sample size and the specific grade crossings chosen for analysis, there are few generalizable conclusions. However, conclusions drawn from the research settings are reliable. The majority of vehicles ignored the warning signs posted. At unmanned crossings, 79% of drivers disregarded the STOP signals, 13% made merely a rolling stop, and only 8% came to a full stop. Drivers' reactions were quicker and safer at night than they were during the day.

Where STOP signs were present, the majority of cars were ignoring them. Heavy trucks have the lowest compliance rate of any type of vehicle (not including school buses). There weren't enough school buses there to draw any valid statistical inferences. One performed a rolling stop, whereas the other did not, which raises some questions. Higher stopping percentages are caused by inadequate viewing distances at grade crossings. The intensity of the viewing distance limitation seems to be inversely correlated with stopping behaviour.

From this limited research, we can draw the following conclusions:

1. The STOP sign is ignored by drivers (albeit more so than the YIELD sign); and

2. No matter how many signs are placed at a crossing, people's actions are heavily influenced by the crossing's physical attributes, notably sight distance.

3. Use of a STOP sign at a grade crossing is avoided unless a trustworthy technical evaluation indicates the requirement for such a sign owing to poor visibility..

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