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Supplementary Notes

<p>Abstract</p> <p>A 1984 study by the Research Council recommended that advance warning signs be placed in advance of skewed railroad-highway grade crossings. Several signs were suggested for use, and the study reported here was undertaken to determine the effectiveness of two of these signs. The study focused upon how well cyclists observed and understood the signs. Questionnaires were distributed to motorcyclists in the Harrisonburg area, and interviews were conducted with bicyclists encountered on the campus of James Madison University. Both of the suggested signs were found to be effective, but one was superior and its use is recommended.</p>

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EVALUATION OF SELECTED WARNING SIGNS
AT SKEWED RAILROAD-HIGHWAY CROSSINGS

by

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Research Scientist Assistant

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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ABSTRACT

A 1984 study by the Research Council recommended that advance warning signs be placed in advance of skewed railroad-highway grade crossings. Several signs were suggested for use, and the study reported here was undertaken to determine the effectiveness of two of these signs. The study focused upon how well cyclists observed and understood the signs.

Questionnaires were distributed to motorcyclists in the Harrisonburg area, and interviews were conducted with bicyclists encountered on the campus of James Madison University.

Both of the suggested signs were found to be effective, but one was superior and its use is recommended.

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BACKGROUND

A 1984 study of the hazards associated with skewed railroad-highway grade crossings found that many accidents involving cyclists were being caused by the narrow wheels on motorcycles and bicycles being caught in the flangeways of the tracks.* Where the railroad intersected the highway at an angle of approximately 90°, few problems were being experienced, but as the angle of the intersection decreased and the path of the railroad became more closely parallel with the highway, the potential for accidents increased. For the study, rail-highway grade crossings which intersected the roadway centerline at an angle of 70° or less were reviewed, and it was found that a skew of 30° or less created the greatest hazard potential.

In compliance with the Manual on Uniform Traffic Control Devices, Section 2C-1, which states that the use of warning signs is warranted "when it is deemed necessary to warn traffic of existing or potentially hazardous conditions on or adjacent to a highway or street," and Section 9B-15, which recommends the use of hazardous condition warning signs "where roadway or bicycle trail conditions are likely to cause a bicyclist to lose control of his bicycle," it was recommended that additional warning signs be installed in advance of skewed railroad-highway grade crossings. The recommended warning sign, shown in Figure 1, depicts a railroad track crossing a highway at an angle and a plaque with the message "Cyclist Use Caution." It was to be erected on a post by itself midway between the crossing and the railroad advance warning sign.

After discussions among the researcher, the Traffic Research Advisory Committee, and the Highway and Traffic Safety Division of the Virginia Department of Highways and Transportation, an alternate sign, shown in Figure 2, was suggested. This was recommended to be used in conjunction with the railroad advance warning sign, which has an "RR" symbol.

The study reported here was undertaken to determine the effectiveness of the two possible recommended signs. It focused upon how well cyclists observed and understood the signs.

Paltell, Eric, An Investigation of Safety Problems at Skewed Rail-Highway Grade Crossings, Virginia Highway and Transportation Research Council, June 1984.

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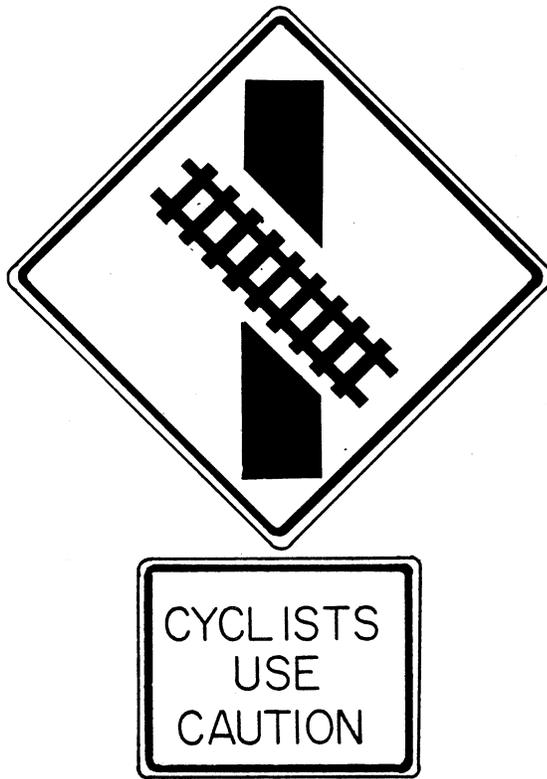


Figure 1. Schematic skewed crossing sign.



Figure 2. Word message skewed crossing sign.

RESEARCH PROCEDURE

For the study, two types of signs and placement were proposed: (1) a sign (Figure 1) bearing a schematic of a railroad track crossing a highway at an angle and a plaque beneath the schematic with the message "Cyclists Use Caution" was erected alone on a post midway between the crossing and the railroad advance warning sign; and (2) a word message sign (Figure 2) with the messages "Skewed Crossing" and "Cyclists Use Caution" divided by a line was placed under the railroad advance warning sign. From the earlier study, two rail-highway grade crossings in Harrisonburg, Virginia--Rte. 11 and Rte. 974--were identified as having severe angles and were selected as study sites. Rte. 11 (Figure 3) has four through traffic lanes, with a fifth lane in the center for turning vehicles, while Rte. 974 is a narrow, two-lane road (Figure 4). Both types of signs were placed at each site; one type facing the northbound traffic and the other facing the southbound traffic.

Data for the evaluation were collected primarily through two questionnaires concerning the cyclists' observance and comprehension of the signs (see Appendix). The first questionnaire was mailed to motorcycle owners in the Harrisonburg area, and the second was used to interview bicyclists on the campus of James Madison University in Harrisonburg. Both surveys questioned the cyclists about the new signs in conjunction with their use of the two crossings.

RESULTS

The responses to the questionnaires used in the study are summarized separately in the subsections below.

Summary of Responses to Questionnaires Sent to Motorcyclists

A questionnaire concerning the observance and comprehension of the signs was mailed to approximately 1,200 motorcycle owners in the Harrisonburg area with a request that they complete the questionnaire and return it by mail. A total of 340 (28.3%) of the questionnaires were returned and the responses are shown in the Appendix. A small percentage, 4.7%, of the respondents stated that they did not use either of the crossings under study. Of the remainder, 86.1% said that they used both sites. One hundred and fifty-one (46.6%) of the respondents were in the 21-to-30-year age group, while 76 (23.5%) were between 31 and 40 years of age.

Of the responding cyclists, 213 (65.7%) used the crossings up to five times a week and 266 (82.1%) had been using them for more than a year.

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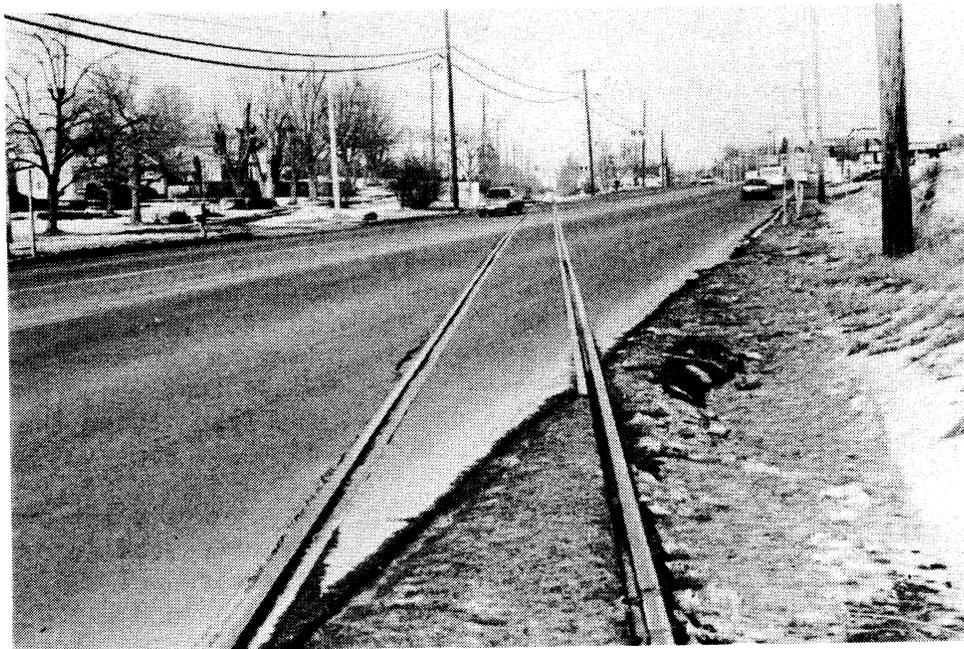


Figure 3. Study site on Rte. 11 in Harrisonburg.



Figure 4. Study site on Rte. 974 in Harrisonburg.

Of the respondents, 207 (63.9%) stated that they had experienced difficulty in crossing the sites. The majority of this group attributed the difficulties to a bad approach angle and poor crossing conditions, mainly on Rte. 974. Many indicated that the signs will help alleviate the surprise of a bad approach angle, but that correction of the poor crossing conditions was the ultimate solution.

When asked if they had noticed these signs, 78.4% of the cyclists responded positively. Their reactions to the signs had included slowing down, changing approach angle, and being more attentive.

When asked what the signs meant, the respondents gave a variety of answers that were categorized as follows: 109 (40.7%) interpreted the signs to mean that they should change their approach angle, 33.1% recognized that they were approaching a rail-highway grade crossing that was not perpendicular to the road, 21.9% thought that they should cross at a slower speed, and the remaining 4.5% interpreted the signs to mean that the crossing was in poor condition. It should be noted that although there was no space on the questionnaire for comments about the cyclists' preference of one sign over the other, many respondents commented on the sign with the schematic of the rail-highway grade crossing, with remarks such as "best sign," "easy to understand," and "can understand at a glance." There were also many negative comments about the other sign such as, "What does 'skewed' mean?" "Is 'skewed' a new word?" or "'Skewed' can be confusing." This leads the author to conclude that although both signs were recognized, the schematic sign is the better of the two because it was easily understood.

Summary of Questionnaire Interviews with Bicyclists

The questionnaire used to survey bicyclists was similar to the one used for motorcyclists. It was administered on the campus of James Madison University once during the summer school session with limited success and then on two consecutive days in the fall session with much better results.

A total of 59 bicyclists were questioned, and their responses are shown in the Appendix. Over 90% of the cyclists were college students.

Of the cyclists questioned, 44 (74.6%) used the crossings five or fewer times a week and 32 (54.2%) had been using them for more than a year.

Thirty-four (57.6%) of these cyclists said that they had had difficulty crossing the study sites. The two main difficulties cited were the bad approach angle and the poor crossing conditions, while other factors such as bad weather, loose gravel, and travelling too fast were mentioned.

Thirty-nine (66.1%) of the respondents said that they had noticed the new signs, and all appeared to understand their function.

Forty-four of the respondents said that they had or would alter the way in which they crossed the railroad track as a reaction to the signs. The most popular reactions cited were slowing down, paying more attention, and changing the approach angle.

CONCLUSIONS AND RECOMMENDATIONS

The study has revealed that skewed railroad crossings present a problem for motorcyclists and bicyclists. Approximately 64% of the motorcyclists and 57% of the bicyclists stated that they had experienced difficulties in crossing the study sites. The main difficulties noted were a bad approach angle and poor crossing conditions. The latter appeared to be the worst difficulty for motorcyclists, whereas the former was the major difficulty for bicyclists, as might be expected because a bicycle tire is smaller than a motorcycle tire. It is believed that a new warning sign will alleviate the surprise of the bad approach angle; however, improvement of the crossing conditions is the railroad company's responsibility.

Both groups of cyclists appeared to have noticed the signs and reacted accordingly. The cyclists had reacted by (1) changing their approach angle, (2) paying more attention to the crossing, and (3) slowing down. More bicyclists than motorcyclists had noticed the signs, probably because the slower speed of the bicycle affords more time for the bicyclists to observe conditions along the road.

The cyclists interpreted the signs to mean one of three basic messages: (1) a change in approach angle is required, (2) the railroad crossing ahead is not perpendicular to the highway, or (3) slow down. The author considers any of these messages to be beneficial to the cyclist in preventing an accident. Also, there were several comments to the effect that these signs would help the first-time user of a skewed rail-highway grade crossing.

In conclusion, because of the numerous favorable comments made about the schematic sign (that it was the easier to read and understand and that the other sign was confusing, mainly because it used the word "skewed"), it is recommended that the schematic sign be installed at

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skewed rail-highway grade crossings having an approach angle of 30° or less and serving cyclist traffic. The suggested placement of the sign is midway between the railroad advance warning sign and the crossing. In any event, it should be placed far enough in advance of the crossing to warn cyclists of the adverse conditions created by the crossing.

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APPENDIX

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QUESTIONNAIRE SURVEY FORMS

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CYCLIST RAILROAD CROSSING QUESTIONNAIRE

Dear Cyclist,

The Virginia Department of Highways and Transportation is seeking ways to improve the safety of railroad crossings for cyclists. We are currently studying two railroad crossings located in Harrisonburg, one is the crossing on Rte. 974 (Old Country Club Road) and the other is on Rte. 11 (Main Street) directly in front of the Rocco Hatchery.

To help us in this effort, we are asking cyclists such as you to complete and return the enclosed questionnaire. Information provided by the public is very useful to the Department in its continuous efforts to improve the level of service of our roads and streets. Please take a few minutes and give us your input.

16 If you are not a cyclist or never cross the intersections cited above, please check and return the questionnaire anyway. Simply fold and mail. No postage is required.

Thank you for your participation in this survey.

Todd Collier
Research Assistant

(Please answer all questions, and return at your earliest convenience)

1. Which of the following railroad crossings have you crossed on your motorcycle? (Circle one.)

- 35 a) Rte. 11 (at Rocco Hatchery) 10 b) Rte. 974 (Old Country Club Road)
- 279 c) Both

2. As a cyclist, have you ever had any difficulties crossing the railroad tracks? (Circle one.)

- 207 a) Yes b) No 115

If NO, skip to question 4.

3. To what do you attribute these difficulties? (Circle as many as apply.)

- 151 a) Poor crossing conditions
- 33 b) Bad weather
- 39 c) Loose gravel
- 174 d) Bad approach angle
- 56 e) Other motorists
- 6 f) Travelling too fast
- 35 g) Slick pavement
- 0 h) Other _____

4. Have you noticed the new signs (pictured here) for cyclists at the crossing(s)? (Circle one.)

- 254 a) Yes b) No 66



5. What does the sign (signs) mean to you?

- a) _____
- 5 b) I don't know

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6. How did the sign affect the way you crossed the tracks? (Circle as many as apply.)

- 64 a) It had no effect
- 129 b) I was more attentive
- 132 c) I changed my approach angle
- 152 d) I slowed down
- 0 e) Other _____

IF YOU ANSWERED (a) ABOVE, GO TO 7, IF NOT GO TO 8.

7. Why don't you think the sign will be helpful? (Circle as many as apply.)

- 16 a) Too small
- 2 b) Wrong color
- 6 c) Not understandable
- 9 d) Blends in with the background
- 12 e) Wrong place
- 0 f) Other _____

8. Approximately how many times do you cross these tracks each week? (Circle one.)

- 213 a) 0-5
- 50 b) 5-10
- 36 c) 10-15
- 14 d) 15-20
- 12 e) over 20

9. How long have you been using this crossing? (Circle one.)

- 3 a) One week or less
- 2 b) A few weeks
- 17 c) 1-6 months
- 22 d) 6-12 months
- 266 e) More than 1 year

10. What is your age? (Circle one.)

- 2 a) Under 18
- 16 b) 18-20
- 151 c) 21-30
- 76 d) 31-40
- 40 e) 41-50
- 22 f) 51-60
- 11 g) Over 60

THANK YOU. PLEASE FOLD AND MAIL.



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A SURVEY OF CYCLISTS AT SKEWED RAILROAD CROSSINGS

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Hi, my name is _____ and I'm working with the Virginia Highway and Transportation Research Council. We'd like to get your input on a study we're doing here at this crossing. Would you be willing to give me a few minutes of your time?

- (yes) I appreciate your cooperation.
- (no) I understand, have a nice day.

1. As a cyclist, do you have any problems crossing the railroad tracks?

(a) yes **34** (b) no **25**

(If no, skip to 3)

2. To what do you attribute these problems?

- | | |
|---------------------------------------|---------------------------------|
| 18 a) poor crossing conditions | 7 e) other motorists |
| 4 b) bad weather | 4 f) travelling too fast |
| 5 c) loose gravel | 1 g) slick pavement |
| 28 d) bad approach angle | 3 h) other _____ |

3. Did you notice the sign concerning cyclists just before the crossing?

39 (a) yes (b) no **20**

(If answer is NO, show them sign.)

4. What would you say the sign means?

- a) _____
- b) I don't know

5. Did (would) the sign alter the way in which you crossed the track?

48 (a) yes (b) no **11**

(If NO, skip to 7.)

6. In what ways did you alter your actions?

- | | |
|---------------------------------|-------------------------------------|
| 44 a) slowed down | 34 c) changed approach angle |
| 36 b) was more attentive | 18 d) other _____ |

