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Study of Road-Rail Crashes in Claremore, OK, and Allocation of Resources for Preventive Measures

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The opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the Indian Health Service.

Tearsheet requests to Mr. Meeks.

Synopsis

Road-rail crossings where a train and motor vehicle crashed were compared with the next crossing in the direction from which the train traveled at the same time of day and day of week of the crash. The odds of a crash were much lower at crossings with automatically lowered gates (odds ratio = 0.11). Average road traffic was much higher at crash sites; the presence of automatic gates was unrelated to the volume of road traffic. Federally funded modifications of road-rail crossings have substantially reduced deaths at such sites. The program would be more cost effective, however, if criteria for highest risk sites were applied more systematically, and funds were apportioned among the States according to their relative proportions of the problem.

In 1973, the U.S. Congress specified that a proportion of the Highway Trust Fund would be allocated to modifications of rail-highway crossings to reduce crashes of trains and motor vehicles (Public Law 93-87). During the next 15 years, more than $2.3 billion was apportioned among the States for the program. The apportionment of funds was based on a weighting of several factors—the State's area, rural population, mileage of rural delivery routes, and urban population. Number of rail crossings in the State was added as a factor for half of the apportionment in 1978 (Public Law 95-599).

There is evidence that the program has had substantial effect. Deaths of motor vehicle occupants at rail-highway crossings were averaging near 1,000 per year in the mid-1970s. As the expenditures for the modification program accelerated, the deaths declined to about 500-600 per year by the mid-1980s, while the number of train and motor vehicle miles traveled increased (*1*). This decline occurred after the scrapping of most cars that were manufactured before the motor vehicle safety standards were enacted in 1968, and after the effects of the 55 miles per hour speed limit were realized. Therefore, these factors would not account for the decline in deaths at rail-highway crossings between 1975 and 1988.

The relative cost-effectiveness of a program depends on the effectiveness of the approaches adopted and the targeting of resources where the problem is most acute (*2*). In a comparison study, this report examines the effectiveness of the approach (short of eliminating the crossing) thought to be the most effective—gates automatically lowered to stop road traffic when a train is approaching. The allocation of funds among the States to modify the crossings is also examined relative to the concentration of these highway hazards among the States.

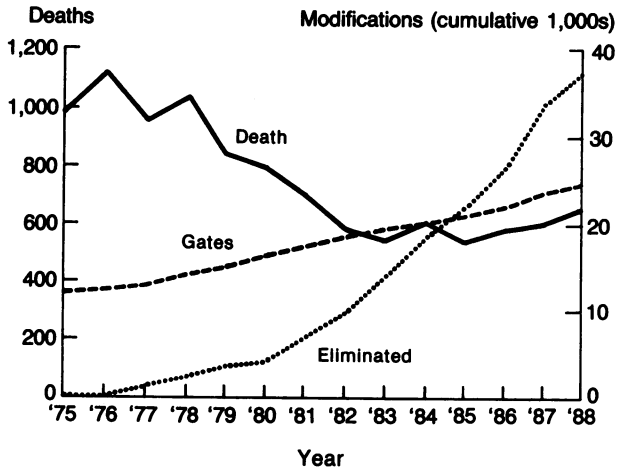
Method

A study of rail-highway crashes and traffic volume was conducted in Claremore, OK, a community of about 13,000 population with train traffic of some 32–50 trains per day. Fewer than 3 percent of road-rail intersections in the United States experience more than 35 trains per day (*3*).

To examine the exposure of motor vehicles to trains, traffic was observed and counted at each of 19 police-reported crash sites and at the next crossing in the direction from which the train traveled. The counts were made at the time of day and day of the week when the crash occurred. The type of traffic control at each crash and comparison site was noted.

The cost-effectiveness of allocating resources among the States by the distribution of Federal funds and eliminating crossings or installating automatic gates at crossings during 1975–88 was examined. The data for these comparisons were the number of deaths and distributions of types of equipment among the States reported annually by the Federal Railroad Administration (*3*) and the funds allocated annually to the States reported by the Federal Highway Administration (*4*).

Numbers of deaths at road-rail crossings, of crossings with barrier gates, and of crossings eliminated, United States, 1975-88



Results

The presence or absence of automatic gates at the 19 case and comparison sites are as follows:

Category	*Crash site*	*Comparison site*
Gated	2	10
Ungated	17	9

NOTE: Odds ratio = 0.11 (95 percent confidence interval 0.01–0.69).

Only 2 of the 19 crashes occurred at gated crossings, while the next site in the direction from which the train traveled was gated in about half of the cases.

The following table shows the average motor vehicle traffic observed at crash and comparison sites at the same time of day and day of week as a crash at crash sites.

	Number of vehicles	
Category	*Crash site*	*Comparison site*
Gated	202	32
Ungated	216	58

The crash sites had substantially more traffic than comparison sites. The presence of gates, however, was unrelated to the traffic count.

Nationally during 1975–88, some 37,200 road-rail crossings were eliminated, and gates were installed at an additional 12,600 crossings. This change increased the number with automatic gates to

Allocation of Federal funds for road-rail crossing modifications among States by quartile distributions of road-rail crossing deaths of motor-vehicle occupants among States during 1975–77 and 1978–88

	Deaths 1975–77		Deaths 1978–88		Dollars in millions	
Quartile[1]	Number	Percent	Number	Percent	Number	Percent
1	30	1.1	127	1.8	$207.3	8.9
2	293	11.0	705	10.1	469.1	20.1
3	682	25.6	1,739	24.9	579.5	24.8
4	1,657	62.2	4,406	63.2	1,079.4	46.2
Total	2,662	99.9	6,977	100	$2,335.3	100

[1] See box for States included in each quartile.

States Assigned to Quartiles by Number of Road-Rail Crossing Deaths During 1975–77

Quartile 1—Alaska, 2; Connecticut, 2; District of Columbia, 0; Delaware 4; Hawaii, 0; Maine, 4; Massa- chusetts, 3; Nevada, 1; New Hampshire, 1; Rhode Island, 1; South Dakota, 4; Vermont, 1; Wyoming, 7.

Quartile 2—Arizona, 9; Colorado, 38; Idaho, 38; Maryland, 13; Montana, 15; New Jersey, 13; New Mexico, 12; New York, 32; North Dakota, 27; Oregon, 30; Utah, 16; Virginia, 25; West Virginia, 25.

Quartile 3—Arkansas, 67; Iowa, 62; Kentucky, 51; Louisiana, 60; Minnesota, 55; Mississippi, 51; Nebraska, 67; Pennsylvania, 51; South Carolina, 54; Tennessee, 57; Washington, 45; Wisconsin, 62.

Quartile 4—Alabama, 85; California, 143; Florida, 185; Georgia, 71; Illinois, 234; Indiana, 205; Kansas, 76; Michigan, 79; Missouri, 72; North Carolina, 73; Ohio, 158; Oklahoma, 72; Texas, 204.

24,600 (see figure). Nevertheless, in 1988 some 107,000 crossings remained with only a "cross-buck" warning—31,400 had flashing lights, and about 9,000 had miscellaneous bells, signs, or other warnings (*3*).

The Federal criteria for the allocation of resources resulted in a wide variation in expenditure relative to the deaths at road-rail crossings among States. To examine the differences, the States were divided into quartiles based on the distribution of deaths in 1975–77 (box). The number of deaths in 1975–77 and 1978–88 and the Federal dollars apportioned to the States during 1975–88 are indicated in the table. The 12 States and the District of Columbia with 1.1 percent of the deaths in 1975–77 were allocated about 8.9 percent of the funds; the 13 States with 62.2 percent of the deaths received only 46.2 percent of the funds. The proportion of deaths in States in a given quartile in 1975–77 was predictive of the proportion in those States during the subsequent years.

Discussion

The funds allocated to rail-crossing modifications apparently made a substantial difference in deaths. About 2,500 fewer deaths than expected occurred during the first 10 years of the program, a savings of about $5 billion in direct costs and lost productivity (*5*). That calculation understates the savings because the savings continue to accumulate with modest maintenance costs for decades. The data in this study suggest that the system could be even more cost-effective than it is. Large amounts of money were distributed to States with few or no road-rail-crossing deaths in the mid-1970s, and those States continued to have relatively few deaths at crossings thereafter.

The comparison study in Claremore confirms the findings of previous researchers that indicate the efficacy of automatic gates at crossings where eliminating crossings by building over- or underpasses is impractical (*6*). It also indicates that traffic volume apparently was not used as a criterion for the installation of gates at the sites studied in Claremore.

Traffic volume is a primary factor in formulas predictive of crashes at road-rail crossings (*7,8*). The General Accounting Office surveyed 23 States in 1977 regarding their use of road-rail-crossing funds and found that 4 used a quantified formula for allocating funds, 5 mentioned specific factors considered, 10 relied on "engineering judgement," and the others gave miscellaneous other responses (*9*).

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