

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

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Forwarded to:

Honorable John M. Sullivan
Administrator
Federal Railroad Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

SAFETY RECOMMENDATION(S)

R-78-42

Many persons walk across or along the Nation's railroad tracks each year, and nearly 500 of these pedestrians are hit and killed by trains annually. The Safety Board has studied railroad pedestrian accidents in order to recommend the development of countermeasures directed at reducing these 500 annual fatalities.

Our study was based on the data from 269 accident investigations conducted by the Board from March 1, 1976, to October 30, 1977. The accidents included 280 fatalities; the Safety Board attempted to exclude known suicides from the data.

The data have been developed into a profile consisting of 11 elements extracted from 41 data elements. (See Appendix I.) By doing this, attention can be focused on factors deserving further examination. The Board realizes, however, that factors not included in the profile may evolve and prove significant after a more indepth analysis. Thus, the profile illustrates a general situation and is not self-supporting. These data together with other FRA data must be analyzed before specific corrective measures can be defined and implemented to reduce pedestrian fatalities on the Nation's railroads.

The 11 elements selected relate to the victim, the day of the week having the highest incidence, the visibility, and pertinent facts associated with the accident site.

Based on the 280 fatalities, the following composite profile of fatal trespasser accidents was developed:

1. Accidents were most frequent on Saturday. -- The review of 269 accidents involving 280 fatalities showed that 56, or 21 percent, occurred on Saturday. Sunday had the second highest incidence, 41, or 15 percent. Monday through Friday averaged 34 fatalities each day, or 13 percent.
2. The victim was a male. -- Two hundred and forty-five fatalities, or 88 percent, were male and 33, or 12 percent, were female. The ratio of males to females was 8:1.
3. He was over 15 years of age. -- Only 14 percent of fatalities were 15 years or younger which is substantially below the 25.8 percent population distribution for 1977. The 239 fatalities, or 86 percent, were in the over 15 age group. The other two age groups, 0 to 5 years and 6 to 15 years, collectively involved only 40, or 14 percent, of the fatalities. Of those 15 years old and under, 30, or 75 percent, were 6 through 15 years, while 10, or 25 percent, were 0 to 5 years. These data reveal a shortcoming in the Safety Board's factual accident reports upper age bracket -- over 15. The absence of a complete distribution of involvement by age reduces the opportunity to determine the precise age of the adult trespasser.
4. The victim had been drinking heavily. -- Alcohol was involved in 58 percent of the cases; the average blood alcohol level was abnormally high. Of the 192 accidents involving persons older than 15 years, where there was knowledge of the physical condition of the victim, alcohol was a factor in 112 cases, or 58 percent. Of these 112 cases, a blood alcohol content was taken in 102 of the cases. The average level was .23; the maximum blood alcohol content level was .43.

The National Safety Council describes a blood alcohol content of .18 to .30 as the stage of "confusion." This suggests that the prevention of pedestrian accidents in more than half the cases cannot rely on informing the trespasser about the hazard; rather some means of keeping him off the property must be provided. Such methods should also tend to be effective against the remainder of the fatalities.

5. The victim was not a transient. -- As defined in our study, a transient is an individual with no fixed address. Less than 10 percent, or 22 of 230 of the victims, were within this definition.

6. The weather was clear and visibility was good. -- Only a small percentage of accidents occurred during inclement weather. Seventy-six percent, or 207 of 273 accidents, occurred in clear weather; 17 percent, or 47 of 273 of the accidents, occurred in cloudy weather; and the remaining 7 percent of the accidents, or 19 of 273, occurred during rain, snow, sleet, hail, or fog.

Track alignment was not usually a contributing factor in the accident. In 215 of 270 cases, or 80 percent, the track alignment did not affect the locomotive engineer's visibility. Vegetation was an adverse influence in 27 of 266 cases, or 10 percent, and was not relevant in 239 other cases (90 percent).

7. The track was straight. -- The results of the data indicated that 80 percent -- or 218 of 274 -- of the accidents occurred on straight track (tangent alignment). In 20 percent of the cases, 56 of 274 cases, the track was not straight.
8. The surface was flat. -- Sixty-three percent, or 172 of 271 cases, occurred on a flat surface. Other terrain characteristics accounted for an additional 37 percent of the accident sites, as follows: Cut -- 8 percent, or 21 of 271; fill -- 18 percent, or 49 of 271; bridge -- 10 percent, or 26 of 271; and tunnel and other -- 1 percent, or 3 of 271.
9. The accident site was on a main line with multiple tracks. -- Most trespassers were killed on a main track. In 244 of the 270 cases, or 90 percent, the site was on a main track. The other 10 percent of the cases were equally divided between branch and yard tracks. When the accident occurred at a main track, there were usually several other sets of tracks adjacent to that main track. The data indicate that 2.6 sets of main track were present at the average trespasser fatality accident site.
10. The accident site was in a "built-up" area. -- Only 8 percent of the accidents, or 22 of 269, were in rural or farm areas. Commercial, industrial, and residential areas were the sites of 171 of the 269 fatalities, or 64 percent. No predominant ground structure appeared at 48 of the 269 accidents, or 18 percent. Only 1 accident happened near a school (0 percent); 15 of the 269 accidents, or 6 percent, happened in a railroad yard; and the remaining 12 of the 269 accidents, or 4 percent, occurred in other unspecified areas. The majority -- 171 cases or 64 percent -- occurred in commercial, industrial, and residential areas as follows: Commercial -- 62 of 269 (23 percent), industrial -- 34 of 269 (13 percent), and residential -- 75 of 269 (28 percent).

11. The number of trains per day was high. -- The mean number of trains passing the accident site was 27 per day, a high traffic density.

Eighty-two percent of the accidents were in unfenced areas. Only 40 of 257 accidents occurred where the right-of-way was fenced; in the other 217 cases, there was no fencing. The relationship of the casualty to a warning was known in 195 of the 280 cases, or 70 percent. The casualty was incurred 73 percent of the time after a warning had been issued (143 of 195 cases). Of the known warnings, 91 percent, or 136 of 149, came from the horn of the train itself. In 27 percent of the cases, or 52 of 195, there was no warning to the victim presumably because the locomotive engineer did not see him between the tracks, the victim walked into the side of the train, he went between the wheels, or the engineer did not have enough time to warn him.

The profile indicates that 58 percent of the trespassers who had an average .23 blood alcohol content would not likely respond to information or warnings as preventive measures. Physical barriers, such as fences, would probably be more effective since a .23 blood alcohol content would be expected to hinder fence-climbing capability.

Trespasser fatalities are about 50 percent higher on Saturday than other days. Further analysis could show whether this is alcohol-related or whether there is greater pedestrian traffic on Saturday. In either case, Saturday would be the day on which special surveillance or enforcement might improve safety.

In a high percentage of cases, the weather was clear, the track was straight and level, and the train engineer was sounding his horn. It is impossible to determine why under these conditions the victim did not perceive the approaching train, especially those who had not been drinking. The apparent lack of perception is a problem not yet understood. Since a large percentage of the accidents occurred on main lines, it is reasonable to suspect that the high speed of trains hindered successful evacuation from the track, or contributed to confusion as to the track on which the train was approaching.

In most cases, these trespassers were killed on main lines where there were two or more main tracks and a high density of train traffic in "built-up" areas. These statistics establish the fact that accidents are not evenly distributed along the right-of-way, but happen in areas of concentrated population where buildings are close to tracks or activities of interest are separated by the track.

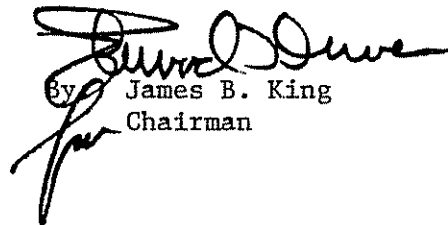
Since 82 percent of the accidents were in unfenced areas, selective fencing might be an effective method of reducing fatalities. These data, combined with the data on accident sites, suggest that the most effective location of fences would be in "built-up" areas through which two or more main lines pass. In addition, other factors, such as ground topography, pedestrian traffic flows, and past accident frequencies, need to be considered as part of the criteria for selecting fencing sites.

The Safety Board has studied the two railroad safety reports prepared by FRA for the Congress -- Railroad-Highway Safety, Part I: A Comprehensive Statement of the Problem (1971) and Railroad-Highway Safety, Part II: Recommendations for Resolving the Problem (1972). While the Part II report includes certain recommendations regarding trespasser casualties, it provides no definitive plan for followup to assure their implementation.

Accordingly, the National Transportation Safety Board recommends that the Federal Railroad Administration:

Develop criteria for the selection of fence sites. In addition to the number of tracks, the frequency of trains on the tracks, and built-up areas nearby, these criteria should consider such items as the direction and purpose of pedestrian traffic movement and the topography of the site. (Class II, Priority Action) (R-78-42)

KING, Chairman, McADAMS, HOGUE, and DRIVER, Members, concurred in the above recommendation.


By James B. King
Chairman

APPENDIX I

CUMULATIVE TALLY SHEET

1.	Number of accidents	269	
2.	Number of fatalities	280	
3.	Day of week	<u>267 Known</u>	<u>13 Unknown</u>
	Monday	36	
	Tuesday	36	
	Wednesday	31	
	Thursday	37	
	Friday	30	
	Saturday	56	
	Sunday	41	
4.	Sex	<u>278 Known</u>	<u>2 Unknown</u>
	Male	245	
	Female	33	
5.	Age	<u>279 Known</u>	<u>1 Unknown</u>
	0-5	10	
	6-15	30	
	16+	239	
6.	Grade Crossings	<u>270 Known</u>	<u>10 Unknown</u>
	19	Yes	
	251	No	

7. Tunnel	<u>266 Known</u>	<u>14 Unknown</u>
0	Yes	
280	No	
8. Light	<u>274 Known</u>	<u>6 Unknown</u>
Day - 131; (avg. 2,552 ft.)		
Dark - 122; (avg. 1,394 ft.)		
Dawn/Dusk - 21; (avg. 1,068 ft.)		
9. Weather	<u>273 Known</u>	<u>7 Unknown</u>
Clear	207	
Cloudy	47	
Rain	12	
Snow	1	
Sleet	0	
Hail	0	
Fog	6	
10. Wind Direction	<u>117 Known</u>	<u>163 Unknown</u>
North	30 (avg. 13 mph)	
East	6 (avg. 7 mph)	
South	64 (avg. 11 mph)	
West	17 (avg. 11 mph)	
11. Temperature (F)	<u>204 Known</u>	<u>76 Unknown</u>
	187 (avg. 52°)	
12. Humidity	<u>87 Known</u>	<u>193 Unknown</u>
	79 (avg. 56%)	

13.	Alignment	<u>274 Known</u>	<u>6 Unknown</u>
	Tangent	218	
	Spiral	1	
	Curve	55	
14.	Cut or Fill	<u>271 Known</u>	<u>9 Unknown</u>
	Cut	21	
	Fill	49	
	Flat	172	
	Bridge	26	
	Tunnel	0	
	Other	3	
15.	Visibility	<u>270 Known</u>	<u>10 Unknown</u>
	a. Did track alignment affect visibility?	55-Yes	215-No
		<u>266 Known</u>	<u>14 Unknown</u>
	b. Did vegetation affect visibility?	27-Yes	239-No
16.	Predominant Aboveground Structure in Area	<u>269 Known</u>	<u>11 Unknown</u>
	None	48	
	Commercial	62	
	Industrial	34	
	Residential	75	
	Rural/Farm	22	
	Railroad Yard	15	
	School	1	
	Other	12	

17. Distance to Nearest Building

231 Known 49 Unknown

231 for 205,352 total feet

18. Type of Track

270 Known 10 Unknown

Main 244

Branch 13

Siding 0

Yard 12

Industrial 1

Other 0

Additional number of main tracks 156 -- for total of 410 (avg. 2.6)

19. Speed in MPH

a. At time of brake application:

221 Known 59 Unknown

221 (avg. 37 mph)

b. At time of accident:

227 Known 52 Unknown

227 (avg. 32 mph)

20. Third Rail Involved - Number 1

21. Number of Trains/Week

223 Known 57 Unknown

223 for total trains 42,629 (avg. 191 trains/wk.)

22. Is There a Fence Along Right-of-way?

Right 257 Known 23 Unknown

40-Yes 217-No

Left	<u>246 Known</u>	<u>34 Unknown</u>
	35-Yes	211-No
23. Distance to Nearest Fence Opening		
Right	<u>32 Known</u>	<u>248 Unknown</u>
	32 (avg. 356 ft.)	
Left	<u>29 Known</u>	<u>251 Unknown</u>
	29 (avg. 361 ft.)	
24. Is There a Fence between the Tracks?		
	<u>235 Known</u>	<u>45 Unknown</u>
	7-Yes	228-No
25. Distance to Nearest Opening		
	<u>6 Known</u>	<u>274 Unknown</u>
	6 (avg. 210 ft.)	
26. Type of Nearest Opening/Crossing		
	<u>54 Known</u>	<u>225 Unknown</u>
Grade Crossing	21	
Overpass	7	
Underpass	9	
Gate in Fence	5	
End of Fence	7	
Gap/Hole	5	
27. Class of Person		
	<u>280 Known</u>	<u>0 Unknown</u>
Employee on Duty	0	
Employee not on Duty	3	

Class of Person	<u>280 Known</u>	<u>0 Unknown</u>
Passenger	0	
Emergency Force (Fire/Police)	0	
Official Business on Railroad	2	
Public on Railroad Business	14	
Public Sightseer Drawn to Accident	0	
Trespasser	261	

28. Individual's Reason for Being in Right-of-Way

	<u>141 Known</u>	<u>139 Unknown</u>
Crossing (walking)	89	
Playing	23	
Working	3	
Railroad User	1	
Not on right- of-way	0	
In vehicle on grade crossing	0	
Other	25	

29. Relationship of Casualty to Warning

<u>195 Known</u>	<u>85 Unknown</u>
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a. Casualty incurred: 52 without prior warning
143 after warning

b. Type of Warning:

	<u>149 Known</u>	<u>100 Unknown</u>
Verbal	4	
Horn	136	
Signal	3	
Light	1	
Other	5	

c. Source of warning:

Train	142
Rail- road	7
Other	3

30. Individual's Action at Time of Casualty

	<u>269 Known</u>	<u>11 Unknown</u>
Walking in vicinity	121	
Sitting, lying, or sleeping on grade	91	
Passing under, over, or through train	9	
Other	48	

31. Physical Condition 192 Known 88 Unknown

No adverse	54
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Physical Condition 192 Known 88 Unknown

Physical disability 10

Nervous disorder 4

Impaired hearing 5

Colorblind 0

Epilepsy 2

Diabetes 1

Other Illness 9

Intoxicants 112

102 known b.a.c.'s for a total amount of 23.58--
are b.a.c. of .23%

Use of drugs
under MD's
care 5

Use of drugs
NOT under MD's
care 4

32. Was Autopsy or Toxicological Exam Performed?

277 Known 3 Unknown

165-Yes 112-No

33. Was Engineer Aware of Impending Accident?

265 Known 15 Unknown

177-Yes 88-No

34. Was Fitness of Crew for Duty Evaluated?

161 Known 119 Unknown

75-Yes 86-No

35. Transient	<u>230 Known</u>	<u>50 Unknown</u>
No Fixed Address	22-Yes 208-No	
36. Distance for Resident		
	<u>25 Known</u>	<u>255 Unknown</u>
	25 (avg. 3,433 yards)	
37. Employed	<u>83 Known</u>	<u>197 Unknown</u>
	36-Yes 47-No	
38. Occupation	<u>78 Known</u>	<u>202 Unknown</u>
39. Family Economic Status		
	<u>2 Known</u>	<u>278 Unknown</u>
Under 5 K		
5-20 K		
Over 20 K	2	
40. Family Status	<u>95 Known</u>	<u>185 Unknown</u>
Single	51	
Married	35	
Divorced	9	
Widow(er)	0	
41. Probable Cause	<u>All Known</u> (23 list two causes)	
1. 425 -- Failure to detect		39
2. 426 -- Failure to vacate		234
3. 424 -- Failure to recognize unauthorized position		18
4. Other		<u>12</u>
		303