Chapter IV

THE ACCIDENT PICTURE

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This chapter describes Canadian accident and casualty trends from data provided by:

- the Railway Transport Committee (RTC),
- Labour Canada's Occupational Safety and Health Division, and
- the Canadian National (CN) and Canadian Pacific (CP) Railroads.

Since each data system differs, the findings from each source are discussed separately. In all cases, differences in the data collection criteria limit the extent to which comparisons can be made with U.S. data. Nevertheless, some comparative findings are included in each section of this chapter.

RTC DATA

Under authority established by the Railway Act and the National Transportation Act, RTC is responsible for collecting data on railroad accidents and casualties resulting from the movement or operation of trains. A later section of this chapter describes the Canadian Occupational Safety and Health Division's data and reporting systems for railroad workers other than those associated with the movement of trains.

As a result of the *1971* RTC safety inquiry, the Bureau of Management Consulting (BMC), a consulting organization within the Canadian Government, conducted a comprehensive analysis of rail safety problems and policies in Canada. Among the studies prepared by BMC was a report entitled, *Statistical Analysis of Railway Accidents Reported to the Canadian Transport Commission, 1956-1973.* The BMC *Analysis* is the primary Government report of railroad safety trends in Canada between **1956** and 1973. However, summary data have been published for subsequent years. * Information contained in the BMC *Analysis* and subsequent summary data are the basic sources of Government information used in this report.

Although the Canadian Government analyzed accident and casualty data for the period 1956-73, and summarized data from 1974-to the present, for purposes of this report Canadian data and trends are being used from **1966** to the present. Canadian reporting requirements for accidents prior to 1966 were different, therefore making 1956-64 data not comparable with data collected from 1965 to the present.

Authority for Accident Reporting in Canada [9]

In March 1922, the Board of Railway Commissioners required that Canadian rail roads report all railroad accidents that involved the movement of trains, casualties to employees or users, and damage to bridges, viaducts, and tunnels, which would make such structures impassable. [1] This was the first Government initiative for monitoring railroad accident data. In 1955, the Railway Commissioners extended the reporting requirements to include all accidents involving train operations irrespective of casualties. [2] However, in 1956 it restricted reporting requirements to accidents involving train operations at rail/highway crossings, and to accidents on the main track involving damage to rolling

*This OTA analysis did not seek to critically evaluate accident data prepared or reported by RTC or BMC. Rather, this report draws on the Canadian information and data considered significant and/or applicable to the U.S. experience.

[1] General Order 361, Board of Railway Commissioners, Canada.
[2] Circular letter #278, Board of Railway Commissioners, Canada.

stock in excess of $1,000,[3] This was the first initiative to place a dollar threshold on reportable accidents. In 1965, accident reporting was further refined by requirements involving:[4] death or personal injury; damage to bridge, culvert, viaduct, or tunnel; public rail grade crossings; collisions and derailments on main track; obstructions; and destruction of stations by fire. In addition, railroads were required to report derailments or collisions with damage to railroad property in excess of *$750.* This changed the 1956 circular by reducing the reporting threshold from $1,000 to $750 and by including in the threshold, damage to rail property, not just damage to rolling stock. '

RTC has seven accident classifications: collisions, derailments, crossing, track car, trespassing, dangerous commodities, and "other. " The general classifications and definitions used by RTC are:

- **Collision: an accident on the main track** wherein a moving train, engine, car, or work equipment comes in contact with another train, engine, car, or work equipment, standing or moving and results in excess of *$750* damage to rail property.
- **Derailment: an accident wherein any mov**ing train, engine, or car becomes derailed on the main track resulting in excess of **$750** in damage to rail property.
- **Crossing Accident: an accident** in which any unit of rolling stock on the rails strikes, or is struck by, a user of a public, private, or farm crossing, at a crossing, and damage or injury results.
- **Track Car Accident: an accident** in which a track car strikes, or is struck by, a train or another track car or becomes derailed. This excludes accidents resulting from a track car striking or being struck by a motor vehicle at a crossing.
- **Dangerous Commodities: accidents or incidents involving commodities that are de**fined as being dangerous according to the General Order of the Commission: "Regulations for the Transportation of Dangerous Commodities by Rail ."
- **Trespassers and Suicides: an accident resulting in the death or injury of a person or persons using railroad pro property not designated for public use, including off-duty employees.**
- **Other: all accidents or incidents not otherwise classified, including a large number of incidents, many of which are personal** injuries such as slipping and falling that are not directly related to train operations.[6]

Canadian Casualty and Accident Trends

Crossing accidents are the largest source of rail-related fatalities in Canada. Between 1966 and 1977, 1,564 or 61 percent of the total rail-related deaths in Canada resulted from grade-crossing accidents. Trespassing fatalities ranked second with 25 percent; derailments accounted for only 1 percent; and *10* percert of fatalities in the rail operating environment were classified "other." The remaining 3 percent of total fatalities was split between collision; and track car accidents.

Data on casualties resulting from the movement or operations of trains, indicated by the aggregate number of persons killed or injured in the various accident classifications, is shown in table 21.

The category "other" represents the largest number of injuries, **33,156** or 73 percent in Canada's railroad statistics. A large number of these incidents are employee injuries that did not occur in train accidents. Crossing injuries rank second in number, 6,950 or 15 percent of total injuries. Derailments accounted 1 or 4 percent of total injuries, collisions 4 percent, track car 3 percent, and trespassing accounted for the least number of injuries or 1 percent of the total. No trends for injuries by type of accident can be ascertained.

[3]Circular letter #279, Board of Railway Commissioners, Canada.

[4]General Order 0-1, Board of Railway Commissioners, Canada.

[5]*Statistical Analysis of Railway Accidents Reported to the Canadian Transport Commission, 1956-1973.* (Ottawa: Bureau of Management Consulting, Canadian Government, 1974), pp. 8-9.

[6]Ibid., pp.1I, 22, 34, 51, 61, 74, 75, 84.

Table 21 .—Canadian Casualties by Type of Accident, 1966-77

Year	Collision		Derailment		Crossing		Track car		Trespassing		Other		Total	
	(Killed	Injured	Killed	injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
1966	8	104	2	65	186	62?	5	115	74	60	33	2910	308	3875
1967	8	5 16	0	56	197	584	5	145	57	66	30	3068	297	4435
1968	4	189	8	141	121	479	8	106	53	59	36	7753	230	3727
1969	4	139	1	92	120	519	8	113	53	60	35	2506	221	3429
1970	2	74	5	230	116	587	3	87	50	55	19	2517	195	3550
1971	5	60	5	134	121	644	7	102	56	43	14	2556	208	3539
1972	3	62	4	187	150	675	2	132	66	80	2 8	2543	253	3679
1973	2	85	2	*180*	150	647	2	112	48	58	24	2517	228	3599
1974	8	343	3	*166*	109	651	3	104	55	48	23	2900	201	4292
1975	0	42	3	132	99	566	2	87	59	65	24	2983	187	3875
1976	1	30	2	*186*	108	524	1	77	32	49	1	3110	145	3976
1977	1	62	1	*51*	87	453	0	126	44	38	– *	2,713	133'	3443
Total (12 yr)	*46*	706	36	*620*	,564	950	45	306	647	681	268	33156	2,570	45,419
Percent of 1 2-year total	2%	4%	1°/r	40%	61 %	15%	2%	3 %	25%	1%	1 o%	73 %		

*1977 total fatals cannot be accurately determined from the information provided.

SOURCE: Bureau of Management Consulting, *Statistical Analysis 1956-73* and Summary Analysis; RTC Safety and Standards Branch, 1978; 1977 Railway Accident Statistics Analysis, Summary of Accidents/Incidents Reported to CTC, 19

Although grade-crossing fatalities show a downward trend, fatality trends for all other accident categories cannot be ascertained. In the aggregate, fatalities appear to have declined steadily since 1972. The BMC *Analysis* stated that crossing accidents for the period studied *(1956-73)* represented "the single most important cause of fatalities on the railways, though the fatalities are not railway employees or railway users, but mostly others *(98* percent)."[7] The *Analysis* looked at crossing accidents by the type of protection afforded at the intersection and found that the greatest number of accidents occurred at unprotected sites for the *1956-73* time period. The second greatest number of casualties, occurred at crossing sites protected by flashing lights and bells.'

Casualties among employees, passengers, trespassers, and others are shown in table 22. The category "other" is comprised predominantly of casualties occurring as a result of crossing accidents. Deaths in this category accounted for the largest, or *63* percent* of all rail deaths. Employee fatalities accounted for 9 percent of reported deaths or the third largest group of rail-related fatalities.

As expected, railroad employees experienced the greatest number of injuries in the rail environment. Trends in employee casualties are not discernible. However in 1976, there was a dramatic decrease in the number of employee fatalities. There was no concurrent decrease in the number of injuries reported, rather a slight increase. According to the BMC *Analysis,* "The reporting of injuries is very inadequate. No attempt is made to attach any severity to the injury; thus the most minor injury, such as a small bruise or some foreign matter in the eye, is lumped in with the most major incapacitation, such as the loss of a limb or an eye. A very large number of injuries are reported, but the data is of doubtful value."[9] The causes of injuries were not reported in available Canadian data.

With the exception of derailments, the aggregate number of accidents in other classifications (collisions, crossing, track car, trespassing, and "other") has remained relatively constant or declined slightly from **1966** through **1977.** Table *23* shows the aggregate number of accidents by classification. Derailments increased gradually from **1969** to a high in *1974* and appear to be declining since *1974.* Table *24* shows the various causes of derailments between *1966* and *1977.* During this time, the total number of derailments due to track conditions

[7] Ibidpp 00-01.

[8] Ibid , p58

* The compilation for the category "Other" for table 22 combines grade crossing deaths and the remaining deaths not accounted for by the other three categories listed

[9] Ibid , p 11.

Table 22.—Casualties, 1966-76

Year	Employee		Passenger		Trespasser		Other*	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
1966	26	2,270	3	905	74	60	205	640
1967	29	2,499	3	1,294	57	66	208	576
1968	28	2,093	6	982	53	59	143	586
1969	26	2,072	4	731	53	60	148	566
1970	21	2,248	4	704	50	55	120	543
1971	18	2,280	3	560	56	43	131	656
1972	32	2,436	6	565	66	80	149	598
1973	21	2,421	2	575	48	58	157	545
1974	24	2,839	1	813	55	48	121	592
1975	23	2,764	—	484	59	65	105	457
1976	8	2,940	1	523	32	49	104	464
Total	256	26862	33	8,136	603	643-	1,591	6,223
Percent	10%	64%	10/0	19%	240/o	1.5%	64%	14.8%

*Com-prised predominantly of crossing casualties

SOURCES Bureau of Management Consulting, *Statistical Analysis, 1956-73,* RTC Safety and Standards Branch, Summary Analysis, 1978, 1977 Railway Accident Summary

Table 23.–Canadian Accidents by Type, 1966-77

Year	Collision	Derailment	Crossing		Track car	Trespassing	Other	Total
1966	55	230	1,133	92	127	2,805	4,442	
1967	39	209	1,183	101	115	3,025	4,672	
1968	49	228	1,139	83	108	2,578	4,185	
1969	41	246	1,032	73	104	2,402	3,898	
1970	46	276	977	53	102	3,168	4,622	
1971	45	265	1,088	66	97	3,210	4,721	
1972	44	323	1,175	76	135	3,065	4,818	
1973	56	299	1,030	72	101	3,130	4,688	
1974	46	420	1,074	72	87	3,118	4,817	
1975	48	330	982	52	112	3,050	4,574	
1976	32	301	923	41	84	3,238	4,619	
1977	39	316	877	51	82	2,920	4,285	

SOURCE Bureau of Management Consulting, *Statistical Analysis,* 1956.73, and Summary of Accident Data 1977

Table 24.—Statement of Canadian Derailments According to Major Causes, 1966-76

Year	Due to track conditions	Rate per billion gross ton miles	Due to equipment defects	Rate per billion gross ton miles	Rate per billion car miles	Other	Total derailments
1966	70	0322	125	0.574	29,07	35	230
1967	53	0.245	82	0.379	19.52	74	209
1968	50	0237	100	0.474	24.39	78	228
1969	73	0.344	128	0.603	31.22	45	246
1970	119	0.511	108	0.464	24.53	49	276
1971	107	0.436	89	0.363	19,35	69	265
1972	134	0525	103	0.403	21.46	86	323
1973	115	0.447	104	0.405	22.61	80	299
1974	157	0.557	130	0.461	26,53	133	420
1975	136	0.527	103	0399	21.91	91	330
1976	106	0.411	107	0.415	23,26	88	301
1977	120	0426	111	0.394	24,13	81	312
Total	1,240		1,290			909	3,439
	36%		38 "/o			26%	

SOURCE Analysis of Railway Accident Statistics 1977 RTC

accounted for approximately 36 percent of all derailments. Derailments due to defective equipment accounted for approximately 38 percent, and the miscellaneous category ("other" causes) accounted for the remaining 26 percent of the derailments. For the 1966-70 period, both in total numbers and on a ton-mile basis, defective equipment represented the most significant cause of derailments. From 1970 through 1975, track conditions caused an increasing number of derailments while defective equipment remained fairly constant. In **1976** and 1977, track and equipment accounted for approximately equal numbers and rates of derailments. [10] Information is not available to factor out derailments reported as a result of inflationary factors, or to explain the unusually high number of derailments in 1974. Although data on accident severity is limited and imprecise, the BMC report indicates that the majority of derailments appear to be low-cost, that is under *$5,000* for a **1965-73** sample. [11]

Railroad and Government officials indicated that they believed heavier axle loading in freight equipment had influenced derailments.[12] Both CN and CP indicated that they believed heavier axle loading on freight equipment has caused increased wear on the roadbed. CN conducted research on the problem and published several reports. These include: Rail *Replacement Costs on the B.C. South Line; Effects of 100-Ton Carloadings on Tie Replacement Costs, B.C. South Line; Track Maintenance Cost, B.C. South Line 1964-74, Summary Report;* and *Effect of 100-Ton Carloadings on Train Accident Costs, B.C. South Line.* The latter study compared train accident costs prior to the introduction of the 100-ton capacity equipment and after for the period 1960-74. That study factored out inflation and increases in traffic. The study conclusions indicated that train accident costs, particularly those accidents resulting from track and employee responsibility, had increased as a result of the heavier 100-ton cars. The increases in "employee responsibility caused" accidents cited by the study may be related to the differences in train-handling techniques necessary to operate the heavier trains.

Costs estimates for equipment and property damage in accidents are not fully reported to the Canadian Government.

Of the dangerous commodity incidents between *1970* and 1973, flammable liquids were involved in 37 percent of the incidents involving dangerous commodities for the 3-year time period. During that period, 2 fatalities and 34 injuries were attributed to dangerous commodities incidents. Table *25* shows the dangerous commodities most commonly involved in incidents in Canada. Since 1973, no fatalities and only seven injuries have resulted from accidents involving dangerous commodities.[13]

As indicated by the BMC study on railroad safety, a number of factors may have influenced Canada's accident picture. Cited among these factors were changes in technology and the use of technology, increases in traffic, changes in maintenance practices in the industry and labor force size and/or assignments, and changes in the amount of financial resources necessary to maintain the rail physical plant .14 While all of these factors were briefly discussed in the Canadian study, no correlations between specific data and possible industry factors were drawn. As in the United States, a concern exists at the Federal level regarding deferred maintenance, particularly for branchlines in Canada, and its implications for safety.

Table 25.—Canadian Incidents Involving Dangerous Commodities

Type of commodity	Total Incidents for 1970-73	Average number of incidents per year
Flammable solids	14	3 5
Flammable liquids	53	1325
Oxidizing organic	22	5 5
Poison	18	4 5
Corrosive	27	675
Explosive	0	0 0
Radioactive	2	0 5
Compound gas	8	2 0
Total	144	360

SOURCCE Statistical Analysis 1956-73 p 75

[10] RTC Analysis of Railway Accident Statistics, 1977, p. 23
[11] *Statistical Analysis*, op. cit., p. 41.
[12] Interviews with Canadian rail officials from CN and CP.

[13] *Summary of Accidents Incidents Reported to the CTC 1977* prepared by RTC, p. 13.
[14] *Statistical Analysis* op. cit., ch. 5, pp. 117-152.

RTC Data Collection System

The Railway Transport Committee of the Canadian Transport Commission (CTC) is responsible for gathering accident information and data from the railroads and investigating accidents as necessary. Accidents are initially reported by telex to CTC headquarters. A subsequent detailed report is sent by the railroad to CTC. The initial report is entered into a computer system. The information contained in the accident report is included in appendix B.

Prior to 1977, accident information was processed manually. Monthly accident summary reports were prepared. Currently changes in accident reporting systems and data bases are being discussed by RTC and the railrcads.

COMPARISONS WITH THE UNITED STATES

Significant differences exist between the U.S. and Canadian Government classifications and the criteria for obtaining and using accident and casualty information. This section describes those differences and compares data when possible.

Data Differences

In Canada, collisions and derailments occurring on the mainline and branchlike are reported when damage to railroad property exceeds $750. In the United States, until 1975 all accidents involving the movement or operation of a train were reported regardless of the location of their occurrence if damage exceeded $750.1[5] Therefore, the U.S. railroads report collisions, derailments, and other train accidents in the yards, whereas Canadian railroads only report mainline accidents. In addition, the U.S. groups collisions, derailments, and other accidents under the heading train accident. There is no such equivalent in the Canadian system.

In Canada, all deaths and injuries to employees under CTC jurisdiction and to other persons are reported. However, in the United States prior to 1975 only those injuries that resulted in more than *24* hours lost time were reported. Since *1975,* all U.S. injuries requiring medical attention are reported as well as injuries requiring "one or more days" off rather than "more than one" day off as previously reported. The U.S. Federal Railroad Administration (FRA) collects all casualty data; whereas in Canada both RTC and the Occupational Safety and Health Division at Labour Canada collect data separately. The differences in reporting requirements precludes meaningful comparison of the two systems.

Other reporting differences between the United States and Canada incluce:

- in the United States, accidents involving suicides or attempted suicides are not reported;
- bridges, viaducts, and tunnels unfit for passing are not reported in the United States; and
- prior to 1975, grade-crossing accidents that did not result in casualties and involved damages less than *$750* were not reported in the United States. [16]

Canadian-U. S. Casualty Comparison

Although the differences in reporting requirements between the United States and Canada are substantial, some comparisons of fatalities are possible.

In the two countries when "like" categories of fatalities are compared, similar fatality patterns emerge. As reported in the OTA *Evaluation of Railroad Safety,* crossing fatalities accounted for the largest portion, approximately *65* percent of the fatalities in the U.S. rail environ-

[15] After 1975, the United States changed its reporting value threshold to $1, 750 and $2,300 from 1477 to account for inflationary impacts on accidents

[16] In 1975 and 1977, the U.S. threshold values changed

ment.[17] This same pattern emerges in Canada with **61** percent of Canada's railroad-related fatalities occurring in grade-crossing accidents. In both countries, trespassers accounted for the second largest group of fatalities, representing 27.3 percent of rail-related deaths in the United States, and 24 percent in Canada. Table 26 displays the similarity of fatality patterns. Only a small percentage of total fatalities occur in collisions and derailments for both the United States and Canada.

U.S. and Canadian fatalities in aggregate numbers and when measured on a train-mile basis, declined steadily from **1966** to 1976 (table 27), When measured by million train miles, the average rate for 1966-76 of Canadian fatalities was 2.50 and in the United States it was 3.69 indicating that the United States had approximately 1.19 more deaths than Canada. Population size, density, exposure levels, and other variables may be the influencing factors in the differing ratios. For example, the United States has 5 times the amount of mainline track as Canada and 10 times the population.

When examining employee fatality rates for the United States and Canada, the average rates for employee fatalities, measured by train miles, for the years 1966-76 were approximately the same (table 28). Data to measure employee fatalities by man-hours worked was not available. The train-mile measurement of employee fatalities, therefore is assumed to be a fairly accurate reflection of the exposure rates of employees to the rail environment, because the number of train miles is an indicator of the amount of rail traffic.

The fatal it y rate resulting from grade-crossing accidents is the largest category of rail-related fatalities in both Canada and the United States. Grade-crossing deaths account for 60 to 65 percent of all rail fatalities in each country. When comparing the grade-crossing fatality rates, several factors should be considered in order to determine the level of exposure. These include: number of crossing sites, amount of rail and motor vehicle exposure, number of protected crossings, and other factors. The data necessary for a comprehensive, detailed comparison were not available for this study. However, crossing fatalities measured by train miles shows the United States with a rate rate *60* percent higher than Canada (table 29). Motor vehicle data, i.e., number of registrations, suggests that the' United States has a higher exposure rate of motor vehicles to crossings. The average number of motor vehicle registrations for the **1966-72** period was 8,238,000 for Canada **and** 105,288,000 for the United States. * The large difference in motor vehicle registrations indicates differing levels of the exposure of the public between the United States and Canada. The comparison of motor vehicle registrations does not take into account many of the factors necessary for a thorough examination of exposure rates and grade-crossing fatalities. Nevertheless, the comparison does suggest that the crossing fatality rates in Canada and the United States are a function of the population size and exposure at rail crossing sites.

Several conclusions can be drawn from examining grade-crossing data for the United States and Canada. These are:

- Between 1966 and 1976, both countries have shown a decline in the total number as well as a decline in the fatality rates resulting from grade-crossing accidents.
- The decline has been more consistent in the United States over the 1966-76 period than in Canada. There was a dramatic decrease in grade-crossing fatalities between 1967 and 1968, but there was an increase as well for the years 1972 and 1973.
- Grade-crossing fatalities represent the largest rail-related fatality problem for both countries.
- On a per million train-mile basis, the 11-year average U.S. rate is 62 percent higher than Canada's.
- Factors affecting the differences in fatality rates could not specifically be determined. However, it appears that the larger U.S. population and greater exposure of that

[17] *Statistical Analysis*, op cit, pp 5-6.

*These averages do not reflect the approximately 10-percent difference between vehicles in use and the number of vehicles registered. The reason for the difference is twofold: some motor vehicles are registered twice any given year: and some motor vehicles may be registered but taken out of service during a given period.

Table 26.—Casualties, 1966-76

Year	Employee[a]		Passenger		Trespasser		Other[b]	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
				Canada				
1966	26	2,270	3	905	74	60	205	640
1967	29	2,499	3	1,294	57	66	208	576
1968	28	2,093	6	982	53	59	143	586
1969	26	2,072	4	731	53	60	148	566
1970	21	2,248	4	704	50	55	120	543
1971	18	2,280	3	560	56	43	131	656
1972	32	2,436	6	565	66	80	149	598
1973	21	2,421	2	575	48	58	157	545
1974	24	2,839	1	813	55	48	121	592
1975	23	2,764		484	59	65	105	457
1976	8	2,940	1	523	32	49	104	464
Total	256	26,862	33	8,136	603	643	1,591	6,223
Percent	10%	64%	1 %	19%	—	—	64%	14 8%
				United States				
1966	168	18,651	23	1,244	678	702	1,815	4,955
1967	176	18,055	12	1,054	646	696	1.649	*4.718*
1968	150	18,116	11	1,329	628	663	1,570	4,500
1969	190	17.255	6	862	627	674	1,476	4,565
1970	172	16,285	8	489	593	646	1,452	3,907
1971	123	14,191	16	536	551	607	1,320	3,638
1972	133	12,973	47	680	537	586	1,228	3.691
1 9 7 3	161	13,511	6	503	578	614	1,171	3,577
1974	144	16,002	7	574	565	674	1,192	3,568
1975[c]	113	47,855	8	1,307	524	703	915	4,441
1976	109	58,477	5	999	458	768	1,112	5,143
Total	1,639	251,411	149	9,577	6.385	7,333	<4,900	46,703
Percent	7%	79 8%	.06%	3%	27.6%	2.3%	64.5%	14 8%

[a]Employees injuries reported 10 RTC listed above do not take into account occupational safety and health Injuries reported 10 La bour Canada U S employee injuries represent OSHA type Injuries
[b]Comprised predominantly of crossing casualties
[c]Accident reporting requirements charged making 1975 data Incomparable with that of previous Years
SOURCES Bureau of Management Consulting *Statistical Analysis* 195673 RTC Safely and Sfandards Branch Summary Analysis 1978 1977 Railway Accident Summary

population to rail hazards could be significant factors in the differing rates between the two countries.

Comparisons of trespasser fatalities (table 30) shows that the United States had approximately 11 deaths to every 1 in Canada when the data is viewed in the aggregate. When measured by train miles, the average rate for the United States in 1966-76 is approximately 70 percent higher than that of Canada, or 1.02 to 0.61 in Canada. The reasons for the trespasser fatality rate differences between the two countries could not be ascertained for this report. To understand the differences in rates, factors such as the locations of trespasser deaths, i.e., rural or urban areas, the population densities, and rail traffic exposure should be correlated with the number of deaths. These types of data from both countries were not available for this report. The Canadian Ministry of Transport is currently issuing a policy to deal with the trespasser problem. This policy, entitled "Pedestrian Safety at the Railroad Right of Way" will become public in 1979.

Overall findings on the fatality rate comparisons between the two countries indicated that:

- Fatalities and fatality rates in both countries declined between 1966 and 1976.
- U.S. fatality rates were higher than Canada's primarily due to grade-crossing and trespasser fatality rates.
- The higher grade-crossing and trespasser fatality rates in the United States appear to be a function of population size and level of exposure to rail hazards.
- Employee fatality rates in the two countries were similar.

Table 27.—Fatalities in Canada and the United States, 1966-76

Year	Canada		United States	
	Fatals	Per million[a] train miles	Fatals	Per million[b] train miles
19~6–	318	3.31	2,684	418
1967	297	315	2,483	408
1968	230	264	2,359	404
1969	218	253	2,299	403
1970	195	224	2,225	304
1971	208	239	1,010	309
1972	253	281	1,945	373
1973	228	257	1,916	338
1974	201	207	1,908	327
1975	187	211	1,560	292
1976	145	1.66	1,684	302
		250		369
		average rate		average rate

[a]U S train miles used for this table were derived from combining locomotive miles (which in eludes freight and passenger train miles and motor train miles
[b]Canadian train miles for 197276 used in this table Included motor train miles and freight and passenger miles

SOURCE Bureau of Management Consulting Statistical Analysis of Railway Accidents 195673 p12 Railway Transport pt I Comparative Summary 197276 table 9 U S FRA Accident Bulletin 114 and 145 p 1

Table 28.—Employee Fatalities in Canada and the United States, 1966-76

Year	Canada		United States	
	Fatals	Per million train miles	Fatals	Per million train miles
1966-	26	27	168	26
1967	29	.31	176	29
1968	28	32	150	26
1969	26	.30	190	33
1970	21	24	172	31
1971	18	21	123	24
1972	32	35	133	25
1973	21	24	161	28
1974	24	25	144	25
1975	23	26	113	21
1976	8	09	109	20
Average		26		26

SOURCE Bureau of Management Consulting *Statistical Analysis of Railway Accidents 195673* RTC Summary Accident Analyses and Federal Railroad Administration Accident Bulletins

Accident Comparisons

Direct comparisons of accident trends, i. e., collisions, derailments, etc., are complicated by significant differences in Government reporting requirements in the United States and Canada. The Canadians do not report yard accidents. Their dollar-loss threshold value for reporting accidents is $750. U.S. carriers report both yard and mainline/branchline accidents. The United States adjusted the threshold reporting value to $1,750 in 1975 and $2,300 in 1977 to account for inflation. Only U.S. accident data for 1975-77 can be broken out to isolate mainline and branchlike data from yard data. However, due to the differences in reporting thresholds, Canada could be reporting proportionately more of their nonyard collisions and derailments.

As previously indicated, the Canadian aggregate data shows that with the exception of derailments, all other accidents have remained relatively constant or declined slightly (see table 23). In Canada, derailments increased through 1974 and then stabilized in the following 2 years

Table 29.—Grade.Crossing Fatalities in Canada and the United States, 1966-76

Year	Canada		United States	
	Fatals	Per million train miles	Fatals	Per million train miles
1 9 6 6	186	1 94	1,780	2.77
1967	197	209	1,632	268
1 9 6 8	121	1.39	1,546	265
1 9 6 9	120	1 39	1,490	261
1970	116	1.33	1,440	261
1971	121	1 39	1,356	263
1 9 7 2	150	1 65	1,260	241
1973	150	1 69	1,185	209
1974	109	1 12	1,220	209
1 9 7 5	99	1 12	978	183
1976	108	1 24	1,168	210
Total average		1.49		241
				62%

SOURCE Bureau of Management Consulting *Statistical Analysis of Railway Accidents 195673* RTC Summary Accident Analyses and Federal Railroad Administration Accident Bulletins

Table 30.—Trespasser Fatalities in Canada and the United States, 1966-76

Year	Canada		United States	
	Fatals	Per million train miles	Fatals	Per million train miles
1966	74	77	678	1.06
1967	57	60	646	1. 06
1968	53	61	628	1.08
1969	53	61	627	1.10
1970	50	.57	593	1. 08
1971	56	64	551	1 07
1972	66	73	537	1 03
1973	48	54	578	102
1974	55	57	565	91
1975	59	67	524	98
1976	32	37	458	82
Average rate		61		1 02

SOURCE Bureau of Management Consulting *Statistical Analysis of Railway Accidents /956-73* RTC Summary Accident Analyses and Federal Railroad Administration Accident Bulletins

(table 3 1). In the United States, collisions and "other" mainline and yard accidents remained relatively constant from 1966 to '1974. However, mainline and yard derailments nearly doubled in that same time in the United States (table 32). Between 1975 and 1977, U.S. collisions, derailments, and other train accidents on the mainline/branchline also increased (table 33).

While the total for U.S. derailments increased over the period studied, there is a wide range of derailment rates among U.S. carriers. As indicated by table 34, the derailment rates on a billion gross-ton-mile basis for 1976 and 1977 among U.S. carriers ranged from a low of 0.28 to a high of 12.50. From the information provided, the averages of the accident rates for the eight or nine largest (ton mile) U.S. railroads in **1976** or in **1977** are not significantly different from the values for either CN or CP recorded in the respective year. However, the averages of the accident rates for the next 10 U.S. railroads in 1976 and in **1977** are significantly higher than the values of either CN or CP recorded in the respective year. The differences in the accident rates among the 20 largest (ton miles) U.S. railroads are statistically significant t. The differences in the accident rates on a carrier-specific basis between the years 1976 and 1977 are not statistical] y significant. The variation among the carriers is highly significant, but the variation from year to year is not significant.

Between **1966** and 1974, U.S. track-caused derailments for mainline /branchlike and yard represented approximately 40 percent of all derailments (table 35). Between 1975 and 1977, track-caused derailments represented 46 percent of all derailments on the mainline and branchline only.

When examining the causes of derailments in Canada for- the 1966-76 period, both defective equipment and track conditions combined, account for 74 percent of the derailments. The split between equipment and rack causes was almost equal by 1977 as shown in table 31. In contrast, the chief cause of U.S. derailments between 1966 and 1974 was defective track as shown by table 35.[18] In 1975-77, track-caused mainline and branchlike derailments continued to be the chief cause for derailments as shown by table 36.

As indicated in the previous OTA *Evaluation of Railroad Safety*, the reasons for- the increase in train accidents, particularly track-caused accidents, appear to relate to a combination of factors. Included among these are: the increased axle loading on freight equipment, deferred maintenance, lack of capital among some U.S. carriers to invest in maintenance and plant improvements, and the management philosophy of some U.S. carriers toward maintenance. A downturn in the trend toward increased derailments does not appear likely in the United States unless there are positive industry economic changes, particular] v among some U.S. carriers. Direct correlation between the financial condition of some U S. carriers and

[18] *Evaluation of Railroad Safety* (Washington D.C.: Office of Technology Assessment, May 1978), p. 75.

Table 31 .—Statement of Derailments According to Major Causes in Canada, 1966-77

Year	Due to track conditions	Rate per billion gross ton miles	Due to equipment defects	Rate per billion gross ton miles	Other	Total derailments
1966	70	0.322	125	0.574	35	230
1967	53	0245	82	0379	74	209
1968	50	0237	100	0474	78	228
1969	73	0344	128	0603	45	246
1970	119	0511	108	0464	49	276
1971	107	0436	89	0363	69	265
1972	134	0525	103	0403	86	323
1973	115	0447	104	0405	80	299
1974	157	0557	130	0461	133	420
1975	136	0527	103	0399	91	330
1976	106	0411	107	0415	88	301
1977	120	0426	111	0394	81	312

SOURCE Analysis of Railway Accident Statistics 1977 R T C

Table 32.— U.S. Train Accidents by Class, 1966-74

Year	Derailments	Collisions	Other	Total train accidents
1966	4,447	1,552	794	6,793
1967	4,960	1 522	812	7,294
1968	5487	1 727	814	8,028
1969	5960	1 810	773	8,543
1970	5,602	1,756	737	8.095
1971	5131	1,529	644	7,304
1972	5,509	1,348	675	7532
1973	7,389	1,657	652	9,696
1974	8,513	1 551	630	10,694

SOURCE Federal Railroad Administration

Table 33.— U.S. Train Accidents by Class, * 1975-77

Year	Derailments	Collisions	Other	Total
1 975'	3 6 0 0	1 7 4 -	266	4,040-
1976	4 123	258	356	4,737
1977b	4010	256	329	4,595
	+ 11 -percent Increase			

. Mainline branchline accidents only This table excludes yard accidents
[d]Accidents reported with estimated damage in excess of $1,750
[b]Accidents reported with estimated damage in excess of $2 3°0
SOURCE Federal Railroad Administration Accident Data

their derailment ratios could not be undertaken for purposes of this report.

In both Canada and the United States, only a small percentage of rail-related fatalities and injuries occurred in derailments compared to other types of accidents in which casualties occur. In Canada, only 1 percent of all rail-related fatalities occurred in derailments for 1966 through 1977. In the United States, 1.7 percent of all rail-related fatalities occurred in derailments for the same period. It appears that derailments are more significant for their resulting property losses than for casualties.

- Examination of the U, S. derailment data on a railroad-by-railroad basis shows a wide range of derailment rates among U.S. carriers. Examination of the averages of accident rates for the eight or nine largest (ton mile) U.S. railroads in 1976 or in 1977 shows that the values for either CN or CP in the respective year are not significantly different from the top (ton mile) carriers in the United States. However, the averages

Table 34. —Mainline/Branchlike— Derailments by Year and Railroad (miles in billions of gross tons)

Railroad	976 mile:	977 mile	Derailment ate, 197f	Derailment ate, 1977
Conrail		2392		247
Burlington Northern	2046	221 7	1 44	1 16
Southern Pacific	1703	1733	1 09	1 25
Union Pacific	160 1	1691	97	86
Santa Fe	1447	1598	63	
	(CN 139.4)	(141. 7)	(1.36)	(1.34)
Southern	1130	121 3	103	92
Norfolk & Western	1149	1080	86	71
Chessie	1149	1108	380	330
Missouri Pacific	1082	111 8	102	98
	(CP 101.0)	(106 2)	(97)	(1. 02)
Louisville & Nashville	81 2	843	303	339
Seaboard Coast Line	799	845	1 55	1 77
Illinois Central Gulf	626	601	337	386
Chicago & Northwestern	571	588	590	510
Milwaukee	504	488	645	733
St Louis-San Francisco	383	388	1 98	1 52
Rock Island	347	351	697	806
Denver Rio Grande	207	21 2	72	61
Soo Line	184	205	315	259
Kansas City Southern	147	162	340	1 79
Western Pacific	134	138	209	1 59
Missouri-Kansas -Texas	11. 6	123	440	4 15
Grand Trunk Western	91	95	396	221
Delaware & Hudson	83	89	494	472
Boston & Maine	62	61	323	328
Clinchfield	59	67	339	358
Colorado & Southern	47	66	426	273
Ft Worth & Denver	48	68	354	221
Florida East Coast	42	50	48	80
Long Island	38	38	105	105
Bessemer & Lake Erie	38	37	1. 58	81
Detroit, Toledo, & Ironton	32	34	563	2.94
Duluth & Missabe Iron Range	36	23	28	
Richmond Fredericksburg & Potomac	27	26	148	222
Pittsburgh & Lake Erie	25	25	880	920
Duluth Winnepeg, & Pacific	24	26	208	
Maine Central	20	20	950	500
Elgin Joilet, & Eastern	18	17	1.11	1. 76
Toledo, Peoria & Western	15	14	333	500
CP-U.S. Lines	1.4	15	214	67
Georgia	14	14	2 14	7 14
Northwestern Pacific	12	12	4 .17	
Illinois Terminal Co	12	12	750	1250
Bangor & Aroostock	12	12	1250	667
Chicago & Illinois Midland	9	7	556	429
Central Vermont	7	7	714	143
Detroit Toledo Shoreline	5	5	1200	800

SOURCE Federal Railroad Administration Accident Information and Association of American Railroads

Table 35.—U.S. Derailments by Contributing Cause, 1966.74*

Year	Track	Equipment	Human factors	Miscellaneous	Total
1966,	1,388	1,550	647	862	4,447
1967,	1,800	1,611	668	881	4,960
1968,	2,062	1.745	743	937	5,487
1969	2,400	1,863	816	881	5,960
1970	2,393	1,602	765	842	5,602
1971	2,194	1,389	721	827	5,131
1972	2,481	1,344	792	892	5,509
1973	3,477	1,755	1,017	1,140	7,389
1974. : :	4,196	1,967	1,043	1,307	8,513

"Includes mainline branchline and yard accidents
SOURCE Federal Railroad Administration

of the accident rates for the next 10 railroads in *1976* and in 1977 are significantly higher than the values of the Canadian railroads in either year.

- Canada has a stable or declining derailment picture whereas U.S. derailments appear to be increasing.

- The U.S. problem attributable to track is nearly twice that of Canada for the 1975-77 period. The United States has a higher derailment rate due to equipment and "other" causes although the difference is not as great as track causes for derailments.

- In both Canada and the United States, only a small percent of rail-related fatalities occurred in derailments. It appears that derailments are more significant for their resulting property losses than for casualties.

Table 36.—U.S. Derailments by Contributing Cause, * 1975.77

Year	Track	Per billion gross ton miles	Equipment	Per billion gross ton miles	Other	Per billion gross ton miles	Total
1975[a]	1,633	88	1,242	67	725	194	3.600
1976	1,921	96	1,405	71	797	207	4,123
1977[b].,	1,844	92	1,324	66	842	199	4,010
Total	5,398		3,971		2,364		
Percent			34%		20%		

*Mainline/branchline only
a Ab$_{ave}$ $1 750 estimated loss
b Ab$_{ave}$ $2 300 estimated loss

LABOUR CANADA DATA

Labour Canada's Accident Prevention Division is responsible for receiving reports and investigating accidents.[19] Additionally, its Division of Occupational Safety and Health is responsible for rail employees not involved with train operations. This includes maintenance-of-way employees as well as employees working in repair shops, on tunnels and viaducts, and other employees normally subject to the Division's jurisdiction.

This section briefly describes Labour Canada's accident data collection system and trends in the rail industry. The Occupational Safety and Health Division as well as the Accident Prevention Division within Labour Canada are responsible for administering programs to all Canadian industries. For example, the accident reporting regulations, described below, apply to all industries, not just the rail industry.

Labour Canada's Accident Reporting Regulations[20]

The accident investigation and reporting regulation for Labour Canada contains several major features. First, it places responsibility on the

[19] *p.IV, Canadian Labour Code.

[20] Labour Canada, Accident Reporting Regulation.

employer for investigation and reporting accidents resulting in: disabling injury or death of an employee, a shock or contaminated atmosphere causing an employee's loss of consciousness, implementation of rescue or revival procedures, or explosions. Second, the regulation requires that in an employer investigation of the accident, the steps necessary to prevent its recurrence be enumerated. These reports are sent to regional safety officers within 10 days of the accident. In addition to the written reports, employers are responsible for notifying by telephone the regional safety officer of a disabling injury to two or more employees, a fatality, or an explosion. A telephone report is required within 24 hours of an accident's occurence.

The Labour Canada regulation defines a "disabling injury" as any work injury that:

- prevents an employee from reporting for work or effectively performing all of the duties connected with his regular work on any day subsequent to the day on which the injury occurred, whether or not that day was a holiday or other nonworking day; or
- results in the loss by an employee of a body member or part thereof or in a complete loss of its usefulness or in the permanent impairment of a body function whether or not the employee is prevented from reporting for work or effectively performing his regular work as described above.

It identifies disabling injury frequency rate by dividing the number of disabling injuries incurred in a specific period of time by the number of man-hours worked during the period and multiplying by 1 million.

The accident reporting regulation also requires that every employer with workplaces of 15 or more employees keep a record of all minor injuries for that location. * Minor injuries where there are fewer than 15 employees at a given location are also reported, but with fewer items of information necessary for the report.

Each March, all employers are required to report their accident history for the preceding year for each workplace.

Accident Data Reported by Labour Canada

Injuries (normalized by man-hours worked) for non-operating rail employees, according to Labour Canada data, appear to have remained constant in the 1972-76 time period. Although the rate of disabling injuries to man-hours worked was 18.3 in 1976, the highest recorded for a 5-year period, a long-term trend of increases in disabling injuries cannot be established. See table 37 for injury data reported to Labour Canada. (Figure 3 shows the injuries plotted by year.)

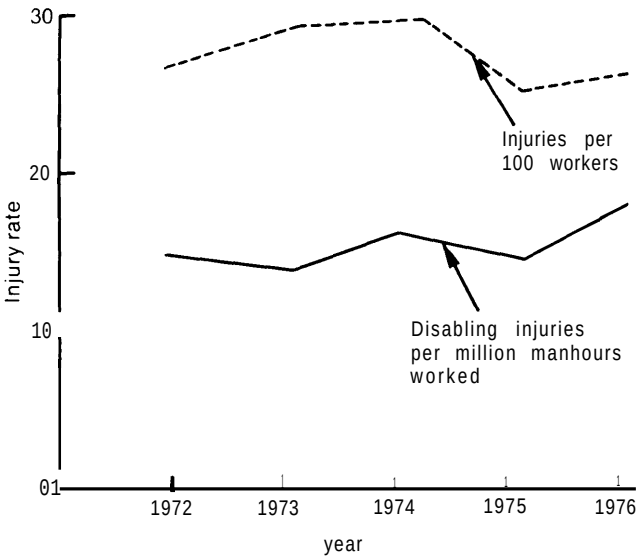
*The items to be included in the record are: the date and time of the accident; the name of the injured employee; the worksite or location where the accident occurred; the principal cause or causes of the accident; the name of the department or unit to which the employee reports for work; a brief description of the injury and its direct cause; the date, time, and type of treatment provided; the initials or name of the person who provided the treatment; and the nature and estimated cost of any property damage or material loss resulting from the accident.

Table 37.—Labour Canada Work Injury Experience for Industries Under Federal Jurisdiction, 5-Year Comparison

	Number of disabling Injuries	Number of nondisabling Injuries	Man-hours worked (000,000's)	Disabling Injuries per million man-hours worked	Injuries per 100 workers	Ratio of nondisabling to disabling injuries
1972	2,867	22,493	1780	161	278	7.8
1973	2,287	20,093	1469	156	297	8.8
1974	2,578	19,954	1479	174	297	7.7
1975	2236	16643	1390	160	265	7.4
1976	2420	16,301	1326	183	275	6.7
5-year average	2478	19,097	1489	166	283	7.7

SOURCE: Labour Canada, Division of Occupational Safety and Health

Figure 3.— Rate of Disabling Injuries



Differences Between U.S. and Canadian Occupational Safety and Health

Prior to 1975, FRA collected injury data on railroad employees involved in train operations as well as those not involved in train operations. The injuries reported to FRA, were only reported if they involved more than 1 day of lost worktime. Beginning in 1975, all injuries requiring medical attention were reported as well as those injuries resulting in 1 or more days of lost worktime.

When comparing the United States and Canada, several differences in the reporting criteria and procedures become apparent.

- Labour Canada collects occupational safety and health data whereas the U.S. FRA collects this data as well as operations employees injury data.
- Labour Canada defines "disabling injury" and minor injury and includes fatality under the term "disabling ." The United States does not have this distinction, however, it does report disabilities and subsequent fatalities. Canada does not break out subsequent fatalities.
- Until 1975, the U.S. railroads did not have to report minor injuries or all incidents requiring medical attention whereas Canadian railroads have reported such accidents since 1971.

Given the differences in reporting requirements, and collection procedures, the occupational safety and health trends, particularly injury data, of the two countries cannot be usefully compared.

RAILROAD ACCIDENT DATA AND REPORTING PROCEDURES

Both major Canadian railroads are required to report accidents and casualties to CTC and Labour Canada under their respective accident reporting regulations. In addition to these reports and agency accident investigations, the railroads have their own extensive accident reporting and investigation systems. This section describes those reporting systems, their uses, and the trends evident from available railroad data.

Each railroad compiles complete accident and injury data and reports such information to chief operating officers on a monthly basis. In addition, CP reports accidents trends to its corporate board on a quarterly basis. CN reports accidents trends to its board on an annual basis.

Information obtained from one railroad (CN) showed that a wide variety of accident data are compiled on a monthly basis for use by the company. Included in the information are: accident performance and disabling injury rates and graphs, monthly claims and accident estimates, expenses due to train accidents and employee injuries, comparisons between performance and projected safety targets, regional safety performance (actual and projected goals), and departmental totals by region. CN's yearly reports include, among other things, data on the number of accidents, costs, and causes. The CN data include all train accidents (yard and mainline) for the year reported, not just those reported to RTC over $750 and occurring on the mainline. Accidents reported to the Govern-

ment in 1977, acccording to the $750 threshold reporting figure, represented 17 percent of the total accidents for CN that year.

Accident data and information were available from both railroads. The information provided by CN shores several patterns for 1977.

CN Data

- While the number of accidents involving train movement occurring in the yards and on the mainline was roughly the same, for CN in 1977, those **accidents occurring on the mainline** accounted for 91 percent of accident costs excluding lading claims.
- Of the total CN mainline accidents only 10 percent cost over $50,000 in 1977. This percentage of severe train accidents is similar to that of the United States. Between 1966 and 1974, less than *10* percent of U.S. train accidents were over $50,000.[2]1
- Of the total number of yard and train accidents for CN in 1977, 52 percent were caused by operating rules violations, 16 percent by track failure, 12 percent by equipment failure, 8 percent by noncompany fault, 5 percent by combination, and 7 percent by miscellaneous causes. In terms of costs, track failure accounted for 53 percent, equipment—l 7 percent, human failure—l 5 percent, combination —5 percent, noncompany —2 percent, and miscellaneous- 7 percent.
- While operating rules violations accounted for the largest number of accidents, track responsibility or track-related failures were the most costly of accidents, for the single year studied. (Tables 38 and 39 display specific human failure and track-related causes respective] y.)
- In terms of equipment responsibility or failure for CN, journal and wheel failures accounted for the largest number of accidents respectively. Journals and track failures accounted for the largest costs. (Table 40 gives a breakdown of leading

[2] I.A. E.Shulmanand c E Taylor, *A n A nalysis of Nine Years of Railroad Accident Data 1966-74* (Research & Test Department, Associationof AmericanRailroads, 1 976), pp. 10-1 1

Table 38.—Accidents Resulting From Transportation Problems or Rule Violations (1977–CN data)

Cause	Number of accidents
Rule 112: Handbrake and Coupling Rule	210
Rule 104 Hand-Operated Switches	202
Other	100
Special Instructions	67
Rule 103 Switching Signals	52
Rule 105 Restricted Speeds on Other Than Main Track	22

Costs of Accidents by Cause

Cause	Percent of total cost for [ran sport problems
Rule 105	36%
Other	21
Rule 112	18
Rule 104	15
Special instructions	6
Rule 103	4
	$3.075M

*This data represents all accidents occurring on CN, not just those reported in excess of $750 to RTC

SOURCE CN Rail

Table 39.—Engineering (Track) Responsibility* (1977–CN data)

Cause	Number of accidents
Sno–wind ice	37
Broken rail	32
Subgrade	30
Tie and fittings	30
Other	30
Switches	29
Line and gauge	16
Employee failure	14
Rockslides, etc..	12
Total	“230–

Cause	Cost percent
Tie and fittings	41%
Broken rail	24
Employee failure	9
Subgrade	7
Slides, rocks	6
Switches and points	4
Snow and Ice**..	3
Other	3
Line and gauge	2

*Thisdatarepresents all accidents occurring on CN not just I hose reportedin excess 01$75010 RTC

**“This category appears to not be reflectedinCanadian Government data due 10 its low cost The same situationmay be truefortheUnitedStates on some rail carriers

SOURCE CN Rail

Table 40.—Equipment Responsibility Accidents for CN (1977 only)

Cause	Number of accidents
Journals	33
Wheels	28
Coupler	17
Employee failure	15
Truck	15
Brake.	14
Body frame	14
Other	13
Axles	3
Total	152

Cause	Percent of total cost for equipment responsibility
Journals	460/o
Trucks	17
Wheels	12
Couplers	11
Body frame	9
Brake	4
Other	3
Axles	8
Employee failure	6
Total	$3.5M

•This data represents all accidentsoccurringon CN, notjust those reported in excess of $750 to RTC
SOURCE CN Rail

equipment-caused problems and their costs.)

- Track-related failures accounted for only 16 percent of CN's accidents but 53 percent of accident costs for 1977. The leading causes of track accidents were snow and ice, broken rail, subgrade, tie and fittings, and switches and switch points. The leading causes in terms of costs were tie and fittings, broken rail, and employee failure. Employee failure is defined as an accident cause when the employee fails to perform a prescribed task, for example, if an inspector failed to detect defective equipment that resulted in an accident.
- For the 5-year period 1972-77, CN's accidents associated with track, equipment, and operating rule violations appear to be declining except for 1974. In constant dollars, accident costs declined by 24.6 percent from 1972-76, as indicated on table 41. However, over the 5 years, costs increases in **1974** reflect the rise in accidents for that year.
- In analyzing available injury information, the chief causes contributing to employee injury were getting on and off trains; material handling and improper lifting procedures resulting in back, hand, foot injuries (need for hand protection); and servicing equipment. These injury causes are similar to those in the United States. The leading causes of employee injuries in the United States for **1966-74** were: getting on and off trains; construction and maintenance of equipment; track maintenance; stumbling, slipping, and falling; coupling and uncoupling; and flying object:.

CN's injury data was not modified to show severity until 1978. Table **42** shows CN's 5-year injury profile.

CN prepares comparative analyses of train accidents and disabling injury ratios for internal review. These analyses take CN accident and injury data and that of CP, selected U.S. railroads, and U.S. railroads in the aggregate. As indicated on tables 43 and 44, CP showed the lowest train accident ratio compared to that of any of the railroads and to the [J. S. railroads in the aggregate. CN showed the lowest injury ratio from 1975 to the present. Prior to 1975 injuries reported by U.S. and Canadian railroads could not be compared. From the CN analyses, overall the Canadian railroads appear to have a better accident and injury ratio than the U.S. railroads in the aggregate.

CP Data

CP supplied its train accident data on an FRA basis for this study. As indicated by their 1974-77 accident data and rates, equipment, track, and "other" train accidents constitute the greatest losses in terms of costs, while employee negligence appears to be the category in which the greatest number of train accidents occur. (See table 45.) When adjusted for inflation, dollar losses resulting from train accidents for CP appeared to have declined. In addition the overall accident rate for CP has also declined in terms of aggregate numbers and by accident rates.

Table 41 .—CN Train and Yard Accidents by Cause, 1972-76

Year	Employee transportation	Equipment	(Track) engineering	Noncompany	Combination	Miscellaneous	Total
1972	1.321	252	623	158	65	236	2,655
1973	1,202	202	436	220	69	168	2,297
1974	1,607	296	556	187	77	198	2.921
1975	1,081	199	351	162	49	147	1,989
1976	783	163	316	104	43	98	1,507

Cost of All Train and Yard Accidents (Excluding Merchandise Claims) in Dollars

Year	Employee transportation	Equipment	(Track) engineering	Noncompany	Combination	Miscellaneous	Total	1972 constant dollars
1972	$3,170513	$2,273,813	$5,557,182	$543,041	$569,052	$1,568.836	$13682.437	$13,682,437
1973	2,383,354	1,671,933	4,394,653	627,590	448,986	2,131,610	11,638,126	10,298,698
1974	4,537,636	4,136,867	4,788,853	872,295	472,085	2,213.649	17,021,385	13,266,863
1975	3,880,695	3,203,970	6,772,869	600,289	827,064	3,123,655	18.408,542	12,256,020
1976	4.072,015	2,250,241	7,146,065	536,204	295,225	2,498,009	16,797,759	10,311,700

SOURCE CN Rail

Table 42.—CN 5-Year Disabling Injury Ratio (per million man-hours worked)

Year	Transportation T.E.Y.	Others	Equipment	Engineering
1972	3660	480	1880	1640
1973	3455	441	2152	1570
1974	3488	595	2044	1942
1975.	3391	372	2034	1733
1976	2729	388	1844	1667
1977 (Jan - Sept.)	2413	298	1921	1452
Variance– 1972 base better (worse) %	341	379	(2 2)	11. 5

T E Y=(Transportation equipment and yard)
SOURCE CN Rail

Table 43.— FRA Comparative Statistics—Train Accidents

	1972		1973		1974		1975a		1976a		1977[b](Jan -Aug.)	
	Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio
CN Rail .	604	861	661	991	880	1184	524	778	518	797	305	727
CP Rail	218	531	214	534	285	6.69	220	563	247	657	124	486
U S. railroad	521	838	586	924	641	990	504	879	735	11 73	480	11 33
U.S. railroad	236	1043	257	1088	287	1216	296	940	441	1266	278	11 11
U. S. Class I railroads	7,012	9.65	8,648	11 10	9,913	1263	8,041	1065	N/A		N/A	

Ratio = Number of accidents multiplied by 1 million divided by locomotive miles
[a]Property damage increased to $1750
[b]Property damage increased to $2300
SOURCE CN Rail

Table 44.— FRA Comparative Statistics— Employee Disabling Injuries

	1975*			1976			1977		
	Killed	Injured	Ratio	Killed	Injured	Ratio	Killed	Injured	Ratio
CN Rail	12	2,092	17,84	8	1,827	15.45	4	1,186	16.44
CP Rail	10	1,621	24,5	7	1,586	24,29	8	812	18,59
U S railroad	6	3,939	48,87	1	3,368	3947	2	2,416	40.83
U S railroad	2	734	19.66	4	774	19,92	2	501	18,91
U.S. Class I railroads	102	22,338	22.87	94	27,040	27,61	80	20,203	30.69

*Effective Jan 1 1975 FRA Regulation changed all lost time cases are changed which resulted in U S road increases
SOURCE CN Rail

Table 45.—CP Train Accidents on FRA Basis

Year	Responsibility	Number	Rate per MLM*	Total damage
1974	Employee negligence	70	1.64	$ 771,741
	Detective equipment	60	1.41	5,157,417
	Defective track and structure	44	1.03	4,591,223
	Others	63	1.48	3,452,609
	Crossings	54	1.27	1,628,999
	Total	291	6,83	$15,602,089
1975	Employee negligence	63	1,61	$ 1,017,217
	Defective equipment	51	1,30	2,635,172
	Defective track and structure	30	.77	2,660,846
	Others	40	1,02	3,104,999
	Crossings	34	.87	2,258,731
	Total	218	5.58	$11,676,965
1976	Employee negligence	83	2.21	$ 1,384,396
	Defective equipment	37	.99	2,865,553
	Defective track and structure	36	.96	5,692,913
	Others	56	1,49	2,054,498
	Crossings	38	1.01	413,995
	Total	250	6.66	$12,411,355
1977	Employee negligence	51	1.33	$6,500,547
	Defective equipment	46	1.20	3,755,786
	Defective track and structure	36	.94	2,863,512
	Others	38	.99	3,133,552
	Crossings	19	.49	296,405
	Total	190	4.94	$16,549,802

*MLM — Million locomotive miles
SOURCE CP Rail