Railroad Safety—U.S.-Canadian Comparison

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RAILROAD SAFETY—
U.S.–CANADIAN COMPARISON



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FOREWORD

In June 1978, the Subcommittee on Transportation and Commerce of the House of Representatives Interstate and Foreign Commerce Committee requested the Office of Technology Assessment to conduct "a detailed comparison between conditions prevailing in railway safety in the United States and a review of safety operations in Canada."

Responding to this request, this OTA report identifies the similarities and differences between the U.S. and Canadian railroad systems and Government/rail relationships. It establishes a base from which the overall comparability of safety between the two systems is made. The report surveys the safety activities of Canadian railroads, Government, labor, and other organizations and compares those efforts with counterpart safety activities in the United States.

This report represents a significant cooperative effort on the part of Canadian and U.S. Government agencies, railroads, and labor groups in creating mutual understanding of railroad safety policy and programs.



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This report, “Rail Safety: A U.S.-Canadian Comparison, ” was undertaken by the Office of Technology Assessment at the request of the Subcommittee on Transportation and Commerce of the Interstate and Foreign Commerce Committee of the House of Representatives.

In conducting the analysis, OTA utilized information and data generated in the previous OTA *Evaluation of Railroad Safety* published in May 1978, and additional information on U.S. rail safety provided by Government, industry, and labor sources. Data, information, and assistance regarding Canadian railroad safety was provided by the Canadian Transport Commission, Labour Canada, the Canadian Pacific (CP) Railway, the Canadian National Railway (CN), and the Canadian Railway Labour Association.

The study was conducted by OTA staff with the contractual assistance of the Newman and Hermanson Company, Mr. Ralph Hoar as editor, and his. Marese Miles as typist. Special assistance was provided by Jim Leach and Joel Miller within OTA. Advice and assistance was provided by a U.S. advisory panel comprised of representatives from the Federal Railroad Administration, the Association of American Railroads, the Railway Labor Executives Association, the Union Pacific Railroad, and Carnegie Mellon University. In addition, numerous other persons provided valuable insight and information regarding safety for the study effort. A detailed list of the persons interviewed is included in appendix A.

This study sought to give a general overview of the similarities and differences between the U.S. and Canadian rail systems, Government structures, accident and casualty pictures, and rail safety policies and programs. Time and data limitations did not permit detailed comparisons of such items as operational data and codes, specific accident comparisons, Government economic policies, and rail resource allocations.

Special thanks are extended to the Canadian Transport Commission and the Railway Transport Committee, Labour Canada, CN Rail, CP Rail, the Canadian Railway Labour Association, and to the numerous persons who assisted in the study effort. Appreciation is also extended to the U.S. advisory panel, the Newman and Hermanson Company, Ralph Hoar, and Teri Miles for their excellent support.

SUMMARY

The major findings of a comparative analysis of U.S. and Canadian rail systems and safety practices are:

1. The Canadian and U.S. rail systems differ substantially in size and structure. The Canadian system is comprised of two primary railroads, the Canadian National (CN) and the Canadian Pacific (CP). CN has been Government-owned since 1923 and CP is privately owned. Both lines are transcontinental. In contrast, the United States has approximately 56 major railroads, none of which are transcontinental or Government-owned. The Consolidated Rail Corporation (Conrail) is the only U.S. freight carrier that has recently received sizable Government subsidies or investments. In general, the U.S. rail system and related Government structure is considerably more complex than the Canadian. The extent to which that difference in complexity may account for the relative effectiveness of safety measures in the two countries could not be determined for this report.

2. The U.S. rail fatality rate, on a train-mile basis, was an average of 47.6 percent higher than the Canadian for the Ii-year period 1966-76. This higher U.S. fatality rate, especially in grade-crossing and trespasser fatalities, seems to reflect the fact that, since the U.S. population and rail system are considerably larger than the Canadian, the level of exposure to rail hazards is much higher in the United States.

3. On the whole, the U.S. derailment rate is much higher than the Canadian. However, derailment rates vary widely among U.S. carriers. The average derailment rates of the nine largest (in ton-miles) U.S. carriers were similar to those of the Canadian railroads for 1976 and 1977. *However,* the average derailment rates for the second 10 U.S. railroads are significantly higher than the rates for the Canadian railroads for those same years. Derailments in the United States are continuing to increase, while derailments in Canada have stabilized.

4. The continued rise in U.S. derailment rates seems to be a result of deferred maintenance and increased axle loadings on freight equipment. U.S. derailment rates will probably continue to climb until the economic condition of some U.S. rail carriers improves. The stabilization of Canadian derailment rates seems to stem from a combination of factors, which include the priority railroad management gives to track maintenance, the economic health of the industry and the availability of capital for it, and favorable Canadian tax structures.

5. In Canada, the National Transportation Act of 1967 changed Government economic policy to encourage greater balance among transportation modes. Under the new policy, railroads gained greater control over their rate structure. Although no direct correlation can be made between this change in policy and rail safety records, the change does appear to have strengthened the economic position of the rail industry in Canada and may be one of the underlying causes of improved rail safety.

6. Several Canadian approaches to rail safety appear to work well and may be worth considering for the United States. They include:

   - Emphasis by railroad management on safety accountability and adoption by management of a systematic approach to safety that includes training, the development and use of accident data, and a high priority placed on track maintenance.
   - Creation of a no-fault system of insurance compensation for work-related injuries.
   - Government use of risk analysis to guide railroad inspection.
   - Government use of risk analysis in the allocation of funds for grade crossings.

- Government use of stop orders rather than penalties as a means of enforcing safety standards.
- Mandatory use of the Hazardous Information Emergency Response form, which outlines the basic information needed for immediately responding to accidents, in all shipments of dangerous commodities.
- Participation and cooperation between labor and management in a Government-sponsored forum.

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Chapter I

U.S.-CANADIAN RAIL SAFETY: COMPARATIVE ANALYSIS

Chapter I

U.S.-CANADIAN RAIL SAFETY: COMPARATIVE ANALYSIS

Rail safety problems and policies in Canada and the United States have been shaped by a number of factors including: Government structure and policy, geography and national resources, economic systems, technologies, and the *role* various transportation modes played in each country's history. Differences in several of these factors between the United States and Canada have produced some differences in each country's rail system and rail safety.

This chapter provides a comparative analysis between the U.S. and Canadian rail systems, rail accident pictures, and major rail safety policies and programs.

The primary sources of information for this report include the Office of Technology Assessment's *Evaluation of Rail Safety* and interviews and documents provided by the Canadian Government, railroads, and labor organizations.

RAIL SYSTEM

The U.S. and Canadian rail systems differ significantly in size and in structure. The U.S. rail system is considerably larger and has many more individual railroads than the Canadian.

Two transcontinental railroads, the Canadian National (CN) and the Canadian Pacific (CP) dominate the Canadian rail system. CN is a Government-owned crown corporation and CP is a privately owned railroad. By contrast, the U.S. rail system is comprised of approximately **56** major railroads, none of which are transcontinental. No U.S. carrier is entirely Government owned, although the Government does have a very sizable ownership interest in the Consolidated Rail Corporation (Conrail), as a result of its recent investments.

The United States has over nine times the population of Canada. Although the two countries are similar in land mass, the great portion of Canada's land mass lies in arctic and subarctic regions and only one-third is populated.

Selected characteristics of the two countries' rail systems are shown in table 1. The rail technology employed by the two countries is

Table 1.—Selected Comparative Characteristics United States—Canada

Year	Characteristic	United States	Canada	United States/ Canada (ratio)
1976	Population (million) .,	'1 5,000,00(	3,000,000	9.3
1976	Land mass (sq. miles)	3,615,100	1,851,800	·
1976	Number of railways (major)	56	2	—
1975	Mainline/branchlike (miles)	199,400	43,900	4.5
1975	Yard/sidings (miles)	124,800	16,100	7.8
976	Total freight fleet (cars)	1,699,000	193,400	8.8
976	Total locomotives (number	27,600	4,008	6.9
976	Average capacity per freight car ., ., .,	73.8 tons	64.6	1 2
975	Total passenger fleet (car)	6,471	1,855	3 5
976	Freight train miles (million	424.5	6 8 6	6.2
976	Gross ton miles (billion)	1,996	273	7,3
976	Passenger miles (billion)	1 0 3	1.8	5 7
1976/ 77	Average number of employees	496,500	107,000	4.6
1976	Operating revenues (billion).	1 8 5	3.1	5.8
1976	Operating expenses (billion)*	1 5 0	2 9	5 1
	Percent expenses to revenues	80%	91%	
1976	Net income (ordinary) (million) .,	358	36.9	9.7

*The differences between Canada and the United States in the percentage of expenses 10 revenues may be explained in part by the capital Investment that is not Included as an expense item in the United States

similar. However, the United States carries a slightly higher weight per train as evidenced by a larger freight car capacity. The freight car capacity for both countries has increased in the last two decades. The United States has over four times as much mainline/branchlike trackage as Canada and over eight times the equipment fleet. The U.S. system travels six times the amount of freight train miles and seven times the gross-ton mileage of the Canadian rail system. In the United States, passenger miles were 5.7 times higher than that of Canada, and the United States hired an average of *4.6* times more railroad employees than Canada. In light of the differing sizes of the two countries and the nature of their economies, the differences in the sizes of the rail systems are to be expected.

ACCIDENT PICTURE

Fatality rates (based on train miles) **in both countries for the** 1966-76 **period declined. However, the United States had a 47.6 percent higher fatality rate (or 1.5 times higher) than Canada. Grade-crossing and trespasser fatality rates are considerably higher in the United States than in Canada, whereas employee fatality rates are similar. These data probably reflect the fact that, since both the U.S. population and rail system are much larger than the Canadian, the U.S. general public has a higher level of exposure to rail hazards.**

For the **1966-76** period, the U.S. rail fatality rate was an average of *47.6* percent higher than that of Canada. Total U.S. rail fatalities declined by *37* percent between **1966** and **1976** (table 2). The U.S. fatalities per train mile declined by *27* percent. In Canada, the total fatalities declined by 54 percent for the same period, and the rate per train mile declined by 50 percent.

A proportionately larger number of trespasser fatalities occur in the United States than in Canada (table 3). On the average, over the **1966-76** period, the trespasser fatality rate for the United States was 67 percent higher than for Canada. The reasons for the differences in trespasser fatality rates between the two countries could not be specifically ascertained. However, factors such as location of trespasser death (urban or rural), population densities, and rail traffic exposure could influence the number and rate of deaths. This data was not available for this report. *

Table 2.—Fatalities in the United States and Canada, 1966-76

	Canada		United States	
Year	Fatals	Per million* train miles	Fatals	Per million** train miles
1966	318	3.31	2684	4.18
1967	297	3.15	2483	4.08
1968 ., ., .	230	2.64	2359	4,04
1969 . . .	218	2.53	2299	4,03
1970	195	2.24	2225	3.04
1971 ., ., ,	208	2.39	1010	3.09
1972 . . .	253	2.81	1,945	3.73
1973	228	2.57	1,916	3.38
1974 ...	201	2.07	1,908	3.27
1975	187	2.11	1,560	2.92
1976	145	1.66	1,684	3.02
		2,50 average rate		3.69 average rate

"U S tram miles used for this table were derived from comb rung locomotive males (whichineludes freight and passenger males, and motor train miles)

● *Canadian tram males for 1972-76 used in this table included motor tram miles, and freight and passenger miles

SOURCE Bureau of Management Consulting, *Statistical Analysis of Railway Accidents*, /956-73, p 12, Railway Transport, pt 1, Comparative Summary, 1972-76, table 9 U S Federal Railroad Administration Accident Bulletin, no 14 and 45, p 1

Between **1966** and *1976,* both countries showed a decline in the number and rate of deaths resulting from grade-crossing accidents (table 4). The decline in the United States was more consistent over the period than in Canada. On a per million train-mile basis, the Ii-year average grade-crossing fatality rate in the United States is *62* percent higher than that of

*The Railway Transport Committee (RTC), the Canadian Government agency responsible for accident data collection and analysis, gathers data on mainline and branchline accidents that result in $750 or more in damage to rail property, equipment, and lading.

(continued)

Table 3.—Trespasser Fatalities in the United States and Canada, 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	1.02
1974	55	.57	565	.91
1975	59	.67	524	.98
1976	32	.37	458	.82
		.61 average rate		1.02 average rate

SOURCE Bureau of Management Consulting, *Statistical Analysis of Railway Accidents, 1956-73* Railway Transport, pt 1, Comparative Summary, 1972-76 U S Federal Railroad Administration Accident Bulletins

Table 4.—Grade"Crossing Fatalities in the United States and Canada, 1966=76

Year	Canada		United States	
	Fatals	Per million train miles	Fatals	Per million train miles
1966	186	1,94	1,780	2.77
1967	197	2.09	1,632	2.68
1968	121	1.39	1,546	2.65
1969	120	1,39	1,490	2.61
1970	116	1,33	1,440	2.61
1971	121	1.39	1,356	2.63
1972	150	1,65	1,260	2.41
1973	150	1.69	1,185	2.09
1974	109	1.12	1,220	2.09
1975	99	1,12	978	1.83
1976	108	1.24	1,168	2.10
		1.49 average rate		2.41 average rate

SOURCE Bureau of Management Consulting, *Statistical Analysis of Railway Accidents*, 1956-73, Railway Transport, pt I Comparative Summary 1972-76, U S Federal Railroad Administration Accident Bulletins

Canada. This rate difference appears to reflect a higher level of exposure of the U.S. population to such hazards than in Canada. For example, Canada has *34,000* public crossing sites compared to 219,000 in the United States. For the *1966-72* period, the United States had an average of *105,288,000* motor vehicle registrations compared to **8,238,000** in Canada. However, in order to determine accurately the exposure levels, more detailed data is needed.

The employee fatality rates for the United States and Canada are quite similar (table 5). Both countries have shown a relatively stable rate, with the exception of a dramatic decline in employee deaths for Canada in *1976.*

In both the United States and Canada, rail grade-crossing fatalities represent the most significant rail-related safety problem.

Grade-crossing fatalities are the largest category of rail-related deaths in Canada and in the United States. In both countries, these deaths account for between **60** to *65* percent of all rail-related fatalities. In both countries, trespasser fatalities accounted for the second largest safety problem in number of deaths.

Canadian railroads with gross ton miles similar to the top-nine ton-mile carriers in the United States have derailment rates similar to those of the U.S. carriers. However, the averages of accident rates for the next 10 **(ton mile) U.S. railroads as a group in** 1976 **and in 1977 are significantly higher than the Canadian railroads. In the aggregate, the U.S. derailment rate is significantly higher than that of Canada. In both countries, derailments are more significant for the property losses and service dislocation than for the fatalities they cause.**

Derailments measured on a gross ton-mile basis increased for both countries over the **1966-74** period, as shown in table 6. After 1974, derailments stabilized for Canada, whereas they

*(continued)

The U.S. Federal Railroad Administration currently collects accident information on mainline, branchlike, and yard accidents that result in $2,300 or more in damage costs. In the United States, prior to 1975, the threshold value for reporting accidents was $750. It was raised to $1,750 to account for inflation in 1975, and to $2,300 in 1977. Mainline and branchlike accidents for the United States could only be separated from yard data for the years 1975, 1976, and 1977. Hence, qualitative comparisons with RTC data could only be made for those years. Although the reporting threshold for derailments is lower in Canada for the 1975-77 period, this should not preclude comparison of derailments between the United States and Canada for that period for mainline and branchlike derailments.

RTC collects data on injuries for operating employees, however, data on injury causes were not available. The United States did not begin collecting injury data for injuries resulting in "one or more" days off or requiring medical attention until 1975. Prior to 1975, injury data were collected for only those injuries resulting in "more than one" day off. The primary difference in accident data collection systems between the two countries is the fact the United States collects yard accident data whereas Canada does not, and the def - initions and procedures used to collect injury data have differed.

Table 5.—Employee Fatalities in the United States and Canada, 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
		.26 average rate		.26 average rate

SOURCE Bureau of Management Consulting *Statistical Analysis of Railway Accidents*. 1956-73, Railway Transport, pt 1, Comparative Summary, 1972-76, U S Federal Railroad Administration Accident Bulletins

Table 6.—Collisions/Derailments in the United States and Canada, 1966-74

Year	Canada		United States	
	Collisions	Derailments*	Collisions	Derailments**
1966	55	230	1,552	4,447
1967	39	209	1,522	4,960
1968	49	228	1,727	5,487
1969	41	246	1,810	5,960
1970	46	276	1,756	5,620
1971	45	265	1,529	5,131
1972	44	323	1,348	5,509
1973	56	299	1,657	7,389
1974	46	420	1,551	8,513

*Mainline only
● *Mamlme and yard combmed
SOURCE Bureau of Management Consulting, *Statistical Analysis of Railway Accidents*, 1956-73, Railway Transport pt 1, Comparative Summary 1972-76, U S Federal Railroad Admininistration Accident Bulletins

Table 7.—Derailments in the United States and Canada, 1975.77*

Year	Canada	United States
1975	330	3,600
1976	301	4,123
1977	312	4,010

" Malnlline/branchlike only for both countries.
SOURCE Railway Transport Committee, Summary Accident Data, Federal Railroad Administration, Accident Bullet Ins,

Table 8.—U.S. Derailments by Cause

Year	Track	Gross ton miles (000)	Equipment	Gross ton miles (000)	Misc. and othe·	Gross ton miles (000)	Total	Gross ton miles (000)
1966*	1,388		1,550		1,501		4,447	
1967	1,800		1,611		1 ,549		4,960	
1968	2,062		1,745		1 ,681)		5,487	
1969,	2,400		1,863		1,697		5,960	
1970,	2,393		1,602		1,607		5,602	
1971	2,194		1,389		1,5411		5,131	
1972	2,481		1,344		1 ,684		5,509	
1973	3,477		1,755		2,157		7,389	
1974	3,196		1,967		2,350		8,513	
Percent of total	(40%)		[30%)		(30%)			
1975**	1,633	.88	1,242	.67	725	.39	3,600	1.84
1976	1,921	.96	1,405	.71	797	.40	4,123	2.07
1977	1,844	.92	1,324	.66	842	.42	4,010	1.99
	(46%)		(34%)		(20%)			

"1966-74 for mainline/branchline and yard derailments
"" 1975-77 for mainline/branchline only (prior to 1975 derailments could not be isolated by location of mainline v yard)
SOURCE Federal Railroad Administration Accident Bulletin am Association of American Railroads, Economics and Finance Department

have continued to increase in the United States (tables 7 and *8).*

While the total derailment picture for the United States appears less favorable than that of Canada, derailment rates among U.S. carriers range from 0.28 to 12.50 on a billion gross-ton-mile basis for the **1976-77** period. Table *9* lists U.S. and major Canadian carriers by their gross ton miles and by their derailment rates. As evidenced from this table, derailment problems vary among individual carriers. From the information provided by table 9, the average accident rates for the nine largest (ton mile) U.S. railroads in **1976** and in **1977** are not significantly different from the values for either CN or CP in those years. However, the averages of the accident rates of the next 10 U.S. railroads in **1976** and in 1977 statistically are significantly higher than the values of either CN or CP in those years. The differences in the accident rates between the years **1976** and 1977 for the individual carriers are not statistically significant. The variation among the carriers is highly significant, but the variation from year to year is not significant.

In the United States, track-caused derailments represent a slightly higher portion of total mainline/branchlike derailments than they do in Canada. Between 1966 and 1977, track-caused derailments accounted for roughly **40 to**

46 percent of all U.S derailments (table 8). * In Canada, during the same period, equipment-caused accidents represented the largest number of derailments between 1966 and 1970 whereas track-caused accidents represented the greatest portion of accidents between 1970 and 1975 (table 10). The slower introduction of roller bearings in the Canadian freight car fleet may account for the slightly larger portion of equipment-caused accidents. By 1976, track and equipment causes together accounted for roughly 74 percent of all Canadian derailments with the split between track and equipment causes being almost equal or approximately 37 percent each by 1977.

In the United States, 1.7 percent of rail-related fatalities for *1966-76* occurred in derailments. In Canada, 1 percent of fatalities for **1966-76** occurred in derailments. Derailments appear more significant for their resulting property losses and service dislocations.

As suggested in the previous OTA Evaluation of *Railroad Safety,* the reasons for the increases in track-caused train accidents may result from a combination of factors including increased axle loading on freight equipment, deferred maintenance, and the unstable economic condition of some U.S. carriers. Data was not available to correlate directly the financial viability of the individual rail carriers with their derailment picture.

Around *1974,* Canadian Government and railroad officials showed a growing concern about increased axle loading on freight equipment. Railroad management states that, as a result of this concern, CN conducted research on the problems, Both railroads decided to increase track expenditures. Although sufficient data was not available to document fully the trends in allocation for track maintenance, the Canadian accident data tends to support statements made by the railroads.

Table 9.—Mainline/Branchline — Derailments by Year and Railroad (in billions of gross ton miles)

Railroad	Gross ton miles 1976	Derailment rate, 197E	Gross ton miles 197i	Derailment rate, 1977
Conrail. . .			2392	2.47
Burlington Northern:	204.6	1,44	221 7	1,16
Southern Pacific	170,3	1,09	173.3	1 25
Union Pacific .	160.1	.97	169.1	.86
Santa Fe	144.7		159.8	.73
	(CN 139.4)	(1.36)	(141 7)	(1 .34)
Southern	1130	1.03	121 3	.92
Norfolk &Western.	114,9	.86	108,0	.71
Chessie ... .,	1149	380	110.8	330
Missouri Pacific	108,2	1.02	111 8	.98
	(CP 101.0)	(97)	(106.2)	(1 02)
Louisville & Nashville. .,	812	3.03	843	339
Seaboard Coast Line	799	1.55	84.5	1.77
Illinois Central Gulf	626	337	601	386
Chicago & Northwestern	57,1	5.90	58.8	510
Milwaukee,	504	6.45	48.8	7.33
St, Louis-San Francisco.	38.3	198	38.8	1 52
Rock Island .	347	6.97	35.1	8.06
St.Louis-Southwestern.	26.2		26.7	
Denver Rio Grande.	20.7	,72	21.2	.61
SooLine, .,	18.4	315	20.5	2,59
Kansas City Southern .,	147	3.40	16.2	1 79
Western Pacific .,	13,4	209	13.8	1.59
Missouri-Kansas-Texas .,	11.6	440	12.3	4.15
Grand Trunk Western	9.1	3.96	9.5	2.21
Delaware & Hudson.	8.3	4.94	8.9	472
Boston & Maine ., .,	6,2	3.23	6.1	3.28
Clinchfield	5 9	3.39	6.7	358
Colorado & Southern .	4,7	4,26	6.6	2.73
Ft. Worth & Denver	4.8	3.54	6.8	2.21
Florida East Coast	4 2	48	5.0	.80
Long Island .	3 8	1.05	3.8	1.05
Bessemer & Lake Erie	3.8	1.58	3.7	.81
Detroit, Toledo, & Ironton	3 2	5.63	3 4	2.94
Duluth & Missabe Iron Range . ,	3.6	.28	2.3	
Richmond, Fredericksburg, & Potomac	2.7	1.48	2,6	222
Pittsburgh & Lake Erie,	2.5	8..80	2,5	9.20
Duluth, Winnepeg, & Pacific ., . ., .,	2,4	2.08	2.6	
Maine Central	20	950	2.0	500
Elgin, Joilet, & Eastern	1,8	1.11	17	1,76
Toledo, Peoria, & Western	1,5	3.33	1,4	5.00
CP-U.S. Lines .,	1.4	214	1.5	.67
Georgia . ,	1,4	2.14	1.4	714
Northwestern Pacific .,	1.2	4.17	1.2	
Illinois Terminal Co.	12	750	1,2	12,50
Bangor & Aroostock.	1.2	12,50	1.2	6.67
Chicago & Illinois Midland	9	5.56	7	429
Central Vermont .,	.7	714	.7	1,43
Detroit Toledo Shoreline,	5	12.00	.5	800

SOURCE Federal Railroad Administration Accident Bulletin and Association of American Railroads

● Prior to 1975, in the United States, derailments occurring in the yards could not be separated from mainline and branchlike derailments. Therefore in the range of 40 to 46 percent of derailments caused by track for the 1966-77 period, 40 percent represents track-caused derailments for mainline) branchlike only, and **46** percent represents track-caused derailments occurring on mainlines/branchlines and in the yards from 1966-74.

Table 10.—Canadian Derailments by Cause

Year	Track	Gross ton miles 000)	Equip-ment	Gross ton miles (000)	Misc. and other	Gross ton miles (000)	Total	Gross ton miles 000)
1966	70	.32	125	.57	35		230	
1967 ..., .	53	.25	82	.38	74		209	
1968, ...	50	.24	100	.47	78		228	
1969. , . . .	73	.34	128	.60	45		246	
1970	119	.51	108	.46	49		276	
1971 ...	107	.44	89	.36	69		265	
1972	134	.53	103	.40	86		323	
1973	115	.45	104	.41	80		299	
1974, ...	157	.56	130	.46	133		420	
1975	136	.53	103	.40	91	.32	330	1.17
1976 ...,.	106	.41	107	.42	88	.31	301	1.08
1977, ...,	120	.43	111	.39	81	.29	312	1.10
	36%		38%		26%			

SOURCE Railway Transport Committee, *Summary Accident Report, 1977*

GOVERNMENT STRUCTURES AND STATUTES

In the history of both Canadian and U.S. railroads, there has been Government involvement in the railroads, but that involvement—in terms of both economic and safety regulations and economic subsidies for the railroads—has differed in several ways.

Canada's early rail system was tied directly to the political union and economy of the country. The first transcontinental railroad, the Canadian Pacific, was stipulated by the British North America Act of **1867.** This Act formed the Canadian confederation by joining British Columbia to the other provinces, particularly to Montreal. CP received substantial initial Government subsidies, land grants, and tax credits. However, it has always been maintained as a private enterprise system.

The Canadian Government has been involved in rail economic regulation since the late-1800's. In **1897,** the Canadian Government entered into the Crow's Nest Pass Agreement with CP. The agreement established rates for hauling grain for specified routes in exchange for subsidies needed by CP to build additional lines. The Crow's Nest Pass Agreement was later extended to include all grain-hauling routes for CP, and those for other rail lines as well.

In *1903,* the Canadian Government enacted the Railway Act, which consolidated a number of existing rail policies and added economic and safety regulatory measures.

The U.S. Government has been involved with economic, safety, and other aspects of its rail system since the late-1800's. The United States provided substantial land grants for building the rail system to foster growth in the West. The Federal Government became involved in the economic regulation of the railroads when it created the Interstate Commerce Commission in **1887.** The Government also became active in railroad safety with the creation of a number of specific safety laws between **1900** and **1920.**

In Canada, CN was established as a Government owned and operated crown corporation in 1923 following the financial collapse of several major private railroads. These were consolidated with previously owned Government lines.

As in Canada, the U.S. railroads experienced financial difficulties in the early 1900's. During World War I, the U.S. Government operated the rail system. However, after the war, the railroads returned to private ownership with Government regulation. The U.S. railroads later received substantial loans from the Reconstruc-

tion Finance Corporation during the Depression. Most of these loans were paid back by the end of World War II. Conrail is the only major carrier that has received sizable Government subsidies in recent rail history.

Today in Canada, CN represents one of several divisions included in the Canadian National Crown Corporation. Its other divisions include trucking, shipping, U.S. rail lines, and hotels. However, CN accounts for the largest source of revenues to the corporation. Although publicly owned, CN's financial position was greatly improved by the Capital Revision Act of **1977-78** which removed substantial CN debts (approximately $2 billion). The remaining CN debt after this Act is approximately *$250* million.

Canadian Pacific is also part of a larger conglomerate, CP Limited, which has assets of $5 billion. CP Limited enterprises include air, trucking, shipping, mining, forestry, real estate, telecommunications, and other investments. Rail accounts for 22 percent of the annual revenues of CP Limited.

The structures of the two Governments and their current rail policies differ in several substantial ways.

Canada has a parliamentary form of government that combines legislative and executive functions. The Minister of Transport, a member of Parliament, serves as the chief executive for the Department of Transport (Transport Canada), the governmental agency with umbrella transportation authority.

In Canada, there are two primary Government entities with rail safety responsibilities; Transport Canada (Department of Transport) and Labour Canada (Department of Labour). Labour Canada is the equivalent of the executive branch Labor Department in the United States. In Canada, the central Government has exclusive jurisdiction over the interprovincial rail carriers, whereas, in the United States, Federal Government jurisdiction preempts but does not exclude State jurisdiction over rail carriers.

Canadian authority for economic and safety regulation of all interprovincial railroads, as well as for economic regulation of other modes, is vested in one primary agency, the Canadian Transport Commission (CTC). CTC reports to Transport Canada. Within CTC, the Railway Transport Committee (RTC) has direct responsibility for rail regulatory activity. CTC was created by the National Transportation Act of **1967** (NTA), which sought to establish a balanced transportation policy. NTA established a national transport policy for the purpose of achieving maximum efficiency from all available modes at lowest cost. With the **1967** Act, Canada removed a number of Government rail economic policies in an effort to allow rail to compete more effectively with other modes. NTA established an appeals process to resolve potential rate disputes in captive markets and to safeguard the public interest. NTA also established the framework for Federal regulation of trucks, historically a function of the provinces. This section, although passed by Parliament, has never been activated. Hence the provinces still exercise regulatory authority over trucking. [1]

Within CTC, the Railway Transport Committee is responsible for implementing Federal rail policies. Its functions are several: administration of rail economic policy, administration of rail subsidies, and administration of rail safety policies involving train operations. RTC rail safety functions include: regulation, inspection, accident reporting and investigation, and grade-crossing and dangerous commodities safety-related activities.

[1] A major study in 1977 of the impacts of rail economic and pricing changes resulting from NTA was undertaken by the Centre for Transportation Studies at the University of British Columbia, a research organization sponsored by the Canadian Ministry of Transport. The study is entitled *Railway Pricing Under Commercial Freedom: The Canadian Experience* by T. D. Heaver and J. C. Nelson, University of British Columbia, Vancouver, Canada, 1977.

While this OTA report does not seek to examine the impacts of Canadian rail economic policies, the previous source gives information regarding the implications of rail economic deregulation in Canada resulting from policies established by NTA.

The study concludes that:

> The dynamic competition provided by the 1967 NTA has proved workable in promoting efficient transport, sophisticated and efficient pricing of railway services, adequate service for the most part, competitive rate levels, and some lessened discrimination in pricing as well as maintaining the commerical and financial viability of the Canadian railways. Further the competition spawned by the Act has stimulated shippers and railways to make needed institutional changes.

In the United States, authority for development and implementation of rail economic policies, including regulatory functions, and rail safety policies and programs is vested in several different Federal agencies. The Federal Railroad Administration (FRA) within the Department of Transportation has responsibility for administering rail subsidies, and developing safety regulations and other programs including research. In addition, FRA shares jurisdictional responsibility with the Federal Highway Administration for grade-crossing safety, and with the Materials Transportation Bureau for hazardous materials safety. The Interstate Commerce Commission (ICC) has economic regulatory responsibilities for rail. Unlike Canada, the United States has continued to maintain substantial Federal regulation of rail economic policies. Trucking regulation is maintained at the Federal and State levels in the United States, unlike Canada where Federal jurisdiction has not been exercised.

The objectives and responsibilities of CTC appear comprehensive and substantially stronger and wider in scope than those vested in ICC and FRA. In particular, CTC can establish rules and seek penalties for violation of its laws and rules from both rail companies and rail employees. It has jurisdiction over construction and operation of railroads. Its inspectors can issue orders to stop train operations or remove a car from a train. CTC decisions are binding within its jurisdiction and may be reviewed only on ap-

Table 11 .—U.S. and Canadian Safety Regulations

Subject	U.S. provision	Canadian provision
Hazardous materials	49 CFR 172-174, 178-179,209	Gen. Order no. 0-29 to O-34
Ambient noise	40 CFR 20 (EPA); 49 CFR 210; 49 CFR 171,211	N/A
Procedural rules	49 CFR 171,211	Gen. Order. no. M-2
State/Province participation	49 CFR 212	None
Track safety standards	49 CFR 213	None
Freight car safety standards	49 CFR 215	None
Special notice, emergency orders	49 CFR 216	None
Operating rules—general	49 CFR 217	Gen. Order no. 0-8
Operating rules— specific (blueflag, etc.)	49 CFR 218	Gen. Order no. 0-8
Two-way radios	49 CFR 220	None
Rear-end marking devices	49 CFR 221	None
Accident reports	49 CFR 225	Gen. Order no. 0-
Hours of service	49 CFR 228	None
Locomotive design, performance and inspection standards	49 CFR 230	Gen. Order no. 0-1 to 0-14,0-16 to 0-19,0-21
Safety appliances	49 CFR 231	Gen. Order. no. 0-10
Power brakes and drawbars	49 CFR 232	Gen. Order no. 0-20 (air brake only)
Signals and related devices	49 CFR 233-236	Gen. Order no. E-12 and E-13
Occupational Safety and Health	29 CFR 1910	SOR 71-30,71-480 ,71-481,71-584, 71-605,71-616,72663, 72-13,72-23, 72-66,72-666,72-171, 72-288, 73-679, and 78-559
Mixed passenger/freight equipment — vestibule doors	None	Gen. Order no. 0-6
Testing employees—sight, hearing	None	Gen. Order no. 0-9
Loading open top cars	None	Gen. Order no. 0-15
Special equipment regulations (mailcars, snow plows, grain cars)	None	Gen. Order no. 0-22-0-24
Air pollution and control	None applicable exclusively to railroads	Gen. Order no. O-26
Fire extinguishers and emergency tools in passenger cars	None	Gen. Order no. O-27
Fire prevention from railroad causes	None	Gen Order no. 0-28, E-16
Grade crossings	None	Gen. Order no. E-3 and E-9
Railroad design (plans, profiles, etc.)	None	Gen. Order no. E-1 and E-2
Utilities on or near rail line	None	Gen. Order no. E-10 and E-12
Fencing	None	Gen. Order no. E-17

peal to the Supreme Court of Canada or the Governor-in-Council.

The Canadian railroads and the U.S. railroads have been subject to similar statutory safety requirements since the early *1900's.* The regulations of similar areas or categories of safety by the two countries contain comparable provisions. However, each country regulates categories not covered by the other.

The *1903* Railway Act established a broad range of requirements and restrictions on the formation, construction, operation, and safety of Canadian railroads. As in comparable U.S. laws, a number of the provisions contained in the 1903 Act are specific in content and are designed to address specific problems. A number of the regulations resulting from the statutes in both Canada and the United States are similar. For example, the safety appliances, hazardous materials, and locomotive inspection regulations are similar. However, Canada has adopted a Uniform Code of Operating Rules, a subject left to the U.S. railroads for the most part, although the Association of American Railroads has a suggested code. By contrast, the United States has track and freight car standards, a subject for which there are no Government standards in Canada. Canada does not consider hours of service as a safety regulatory matter. Table 11 indicates the rail safety regulations adopted by each country.

As in the United States, responsibility in Canada for the safety and health of railroad employees is divided between transportation and labor agencies.

In Canada, the safety of some railway employees, primarily those in operating positions, is within the jurisdiction of CTC; other railway employees are within the jurisdiction of Labour Canada. In the United States, the safety of railroad operations employees is under FRA, while the occupational safety and health of employees rests with the Occupational Safety and Health Administration (OSHA) within the Department of Labor. However, unlike CTC in Canada, FRA collects all accident and casualty statistics for both OSHA and FRA.

Labour Canada has developed regulations to cover employees working in industries under their jurisdiction, including those working for the railroads. Labour Canada has not promulgated occupational safety and health regulations for hazards specific only to railroads. CTC, to date, has not promulgated occupational safety and health regulations covering employees under its jurisdiction. In the United States, there is no gap in the statutory authority to deal with occupational safety and health hazards since OSHA can exercise it to the extent that FRA does not. However, FRA has not exercised any substantive jurisdiction in this area for a variety of reasons, and has basically left the matter to OSHA for functions not involving rail operations. To date, OSHA has not issued any regulations exclusively applicable to railroads.

Canadian compensation laws are established by the provinces, rather than by the central Government. Compensation for work-related injuries is no-fault in concept. These plans are viewed by both management and labor as providing fair treatment and compensation. In contrast, in the United States, compensation for work-related railroad disabilities or injuries is under the authority of the Federal Employers' Liability Act (FELA). The employee must sue the railroad and prove negligence in order to receive disability compensation. These compensation suits are handled in the Federal court system. Results from these suits may differ according to the court in which the case is tried.

There are 10 separate compensation and rehabilitation plans in Canada—one for each province. In general these plans provide full medical treatment, and disability benefits for unlimited time periods. * Rehabilitation boards at the provincial level make determinations regarding needed medical treatment and rehabilitation programs. The railroads pay into no-fault insurance funds maintained by the provinces, or

*For example, one plan provides for a maximum disability compensation at $20,000 annually. Widow\ may receive $250 per month until cleat hor remarriage and $54 per dependent up to age 18.

pay the employees directly according to the provincial plans.

In the United States, compensation for disability or injury incurred by railroad employees in the line of work is under Federal jurisdiction by the authority of FELA. In order to receive disability compensation, the U.S. rail employee must sue the railroad and prove railroad negligence. Thus, the U.S. system is a legal one that adjudicates responsibility for the injury. FELA proceedings are handled in the Federal court system. Results from lawsuits may differ according to the court in which the case is tried, or according to the railroad's history of case settlements.

The Canadian system, unlike that in the United States, does not attempt to adjudicate responsibility for the injury. Decisions on whether and how much disability compensation should be awarded are made without involvement in the legal system or in an adversary environment. Injured employees are assured of compensation and rehabilitation payments. Canadian injury compensation and rehabilitation programs are reported as acceptable to both labor and management and are not an area of dispute in Canada. However, in the United States, FELA has long been a divisive force between management and labor.

U.S.-CANADIAN GOVERNMENT, INDUSTRY, AND LABOR APPROACHES TO SAFETY

In both countries, Government concern for safety was heightened in the early *1970's* by a series of accidents and by increases in dangerous commodities.

In the United States, the Government's response to the increases in accidents was a series of hearings and the enactment of the Railroad Safety Act of *1970* and the Hazardous Materials Transportation Act. The *1970* Safety Act gave the Department of Transportation regulatory and administrative powers to deal with safety and hazardous materials transportation problems. Prior to the enactment of the Railroad Safety Act of 1970, track-caused train accidents were increasing. After the passage of the Safety Act, a series of regulations have been promulgated by FRA and new inspection programs to ensure compliance with those regulations have been introduced. The primary regulations dealing with substantive, rather than procedural, safety concerns that have resulted from the 1970 Safety Act and from the Hazardous Materials Transportation Act include: track standards, equipment standards, and standards for component designs and performance of tank cars.

The Canadian rail safety inquiry, begun in the early *1970's,* **was** a Government effort that investigated several major accidents and was later expanded to investigate the effectiveness of Government and industry rail safety policies and programs. The inquiry included testimony of the railroads and labor regarding safety issues and problems. The inquiry lasted over 3 years. It was followed by an in-depth analysis of safety problems and Government programs. The resulting reports were intended to establish and quantify the need, if there was a need, for increased Government safety activity and programs to reduce accidents and injuries.

One of the results of the Canadian inquiry was that the railroads increased their own safety efforts. They expanded their data collection and analysis procedures for safety, ir creased communication with employees by utilizing safety committees more effectively, established rehabilitation programs, and began to explore track-related problems in greater detail. Today accident and casualty data are used by the railroads to establish safety targets, to identify areas in which safety problems exist, and to examine and apply possible corrective actions to such problems.

Both U.S. and Canadian Governments use inspections as a part of their railroad safety programs. However, the two Governments

differ somewhat in their approaches to inspection and allocation of inspection resources.

The Canadian RTC combines safety inspections with other routine responsibilities of its field personnel. Canadian inspection practices are based on the premise that safety is an integral part of efficient rail operation and should be viewed as such. Responsibilities of the Rail Services Branch of RTC are divided among safety inspection programs, branchlike rehabilitation, evaluation of passenger services, and station retirements. RTC officials estimate that about 35 percent of the professional staff time spent in the field involves safety matters. The Rail Services Headquarters Branch has about *29* staff members to carry out its responsibilities, Estimates of the extent to which safety is a part of headquarters work of the Rail Services Branch were not available. Allocation of inspection resources to a particular type of inspection results primarily from priorities established by RTC officials and the requirements of statistically based sampling. The inspection programs conducted by RTC include: track, car, locomotive, operations, dangerous commodities, fire prevention, stationary mechanical equipment, and structures and signals including grade crossings. Highest Government priority for inspections are on: developing an improved accident investigation procedure, grade-crossing inspections, and safety inspections administered by the Rail Services Branch, particularly equipment inspection. RTC with the assistance of the Bureau of Management Consulting developed an approach to equipment inspections that utilizes risk factor analysis and inspection sampling as the primary method for equipment inspections. This system was recently employed. Its effectiveness has not yet been determined. RTC views the Government's role as one of monitoring railroad activities. As in the United States, Canadian Government inspection programs do not appear to have measures by which the effectiveness of inspection programs can be ascertained.

In the United States, a significant portion of the FRA safety resources is dedicated solely to safety inspections. FRA conducts inspections in five major areas: track, operating practices, motive power and equipment, signals and train control, and hazardous materials. The basis FRA has used in establishing and assigning levels of effort to the five inspection programs is not apparent. As of 1977, inspection resource allocation did not coincide with the accident patterns in the United States. FRA has recently reviewed existing regulations and is currently proposing changes. The extent to which these regulatory changes will alter the inspection process in the United States is not yet known. In the United States, the Government has a shared Federal/State inspection program. This contrasts with Canada where interprovincial railroads are under the sole jurisdiction of the central Government.

In both countries, transportation of dangerous commodities by rail has become an increased concern for the Governments and the railroads. The approaches taken in each country to dangerous commodity transportation is largely the same, with the exception of the use of emergency information forms in Canada.

In the early *1970's,* dangerous commodity shipments became a heightened concern in the United States and Canada. In both countries, the increased concern was prompted by several major accidents and increases in hazardous materials shipments. Risks brought about by dangerous commodity transportation in Canada have been addressed by: a) adoption of U.S. tank car standards, b) development of a Hazardous Information Emergency Response (HIER) form that accompanies each shipment of dangerous commodities, and c) voluntary industry actions. These same types of programs have been undertaken in the United States with the single exception of the use of the HIER forms. In addition, both countries have almost identical hazardous materials regulations. The Canadians adopted the recent U.S. tank car standards requiring head shields and shelf couplers although the timetable for implementing the standards will be slower and retrofitting will be voluntary in Canada.

Canada requires the HIER forms to accompany all tank car shipments carrying dangerous commodities from origin to destination. The

form contains the name of the commodity, the danger classification of the commodity (i.e., explosive, gas, etc.), potential hazards, and immediate action information. The purpose of the form is to aid people in response procedures in case of an accident. Use of the form was made mandatory by RTC.

In the United States, there is no specific equivalent to the Canadian HIER form, although some information is required on the waybill. Some U.S. railroads have more extensive response procedures for dangerous commodities than others. A committee of the Association of American Railroads is currently studying the Canadian system, although no conclusions have been reached regarding its adoption. The major objection voiced by some U.S. railroads to the form is that it increases the paperwork carried for freight shipments at a time when the railroads themselves are trying to move to more automated systems.

Grade-crossing safety is the most serious rail-related safety problem in both Canada and the United States. While primary authority for grade-crossing improvements rests with the central Governments in both countries, the Canadian Government appears to have broader powers and more detailed controls over grade crossings than in the United States. In contrast, in the United States, major funding authority for grade crossings, though vested at the Federal level, is split administratively among a number of different entities and basically administered by the States.

The Railway Transport Committee within CTC has jurisdiction for grade-crossing safety improvement programs. In contrast, the U.S. Federal Highway Administration has primary jurisdiction at the Federal level for grade-crossing improvement programs.

Today, Canada has detailed information on over 34,000 public crossing sites. The Canadian Government attempts to match the grade crossing with the most appropriate and cost-effective warning device. Onsite investigations of the crossing are one method used by RTC to determine the relative risks of the site. Further, RTC is developing a model they hope to use to set priorities among crossing sites requested by the road authorities (Federal, provincial, and municipal) to receive funding. The Canadian Government has broader powers and exercises more detailed controls than the United States over grade crossings. Canada and the United States both have problems with grade-crossing program administration.

There are fewer public crossing sites in Canada than in the United States. Canada has **34,000** and the United States had 219,000 public sites. Predominant jurisdiction for funding of crossing projects falls under Federal Government jurisdiction in both countries. The U.S. Federal Highway Administration has major funding authority for grade-crowing improvement. It allocates funds to the States on a formula basis. The States subsequently distribute crossing projects funds among localities. As a result, in the United States, priority determination, and the matching of crossing sites with the appropriate warning device, occurs at the local level, which does not, in turn, control the formula allocations of funds. Hence the complexity of the U.S. system and the divided jurisdictions have so far worked against a more systematic approach for addressing the most serious safety problems.

While in Canada the RTC provides funds for grade-crossing protection, it usually relies on the road authority or local municipalities to apply for funding. When this system does not work, RTC can order protection to be provided. A growing problem in Canada is that maintenance costs for crossing protection are escalating so rapidly that road authorities who are responsible for maintenance are becoming less inclined to pursue protection funding.

Canadian railroads maintain a philosophy that ties safety closely to economic and operational efficiency. Canadian railroads place a high priority on maintaining and upgrading track.

Both Canadian railroads consider safety an integral part of all their operations. This consideration is also voiced by the I-J. S. railroads. The increased concern for safety among the Ca-



Photo CP Rail

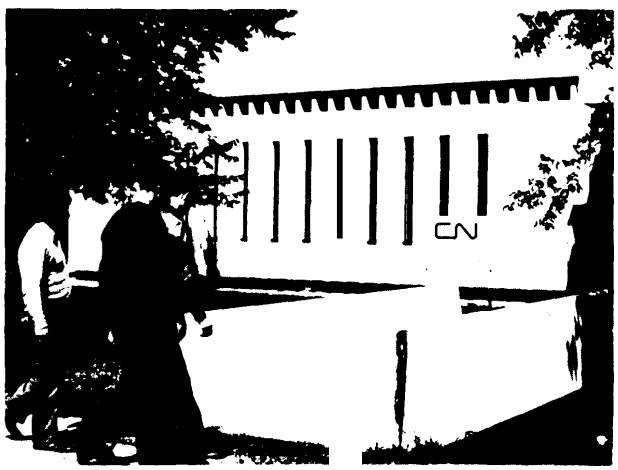

Photo CN Rail

School Days— Both Canadian National and Canadian Pacific conduct regular training and refresher courses for employees utilizing the latest teaching techniques. CN operates their training center at Gimli, Manitoba; CP operates their training centers across their rail system.

nadian railroads dates to about 1974 after the Government safety inquiry. Since that time both CP and CN have increased existing safety activities and initiated a number of new programs. Among these activities are: the emphasis on supervisor accountability for safety, yearly safety targets, and increased and improved training. Progress is discussed at the board of directors meeting for both railroads. In addition, the railroads serve on the RTC Railway Safety Advisory Committee. The reasons for the railroads' safety philosophy include: the desire to protect human and physical resources, the economic costs of accidents and casualties, and the wish to forestall any greater Government involvement in their activities.

The Canadian railroads consider the conditions of the track, particularly the mainline, of paramount importance to their efficient operation. The Canadian railroads recognized the implications of increased maintenance costs resulting from increased weight of freight equipment. CN conducted research to determine rail replacement costs and maintenance costs resulting from increased axle loadings. The results of that research were a significant factor in the decision to use concrete ties, heavier rail, and deeper ballast. Similarly, the CP management increased capital spending for track upgrading and replacement when it recognized the effects

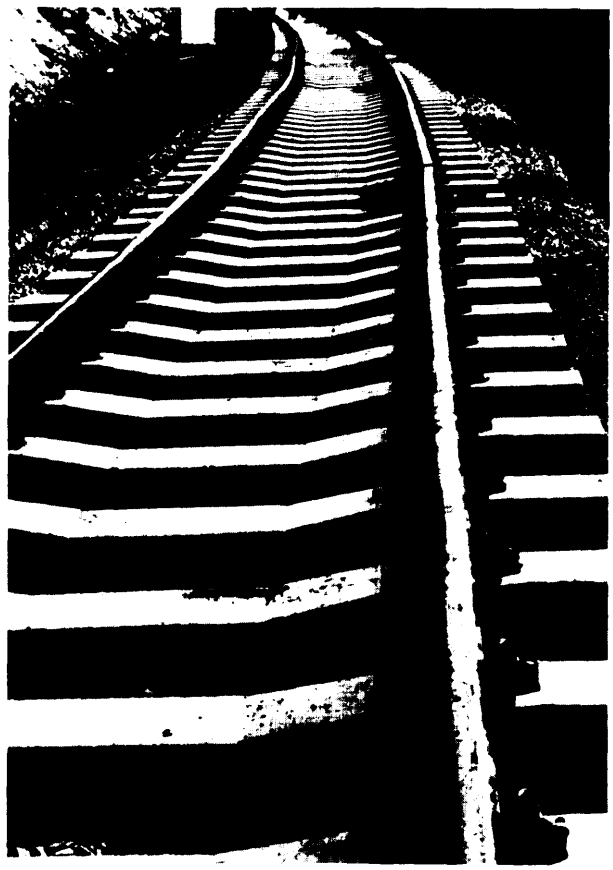

Photo CN Rail

CN utilizes concrete ties as shown in this photo based on research on increased axle loadings.

of 100-ton freight cars and the six-axle diesel electric locomotive on the roadbed. Canadian management indicates that track maintenance is a high priority in terms of allocations of resources. However, sufficient data was not available to adequately determine the extent to which this priority is supported by financial commitments. While rail officials in Canada indicate that track should be maintained to the highest level, the line profitability, traffic density, and other factors are among the considerations given to assigning limited financial resources to track maintenance and replacement programs. In both the United States and Canada, track standards and safety, line profitability, deferred maintenance, and common carrier obligations of the railroads are issues of concern and discussion among the railroads, labor, and Government.

In the United States, track deterioration, resulting from deferred maintenance and heavier axle loading on freight equipment, has caused increased Government concern. The extent to which track conditions cause significant safety problems among U.S. railroads appears to be related to the financial health of a given carrier, management philosophy toward track maintenance, track lifecycle, and available capital.

In both countries, rail labor representatives participate in the safety regulatory process.

As a matter of policy, Labour Canada consults widely with labor representatives as it formulates workplace safety regulations. CTC, after the safety inquiry of 1971, included labor representatives in the tripartite forum of the Railway Safety Advisory Committee. Although CTC has not promulgated safety regulations for working conditions of the railroad employees under its jurisdiction, it formally consults with labor representatives on any matter that relates to safety regulation.

In the United States, railroad labor participates in a number of executive and legislative branch hearings and deliberation. Though no formal safety advisory committee exists in the U.S. structure, safety advisory committees are appointed for a number of functions undertaken by executive branch agencies. Generally both labor and management participate in the functions. Cooperation between labor, management, and Government entities in the United States for improving safety is increasing. However, additional cooperation is needed if further inroads into safety problems are to be achieved.

Chapter II

CANADIAN RAILROAD SYSTEM

Chapter II

CANADIAN RAILROAD SYSTEM

A common assumption about the railroad systems in the United States and Canada is that they are directly comparable. Similarities in operational purpose, close geographic proximity, and commonality of technological systems imply that comparability. This chapter explores the validity of this assumption. It establishes a framework for the Canadian railroad system from which specific Canadian safety policies and programs are examined for their application to the United States.

The following sections describe: Canadian resources and demography; an outline history of the railroad system; and specific physical, operational, and economic characteristics of the system. The final section of this chapter summarizes the major relevant similarities and differences between the Canadian and U.S. rail systems.

BACKGROUND

Canada's population, geography, climate, and resources have played a significant role in the evolution of its transportation system. These characteristics, Government policies, and other transportation technologies continue to heavily influence the rail system.

Canada's land mass covers approximately **3,851,809** square miles.[1] Its varied terrain includes vast prairies, agricultural and forest lands, the rugged areas of the Laurentian Shield, the mountainous regions of the West, and the subarctic and arctic regions in the North. Its winter climate is more severe than many regions of the United States.

Canada's population is approximately *23* million, of which the majority *(58* percent) live between the U.S. border and a 650-mile east-west line from Sault Ste. Marie to Quebec City. Only one-third of Canada's land mass is developed. One-third of Canada's population lives in its eight largest cities, with Montreal and Toronto being the two largest metropolitan areas.[2]

Canada's railroads have been linked historically with the population settlement patterns and development of natural resources. The following briefly describes the history of the Canadian rail system.

[1] *Canada Yearbook: 1976-1977 Special Edition* (Statistics Canada, Ministry of Industry, Trade, and Commerce, December 1977), p. 3.

[2] Ibid. p. 4.

HISTORY

Canada's railroad system began in the 1830's when the lines established served primarily as portage roads. Substantial railroad construction did not begin until the 1850's with the development of the Grand Trunk.

Construction of the railroads connecting British Columbia and the Maritime Provinces to Montreal, was essential to the political union of Canada in the British North America Act of **1867.** The Intercolonial Railway was completed

in **1876** and the first transcontinental railway, the Canadian Pacific (CP), was completed in **1885.**[3]

The first transcontinental railroad, although perceived as a public enterprise, was initiated and built by private enterprise with substantial Government assistance. Its development was significant to the confederation, in part because of the potential expansionist policies of the United States at the time.' An agreement between the Canadian Government with CP for the construction and operation of the system included: a cash subsidy of *$25* million, a land grant of 25 million acres, and valuable tax and customs concessions.[5]

The railroads were perceived as tools of Canada's development. Early Government initiatives as well as the British North America Act established the central Government's jurisdiction, rather than provincial jurisdiction, for rail and water transportation services. In addition to being significant to the political union of Canada, the railroads were essential to its economic development. CP was a primary instrument of Government policy in settling the West and developing Canada's agricultural resources. Similarly the railroads were critical to the development of ports in the Maritime Provinces.

In *1897* the Crow's Nest Pass Agreement (sec. **271,** Railway Act) was signed. It established rates for shipment of grain moved by CP to certain ports. This rate stipulation was later expanded and applied to other rail operations including those of Canadian National. The Crow's Nest Pass requirements remain in effect today. Grain shipment rates are the only area in which Canadian rail rates have not been deregulated.

In addition to the transcontinental CP, two other lines connecting the western with eastern mainlines were established by 1915, the Canadian Northern and the Grand Trunk Pacific. The addition of these two lines resulted in significant financial overinvestment in terms of physical plant necessary for a country of *8* million people.[b] Too much line had been built for the amount of rail traffic available at the time.

As a result of the overinvestment in rail plant, the railroads, with the exception of CP, faced serious problems. In *1917,* the Canadian Government appointed a royal commission to investigate the problems. By **1923,** a number of railroads were consolidated to form the Canadian National (CN) Railways, a crown corporation with a Government-appointed board. The consolidation into a Government entity represented the integration of three private bankrupt railroads, four Government-owned systems, or *149* separate companies with **251** different security issues.[7]

At the outset, CN confronted significant, if not overwhelming, problems. Included among its problems were:

- an inherited debt of *$1,3 [1,448,713* (in *1922* its operating expenses were **$231.2** million and its gross revenues were **$234.1** million);
- an unnecessary duplication of line;
- deferred maintenance;
- nonstandard gauge track in areas of the system;
- fierce competition with CP which had initially offered to run the system; and
- political interference.[8]

Subsequent to the initial incorporation of CN, debts amounting to over $3 billion were backed or removed by the Canadian Government in *1936-37, 1951-52,* and in *1977.* In addition a balance of other ongoing subsidies have been met by the Government at various intervals. The 1977 Capital Revision Act removed substantial accumulated debts (approximately $2 billion) of CN. This Act placed CN in a

'"An Interim Report on Freight Transportation in Canada" (Transport Canada, June 1975), p. 1.

[4]W. K. Lamb, *History of the Canadian Pacific Railway (New* York, N. Y.: McMillian Publishing Co., Inc., 1977), pp. 73-74.

'Ibid., pp. 73-74.

[6]"An Interim Report on Freight Transportat on in Canada," op. cit., p. 2.

'Robert F. Leggett, *Railroads of Canada (New* York, N. Y.: Drake Publishers, 1973), p. 134.

[8]Leggett, op. cit., pp. 134-135; and G. R. Stevens, *History of the Canadian National Railway (New* York, N. Y.: McMillian Publishing Co., Inc., 1973), pp. 313-3]5.

significantly more favorable financial position. [9] In **1978, CN** achieved *$168* million in profits.

Between its genesis and the present, CN as a crown corporation diversified its operations. It controls several U.S. rail lines (Central Vermont; Grand Trunk Western; Duluth, Winnepeg, and Pacific), trucking lines, hotels, and other enterprises. Its air carrier operation became a separate crown corporation in the 1960's.

The Canadian Pacific Railroad, as a result of its vast landholdings and financial management, expanded and evolved into a highly diversified corporation known today as Canadian Pacific Limited. In the mid-1960's, the Canadian Pacific Railroad changed its name to Canadian Pacific Limited because the previous name did not reflect its many interests. Today CP Rail is one enterprise within CP Limited. As a conglomerate its current assets are approximately $5 billion.[10] Its enterprises include rail operations, air carriers, trucking, shipping, hotels, mining, real estate, forestry, telecommunications, and other investment holdings. CP Rail operations represented *22* percent of CP Limited's revenues in 1977.11

The transportation services of both CN and CP are not restricted to rail mode. They are multimodal transportation companies. The fact that rail companies operate trucking enterprises, however, has not prevented some erosion of rail's share of freight. Further, passenger rail service has eroded with competition provided by automobile technologies. Multimodal ownership does appear to influence the management structure and operation by providing the companies increased system flexibility to respond to new or available markets. The extent to which the companies use their flexibility is unknown. Current managements claim to maintain a competitive philosophy between the modes.

[9] *Canada Gazette*, vol. 3, no. **6,** pt. III, 26-27, Elizabeth II, ch. 34, Canadian National Railways Capital Revision Act.

[10] Canadian pacific publication supplied by E. Bradley, Director of Rules, Accidents, and Prevention, Canadian Pacific Railroad.

[11] *Annual Report, 1977* (Canadian Pacific Limited).

CANADIAN RAIL SYSTEM PHYSICAL PLANT AND EQUIPMENT

The Canadian National and the Canadian Pacific Railroads comprise the majority of the Canadian rail system. In 1975, these railroads controlled approximately 94 percent of the 43,000 miles of mainline track.[12] As indicated in table 12, most mainline track was in place by the late-1920's.[13] In **1976,** CP operated about 16,400 miles[14] of mainline and branchlike track and accounted for *38* percent of the total Canadian trackage. CN has approximately *25,000* miles of mainline and branchlike track and represents 56 percent of Canada's system.

Several other Canadian railroads operate as regional systems. These companies control the remaining 6 percent of Canada's rail trackage. Included among these companies are: the British Columbia Railway, which operates from North

Table 12.—Railway Trackage*

Year	Total miles in operation*
1900	17,657
1910	24,731
1920	38,805
1925	40,350
1930	42,047
1935	42,916
1940	42,565
1945	42,352
1950	43,979
1955	44,444
1960	43,029
1965	45,157
1970	44,983
1971	44,153
1972	44,025
1973	44,232
1974	44,260
1975	43,941

*Mainline track–defined as single track extending the entire distance between terminals on which the length of road is based

NOTE From 1971101975 Canada averaged 16000 miles of track of her than mainline

SOURCE *Canada Yearbook, 1976-77*

[12] *Canada Yearbook. 1976-77,* op. cit., p. 760.

[13] Ibid. p. 760.

[14] Data furnished by Canadian Pacific Rail, Sept. 29, 1978.



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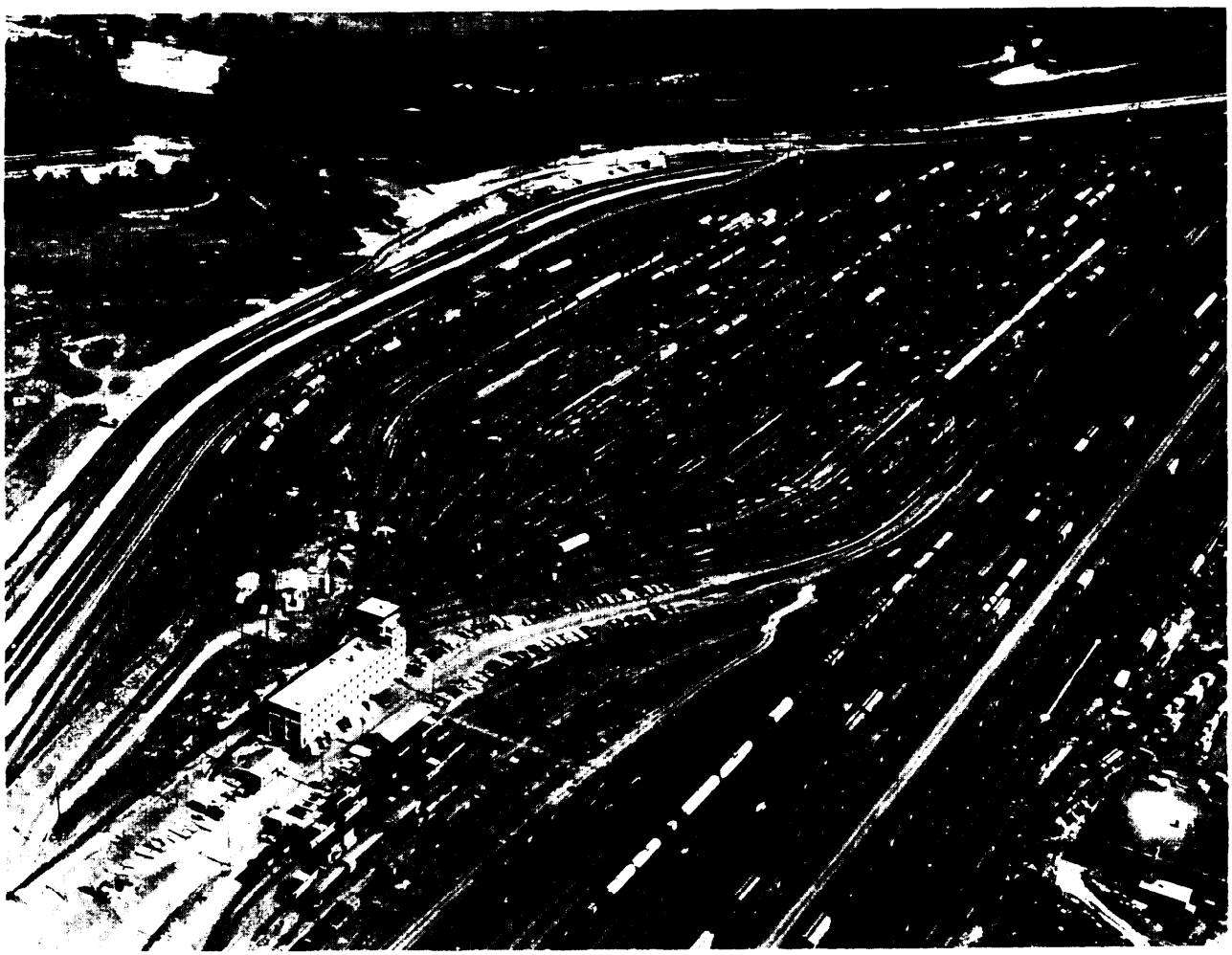


Photo CP Rail

Sorting —CP Rail's Alyth Yard in Calgary, Alta., is one of the most modern in Canada. Located on the railway's mainline, the yard contains sorting and hump yards, maintenance facilities for cars and locomotives, and repair facilities.

Table 13.—Locomotive Equipment

Year	Steam	Diesel-electric	Electric	Total
1960	403	3,308	41	3,752
1970		3,399	18	3,417
1971		3,449	14	3,463
972	—	3,598	14	3,612
1973	—	3748	14	3,762
1974		3870	16	3,884
1975		3963	16	3.877

SOURCE Canada Yearbooks.

ownership. The number of Canadian rail-owned freight equipment remained a relatively constant size between 1960 and 1975. As the table also indicates, the number of tank cars increased from 5,000 in 1960 to 14,700 in 1975, an increase of 194 percent. This increase is one clear indicator of an increase in the amount of hazardous commodities shipped by rail in Canada, although not all tank cars are used to ship dangerous commodities.

Canadian rail officials indicated that the Canadian fleet evolved to heavier axle loadings on freight equipment (100-ton cars) by the late-1960's.-'" Today the average freight car capacity in Canada is 64.6 tons.

"Interviews with Canadian National and Canadian Pacific Railroads Oct 10-11 1978

In addition to the evolution of the freight equipment fleet, the decline in number of passenger service cars indicated in table 14, demonstrates the declining rail passenger market.

The average employment for Canadian railroads in *1977* was over *107,000.* As in the United States, employment has dropped over the last two decades .17

'Letter, Canadian Railway Labour Association.

Table 14.—Freight Rolling Stock

Type	1960	1970	1971	1972	1973	1974	1975
Auto	7,249	2,178	2,280	2,607	2,579	2,617	2,776
Ballast	3,128	2,639	2,408	2,383	2,363	2,296	2,199
Box	111,217	101,746	99,904	97,162	95,239	95.538	92,669
Flat	12,645	18,043	19,738	20,414	22,010	24,898	25,733
Gondola	20,310	20,975	20,354	20,450	20,464	20,414	21,370
Hopper	15,578	24,496	25,175	25,539	26,464	27,398	29,287
Ore	5,930	6,735	6,819	7,241	7,371	7,151	7,731
Refrigerator	10,076	6,673	5,403	5,292	4,955	4,772	5,016
Stock	4,917	2,827	2,687	2,583	2,503	2,463	2,359
Tank	472	487	468	474	484	494	379
Other	31	1,938	2,080	2,320	2,320	2,851	3,689
Total	191,553	188,737	187,316	186,465	186,752	190,892	193,208
Tank	4,999	14,957	14,207	14,296	14,324	14,426	14,699
Other	32	1,254	1,353	3,778	3,384	4,504	7,301
Total	5,031	16,211	15,560	18,074	17,705	18,930	22,000
Passenger cars	5,119	2,801	2,516	2,383	2,175	2,056	1,936

SOURCE *Canada Yearbooks, /970-75*

RAILROAD FINANCIAL PICTURE

Agricultural, forestry, and mineral resources are among the most important natural resources in Canada and represent a significant part of rail freight tonnage. Historically rail, as a shipper of bulk commodities, has been important to the political and economic well-being of Canada. While rail was once the only freight transportation mode, trucking became a dominant transportation growth area and carrier of nonbulk commodities. However, in ton miles in Canada, rail has remained the dominant carrier with 55 percent of all intercity freight. Table 15 shows the modal split of the freight transport market between **1944** and **1968.** Table 16 shows the split among commodities carried in **1969** and 1974. As indicated by the first table, though still dominant, rail's share of the freight market declined from 1944 to 1968 by 20 percent. Truck and water transportation increased by 10 percent during that time period. As shown by the types of commodities in the second table, a large percentage of current rail freight is bulk commodities.[18]

Of 397.4 million tons of freight carried by rail and truck in **1972,** rail accounted for *57* percent of the tons shipped. However, of the *$4.26* billion in gross revenues earned by the two modes, truck claimed *52* percent of the revenues or $2.23 billion. " This combination of factors indicates the growth of trucking (competition for higher valued nonbulk freight in Canada. Rail depends heavily on bulk raw materials transport. However, it faces great competition from trucking for the transport of manufactured goods. [20] As Canada increases production of

[18]T.D. Heaver and J. C. Nelson, *Railway Pricing Under Commercial Freedom: The Canadian Experience* University of British Columbia, 1977), p. 24.

[19]Ibid., p. 23.

[20]ibid,, p.23.

Table 15.—Intercity Freight by Mode of Transportation in Canada (excluding pipelines), 1944-68

(billions of ton miles and percent of total by each mode)

Year	Rail		Road		Water	
	"on-miles	Percent	[on-males	Percent	Ton-miles	Percent
1944	'65 93-'	74	267	3	2031	23
1948	5908	68	519	5	2320	27
1952	6843	63	890	8	3087	29
1956	7883	61	1061	8	3941	31
1960	6545	56	1384	12	3687	32
1961	6583	54	1610	13	3938	33
1962	6794	53	1658	13	4295	34
1963	7580	53	1670	12	5012	35
1964	8503	52	1747	11	5919	37
1965	8719	53	1820	11	5782	36
1966	9510	53	1895	11	6441	36
1967	9410	55	1954	11	5715	34
1968	9686	55	21 13	12	5811	33

SOURCE Calculated from the Dominion Bureau of Statistics *Special Release* April 1969

Table 16.—Commodities Accounting for More Than 2 Percent of Rail Ton-Miles in 1969 and 1974 in Canada

Commodity	Rank in 1974	1974 ton-miles		1969 ton-miles	
		Millions	Percent	Millions	Percent
Wheat	1	1245	136	926	144
Bituminous coal	2	978	107	425	66
Potash	3	572	63	361	56
Sulfur	4	519	5.7	14.8	23
Barley	5	344	38	267	4.2
TOFC	6	33.3	36	247	38
Lumber	7	247	27	19.2	30
Freight forwarder and shipper associations	8	21	2 23	123	19
COFC	9	186	20	02	—
Total of commodities above		4636	507	2691	41 8
Total of all rail traffic		9155	100	6436	100

SOURCE Canadian Transport Commission Waybill *Andy s/s* 1974 and 1969

manufactured goods and nonbulk freight, historical trends indicate that truck competition with rail will also increase. Trucking regulation has historically been the jurisdiction of the provinces. Although the 1967 National Transportation Act gave some power to the central Government, the power has never been implemented so that jurisdiction is still exercised at the provincial level.

The declining number of passenger cars (cited in table 14) in the Canadian rail equipment fleet indicates a decline in rail passenger traffic. As in the United States, the rapid growth of the automobile and air passenger services were two dominant factors leading to the decline of rail passenger service. In October 1978, Transport Canada officially assumed full control and management of rail passenger services in Canada. A crown corporation called VIA Rail Canada Limited, purportedly similar to AMTRAK in the United States, has been established to provide rail passenger services. VIA Rail is responsible for the operation of all long-distance and intercity passenger services in Canada. It owns all passenger equipment and is completely responsible for the management and marketing of rail passenger services. VIA Rail trains run on CN and CP track on a leased basis.

From the annual reports and other available financial data, CP has shown steady growth in net income for the .5-year period 1973-77, with the exception of 1975, a recession year. Table *17* displays CP financial data. In 1975, CP Rail had a rate of return on net investment of 4.9 percent, compared to 6.3 percent in 1976 and 6.7 percent in 1977. Of total CP Rail revenues for 1977, Government subsidies for unprofitable branchlines and passenger services represented *8* percent.[2]1

In *1977, 15.7* percent or *$193* million of CP Rail's operating expenses was spent on track and facilities maintenance compared to *$108.6* million or 14.4 percent for 1973 as shown in table *18.* For CP, expenditures for track maintenance adjusted for inflation* increased approximately 25 percent over the 1973-77 time period. CP spent approximately $259 million on equipment maintenance in 1977 compared to *$158.2* in 1973, an increase of 15 percent in operating expenses. When viewed in constant dollars, total maintenance expenditures increased by 19 percent between 1973 and 1977 for CP. The ratio of track maintenance expenditures v. equipment maintenance expenditures remained constant over the time period.

Capital expenditures of CP for- roadway increased steadily from 1973 to 1977, with the exception of 1975. Table 19 shows the CP capital expenditures for the 1973-77 period. By 1977,

[2] *Annual Report* (Canadian Pacific Rail publications Sept 29, 1978)

*Canadian Consumer Price Index

Table 17.—Canadian Pacific Rail Financial Fact Sheet

Year	CPR net income (in millions)	Total CP limited net income	Percent rail	Year	Rate of return CPR
1973	"35 2	125	28	1 9 7 5 ,	4.9
1974	446	194	23	1 9 7 6 ,	6 3
1 9 7 5	31 7	175	18	1 9 7 7 .	6 7
1976	51 1	190	27		
1 9 7 7	548	247	22		

Year	CPR operating expenses including tax	CPR operating revenues		Revenue distribution 1975	1976	1977
1975	990,262	1,021,953	Freight	887,666	1,006,624	1,112,094
1976	1,111,849	1,162,946	Passenger. .,	21,497	21,708	21,541
1977	1,231,600	1,286,392	Other railway	26,188	29,862	35,878
			Coastal steamships	16,486	16,690	14,763
			Gov't. subsidy	70,116	88.062	102,111
				1,021,953	1.162,946	1,286,387

SOURCE Canadian Pacific annual reports.

Table 18.— Maintenance Expenditures for the Canadian Pacific Railroad, 1973.77 (dollars in thousands)

Year	Road	Percent of total operating expense	Equipment	Percent of total operating expense	Total	Percent of total operating expense
1 9 7 3	$108,600	14.4	$158,200	21.0	$266,800	354
1 9 7 4	130,100	141	188,500	20.5	318,600	34.6
(in 1973 constant $).	(117,300)		(170,000)		(287,300)	
1975	141.700	143	195,300	19.5	337,000	34.0
(in 1973 constant $)	(1 15,300)		(158,900)		(274,200)	
1976	167,600	15.3	216,800	19.5	386.400	348
(in 1973 constant' $).	(1 26,900)		(164.100)		(292,500)	
1 9 7 7		157	258,900	210	452,000	36.7
(in 1973 constant $) :	(135,300)		(181 ,400)		(316,700)	
Percent increase in 1973 constant $ from 1973-77	+ 24.6		+ 147		+ 18.7	

SOURCE Canadian Pacific Rail general publication

Table 19.–Capital Expenditures for the Canadian Pacific Railway, 1973-77 (dollars in thousands)

Year	Rolling stock	Percent of total	Diesel units	Percent of total	Road*	Percent of total	Maintenance shops	Percent of total	Total
1 9 7 3	$7,973	13	$23,476	39	$25,362	43	$2,682	5	$59$793
1 9 7 4	17,592	24	19,139	26	34,457	47	2,204	3	73,392
(1973 $)	(15,900)		(1 7,200)		(31,100)		( )		(66, 179)
1 9 7 5	30,441	32	24,509	26	36,184	39	2,556	3	93,690
(1973 $)	(24,700)		(19,900)		(29,400)		(2,100)		(76,233)
1 9 7 6	31,199	32	12.145	13	48,450	50	4,955	5	96,749
(1973 $)	(23,600)		(9,200)		(36,700)		(3,800)		(73,239)
1 9 7 7	13,130	13	16,134	16	61,406	61	10,771	10	101,441
(1973 $).	(9,200)		(11,300)		(43,000)		(7,500)		(71 ,087)
Percent Increase (+) or decrease (-) in 1973 $ from 1973 -77	+ 15		- 5 2		+ 70.0		+ 180		+ 18.9

*Includes rail ties ballast and road maintenance machines
SOURCE Canadian PacificRail generalpublication

CP's capital expenditures for track accounted for roughly *60* percent of its total capital expenditures budget. Rolling stock accounted for *30* percent (rolling stock and diesel units combined). According to CP officials, the shift in capital expenditures for track "was a conscious management decision in response to a perceived need. The introduction of the 100-ton nominal capacity freight car and the six-axle diesel electric locomotive led to the realization that the existing track structure was simply not strong enough."[22] The capital expenditures budget for CP from *1973* to **1977** increased by *18.9* percent when measured in constant dollars .23

In the aggregate, the U.S. railroads ratio of capital expenditures for track v. equipment for the 1973-77 period was roughly *30* percent for track and *70* percent for equipment as shown in table *20.* In comparing the U.S. aggregate with the CP data, the difference in ratios of capital expenditures for track v. equipment may have several possible explanations: a difference in the availability of capital for railroads in the two countries, differences in management philosophy, a difference in industry accounting mechanisms, and Government tax structures. According to rail officials "Canadian corporate income tax laws tend to lead to economic evaluation which, as a whole, strongly favors rebuild (maintenance) as opposed to renewal (capital) particular] y for equipment. "[24]

Table 20.—Capital Expenditures—U.S. Class I Carriers (dollars in thousands)

Year	Equipment	Percent of total	Road/ structures	Percent of total	Total
1973	$ 892,700	67	449.400	33	$1.342.100
1974	1,038,100	66	527.300	34	1.505.400
(1973 $)	(935.200		475,000)		(1.410.270)
1975	1,303300	73	486.400	27	1,789.700
(1973 $)	(1,076,200		401,700)		(1.477.870)
1976	1,174,800	68	549.900	32	1,734.700
(1973 $)	(917, 100		454.100)		(1,354.176)
1977	1,540300	67	750.900	33	2.291.200
(1973 $)	(1, 128,400		550.100)		(1,678.535)
Percent Increase in 1973 $ from 1973-77	+ 26		+ 22		+ 25 11

SOURCE: *Railroad Factbook, 1977.* Association of American Railroads. Consumer Price Index

[22] Review comments letter on preliminary draft of (IT A: *Railroad Safety AUS (Canadia)* 1 *Compan*●, on received from Char-1(+ Pike, Chief Mechanical Officer Canadian Pacific Rail, Jan. 23, 1979

"I)dt<) turn] shed by Canadian Pacific Rail, Sept 29 1978

[24] I etter from Charles Pike op cit 1.in 23 1979

COMPARISON BETWEEN U. S.= CANADIAN RAIL SYSTEMS

Several comparisons can be made between U.S. and Canadian railroad systems. These comparisons may influence safety directly or indirectly.

a. As a result of the severe Canadian winter, Canadian rails may require somewhat different maintenance procedures and practices than required by many U.S. carriers. It appears that Canadian climate does influence the number of accidents and may also adversely affect employees working in this environment.

b. Due to the considerably smaller Canadian population, and fewer miles of rail, there is statistically less exposure of the Canadian population to rail safety hazards (dangerous commodities, hazards, etc.). In size, the Canadian mainline rail trackage is *43,000* miles compared to *200,000* in the United States. Canada's population is *23* million whereas the U.S. population is *220* million people. The general ratio of population to rail trackage is 535 people to 1 mile of track in Canada, compared to 1,075 people to 1 mile of track in the United States. This comparison should be considered only in a general context as population density and traffic volume are two variables necessary to determine specific exposure rates.

c. Because of the smaller population base, and the fewer and smaller urban areas, Canada may be expected to have a less severe "trespassing" safety problem than that potentially associated with congested urban areas in the United States. One-third of Canada's population is located in eight large cities. Of these cities Montreal and

Toronto are the largest, with populations of 1,214,352 and 712,786 respectively as of 1971. It is assumed that a majority of trespasser fatalities occur near populated areas. No data or correlations have been made to determine this assumption.

d. The existence of only two major rail carriers in Canada may have facilitated Government and railroad formulation of operational and other policies. A specific example of this is the Uniform Code of Operating Rules, which has been a Government standard for all railroads in Canada since *1958.*

e. In *1976,* the United States had approximately 56 class I carriers that accounted for *99* percent of the revenue traffic and *96* percent of rail mileage. Of the 56 carriers, approximately 10 accounted for 80 percent of the operating revenues.[25] In contrast, Canada has only two major rail carriers, CN and CP. These railroads account for 94 percent of Canada's rail trackage and *90* percent of its revenue traffic.

f. The transcontinental nature of the Canadian system may allow its rail managements greater flexibility in freight traffic control and also in scheduled maintenance and repair of freight equipment.

g. Canada, like the United States, introduced diesel locomotives which subsequently allowed for increases in the size and capacity of freight cars. Increased productivity resulted, However, these factors appear to also increase track wear and may influence safety. Railroad maintenance procedures could offset the impact of increased track wear.

h. From limited data, CP appears to be increasing capital expenditures in track and facilities more significantly than increases in its expenditures for equipment. In contrast, while aggregate U.S. expenditures (in constant dollars) for track have increased 22 percent, the percentage ratio of total capital expenditures for track v. equipment is remaining the same. These ratio's appear to have occurred for several reasons: 1) the Canadian railroad may have available more cash for track investment; 2) in Canada, though the average capacity per freight car has not increased as much as in the United States, the effect of changes in technology were recognized and the pace of mainline plant replacement and upkeep was considered significant to the overall operation; 3) Canadian plant lifecycle was such that replacements may have been needed; and 4) tax structures and other financial incentives were different in Canada than in the United States.

i. As in the United States, the introduction of the automobile and increase in its usage brought greater exposure to rail-highway grade-crossing risks. Similarly the rise in auto and air transportation led to the decline in rail passenger traffic, a factor that naturally reduced the number of people exposed to rail-related hazards.

j. Both countries are experiencing increases in rail transportation of dangerous commodities. This results in an increased exposure level of both populations to the potential hazards of these commodities.

[25] "A Prospectus for Change in the Freight Railroad Industry," October 1978, A Preliminary Report, U.S. Department of Transportation.

Chapter III

GOVERNMENT INSTITUTIONS AND RAIL SAFETY

Chapter III

GOVERNMENT INSTITUTIONS AND RAIL SAFETY

GOVERNMENT INSTITUTIONS

Comparison between the U.S. and Canada's rail safety legal and regulatory provisions can only be made with some recognition of the major differences between the two countries' Government institutions. Primary among these differences is that Canada has a parliamentary system of government in which the legislative and executive functions overlap. The United States has complete separation of the executive and legislative branches. Canada's form of government has evolved over many years from the English constitutional monarchy and parliamentary system. Canada, however, has also drawn from the American system as a separate government model. While Canada does not have a formal "constitution," it does have a series of laws and customs that make up the Canadian "constitution," which is primarily embodied in the British North America Act of *1867.*

The executive branch of the Canadian Government has "formal" and "political" institutions. The former is composed of the Crown, the Governor General (formerly the Crown's representative in Canada), and the Governor General presiding over his advisors in the Privy Council. The latter is the Cabinet, being the heads of Canadian ministries or departments and certain other senior advisors to the Prime Minister. It is headed by the Prime Minister.

The Prime Minister, the political head of the Government, is the chosen leader of the majority political party and is always a member of the House of Commons, one of Canada's two legislative bodies. He selects each of his Cabinet members or ministers from members of the majority party in the House of Commons. Cabinet ministers retain their elected posts in the House of Commons. The functions of the Cabinet are to: 1) establish Government policy and influence Parliament to legislate that policy, 2) coordinate the various Government departments, and 3) supervise the administration of policy as legislated by the Parliament. It is this merging of legislative and executive functions in the Cabinet that is one of the major differences between Canadian and U.S. Government structures.

The ministries of Canada are much like the executive departments of the United States. They are headed by a Minister (in the United States, by a Secretary) and are staffed primarily by civil servants who are not part of the political system. In addition to the Canadian Federal agencies, there are "crown corporations" which are organizationally independent, though generally subject to the policy guidance of a ministry. Canada's first crown corporation was the Canadian National Railway.

As in the United States, the legislative branch of the Canadian Government is bicameral. The Senate is composed of *102* members on a regional basis appointed by the Governor General on the advice of the Prime Minister. The House of Commons is composed of *263* members divided among the provinces primarily on a population basis (with one each from the Yukon and Northwest Territories). The House is by far the more powerful of these two bodies because its members are elected and are considered to represent the body politic. The House, which originates all public bills, carries on its business in much the same manner as our Congress. The Senate's function is to review House-enacted legislation, handle private bills, and oversee the executive agencies. Once a bill passes both bodies, it is presented to the Governor General for royal assent in the Queen's name.

The judicial branch of the Canadian Government is quite similar to the U.S. court system. There are separate and multitiered provincial and Federal systems, each of which has trial and appellate divisions. However, the Province of Quebec differs from the other provinces in that

it follows Roman or civil law concepts rather than English common law. (The State of Louisiana in the United States is similar to Quebec in this regard.)

The Supreme Court of Canada has nine judges, selected on geographical and minority group representation principles. The court hears most cases in small panels (three members), rather than en bane, as in the United States. At the request of the Governor-in-Council, the Supreme Court is required to render advisory opinions on matters of law. This procedure is not followed in the United States.

Transportation Agencies

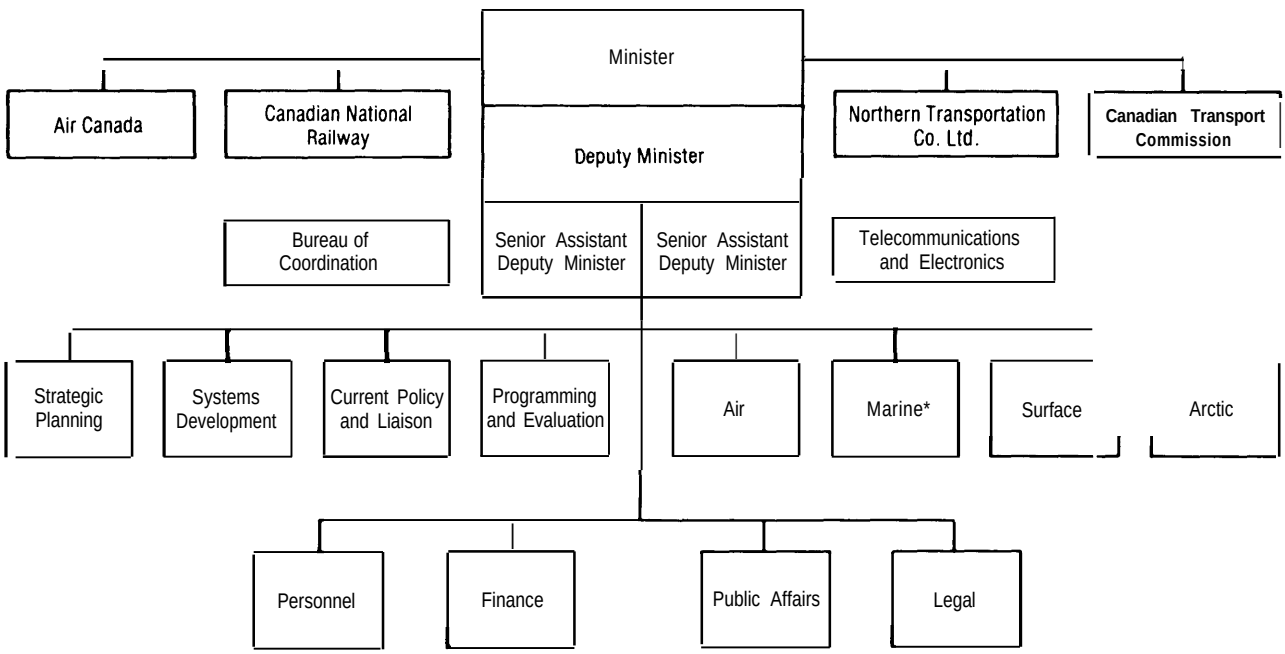
Canadian agencies responsible for transportation matters and railroads in particular are more" closely allied to each other than in the United States. The major Canadian agency is the Transportation Ministry, called the Department of Transport (also called Transport Canada), whose head is a member of the Cabinet. The Ministry is responsible for development of policy and Government programs 'or all modes of transportation. It provides the central link among all of the transport agencies. Figures 1 and 2 show the relationships of Government transport entities.

One of the agencies under the Transport Canada umbrella is the Canadian Transport Commission (CTC), established by the National Transportation Act of **1967.**[1] **It has** responsibility for economic regulation of all modes of transportation subject to Federal jurisdiction (i.e., excludes intraprovince transportation). Railroads are the only mode for which CTC regulates both economic and safety matters.

CTC has **17** Commissioners, including a president and two vice-presidents, who are appointed for 10-year terms. CTC is divided into seven committees, each with specific regulatory responsibilities. One of these committees, the

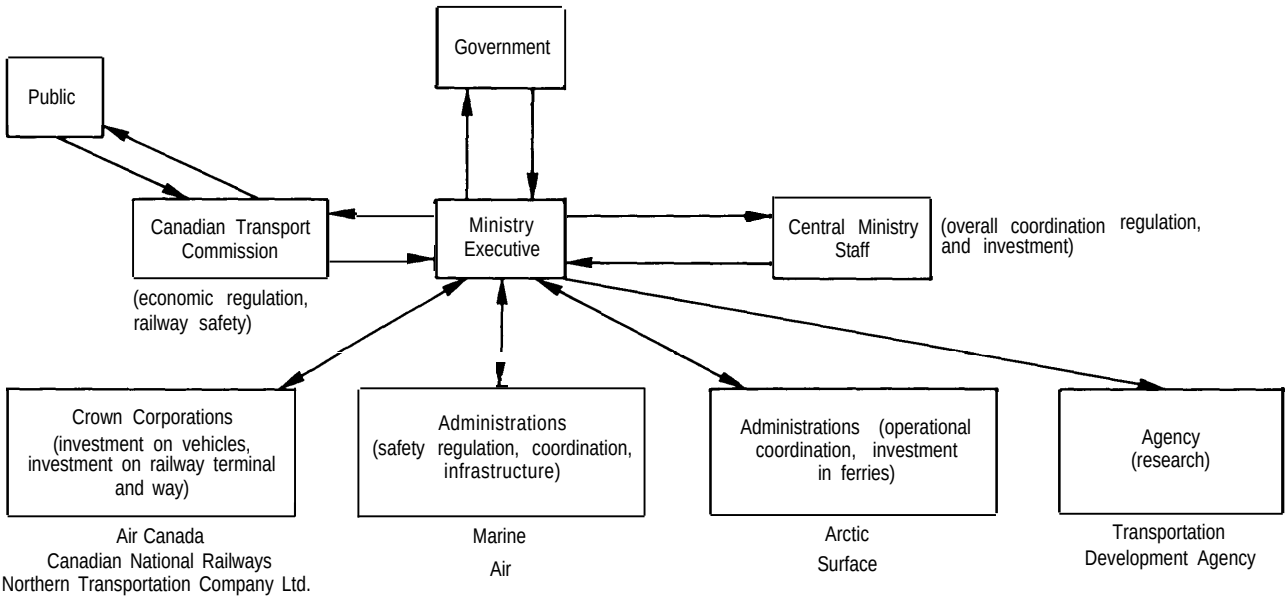
[1]Ch. N-17, R.S. C. , 1970.

Figure 1 .—Transport Canada



"Includes St Lawrence Seaway Authority. National Harbours Board, Atlantic Pilotage Authority, Great Lakes Pilotage Authority, and Pacific Pilotage Authority
SOURCE Transport Canada

Figure 2.— Relationship of Ministry "Family" to Transportation Regulation



SOURCE Transtport Canada

Railway Transport Committee (RTC) handles all railroad matters. The railroad responsibilities of CTC have been exercised by similar nonpartisan commissions since the enactment of the Railway Act in 1903.

The third Canadian entity with railroad responsibility is the Canadian National Railway (CN), a crown corporation. CN is a result of the Government takeover of certain rail operations in 1923. Since it is owned by the Government, it is subject to the policy guidance established for it by the Transport Ministry. It is also subject to the rail regulation of CTC in the same manner as the Canadian Pacific Railway (CP).

LAWS DIRECTLY AFFECTING RAIL SAFETY

Four basic statutes affect Canadian rail safety. The oldest is the Railway Act,[2] originally enacted in 1903. It prescribes most of the economic, safety, and other operational requirements. Its U.S. analog would be a combination of part I of the Interstate Commerce Act[3] and all of the rail safety statutes.

The second of these laws is part IV of the Canada Labour Code.' Part IV 'establishes the authority for workplace safety regulations for interprovincial rail operations. Its counterpart U.S. statute is the Occupational Safety and Health Act of *1970.*[5]

The third law is the National Transportation Act (NTA), enacted in 1967. It established CTC, and transferred to CTC the functions previously assigned to a number of modal regulatory boards. It also proclaims a new national transportation policy. The law details the functions, powers, duties, and procedures of CTC.

The fourth law is the Railway Relocation and Crossing Act,[6] enacted in 1974. This Act goes

[2]Ch. R-2, R. S. C., 1970.
[3]49 U.S. C. 1 et seq.
[4]Ch. L-1, R. S. C., 1970.
[5]29 U. S .C. 651 et seq.
[6]Ch. 12, 23 Elizabeth II.

well beyond existing U.S. legislation on this subject by providing: 1) financial assistance for preparation and implementation of "urban development and transportation plans, " with respect to railway relocation in urban areas, 2) special grants for grade separations, and 3) a continuing fund for grade-crossing safety improvement projects.

Canadian railroad casualty compensation laws are established at the provincial level, rather than at the Federal level. These laws are no-fault in concept, and generally allow for full medical treatment without time limits and major tax-free disability compensation. Provincial compensation boards oversee payments and ensure treatment and rehabilitation adequate for the injured employee. These provincial laws are in significant contrast to the U.S. statute. The Federal Employer's Liability Act' depends on legal determination of negligence to establish compensation. The Canadian compensation plans are discussed further in chapter VIII.

The National Transportation Act

As in the United States, railroads in Canada were initially viewed as monopolies because of the absence of competition. They were regulated as such. In the middle of this century, railroads met increased competition from other modes, which eliminated their dominant position. In 1959, a royal commission studied this change and recommended that the Government's regulatory approach be changed to encourage competition among and between modes. The result was the **1967** enactment of NTA.

This law placed the regulation of all transportation modes in one entity —CTC. One of its primary purposes is to coordinate the regulation of all of the modes under a policy that will allow competition to be the primary regulating force.

While the **1967** Act curbed numerous economic regulatory restrictions, some still remain. One example is the limitation on grain tariffs established by the Crow's Nest Pass Agreement. This agreement between the Government and CP subsidized the extension of CP lines into the interior of British Columbia in return for a fixed rate for transportation of grain in certain areas. In **1925,** these rates became statutory and were extended to additional parts of Canada and to CN.[8]

CTC has authority to prescribe rates in monopolistic situations (the "captive" shipper) and to intercede when rates are prejudicial or not in the public interest if satisfactory rates cannot be negotiated between the railroads and shippers.

CTC has jurisdiction to hear complaints from any interested party or to act on its own motion, and to hear and determine all matters of law or fact consistent with its jurisdiction. CTC can act as a superior court by taking evidence. Having heard or considered a matter, it can issue a final order mandating or restricting particular action. If a regulation, order, or decision is published in the Canada Gazette (the Canadian equivalent to the U.S. Federal Register) for 3 weeks, the order has the effect of a statute. However, the Governor-in-Council may at any time vary or rescind any order, rule, or decision of CTC. The rescinding order is binding on CTC. This power is rarely exercised.

Within the scope of its statutory authority, CTC can adopt regulations or orders on any matter. It can establish penalties for violation of any order or regulation to the extent that those penalties are not otherwise established by statute. Moreover, CTC has jurisdiction to hear and resolve disputes between parties concerning any aspect of a railroad line, whether construction, maintenance, or operation, or concerning any structure, appliance, or equipment used in connection with a railroad. CTC can request that the Ministry of Justice provide counsel in matters for which it feels the public interest needs specific representation.

NTA has two special limitations with respect to safety matters. First, if a law requires approval of CTC before particular work can be conducted and if the work affects the safety of employees or the public, that approval cannot be given without "due notice and hearing."[9]

[7] 45 U.S. C. 51 et seq.

[8] Sec. 271, ch. R-2, R. S. C., 1970.

[9] Sec. 52, ch. N-17, R. S. C., 1970.

Similarly, where any work that affects the safety of the public or employees is required by regulation, order, or decision of CTC within a specified time, that time limit cannot be extended by CTC without "hearing or notice. "[10]

NTA grants CTC and the Ministry broad investigatory powers, It can request that any person make a report or inquiry on any matter within its jurisdiction. Its agents may enter on any property the agent thinks necessary for the purpose of investigation. The agent or committee may inspect any rolling stock, or summon witnesses, or require submission of documents, or take oaths or otherwise act as a court in a civil case.

The importance of this Act in the context of rail operations is twofold. First, it substantially revised the approach to economic regulation, which had a particularly significant impact on the economic condition of the railroads. By providing the railroads a greater opportunity to compete freely, the Act may have provided them more resources to carry out maintenance and make improvements consistent with safe and efficient operations. Second, it brought together in one body a number of agencies with transportation powers. In theory, at least, this should enable a more coordinated approach to the entire range of problems facing Government and transportation industries.

In comparison to U.S. laws, NTA provides substantially greater powers to CTC than those provided to the U.S. Department of Transportation (DOT) or the Interstate Commerce Commission. NTA is generally more flexible concerning the manner in which powers are exercised. For example, outside the labor law context, U.S. law does not generally provide parties involved in a dispute on a railroad matter (e. g., a loss and damage claim or an interline settlement claim), a forum other than a court for resolution of such a dispute, whereas in Canada, CTC can resolve such a dispute. Moreover, there appear to be fewer procedural constraints on the CTC's ability to exercise its power such as are provided in the United States by the Administrative Procedures Act and related laws. As the final arbiter of facts in matters under its jurisdiction, and having the power to determine matters of law under the Railway Act, CTC's orders and regulations appear less likely to be the subject of litigation than those of a U.S. agency.

[10] Sec. 53, ch N-17, R S C ., 1970.

The Railway Act

The Railway Act, originally adopted in 1903, is the seminal law for the information, construction, operation, and safety of Canadian railroads. It covers the CP and CN railroads with respect to their Canadian operations and all other railroads that cross provincial or international boundaries. Its provisions and the regulations and orders issued under them apply specifically to: 1) internal corporate matters of any railroad incorporated under a special act of the Parliament; 2) engineering and location of railroad lines; 3) operation of railroad equipment, including safety matters; 4) treatment of uneconomic branch lines; 5) requirements for accommodating shipper demand for service; *6)* investigation of accidents, penalties, and treatment of damages caused by breach of the Act or rules or orders under it; and 7) railroad accounting.

The comprehensiveness and detailed treatment of many of its subjects distinguishes the Canadian Railway Act from any single rail statute in the United States. Much of what appears to be treated in the Canadian Railway Act is not the subject of Federal statute in the United States, but rather is covered by internal railroad rules or by interrailroad agreement such as the rules for interchange of traffic between carriers. The following discussion describes the contents of designated sections of the Railway Act that relate directly to rail safety.

Safety and Care of the Roadway [11]—Some of the provisions under this subpart of the law reflect the early origins of the Act and the essentially rural nature of the then rail environment. It prohibits animals from running-at-large near a grade crossing, requires weeds to be removed, and requires certain safeguards against roadway fires. Violation of those provisions subjects the

[11] Secs. 218-224, ch. R-2, R.S.C., 1970.

violator to relatively insignificant monetary penalties. In the United States, these matters are essentially left to State law.

In a broadly drawn provision (sec. *223),* CTC may direct an "inspecting engineer" to inspect railway (the Canadian term for right-of-way) that may be "dangerous to the public using the railway" and can order any repairs, reconstruction, etc., that appear to CTC to be necessary or proper. '2 CTC can limit or prohibit the use of railway that is subject to such an order, pending execution of the order's requirements. CTC can also forbid use of rolling stock that it considers unfit for either use or repair. An inspecting CTC engineer may also limit or prohibit the use of track or equipment if he finds its use would be "dangerous." Notice must be given to the railroad and to CTC of this action and the reasons for it must be stated. CTC may modify or override the action of the engineer. Violation of these orders or the notice of the inspection engineer subjects the company to a penalty of up to $2,000 and subjects any person willfully and knowingly aiding or abetting the violation to a penalty of *$20* or *$200.*

There are two provisions in U.S. law that can be used to stop operations or equipment use. Both are contained in the Federal Railroad Safety Act of **1970** (FRSA).[13] One provision permits the Federal Railroad Administration (FRA) to issue an order directing compliance with particular safety requirements established under FRSA. Such an order can include a direction to stop operations or equipment use until compliance is achieved. In addition, there is the power to order track or equipment out of service upon a determination that there is "an emergency situation involving a hazard of death or injury to persons affected by it. " In the United States, neither of these powers has been delegated to the inspector discovering the violation. The maximum penalty for each violation of an emergency order in the United States is *$2,500,* but no penalty can be assessed against an individual as in Canada.

The Canadian statutes do not set forth specific safety requirements with respect to the roadway, which is also the case in the United States. As discussed in chapter VI, the United States does have extensive regulatory requirements for track safety. Canada requires that plans for construction, diversion, or modification of track be submitted in advance to CTC for its review and approval, a power not established under U.S. law. Thus, CTC has far greater control than its U.S. counterpart of the original safety of rail lines and, one might suppose, greater knowledge of the condition of the system's track.

Accidents[14]—The Railway Act requires that a railroad, immediatel, after informing its officers, give notice of any accident in which an injury occurs to a person using the railroad or to any railroad employee, or of any occurrence whereby a bridge, culvert, viaduct, or tunnel is impassable or unfit for use. Employees in charge of a train also have the duty to notify CTC of an accident. CTC has the power to: 1) regulate the manner and form of accident notices and the information required, 2) conduct inquiries into the cause of the accidents or accident situations in general, and 3) investigate the means of preventing accidents. Failure to give notice of an accident may result in a penalty of *$200* per day for the. railroad, and up to $100 for a willful or negligent failure of an employee to so report.

In the United States, the Accident Reports Act[15] requires monthly (although the regulations prescribed under other authority require immediate notification for most types of accidents) reports to DOT of accidents resulting from rail operations that cause death or injury to any person or damage to equipment or roadbed. The carrier is subject to a fine of up to $100 per day for failure to so report.

Operation and Equipment[16]–The Act gives CTC very broad rulemaking authority covering among other things:

- speed of trains in populated areas,
- coupling of cars,

'2Sec. 223, ch. R-2, R. S. C., 1970.
1345 U.S.C. **421** et seq.

[14]Secs. 225-226, ch. R-2, R. S. C., 1970.
[15]45 U.S.C. **38.**
[16]Sees. 227-251, ch. R-2, R. S. C., 1970.

- provision of shelter to employees on duty,
- length of track sections required to be kept in repair by employees and the number of employees per section "so as to ensure safety to the public and its employees, "
- the number of "men" employed on trains "with a view to the safety of the public and of employees, "
- hours of service of employees, and
- other matters affecting safety in the operation of trains or their speed and use of engines. [17]

While CTC has adopted regulations on some of these subjects, such as speed limits in populated areas, coupling of cars, and other matters affecting operational safety, it has not adopted regulations concerning employee shelter, hours of service, or the number of men employed on a train, which are presumably left to collective bargaining.

CTC is also directed to "endeavor to provide for" uniformity of construction of equipment used on the roadway. [18] Railroads are granted authority to adopt bylaws, rules, and regulations concerning many operational matters but these must be sanctioned by the Governor-in-Council acting on the advice of CTC.

With respect to safety appliances, the Railway Act directs that railroads have "modern and efficient apparatus, appliances, and means" for: 1) communication among employees, 2) checking speed of the train, 3) coupling devices that couple upon impact and do not require employees to go between the cars to uncouple, and 4) power or train brakes that do not require use of handbrakes to stop the train. The brake system is required to be continuous throughout the train. Ladders and handholds are required for box cars. Draw bars must be of a standard height fixed by CTC, and locomotives are forbidden to have valves that require oiling from outside the cab while in motion. CTC is given power to determine what constitutes compliance with this legislative direction through regulation of general applicability or by order applicable to a particular case. An improved method of brake testing is at an advanced stage toward promulgation.

The Act also specifies a variety of rather detailed requirements in connection with operation of the trains, e.g., regular schedules printed on timetables in English and French, stopping of trains before entering onto a swing- or drawbridge, stopping at railroad switches for signal to proceed unless there is a switch-signal interlocking device or similar device, and using the train whistle continuously from *80* rods before a grade crossing until the engine has passed the crossing. A train cannot exceed 10 miles per hour in a "thickly populated area" unless the track is fenced or otherwise protected or unless CTC otherwise approves a greater speed. Trains must observe that speed limit at a grade crossing in such an area unless, in the view of CTC, the crossing is adequately protected. In the event of a crossing accident involving death or injury, a train cannot exceed 25 miles per hour unless the speed restriction is removed by RTC. If a train is traveling in reverse, except in a switching or yard movement, and is traveling along or across a highway, someone must be stationed in the lead car or other piece of equipment to warn persons in the train's path. Finally, a train may not block a highway by standing still or shunting cars for more than 5 minutes.

Penalties of up to $200 a day are provided under Canadian law for failure to equip a train properly. Failure to stop at a draw- or swing-bridge can produce a penalty of up to *$400*. Employees who do not observe company rules are liable for a penalty of up to *$400* or *6* months in jail or both. Failure to observe the grade-crossing requirements (except the whistle requirement) can result in a penalty of $100. The penalty for blocking a highway is $50 for the engineer and $50 for the company. However, employees can be exempted if they can show they were following company rules.

It can be seen that both Canada and the United States recognize the same subjects as worthy of consideration from a safety point of view, though the approach is often quite different. For example, whereas the Railway Act authorizes CTC to establish regulations for

[17] Sec. 227, ch. R-2, R. S. C., 1970.
[18] Sec. 228, ch. R-2, R. S. C., 1970.
[19] Sec. 238, ch R-2, R.S.C., 1970.

employee hours of service it has not established any particular requirements in this regard. In the United States, very specific requirements are established by statute and little regulatory power is granted to FRA.[20] The Canadians also impose by statute a variety of limitations on the manner in which a train is operated, whereas in the United States this subject is not covered by statute but rather by agency (FRA) regulation and in the absence of such regulation (which is generally the case) the railroads are free to adopt through their own operating rules. On the other hand, many of the safety appliance requirements are treated in a similar manner by both countries, e.g., automatic couplers, driving wheel brakes, and draw bars.

Another area of comparison is the treatment of power or train brakes. In Canada, the statute mandates that "such a number of cars in each train be equipped with such brakes as to permit the engineer to control its speed or bring it to a stop in the quickest and best possible manner" without requiring use of the common hand brake.[21] In addition, on passenger trains such a brake system must be continuous and self-applying in the event of any failure in their continuity of action. Inspection requirements are not specified. In the United States, the law originally required one-half of all cars to be so equipped with power or train brakes[22] but this percentage has been increased administratively to include all cars in a train .23 No distinction is made between passenger and freight trains. Finally, U.S. law mandated the adoption of the Association of American Railroads (AAR) power brake maintenance and inspection standards.

Dangerous Commodities—The Railway Act contains two short provisions concerning transportation of dangerous commodities .24 The first prohibits passengers from carrying such goods except in conformity with CTC rules. It also requires a shipper to mark clearly the nature of such goods on the outside of the packing and give identical notice to the station agent or whoever receives them for shipment. The second provision prohibits a railroad from carrying such goods except in conformity with CTC rules and permits it either to refuse to handle, except in accordance with CTC rules, a parcel containing goods it suspects to be dangerous or to require that the parcel be opened. Violation of the first provision carries a fine of up to $2,000 or 2 years in jail or both; violation of the second provision can result in a maximum penalty of $500.

There is considerable difference in the statutory approach to regulation of the transportation of these commodities in Canada and the United States. The United States has both criminal and civil penalties of substantial dimensions for violations of hazardous cargo regulations, whereas Canada has relatively mild penalties, particularly for the railroad. Moreover, the U.S. statute seems to envision regulation of a broad scope of activity concerning such materials from labeling, packaging, and handling through transportation. The Canadian statute dealing with hazardous materials seems to envision regulation of a more limited scope of activity with those materials, although CTC may be able to take the same steps as the comparable U.S. agency due to the broad powers otherwise available to it.

Offenses, Penalties, and Other Liabilities[25]— In addition to the penalties for violation of particular statutory or regulatory requirements, the Railway Act also specified a penalty of $20 to $5,000 for any company that does not obey a CTC order. Moreover, if the company is proven to have so disobeyed CTC rules, the president, each vice-president, and each director and managing director of the company is subject to a penalty of the same range an ~/or up to 12 months in prison unless they can prove that they did everything in their power to see that the order was carried out, and they were not at fault for the violation. Canadian Government officials indicated that these penalties are levied infrequently, if at all. U.S. law does not impose such personal penalties on officers of railroads.

[20] 45 U.S.C. 64 et seq.
[21] Sec. 238(3), ch. R-2, R.S.C., 1970.
[22] 45 U.S.C. 65 et seq.
[23] 49 CFR.
[24] Secs. 295-296, ch. R-2, R.S.C., 1970.
[25] Secs. 343-399, ch. R-2, R.S.C., 1970.

The Railway Act provides for a summary procedure before a justice of the peace, if a penalty is less than $100. If the penalty is between $100 and $500, the summary procedure must be before two such justices or other officials with equivalent power. CTC can also seek enforcement through the offices of the Attorney General or in his name.

The Canada Labour Code—Part IV

The Canada Labour Code establishes the framework for Federal regulation of workplace safety. It applies to interprovincial railroads rather than intraprovincial companies. However, the Labour Code does not apply to employment "upon or in connection with the operation of . . . trains . . . ."[26] CTC has jurisdiction for the safety of train operations.

The Labour Code places a general duty upon employers to conduct business in a manner that will not endanger the health or safety of their employees, and to adopt and carry out reasonable procedures and techniques designed to reduce the risk of workplace injury. The employee likewise has a duty to take reasonable measures and precautions to protect his own safety and to use protective devices provided by the employer. The Code provides a specific procedure through which employees can refuse to work when they believe to continue to work would constitute an "imminent danger" to themselves or other employees. The Code also grants broad regulatory authority to the Governor-in-Council. This authority is exercised by the Minister of Labour.

The Code's mechanism used to oversee safety in the workplace is to require or authorize industries or companies to establish safety and health committees, with at least half of committee membership comprised of employees. These committees handle all health and safety matters between the employers and employees. Included among committee responsibilities are handling complaints, conducting inquiries, developing safety programs, recordkeeping, and cooperation with appropriate Government agencies.

The Code provides for appointment of "safety officers" to enforce its provisions. These officials have authority to enter the premises of an employer "at any reasonable time" to conduct inspections, inquiries, and tests. If something constitutes a "source of imminent danger to the safety or health" of employees or is contrary to the Code or regulations, the "safety officer" may direct an employer or person in charge, in writing, to take certain safeguarding actions or direct that the place, matter, or thing not be used until directions are complied with .27 A procedure for industry appeal of such a direction is provided. The employer is subject to a penalty of up to $5,000 *or 1* year in prison or both for the following: 1) a violation of the Code, or regulations issued under the Code; 2) violation of the direction of a safety officer; 3) industry discrimination against employees who participate in or provide information for a safety inquiry; 4) adverse action from industry against employees who stop work because they believe they are in imminent danger; or 5) failure to provide requested information to a safety committee. Employees and managers can also be punished personally.

The approach of the United States and Canada to occupational safety and health appears to be generally similar. With respect to railroads in particular, FRA has accepted responsibility for safety of railroad operations (meaning the safe movement of equipment over rails) including health matters related to such operations, and ceded the balance to the Occupational Safety and Health Administration (OSHA) of the Department of Labor. While the area covered by FRA appears to be somewhat broader than the safety and health matters under CTC jurisdiction, both countries divide safety and health regulation, especially in the case of railroads, between two agencies and generally along the same lines. Both countries establish general responsibilities for employers and employees, and have broad regulatory power to establish minimum safety and health requirements. In addition, they have a similar enforcement structure of inspections coupled with a power to order abatement of the hazard

[26] Sec. 80(2), ch. L-1, R. S. C., 1970.

[27] Sec. 94, ch. L-1, R.S. C. , 1970.

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or levy of a monetary penalty. Both countries have procedures for administrative review of the order. However, when the Canadian and U.S. occupational safety and health provisions are examined in detail, many differences appear. These differences do not relate to the treatment of railroads per se, and therefore are not examined in detail here.

In sum, it can be said Canada's statutory approach is one that appears to be based both on inspection and intracompany safety awareness through safety and health committees, whereas the U.S. approach is based more on inspection and enforcement. The difference in these two approaches is that the Canadian system is directed more at resolution of the safety problems at the company level through joint and equal participation of labor and management but with a strong residual enforcement power granted to the Government. The U.S. system is more adversarial in nature pitting employer against the Government and the employee. However, the enforcement powers for OSHA violations in the United States are not as comprehensive as those in Canada.

Railway Relocation and Crossing Act

Since 1955 Canada has recognized the special safety problems of rail-highway grade crossings. The Railway Act established a railway grade-crossing fund to provide financial assistance for the improvement of grade crossings.[28] In 1974, this provision was replaced by the Railway Relocation and Crossing Act. A more comprehensive approach was taken to the physical relationship between railroads and highways. The new Act retained the original railway grade-crossing fund administered by CTC. This fund is used on a cost-sharing basis for: 1) work done for public protection, safety, and convenience on grade crossings existing for at least 3 years; 2) work done to reconstruct or improve a grade separation in existence for at least 15 years; 3) placing reflective markings on the sides of rail cars; and 4) placing revolving lights on locomotives. The Federal share of the cost of such work varies from *sO* to *80* percent.

[28] S c 202, ch . R-2, R.S.C. , 1970.

The Railway Relocation and Crossing Act provided two types of assistance. The first is financial assistance provided by the Minister of Transport and the Minister of State for Urban Affairs for up to one-half of the cost of transportation plans and urban development plans respectively. The former is a plan for control of transportation of all types and modes within a defined area and the latter is a plan for land use and development within or adjacent to an urban area. Where such plans have been developed and agreed to by provincial and municipal authorities, they can apply to CTC for a special order that will permit abandonment of lines, removal of structures, sharing of trackage rights, relocation of railway lines, building of new lines, elimination of grade crossings, and limitations on rail traffic. The plans, including the related financial plans, showing that no affected railroad will receive burdens or benefits greater than the corresponding receipts or costs, must be acceptable to CTC before it can issue such a special order. In addition, CTC can recommend that the Minister of transport provide a "relocation grant" to meet up to one-half of the net costs of railway relocation.

The other new form of assistance is provision for special grants for construction or reconstruction of a grade separation that costs more than **$1,250,000.** The total amount obtainable for such a grant ranges from $1,150,000 to $3,250,000 plus 40 percent of the costs in excess of $5 million for new construct on, with substantially lesser amounts for reconstruction projects. This latter provision s intended to meet the many situations needing assistance that were not eligible under the earlier railway grade-crossing fund.

It should also be noted that the Railway Act, gave CTC authority to control the protections at grade crossings and order any necessary changes including grade separation.

The United States has generally financed grade-crossing improvements from the Highway Trust Fund and on a cost-sharing basis with State highway authorities.[29] It has also provided substantial sums under the Federal Aid High-

[29] 23 U.S.c. 130.

way Act for a series of demonstration projects which have included relocation of some urban rail lines.[30] However, the United States has not provided any generally available funding for the marking of rail cars or lights on locomotives although it is currently conducting a demonstration project with four railroads providing for use of strobe lights on locomotives.

[30] Public Laws 93-87, 93-643, 94-280, and 94-387.

SUMMARY

The laws affecting railway safety in Canada are comprehensive in scope, touching at least generally all of the same subjects as U.S. laws. However, a comparison of the statutory framework of these laws for each country indicates several differences in emphasis and detail. First, the Canadian laws are considerably more restrictive concerning the design and engineering of a railroad when first constructed but Canada does not regulate its subsequent maintenance. In the United States, the law does not cover design and engineering but subsequent maintenance is regulated. Second, the Canadians have numerous detailed statutory requirements for operating the railroad of which the United States has very few. Third, the Canadians have more comprehensive penalty provisions for violation of its legal requirements that are applicable to officers and employees as well as companies. However, the penalties are apparently not generally invoked and do not seem to be a major part of the enforcement structure. In the United States, the penalties appear to be somewhat higher, and do provide an integral part of the enforcement scheme, but are not applicable to railroad officers and employees. Fourth, the Canadians do not appear to have mandated by law or regulation particular requirements for hours of service or employee quarters or other such subjects that are considered part of what should be left to collective bargaining. In the United States, specific legislative requirements have been established on such subjects. Finally, the Canadians have been considerably more comprehensive in their legislative approach to the grade-crossing problem both in terms of establishing requirements for train operations and installation of protections at crossings as well as providing funding mechanisms.

Chapter IV

THE ACCIDENT PICTURE

Chapter IV

THE ACCIDENT PICTURE

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.)

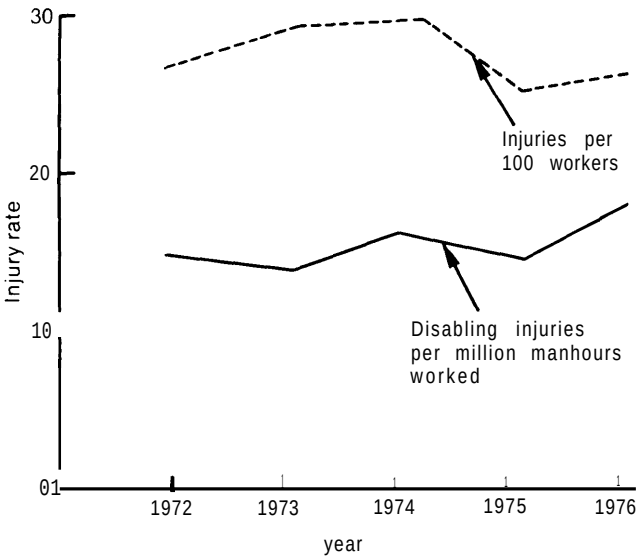
*The items to be included in the record are: the date and time of the accident; the name of the injured employee; the worksite or location where the accident occurred; the principal cause or causes of the accident; the name of the department or unit to which the employee reports for work; a brief description 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

Chapter V

THE RAILROAD SAFETY INQUIRY

Chapter V

THE RAILROAD SAFETY INQUIRY

Railroad officials, labor representatives, and officials of the Canadian Transport Commission (CTC)/Railway Transport Committee (RTC) generally agree that a major step towards improving Canadian railroad safety was the railway safety inquiry conducted by RTC. This chapter covers that inquiry, the events leading to it, and some activities that were a direct result of the inquiry.

Critical dates and activities leading to the inquiry and inquiry milestones were as follows:

1904	Jurisdiction for safe operation of Canadian trains came under Federal jurisdiction through the Board of Transport Commissioners
1967	Authority for regulating the safety of the railroads transferred to the Canadian Transport Commission/Railway Transport Committee
1970 (summer)	Series of accidents, including derailments in Cobourg and Port Hope and a collision in Brockville
Sept. 1, 1970	RTC issued a formal notice that a public inquiry would be held regarding three accidents
Sept. 24, 1970	lnquiry on three accidents began
Jan. 18, 1971	Second phase of the inquiry on Midland Structural Company —safety of a subway structure
Jan./March 1971	Series of accidents involving dangerous commodities (sulfuric acid, propane gas, liquid sulfur, fuel, etc.) and a derailment in the Fraser River Canyon
Jan. 18, 1972	Resumption of the satety inquiry to include investigation of a CN derailment near Dun robin, Ontario
April 19, 1972	Filing of the initial report of the railway safety inquiry
July 17, 1972	Filing of the second report of the railway safety inquiry
Dec. 28, 1973	Filing of the third report of the railway safety inquiry
1973	CTC approached the Treasury Board requesting additional staff resources to be used to ensure railroad satety — request denied
1974	Beginning of the Bureau of Management Consulting study of railway safety

As indicated in this chronology, the inquiry was divided into three phases during the September **1970** through December 1973 period. This chapter describes: the events leading to the safety inquiry; the inquiry process, findings, and recommendations; and, the steps following the inquiry including the Bureau of Management Consulting study and the creation of the Railway Safety Advisory Committee.

EVENTS LEADING TO THE SAFETY INQUIRY

The Railway Transport Committee and its predecessor, the Board of Transport Commissioners, had jurisdiction over the safe operation of the railroads from the early 1900's.[1] As a result of its authority and growing concern at CTC about the safe operation of Canadian railroads, RTC began an inquiry on railway safety in **1970.** The inquiry was prompted by an increase in the number of accidents involving heavier tonnage trains and an increase in accidents involving dangerous commodities.[2] A series of accidents occurred during the summer of 1970 including two derailments and a collision. These three accidents were the subject of the initial inquiry.

[1] Railway Transport Committee, Review Committee, address by D. H. Jones, Ottawa, September 1975.

[2] *Initial Report of the Railway Safety Inquiry* (Railway Transport Committee, Apr. 19, 1972), p. 1.

SAFETY INQUIRY: PROCESS, FINDINGS, AND RECOMMENDATIONS

The Railway Transport Committee conducted the inquiry by the authority contained in section 226 of the Railway Act and sections 45 and 46 of the National Transportation Act. On September 1, 1970, RTC issued a formal notice that a public inquiry would be held regarding the three accidents. In addition, evidence was requested concerning maintenance and operating practices, and other matters related to derailments and collisions.

The inquiry took several forms including public hearings and field investigations. The Canadian National (CN) and Canadian Pacific (CP) Railroads, and the Canadian Railway Labour Association participated in the inquiry.

RTC received evidence about three specific accidents (Cobourg, Port Hope, and Brockville). However, during the hearings, the panel decided to observe operating procedures firsthand. The panel conducted onsite investigations of the yards of both CP and CN.[3]

RTC attributed the Cobourg and Port Hope accidents to journal failures that resulted in the derailments (the Port Hope accident also involved postcrash leakage of toxic and flammable weedkiller). It attributed the Brockville accident, a collision between a train and a track motor car, to human error on the part of the track car operator who apparently misjudged the closing speed of the train.

The investigation of the three accidents convinced RTC that an expanded investigation was necessary to determine: whether the railroads were implementing CTC rules and regulations, the adequacy of the railroad's maintenance procedures, and the adequacy of its own review procedures.[4] The expanded inquiry specifically explored:

- a CN derailment near Dunrobin, Ontario, where 39 passengers reported minor injuries;
- a derailment in the Fraser River Canyon involving a rockslide that killed three crew members; and
- a number of accidents involving dangerous commodities.

After hearings, investigations and analyses, RTC issued its report. Among the major findings of the general inquiry were:

- the need for more active research into possible improvements for the design of railroad signaling devices and equipment;
- derailments caused by journal failures required better evaluation;
- reporting requirements for accidents at rail grade crossings should be improved;
- systems to detect rockslides were often inadequate and should be improved; and
- deteriorating track conditions were increasing the potential for derailments.

Based on its findings, RTC recommended several research projects on specific safety problems identified during the inquiry. It also recommended that the Government's regulatory and oversight functions be strengthened. For example, it called for increases in RTC staffing. Most significant, it created a Railway Safety Advisory Committee. The committee consists of railroad company representatives, CTC members, one of which chairs the committee, and representatives from the railroad unions. Its purpose is to explore solutions to safety problems and make recommendations to CTC.[5] (Advisory committee activities are discussed in chapter VI.)

In **1973,** CTC requested that the Treasury Board grant it 55 additional staff to conduct a number of rail safety programs. The Treasury Board initially denied the request on the basis that the need for the programs was insufficiently documented. ' The Board requested justification of the programs by careful analysis and demon-

[3] *Ibid*, p 9.
[4] Ibid , p 10
[5] Ibid., p. 10.
[6] Interviews, Canadian Transport Commission, 1978

stration of their potential effectiveness. CTC then requested that the Bureau of Management Consulting (BMC) conduct an independent study of rail safety problems. Specifically, CTC requested comments on the functions of a regulatory agency and proposals for a rail safety program. The resulting study, which required 4 man- years, produced a 13-volume report consisting of:

- an evaluation of current CTC programs,
- a study of the railroad environment,
- an analysis of railroad accident statistics,
- a compilation of the views of railroad and union officials,
- research on the economics of safety regulations, and
- policy alternatives.

BMC concluded that:

- Much of the increase in derailments could be attributed to increased traffic and larger heavier trains.
- Rail grade-crossing accidents declined between 1956 and 1973.
- The number of collisions during that period had not changed substantially.
- The economic input into maintenance of rails and associated structures had progressively decreased over a period of 20 years. (It recommended that the issue of deferred maintenance be studied by Government in cooperation with the railroads and if a problem was found to exist, it should be addressed by a combination of fiscal and regulatory policies.)
- The accident data was not fully reliable. Differences existed in the data collected by the Government and that collected by the railroads.
- Problems existed in implementing programs to deal with the highway/rail-crossing problem. (Highway/rail-crossing findings are discussed in chapter VI.)
- Problems existed in the handling and shipment of dangerous commodities. (See chapter VI.)

The safety programs of RTC were evaluated and a number of further improvements were suggested by BMC. These included the redesign of inspection programs, accident investigation, data reporting and analysis, and the introduction of some new standards. [8]

BMC made the following policy observation: In order to set a level of collective risk, the Government must consider the societal costs of damage and societal benefits from transportation, as against the railway cost and railway benefits. The difference between the societal costs and railway costs from accidental damage arises due to the fact that the railways do not suffer the total economic loss from accidents. The societal costs of accidents are greater than that considered by the railways. To induce a higher level of safety, society can use the following three policy instruments: subsidy, taxation, and regulatory measures.[9]

Railway Safety Study (Bureau of Management Consulting, Canada, 1975)

[8] Review Comments for Preliminary Draft of OTA Rail Safety: A U.S.—Canadian Comparison submitted by E. W. Eastman, February 1979.

[9] *Overview of the Rail Safety Study*, (Railway Transport Committee, Review Committee, Bureau of Management Consulting), p. 11.

Chapter VI

GOVERNMENT PROGRAMS

Chapter VI
GOVERNMENT PROGRAMS

Two Federal organizations have responsibility for Canadian railroad safety: the Canadian Transport Commission's (CTC) Railway Transport Committee (RTC), and the Department of Labour's Occupational Safety and Health Division.

CTC was established in **1967** by the National Transportation Act. CTC is the Federal Government's regulatory body responsible for all transportation modes. RTC is responsible for limited economic regulatory activity, safety regulatory activity, and financial assistance programs for Canada's railroads. RTC has six commissioners, some of whom have responsibility for the regulation of other transportation modes. RTC is organized around the following activities: rail systems engineering, rail safety and standards, rail services, rail economic analysis, and tariff and traffic. The CTC/RTC regulates all railroads except those that are intraprovincial. Provincial jurisdiction does not extend to railroads under CTC jurisdiction.

The Department of Labour's Occupational Safety and Health Division is a regulatory body similar to the U.S. Occupational Safety and Health Administration within the Department of Labor.

This chapter is organized as follows:

Canadian Transport Commission Activities
- Regulation
- Inspection
- Dangerous Commodities/Explosives Safety
- Highway/Railroad Crossing Safety

Labour Canada's Occupational Safety and Health
- Regulations
- Activities

Railway Safety Advisory Committee

CANADIAN TRANSPORT COMMISSION ACTIVITIES

Regulations

A range of subjects directly or tangentially significant to railroad safety is covered by regulations in Canada and in the United States. The regulations in the United States applicable to rail safety are primarily developed and administered by the Federal Railroad Administration (FRA). Promulgation of the Canadian rail safety regulations is one of the functions of CTC. Other important regulations are those for occupational safety and health, which in the United States are issued by the Department of Labor and in Canada by Labour Canada. In both countries there are not any workplace safety and health rules applicable exclusively to the railroads. Table 46 indicates the range of rail safety regulatory subjects covered by each country.

The Canadian body of law that is comparable to title 49 of the U.S. Code of Federal Regulations, with respect to railroads, is the Revision and Consolidation of General Orders of the Board of Transport Commissioners of Canada (now CTC). This is, as the name suggests, a compilation and revision of all orders establishing regulations of general applicability issued by CTC and its predecessors since 1906. It has four parts of which two—Operating and Engineering—have safety implications. These orders, generally, were effective as of February 1965, when the consolidation occurred.

Accident Reporting

The regulatory requirements for accident reporting are substantially more broad than the statutory requirements for accident reporting.

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Table 46.—U.S. and Canadian Railroad Safety Regulations

Subject	U.S. provision	Canadian provision
Hazardous materials,	49 CFR 172-174, 178-179, 209	Gen. Order no. 0-29 to O-34
Ambient noise	40 CFR 20 (EPA), 49 CFR 210; 49 CFR 171, 211	N/A
Procedural rules	49 CFR 171, 211	Gen. Order no. M-2
State/Province participation	49 CFR 212	None
Track safety standards	49 CFR 213	None
Freight car safety standards	49 CFR 215	None
Special notice, emergency orders	49 CFR 216	None
Operating rules–general.	49 CFR 217	Gen. Order no. 0-8
Operating rules–specific (blueflag, etc.)	49 CFR 218	Gen. Order no. 0-8
Two-way radios	49 CFR 220	None
Rear-end marking devices.	49 CFR 221	None
Accident reports.	49 CFR 225	Gen. Order no. 0-
Hours of service	49 CFR 228	None
Locomotive design, performance	49 CFR 230	Gen. Order no. 0- 1 to 0-14,0-16 to 0-19,0-21
Safety appliances.	49 CFR 231	Gen. Order. no. 0-10
Power brakes and drawbars.	49 CFR 232	Gen. Order no. 0-20 (air brake only)
Signals and related devices	49 CFR 233-236	Gen. Order no. E-12 and E-13
Occupational Safety and Health	29 CFR 1910	SOR 71-30, 71-483, 71-481, 71-584, 71-605, 71-616, *72-663*, 72-13, 72-23, 72-66, 72-666, 72-171, 72-288, 73-679, and 78-559
Mixed passenger/freight equipment–vestibule doors.	None	Gen. Order no. O-6
Testing employees–sight, hearing	None	Gen. Order no. O-9
Loading open top cars.	None	Gen. Order no. O-15
Special equipment regulations (mailcars, snow plows, grain cars).	None	Gen. Order no. 0-22-0-24
Air pollution and control	None applicable exclusively to railroads	Gen. Order no 0-26
Fire extinguishers and emergency tools in passenger cars	None	Gen. Order no. 0-27
Fire prevention from railroad causes	None	Gen. Order no. 0-28, E-16
Grade crossings.	None	Gen. Order no. E-3 and E-9
Railroad design (plans, profiles, etc.)	None	Gen. Order no. E-1 and E-2
Utilities on or near rail line	None	Gen. Order no. E-lo and E-12
Fencing	None	Gen. Order no. E-17

The regulations require reports on five types of accidents to CTC:

1. accidents attended by death or personal injury or whereby any bridge, culvert, viaduct, or tunnel has been damaged;
2. accidents not attended by death or personal injury
   —at public highway crossings, or
   —collisions and derailments on main track where damage to railway property is in excess of $750;
3. obstructions on railway causing delay in operations of more than 24 hours,
4. employees suddenly stricken while on duty and death ensues, and
5. accidents involving handling of dangerous commodities.[1]

Only the first is required by statute. The information required in the report and the speed of its delivery vary depending on the nature and severity of the accident. Reports are not required for accidents that occur for reasons other than "as a result of transportation, that is to say where trains, engines, cars, or other rolling stock either while in motion or stationary are involved . . . ."[2] Accidents occurring in shops or other facilities are specifically excluded unless

'General Order O-1.
'Ibid.

they occur directly or indirectly or a result of transportation as so defined.

By comparison, the FRA accident report regulations are substantially more comprehensive with respect to casualties. They require reporting of all types of accidents involving rail operations, not just derailments and collisions, if damage to railroad property is in excess of $2,300. It also appears that the amount of detail required by FRA concerning a reported accident or casualty is substantially greater than that required in Canada. On the other hand, Canada requires accidents resulting in damage to a bridge, culvert, viaduct, or tunnel or where there is an obstruction on the track causing a delay of 24 hours or more, regardless of whether there is significant damage or casualty. This presumably is intended to give CTC notice of conditions that may impair subsequent safe transportation. Canada is considering a complete revision of its accident-reporting requirements.

Operating Rules

CTC established by general order a uniform code of operating rules for use by all railroads subject to its jurisdiction. These are the rules that govern the continuing activities of rail employees in the conduct of rail operations. The current version of these was adopted in **1976.**[3] All employees involved in rail operations must initially pass a written examination administered by the railroads and, every 3 years thereafter, must pass an oral examination on the operating rules.

This regulation also sets forth seven additional rules that modify or extend earlier rules contained in Canada's Uniform Code. First, it states the manner and type of blue-signal display necessary to meet the requirements of Rule 26 of the Uniform Code. The blue-signal display is intended to alert railroad crews that employees are working under or between certain rail equipment and thus that equipment should not be disturbed. The special Canadian rules also require locking with special locks for all switches leading to repair track with the keys carried by the foreman or other person in charge.

The Canadian rule differs from the U.S. blue-flag rule as recently amended in a number of substantive respects. First, the Canadians require the signal to be mounted on a steel frame at a height of 5 feet. The frame is attached to the track between the switch and the first piece of rolling stock (presumably at both ends of the track if both are open to a switch). The United States has a variety of requirements as to the location of the blue signal depending on the nature and location of the equipment involved. Second, the Canadian rule does not distinguish in its requirements between main and other track, or between manually operated and remotely controlled switches as does the U.S. rule. Third, the Canadian rule does not contain most of the operational detail and alternative forms of providing protection that are contained in the proposed U.S. rule. For this reason the Canadian rule is probably one-tenth as long as the U.S. rule.[4]

The remaining special Canadian operating rules, which have no similar U.S. Government requirement, are on the following subjects and generally relate to or modify the requirements of the Uniform Code: protection of impassable or slow track, speed limits and operating procedures at crossings of one rail line by another at grades and drawbridges, speed of trains at highway-level crossings, flagging equipment on engines, signals at public crossings, and appointment of conductor to protect light engine movements on main track.

Finally, in a separate order,[5] CTC requires the testing by the company of the visual acuity, color perception, and hearing of railway employees. The tests are specified in the rule. Periodic re-examination is also required. In the United States, virtually all aspects of operating rules, including the testing of employees, are left to the separate determination of each company.

[3] General Order O-8.

[4] 44 F.R. 2174, Jan. 10, 1979.

[5] General Order o-9.

Safety Appliances and Locomotive Inspection

For the most part the safety appliance regulations, which establish requirements for certain "appliances" to be used on rail equipment for safety purposes, are virtually identical in Canada and the United States to the extent they address the same subject. Only three provisions appear in the Canadian orders that do not appear in the comparable section of the U.S. regulation.' They address safety appliances for "boarding cars" and appliances for locomotives of special construction. The United States, on the other hand, has provisions for safety appliances not covered by Canadian rules. They pertain to certain kinds of unidirectional passenger cars, box and other house cars with high roofs, self-propelled track motorcars, road locomotives with corner stairways, and locomotives used in switching.

Canadian and U.S. requirements for locomotives, including their inspection, appear to be similar in that they address the same areas. However, design specifications, for example, cab interiors, which do not seem to receive treatment in Canada, do receive detailed treatment by the United States. In some instances many of the U.S. and Canadian regulations for identical subjects may be similar but the United States, by comparison, regulates in far greater detail than does Canada' (compare U.S. requirements for multiple-operated electric units in 49 CFR 230 D with Canadian requirements in General Order 0-21 adopted in 1970 for inspection and maintenance for motive power equipment).

Dangerous Commodities

Dangerous commodities regulations of CTC are substantially similar to the U.S. regulations.[8] However, Canadian dangerous commodities regulations cover some areas that are not subject to Federal regulation in the United States. First, CTC established rules governing transportation of dangerous commodities in piggyback service, adopting the Interstate Commerce Commission (ICC) tariff 'requirements for the cargo tank unit. Second, the CTC rules cover the design, location, construction, operation, and maintenance of stationary bulk storage facilities for liquefied petroleum gases, flammable liquids, and anhydrous ammonia; unloading facilities for chlorine tank cars; and storage of ammonium nitrate and ammonium nitrate mixed fertilizers. CTC requires the railroad to submit the plans and specifications for each of these for approval. The U.S. Department of Transportation does not have similar specifications for such facilities. Canada also regulates design, location, construction, and operation of gas fuel systems c n railway cars. The United States does not.

Rail/Highway Crossings

CTC has regulations governing four aspects of rail/highway crossings—grade crossings,[9] grade separations, [10] protective devices,[11] and requirements for financial accounting for grade-crossing projects.[12] In the United States, these subjects are not covered even in part by Federal regulation, but rather are administered by the States using Federal funds. CTC approves the plans of a railway line before it is constructed as well as those of any modification to the line. Thus, review of the plans of all aspects of rail/highway crossings is consistent with this regulatory scheme.

In seeking approval for new grade crossings, the crossing party must submit a detailed application to CTC. CTC regulations establish specific requirements for the incline of approach of the highway, length and width of crossing surface, fencing, and signboards. The party constructing the crossing must pay the cost of construction and maintenance unless it has senior title to the property.

Canadian grade-separation regulations (which have not been revised to account for the changes made by the 1974 Railway Relocation

'49 CFR 231.
'Compare 49 CFR 230D with General Order 0-21 regarding inspection and maintenance of motive power equipment.
'General Order O-29 thru O-36.
'General Order E-4.
[10]General Order E-5.
[11]General Order E-6.
[12]General Order E-7 thru E-9.

and Crossing Act concerning financial assistance) also require submission of detailed plans and specifications to CTC for approval. The applicant must also submit certain financial data when funds are requested. The regulations outline cost-sharing formulas of the Government, the highway authority, and the railroads for each project and for its future maintenance. Allocations vary depending on the type and size of the project.

Protective device regulations are essentially design and installation specifications for particular types of grade-crossing warning devices. They are guidelines for the railroads to follow when they install and maintain protective devices at crossings. The regulations concerning treatment of accounts in joint rail/highway crossing projects are used in those projects undertaken pursuant to CTC order. They provide detailed treatment of the subject matter, such as rental rates of 254 different types of equipment.

Signals and Related Systems

CTC retains complete control over all aspects of the design, construction, location, and use of interlocking and signal systems. 13 Plans for the construction and modification of such systems must be submitted to CTC for review and approval. The regulations establish detailed requirements for these systems and provide, in effect, for uniformity of such systems on all railroads subject to the jurisdiction of CTC. However, the regulations do not establish requirements for inspection, maintenance, or repair of these systems. In the United States, a different approach is used. Plans and specifications for new systems are not approved although any applicable requirements for systems once installed must be observed. Discontinuance or modification of the signal system requires FRA approval. In addition, the carrier must observe certain periodic inspection requirements and report signal failures and accidents resulting therefrom. The U.S. requirements appear to be at least as detailed as those in Canada, if not more so.

Summary

In the long established areas of railroad safety regulation, such as those for safety appliances and locomotives, there appears to be little significant difference between the requirements of the two countries, although U.S. regulations, in some respects are considerably more detailed. In matters dealing with the fixed plant of the railroads, the approach is quite different. Canada requires review and approval of initial plans and specifications and of subsequent modifications. It also establishes many design requirements. However, it does not establish maintenance standards or minimum inspection requirements. The United States, on the other hand, prescribes maintenance and inspection practices but does not require pre-installation review.

The United States and Canada also take an entirely different approach to operating rules. The United States has traditionally left operating rules to the railroads' discretion. The Association of American Railroads has produced a set of operating rules as a guide to their members. However, in recent years the United States has begun to consider piecemeal adoption of a Federal operating rule on certain matters believed to need nationwide uniformity. An example is the blue-flag rule. Canada, on the other hand, owing probably to the fact that there are only two major carriers, has established a Federal Code of Uniform Operating Rules. These rules appear to generally follow a relatively simple format and style similar to that used by many U.S. carriers. This simplicity contrasts greatly with the comparatively detailed and lengthy style used by FRA in the few rules it has established.[14]

While much of the focus of U.S. regulatory activity in the past 7 years has been on track and freight car standards, Canada does not have any rules in those areas. Moreover, it has not adopted any regulations concerning hours of service despite a statute specifically authorizing it to do so. This subject is left to collective bargaining between labor and management. On the other hand, Canada has been very active in de-

[13] "General Order E-12 and E-13.

[14] 49 CFR 218.

signing new programs for rail/highway crossings, whereas in the United States this has essentially been left to the States with matching-share Federal funding, with the addition of some federally funded studies and demonstration projects.

Finally, the Canadians use a somewhat different approach for reporting accidents. They do not report yard accidents unless they result in injury or death. They also do not collect data on occupational safety and health hazards as distinguished from operational safety. However, they do require reports of incidents that cause train delays or obstructions regardless of whether any injury or damage is incurred.

Overall, Canadian regulations suggest a closer working relationship between the railroads and CTC than exists between U.S. regulatory agencies and the railroads in this country. This is supported by the fact that CTC does not rely on collection of fines as its major enforcement tool. Also the fact that CTC has not sought to revise its regulations continually to meet changing needs seems to indicate, among other things, that it is not relying heavily on a regulatory structure to accomplish its safety objectives.

Inspections

The Government safety inspection programs are carried out by the Rail Services Branch of RTC. The safety inspection programs implemented and planned by the Branch include track, car, locomotive, operations, dangerous commodities, fire prevention, stationary mechanical equipment, structures (including highway grade crossings), and signals. In addition, the Rail Services Branch has responsibilities that are not directly associated with railroad safety. These responsibilities include such diverse areas as monitoring the rehabilitation of grain-hauling branchlines, administering the branchlike abandonment program (including the capital expenditure fund for lines eligible for subsidies in connection with abandonment), evaluating passenger service, and monitoring station retirement and agency centralization activity.

Thus, RTC's organizational structure by combining inspections with other activities reflects the philosophy that railway safety is an integral part of all aspects of rail service delivery. Nonetheless, safety is considered an essential aspect of rail service delivery and specific attention is paid to it in the particular inspection programs, listed above, that are carried out by the Railway Services Branch. The Branch itself is organized into two divisions: the Infrastructure and Equipment Assessment Division and the Rail Systems Performance Evaluation Division, both of which have some responsibility for safety inspection. The Infrastructure and Equipment Assessment Division is responsible for monitoring compliance with track (including all aspects of the right-of-way), fixed structures, and equipment standards and regulations. The Rail Systems Performance Evaluation Branch is responsible for monitoring compliance with service, dangerous commodities, and the Uniform Code of Operating Rules.

The Rail Services Branch is authorized 29 staff in headquarters to carry out all of its responsibilities; these persons are divided approximately equally between the two Divisions. The Branch believes that almost all of the activities of the Infrastructure and Equipment Assessment Division and about half of the Rail Systems Performance Evaluation Division activities are directly linked to railroad safety. In addition to the headquarters activities associated with safety, RTC has field offices in six different locations throughout Canada .15 The field offices work in the general areas of accident investigations, quality control inspection programs, applications processing (for example, applications for abandonments), and investigation of complaints. In a field force of 84, approximately 59 persons spend some time on safety-related inspections. CTC estimates that about 35 percent of the professional person-hours available in the field are spent on safety matters. Although the headquarters Rail Services Branch does not have direct authority over the regions, it establishes the programs of work and the standards of performance for the field safety inspections.

[15]Monoton, Montreal, Toronto, Winnipeg Calgary, and Vancouver.

The top management of CTC views the inspection priorities as follows:

- accident investigation,
- grade-crossings inspection (including an informal supplement to ongoing programs administered by the Rail Services Branch), and
- safety inspection programs administered by the Rail Services Branch (of which car equipment inspection has received highest priority).

These priorities were arrived at by an informal consensus process as well as by management decisions made as a result of top management's perception of the existing problems. Some feeling was expressed by top management that the Rail Services Branch should give greater priority to the track inspection and operations (human error) problems. At this time, CTC acknowledges that the Rail Services Branch has been unable to match the priorities of the inspection program against accident data, because of inadequacies in the data collection system. With regard to the bulk of the safety inspection programs, the Rail Services Branch recognizes that with limited personnel it cannot inspect 100 percent of the railroad's plant and operations. It sees the Government's role in the inspection program as monitoring what the railroads are themselves doing. In this monitoring, Government inspectors note conditions and defects that require correction and, in this way, the Rail Services Branch sees its activities as directly related to the prevention of and the reduction of accidents. In addition, from its perspective the Rail Services Branch believes that there may be two other principal benefits stemming from the inspection activity. These are:

- The fact that Government is concerned about railroad safety and is monitoring the railroads' safety performance by means of inspection in itself tends to raise the general level of compliance.
- The fact that Government is concerned about railroad safety and is monitoring the railroads safety performance by means of inspection helps the various operating levels in the railroads' own organizations justify and receive more funds for maintenance than they might have otherwise received. The Rail Services Branch, however, acknowledges that it has no absolute measures of effectiveness for the inspection programs, although such indices are currently being developed. "

The Rail Services Branch believes that the effectiveness of an inspection effort that is based on the concept of periodic monitoring must be based also on the credibility of the inspections with the railroads—both with management and with the individual supervisor or employee at the working level. The Rail Services Branch has, therefore, followed a policy of hiring personnel who have had considerable experience in the railroad industry itself and who have achieved a certain stature within the organization of the railroad. Thus, it is not uncommon for RTC inspectors to be people who have reached the assistant superintendent level after 10 years with the railroad. In the opinion of the Rail Services Branch, however, such a policy is increasingly difficult to implement given the hiring constraints placed on RTC and the railroads' ability to compete successfully with the Government in terms of benefits.

CTC attempts to make the inspection efforts both systematic and representative. However, the individual inspectors are given latitude in devising their own inspection strategy. A description of the major inspection activities directly related to safety follows.

Track Inspection

The goal of the track inspection program is to monitor, evaluate, and regulate the quality of track and right-of-way .17 Since there are no Government-mandated track standards, RTC inspectors check against the railroads' own standards, which approximate the American

[16] The Bureau of Management Consulting is conducting a study to develop measures of effectiveness for the inspection *program as* a whole. In the Rail Services Branch, Activity Resource Allocation forms, which describe specific program components of the Branch's work, set forth "criteria to asses effectiveness and efficiency. " These criteria do not measure the degree of impact of any given program, but rather indicate what areas should be affected if the program is having an impact.

[17] CTC Activity Resource Association, "Track and Right-of-Way Quality Control."

Railway Engineering Association (AREA) recommended standards and which RTC representatives feel are adequate. At the present time, track inspection is conducted generally in the course of other engineering inspection duties, such as inspecting drainage, fencing, or crossing problems, However, the Rail Services Branch stated that it tries to make the inspections as systematic as possible.

Recently RTC began two additional efforts that can serve as tools of the inspection program. A description of each undertaking follows:

Comprehensive Track Inspection Effort: RTC assigned an engineer with substantial railroad experience to inspect the entire mainlines of both CN and CP. The inspector went over both systems in a high rail car (stopping along the way to make spot checks), passenger train, and freight train. In addition, RTC obtained information from the railroads about the type of rails and ties installed during the past 5 years, the ballasting and surfacing programs undertaken, the number of inspectors and track forces (mobile and fixed) assigned, and the tonnage moved over various subdivisions. RTC also gathered information on the branchlines and conducted some inspections but it did not conduct a complete field inspection.

From the analysis of information obtained from all these activities, the Rail Services Branch's opinion was that, in general, the mainlines of both railroads are in good condition. However, the branchlines are not in as good condition as they were in the early 1950's when short section forces were responsible for manually inspecting and maintaining the road. Nonetheless, the Rail Services Branch's opinion indicated that the branchlines are not in an unsafe condition. Representatives of the Rail Services Branch indicated their belief that the condition of the lines represented policy decisions by the railroads to place primary emphasis on the mainlines.

[18] On discussions with CTC representatives, there seemed to be some difference of opinion as to the condition of the track. Some high-ranking members of CTC believe that the track may not be in as good condition as the inspection reports might indicate.

Photographing of Mainlines: Based on a pilot study, the Rail Services Branch has proposed to photograph the mainlines at prescribed intervals (of approximately 300 feet). The photographs would be made by a camera mounted on a high rail car. The camera would take a picture with a wide area of vision (two frames sideways would constitute one picture) and would code the section of the track photographed. RTC believes that a photographic record of the track would aid in accident investigation as well as in headquarter's analysis of any particularly difficult inspection issue that might arise. RTC proposes to update the photographic library whenever a major change in the configuration of the track might occur (e.g., installation of a new grade crossing). [19]

Car Inspection

The goal of the car inspection program is to monitor, evaluate, and regulate the quality of railroad cars. CTC gives this program highest priority of all inspection activities. As in the track inspections, the principal activities are to: develop and update information concerning the condition of railroad cars in Canada by a systematic cyclical inspection program; to effect improvements in related railroad maintenance practices where deficiencies are identified; and to investigate complaints and ensure that necessary remedial action is taken ,[20]

The inspection program is based on a risk factor analysis developed by RTC. In this context, the term "risk" is defined as "expected severity within the system ."[21] The concept combines probability of defect occurrence with the potential severity of occurrence. RTC developed the risk factor by rating **125** typical defects on a severity scale of 1 to 20. The defects were rated in terms of potential for personal injury and property damage. The ranking was performed by various people knowledgeable in railroad

[19] The Rail Services Branch representatives indicated that the Canadian highway department has made a similar photographic record of highways; however, the purpose of the record was not safety inspection, but rather to judge efficacy of signing.

[20] CTC Activity Resource Allocation, "Car Quality Control. "

[21] "'Analysis of Defect Severity and Risk for Railway Car Equipmerit, " working paper completed for RTC, project no. 3-1265, August 1977 (draft), p. 1.

operations. The severity number finally assigned to each defect resulted from averaging the severity numbers assigned to it in the categories of personal injury and property damage.

When an inspection is carried out and a defect is discovered, the inspector enters the defect code on their inspection report. The information is computerized. By the time that the end of a quarter is reached, a "scientific random sampling" of cars has been made. RTC is then in a position to describe what the condition of the fleet is, based on the established measures. The inspectors examined a total of 11,000 cars in a representative quarter; however, the risk factor for that quarter does not mean anything in isolation. RTC believes that the significance of the risk factor lies in the comparisons that it will enable RTC to make over different time periods. The risk factor inspection of car equipment is a new program of RTC.

RTC inspectors are instructed to inspect cars at the large centers through which cars pass, and at points where there might be captive cars (cars that run only between certain points and do not go through one of the large interchange centers). Inspectors are also to inspect cars in receiving yards, on repair tracks, and in leaving yards. Inspectors inspect one side of a train only and check the brakes on every 10 cars that they inspect. They are assisted in making their inspection reports by recording equipment, from which they transcribe their findings onto a standardized form. The forms are in triplicate: one copy for the railroad supervisor, one filed with headquarters, and one retained by the inspector. The Rail Services Branch estimates that between 30,000 and 40,000 units are inspected annually.

Motive Power Inspection

The goal of the motive power inspection program is to monitor, evaluate, and regulate the quality of motive power units. As in the car and track programs, the principal activities are: to develop and update information concerning the condition of railroad motive power units by a systematic cyclical inspection program, to effect improvements in related railroad maintenance practices where deficiencies are identified, and to investigate complaints and ensure that necessary remedial action is taken .22

The motive power inspection program is carried out in a similar way to the car inspection program. Inspectors check a sample of motive power units at various points in service, such as in the receiving yards, and the leaving yards. RTC is developing a risk factor for motive power units that will be similar in concept to that developed for cars.

Dangerous Commodities Inspection

The goals of the dangerous commodities inspection program are twofold: to ensure the safe storage, handling, and transportation of dangerous commodities on the railroad system in Canada; and to monitor, evaluate, observe, and regulate railroad and shipper compliance with CTC regulations for the transportation, storage, and handling of dangerous commodities. The major activities of personnel in this program are the systematic inspection of various railroad facilities, the ongoing inspection of shipper and carrier facilities, and the conduct of training sessions to ensure understanding of the regulations.[23] The inspectors look primarily at the adequacy of the storage and handling of the dangerous commodities being shipped .2'

RTC has one full-time dangerous commodities officer in Vancouver. Otherwise, the dangerous commodities inspections are conducted by the car inspectors, the transportation officers, and the operations inspectors. CTC estimates that any given inspector can inspect from 40 to *80* tank cars a day. The inspector must break the seal on each car, check empty cars, and verify that the Hazardous Information Emergency Response form (HIER), giving information about action to take in the event of an accident, is present for shipments of dangerous commodities.

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[22] CTC Activity Resource Allocation, "Motive Power Quality Control. "

[23] CTC Activity Resource Allocation, "Dangerous Commodities Regulations Compliance".

[24] The Canadian Government's Bureau of Explosives has responsibility to protect carriers from committing infractions but is not a regulatory agency.

Every 30 days, the inspectors concentrate on a specific dangerous commodity activity, paying particular attention to what defects are present in the aggregate, RTC uses this information to determine whether trends might be developing. Inspectors are authorized to stop a train if a specific defect found during the course of any inspection is sufficiently serious, in the judgment of the inspector.

In addition to the inspection activities, RTC staff hold regional seminars to develop awareness among both RTC staff and railroad employees about the requirements for handling dangerous commodities. These seminars are oriented to the practicalities of handling commodities—i.e., setting up trains, re-railing cars, handling leakage, and the like—as well as to the overall requirements and enforcement policies of RTC. RTC is also beginning to conduct seminars for the shippers of dangerous commodities. Dangerous commodities are discussed in greater detail in the following section.

Operations Inspection

The goal of the operations inspection program is to monitor, evaluate, and regulate the quality of railroad operations of trains on mainline and yard operations. The operations inspectors systematically monitor railroad operating procedures to determine the quality of railroad operations as they relate to safety and, in particular, to the Government-mandated Uniform Code of Operating Rules and other related instructions and regulations .25

All written complaints by operating crews concerning operating conditions are investigated. Two inspectors, one in headquarters and one in Calgary, concern themselves almost exclusively with operating practices, including in-cab observation of engineers. Inspectors in each of the regions conduct operations inspections in addition to their other responsibilities. The two inspectors who are concerned almost exclusively with operations inspection devote most of their time to engine handling. Other operations inspectors are concerned with the observance of the operating rules generally—both by labor and by management.

When an employee has violated an operating rule, the RTC inspector reports the violation to the employee. Depending on the nature of the violation, it may be reported also to the railroad. However, representatives of the Rail Services Branch stated that the violations do not usually warrant discipline by the railroad. Instead, the violations are usually of such a type that they relate to the system of operations.

Other Inspection Programs[26]

Other RTC inspection programs are designed to ensure that measures taken by the railroads are adequate to prevent, detect, and suppress fires on and near the railroad right-of-way; to monitor, evaluate, and regulate the quality of railroad stationary mechanical equipment; to monitor, evaluate, and regulate the quality of maintenance of railroad structures; to ensure that the protection, safety, and convenience of the public is provided for by an adequate level of maintenance of highway/railroad crossings and ancillary installations;[27] and, to monitor, evaluate, and regulate the quality of railroad signal installations.

The inspection programs for stationary mechanical equipment, railroad structures, highway grade crossings, and signal installations are based primarily on a systematic approach to inspection and secondarily on response to complaints. However, the fire prevention inspection program, is directed by a greater responsiveness to incidence of complaints. The five inspection programs mentioned here are similar to each other and the others discussed above in that they operate from a regional base. Taken together, these five programs are intended to provide assurance that the rail operating environment does not in itself pose hazards.

[25] CTC Activity Resource Allocation, "Train Operations Quality Control."

[26] CTC Activity Resource Allocation, "F re prevention, Stationary Mechanical Equipment Quality Cent-ol, Structures Quality Control, Signal Quality Control, Crossing; Safety, and Protection Evaluation."

[27] See a subsequent section of this chapter for a full discussion of the highway grade-crossing program.

A detailed quality control program is being developed for signal and crossing inspections.[28] This program will entail compiling an inventory of signal equipment by subdivision and inspecting crossing warning devices and various signal systems in a comprehensive way. This effort is planned to take place in cooperation with the railroads. However, staff limitations have impeded the implementation of a planned structures comprehensive review similar in concept to the signal and crossing review.[29] RTC is currently reviewing the procedures and effectiveness of the fire prevention inspection programs. In the view of the Rail Services Branch, a meeting arranged by RTC between railroad officials and forestry representatives in British Columbia and Ontario resulted in greater cooperation and fewer railroad-associated fires .30

Dangerous Commodities

The Railway Transport Committee, in its initial report of the railway safety inquiry, noted a "factor of grave concern was the rapidly increasing involvement in railroad accidents of cars carrying a wide variety of dangerous commodities whose cargo, if accidentally released, could pose a serious hazard not only to railroad employees but also to the lives and property of the public. "[31] During the inquiry, derailments occurred involving dangerous commodities that increased the inquiry panel's interest in that type of accident .32 The inquiry panel concluded that shipment of dangerous commodities confronted Canada's regulatory authority with a new dimension in destructiveness and danger of life and limb. 33

In *1974,* the Bureau of Management Consulting (BMC) concluded that very little data was available on incidents involving dangerous commodities. BMC contended that dangerous commodities incidents, although relatively infrequent, presented the potential for major catastrophes. Available data for the years *1970-73,* showed 2 fatalities and 34 injuries resulting from accidents involving dangerous commodities. Table 47 provides the information of the Bureau.

Dangerous Commodities Safety Responses

Transportation of dangerous commodities comes under the jurisdiction of the Federal Government. Canada's Railway Act specifies that:

- No passenger shall carry, except in conformity with a CTC order, gunpowder, dynamite, nitroglycerine, or any other goods of a dangerous or explosive nature.
- Every person sending dangerous commodities shall indicate the nature of the shipment on the outside of the package and give written notice of the commodity to the employee of the company receiving the goods.
- The railway shall not carry goods of an explosive or dangerous nature except in conformity with CTC regulations. [34]

Dangerous Commodities Task Force

During the general inquiry, RTC explored problems associated with the shipment of dangerous commodities. It examined, for example, whether new railroad technology was increasing the hazards; whether railroad practices and rules for dangerous commodities were adequate to meet the increased hazards; and whether ex-

Table 47.—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	13,25
Oxidizing organic	22	5.5
Poison	18	4.5
Corrosive	27	6.75
Explosive	0	0.0
Radioactive	2	0.5
Compound gas	8	2.0
Total	144	36,0

SOURCE Slat! stical Analysis 1956-73 p 75

[28] Rail Services Branch, "Status of Programs," June 30, 1978, PP. 5-6.
[29] Ibid., p. 7.
[30] Ibid., p. 15.
[31] *Initial Report of the Railway Safety Inquiry* (Canadian Transport Commission, 1972) p. 1.
[32] Ibid., p. 1.
[33] Ibid., p. 19.
[34] Railway Act, ch. R-2.

isting rules were being properly applied and monitored. RTC felt these issues about the adequacy of the research effort were not satisfactorily answered during its inquiry .35 RTC therefore proposed that CTC create a task force to examine rail transportation of dangerous commodities. In 1971, CTC created a task force with representatives from CP, CN, and the Canadian Railway Labour Association. This group was to review the hazards associated with the transportation of dangerous commodities by rail. The task force was to recommend measures to ensure the highest level of safety compatible with the economy of operation and expeditious movement of goods. The task force had available to it some of the best expertise in industry (chemical, gas and oil industries, and tank car lessors); other Government agencies (such as those dealing with the military, atomic energy, explosives, and natural hazards); other carriers (such as motor vehicle, aviation, and water); certain shippers of dangerous commodities; and health, fire, environmental, and safety specialists.

Reporting Requirements

Canadian regulations require certain reports whenever trains, engines, cars, or other rolling stock are involved in an accident that results in the release of a pollutant or a dangerous commodity.[36]

In addition, RTC requires that each dangerous commodity shipment be accompanied by a HIER form, which is completed by the shipper of explosives or other dangerous commodities. The form, included in appendix C, contains the following information.

- designation of the commodity/explosive,
- commodity/explosive classification (e. g., flammable compressed gas),
- potential hazards (fire, explosion, and health), and
- immediate action information (general, fire, spill or leak, first aid, and emergency phone).

[35] *Railway Safety Study* (Bureau of Management Consulting)
[36] Revision and Consolidation of General Orders, General Order 0-1.

Dangerous Commodity Program Implementation

CTC specifications for the design and/or performance of tank cars are similar to those issued by the U.S. Department of Transportation (DOT). The most recent DOT tank car standards have been adopted by CTC almost completely. However, the compliance schedule differs.

The present plan for the assurance of safety of the tank cars does not provide for retrofitting. Nor does CTC have the authority to require retrofitting. RTC officials note, however, that many of the tank car manufacturers are cooperating without regulation.

Highway Crossings

There are about **34,210** public highway/railroad crossings in Canada. Approximately 8 percent of the public crossings are grade separated; 21 percent have some form of automatic protection, such as flashing lights or automatic gates; and the remaining have crossing signs .37

Between **1956** and **1973,** the average number of crossing accidents was 1,156, There were on the average, 160 fatalities and 618 injuries annually. Crossing accidents are the largest cause of railroad-related fatalities.[38] The Rail Systems Development Branch of RTC roted in a 1978 report that:

> At the crossings that are not grade separated there is an inherent danger to road and rail users of colliding with each other at the crossing; however, the extent of hazard is a site-specific condition and depends on the features of the crossing; one is more or less hazardous than another because the features of all crossing differ. For example, over the period 1970-75 there have been no accidents at **90.6** percent of all crossings, one accident at 7 percent of all crossings, two accidents at 1.5 percent of all crossings, three accidents at **0.5** percent of all crossings, four accidents at **0.2** percent of all crossings, five accidents at 0.1 percent of all crossings; none had more than six accidents. 39

[37] *Railway Safety Study,* op. cit., 1974.
[38] Ibid.
[39] *Rail Systems Development Branch Report* (Railway Transport Committee, 1978).

RTC representatives note a steady decrease in the number of crossing collisions over the past 5 years. Automobile mileage has increased.

The objectives of CTC regarding crossing safety are to: 1) establish the characteristics of a crossing in accordance with the regulations and standards developed by the Commission for the safety of the users of the crossing; 2) authorize or encourage road authorities or railroad companies to carry out works improving physical features or to install warning devices with or without grants in order to reduce hazard to the users of the crossing. 40

Legislative History

The Canadian Government first addressed the highway-crossing problem in 1909 with amendments to the Railway Act. These amendments established the railway grade-crossing fund. The prior 1888 Railway Act led to interest in the crossing problem by raising the general level of consciousness of the public and the railroad industry on the issue of crossing safety. Following that 1888 Act were the beginning installations of passive protections, such as crossbucks and signs. Legislative provisions are discussed in chapter 111. The following summary includes the basic provisions of the 1909 amendments, the 1958 Act, and the 1974 Railway Relocation and Crossing Act. The basic provisions in chapter R-2 of the Act are as follows :[41]

- Railroads shall submit to CTC a plan and profile showing the portion of the railroad and highway to be affected by proposed rail construction. CTC may withhold approval of an application pending adequate railroad steps to ensure the safety.
- Where a railroad is already constructed, CTC may on its own motion or upon complaint, order the railroad to provide additional safety at a crossing.
- A railway grade-crossing fund exists to aid construction work for the protection, safety, and convenience of the public at crossings. Amounts from the fund are available only to crossings 3 years old or older.

Under the Railway Relocation and Crossing Act, up to 80 percent of the project installation cost can be funded by the Federal Government. The remaining 20 percent of the installation cost is divided between the road authorities and the railroads. The Act does not provide for Federal funding of the maintenance of the protection. Usually 50 percent of the maintenance cost is borne by the road authority and 50 percent by the railroad.

Program Implementation

Past Evaluation of CTC Program Effectiveness. One of the most comprehensive reviews of CTC's grade-crossing program was conducted by BMC in 1974. The Bureau found relative to highway crossings that:[42]

- RTC has not initiated much of the activity in bringing about crossing safety, but rather is in a reactive posture. Over 90 percent of the projects originate from art external application or complaint. RTC places reliance almost entirely on the railroads and the highway authorities to identify those crossings that present the greatest hazard.
- Since there is a shared funding responsibility for the installation of crossing protection and since the responsibility for the maintenance of automatic devices is with the railroads and the highway authorities, RTC initiatives in reducing risks at hazardous crossings are sometimes difficult to achieve.
- Insufficient attempts are made to establish priorities based on risk in decisions to approve a grant.
- The criteria for fund dispersals did not appear to include an analysis of the relationship between the crossing problem and the most cost-effective protection.

PRESENT PROGRAM STRATEGY

Survey and Data Collection: Data on approximately 30 typical attributes of grade crossings have been collected for a number of crossings

[40]Interviews with representatives of CTC, 1978.
[41]Railway Act, ch. R-2.
[42]*Railway Safety Study*, op. cit., 1974.

and placed in a computerized file. The data can be grouped into the following six categories:

- location and jurisdiction,
- accident history,
- protection at the crossing,
- track and train characteristics,
- road and road vehicle characteristics, and
- year of last inspection.

During **1978,** RTC conducted onsite surveys of some 12,000 of the likely most dangerous crossings. Specific attention was paid to: the annual traffic (based on the daily traffic rate), the nature of crossing physical characteristics (e.g., description of the sight lines), and the type of existing protective devices. These data supplemented other information already computerized. Following the survey, CTC officials met with many of the road authorities with jurisdiction over surveyed grade crossings. The purpose of those meetings was to come to some agreement on the most cost-effective approach to dealing with the problems on a crossing-by-crossing basis.

Federal Government Funding of Crossing Projects

The Canadian Federal Government provides financial assistance for crossing improvement under the authority of the Railway Relocation and Crossing Act. Each application is reviewed against criteria developed by RTC. The criteria are based on protection, safety, and convenience to the public.

Six months is usually required between the time of receipt of a crossing improvement assistance application and a grant approval. Another 3 years is generally needed for funds disbursement and project implementation .[43] A large majority of the projects begin with an application from a local jurisdiction or a complaint. For those applications under serious consideration, RTC sends an engineer to make an onsite inspection to validate or alter the proposal, as necessary, from the jurisdiction applying for the grant. In 1977, 1,519 applications were received for crossing improvement work. Funding was provided for 399 of those projects, totaling over $17 million. The projects qualifying for assistance included 29 grade separations, 166 installations of new or improved automatic protection devices, and 36 improvements in approach and/or visibility at grades .44

Present Problems With the Grade-Crossing Program

According to RTC officials, some problems of the grade-crossing program identified by BMC in 1974 still exist today. Following is a discussion of some of the grade-crossing program problems and the present efforts to deal with those problems.

RTC uses inadequate methodology to set correction priorities by degree of hazard, or to determine the most cost-effective method of reducing existing hazards.

The Rail Systems Development Branch of RTC is attempting to develop an objective evaluation method to determine the most cost-effective crossing improvements. A statistical analysis of crossing accident data, including physical and warning characteristics of the crossings, is being developed. The resulting mathematical model, called a hazard index, would represent in the aggregate, the average number of accidents that a typical crossing with a given set of charactistics could be expected to have. The next step in the analysis will be to determine what the effect of altering certain characteristics will be on the number of accidents. The methodology is expected to provide a means for: 1) ranking crossings by hazard, and 2) determining the relative effectiveness of one type of improvement over another.

While the research is being conducted, RTC is funding projects based on a subjective evaluation of the physical characteristics of a crossing, and the road and rail traffic.

[43] Review Committee of Railway Transport Committee, Sept. 22-23, 1975, Bureau of Management Consulting presentation, slide 6-12, Ottawa.

[44] Report of th, Canadian Transport Commission, 1977.

Intermediate protection devices (between passive protection and automatic devices) are currently ineligible for funding.

Some argue that no intermediate technology exists; others argue that such technology exists, but is not accepted for funding. RTC is exploring options, given the fact that many municipalities cannot afford the automatic devices and believe that they do not need such level of protection. The "ditch lights" now being used by CP serve as an intermediate option that some argue should be considered. Statistics (which have yet to be analyzed by RTC) show a reduction in accidents at crossings when railroads have been using ditch lights.

An increase in the number of illegal (de facto) crossings presents a hazard to the general public.

Agreements between the railroads and a number of private landowners have produced crossings that the landowners can use when the rail track crosses their land. Increasingly those crossings are being opened to a larger public with the acquiescence of the railroads. These crossings are not under the jurisdiction of the Federal Government, hence the public is not adequately protected.

The fact that maintenance is not funded by the Federal Government results in inadequate protection for many of the smaller, poorer municipalities.

Efforts are underway to amend the law to provide some level of Federal support for maintenance of automatic devices.

It is possible that grade crossings will no longer receive the necessary attention or resources because of changes in the allocation of funds.

Under the urban transportation assistance program, provinces can use funds formerly authorized solely for grade-crossing protection, to finance grade separations, equipment, and other highway programs. The railroads fear that broadening the discretion of the provinces will decrease the amount of money spent on grade crossings and possibly increase the number of grade-crossing accidents.

LABOUR CANADA'S OCCUPATIONAL SAFETY AND HEALTH

The Department of Labour (Labour Canada) has responsibility for safety of some railroad employees; CTC has responsibility for others. Employees under the jurisdiction of Labour include: employees involved in maintenance-of-**way** activities, repair shop employees, freight handlers, and porters and dining car employees.

Protections Provided

The Department of Labour has issued rules that protect employees under its jurisdiction. The rules are applicable to employees, irrespective of the industry. In other words, the Department of Labour attempts to provide the same level safety to railroad employees as it provides to employees of a steel mill. The only Canadian industry that has specific standards is the coal industry. In addition to the protections cited above according to Department officials, employees can refuse to work if the work environment presents an imminent danger.

Labour Canada requires investigation of every injury if the employee loses 1 or more day's work. In addition, the Occupational Safety and Health Division, or its agent, investigates all fatal accidents and "significant" disabling accidents. Accident investigators are used for encouraging compliance and for the training of employees.

In addition to accident investigation, the Federal Government is involved in inspection. Representatives of the provincial governments have performed the investigations under contract with the Federal Government. However, the arrangements with the provincial govern-

ments did not extend beyond February 1979. After that time the Department of Labour will conduct its own investigations relying on information from local safety committees composed of railroad and union representatives. The sanctions that can be imposed for violations of Department rules can be up to $10,000 or incarceration. The Department of Labour also has authority to close operations until there has been compliance with the rules.

Problems Associated With Providing Occupational Safety

According to Department of Labour officials, problems in providing the necessary level of safety to railroad employees are both jurisdictional and substantive. The jurisdictional problem arises from the division of responsibility between Labour and CTC. The fact that CTC has not issued occupational safety rules appears to compound the jurisdictional problem.

The environmental hazards for railroad employees have been identified as follows:

- the potential for harm to those involved in welding because of the nitrogen dioxide fumes,
- the potential for harm from nitrogen dioxide to those employees spending long periods of time in the tunnels, and
- noise level in shops.

(The Department of Labour is, however, working with one of the railway companies to develop a pilot program of audio-metric examinations. This project may be a joint railroad/Occupational Safety and Health Division noise evaluation system.)

One other problem relates to the effectiveness of the regulations. The Department is required to conduct socioeconomic analyses when the cost of implementing a regulation has the potential of exceeding $10 million. The Department has the difficulty of obtaining the resources to conduct meaningful analyses.

RAILWAY SAFETY ADVISORY COMMITTEE

One major initiative of RTC prompted by the safety inquiry was the establishment of the Railway Safety Advisory Committee in 1973. That committee is a tripartite committee with representation from the railroads, the unions, and RTC. Initially the committee was organized into working groups for addressing such matters as public disclosure of accident information, track inspection requirements, maintenance of signal devices and equipment, detection of rockfalls, and the development of standards for track right-of-way.

Since 1973, the committee has established four technical committees and one administrative committee: The administrative and technical committees that form part of the Safety Advisory Committee are:

- Orders and Regulations—Administrative/Legal Committee,
- Dangerous Commodities Technical Commit tee,
- Track and Structures Technical Committee,
- Crossings and Signals Technical Committee, and
- Rolling Stock and Operations Technical Committee.

Each of the technical committees has representation from the railroads, the unions, specialists as required, and RTC staff officers. The administrative committee consists of RTC staff members only since its responsibility is to translate the standards/criteria into orders and regulations. Working groups may be organized within each technical committee in order to explore specific issues in greater detail.

The technical committees operate under the principle that although they should attempt to integrate divergent points of view, they will not seek consensus.

Chapter VII

RAILROAD SAFETY PROGRAMS

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Chapter VII

RAILROAD SAFETY PROGRAMS

INTRODUCTION

The management philosophy of both major railroads in Canada, although different in many other respects, appears to be characterized to a considerable extent by an active concern for safety. Managements of both railroads perceive operational safety as directly related to productivity and efficiency. Thus, in both cases, an effort has been made to extend a concern for safety throughout the organizations. Each railroad places emphasis on supervisor accountability for safety as well as on conveying to the individual employees that they have a responsibility for ensuring safety. The Government-mandated Uniform Code of Operating Rules says, in its first point, "Safety is of first importance in the discharge of duty.'"

Individual responsibility for safety into individual accountability is done in various ways by the two railroads. However, in both case, the significance attached to safety is indicated by the fact that the most senior operating official, the vice president for operations, is responsible to the board of directors for the safety record of the railroad. The Canadian Pacific (CP) requires the vice president for operations to report to its board of directors specifically on the subject of safety four times every year. The Canadian National (CN) requires the vice president for operations to report to its board once a year. In each case, the significant point is that safety is a subject of explicit concern and accountability at the highest corporate levels.

'*Uniform Code of Operating Rules* Revision of 1962, approved and prescribed by the Board of Transport Commissioners for Canada by General Order No. 873, dated the 1.5th day of November 1961. Effective Oct. 28, 1962, p. 2.

SUPERVISOR ACCOUNTABILITY

Since the highest ranking officials of CN and CP must answer for the safety records of their companies and since both managements appear to be convinced that safety and productivity go hand in hand, they have both implemented systems for monitoring the safety performance of their various divisions. Both managements trace their increased concern for safety in the workplace to about 1974. A representative of CP said that he saw personal injuries in the workplace as an "attitude problem, " and in assigning management priority to safety believes that attitudes have changed.

Each railroad is able to get a complete picture of its safety record–both train accidents and personal injuries—for any particular month as early as 10 days into the following month. Management discussions and decisions flow from this information. A headquarters office in each railroad is charged with accident prevention and so with managing this data system. In CP, when an accident occurs—whether it involves personal injury or property damage—the costs for that accident are charged directly to the budget of the division responsible. CN's system consists of safety performance goals against which supervisors are judged. Goals are set by the joint headquarter/field process. Individual performance of each division is discussed by conference call with headquarters every month. CP has a similar safety performance goal system.

PREVENTIVE PROGRAMS

In addition to their accident and casualty reporting systems, the data analyses they conduct, and their systematic program of supervisor accountability, the two railroads approach the problem of promoting and maintaining safety in a variety of ways. Generally, the programs implemented by the two railroads are preventive in nature and attempt to integrate safety concerns with other functions. The major programs are:

- inspection and maintenance,
- training,
- research,
- safety committees and other activities, and
- rehabilitation.

Each of these programs is undertaken to some extent by both railroads. However, the emphasis placed on one program over another may differ between the railroads.

Inspection and Maintenance

Track

The railroads inspect the roadbed for a number of reasons. In most cases the inspections have some implications for safety. Neither of the railroads differentiates between safety inspections and maintenance inspections. However, in the track and roadbed area, both railroads agree that safety standards are "minimal" standards. Both claim to maintain their track at a level higher than the standards prescribed by the U.S. Federal Railroad Administration (FRA).[2] A representative of one of the railroads said that if the track gets to the point of being maintained to a level of safety rather than above the minimum safety standard, "then, you have a real problem, " in terms of the economic well-being of the railroad. Both railroads apparently recognized that track-related accidents were beginning to be very costly at about the time of the 1971 safety inquiry. Since that time both railroads claim to have expended significant sums to upgrade their track system.

[2]There are no Government-mandated track standards in Canada.

There are specific examples of continuing track improvement programs undertaken by the railroads. For instance, CN has recently instituted a program of installing concrete ties in certain areas where track curvature exceeds two degrees and where there is significant traffic with heavy axle loadings. As another example, CP recently overhauled a difficult section of track along which several derailments took place. Both railroads agree that well-maintained track is the backbone of a productive railroad. However, they acknowledge that the problem of maintaining the roadbed is complicated by increased traffic with heavier axle loadings.

There appears to be a consensus of the two railroads that deferred track maintenance has not been a problem in the same sense that it has in some places in the United States. Canadian railroads recognized in the early *1970's* that maintenance of the roadbed had to be a priority item if they were to remain v able. Although track conditions may not have been ideal at that time, the railroads believe that maintenance had not been deferred to the point of causing irreversible problems. However, they acknowledge that this is more true for the mainlines than it is for the branchlines. Many of the branchlines are principally used for hauling grain and are not revenue producing, For that reason, the railroads have consciously limited maintenance on these lines, However, they emphasize that the branchlines are still maintained above a minimum level of safety.

Both railroads are organized by regions. Their inspection force operates four of the regions; however, the headquarters Office of Engineering serves a quality control function, providing the regions with the standards of inspection and performing spot checks to see how the inspection function is being carried out. Track inspections are carried out on a schedule determined by the frequency of track use. One railroad representative stated that although precise inspection requirements exist for different sections of track, it is possible to generalize that the mainline track is inspected at least once every two calendar days. Foremen, supple-

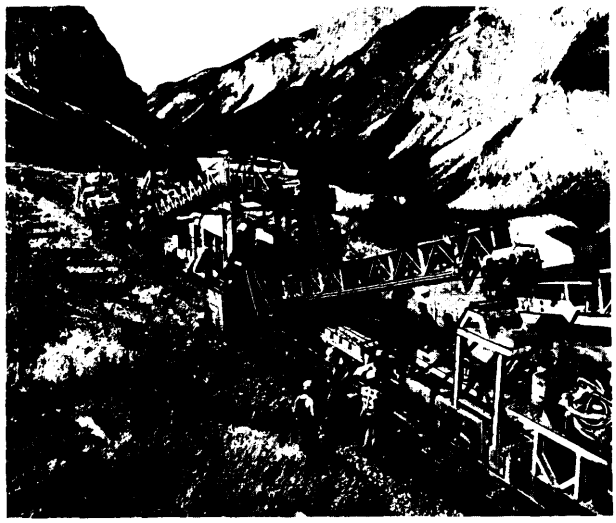


Photo CP Rail

Upgrading —CP Rail spends millions of dollars each year upgrading its track

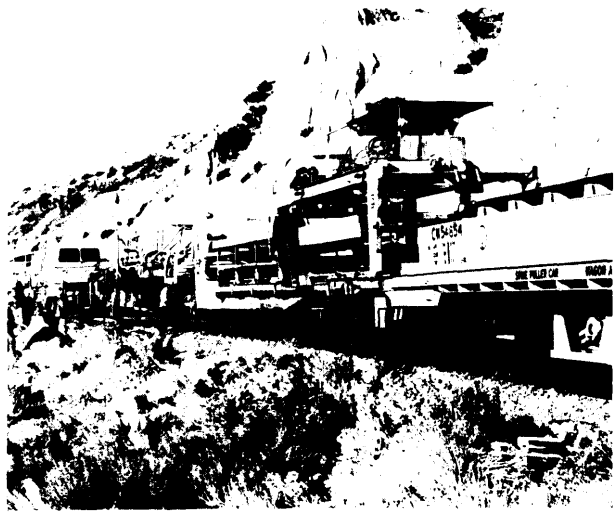


Photo CN Rail

Upgrading —CN concrete tie and rail installation machine

mented by roadmasters, inspect the track by high rail car, by track motor car or, sometimes, by train looking for specific aberrations.

The inspections reports are used to allocate immediately available resources. The reports also provide some input to decisions about how the projected resources available to the railroad as a whole should be allocated in the long term. However, the two railroads appear to rely on different systems for general allocation of resources. CN relies, to a considerable extent, on a sophisticated data bank that provides information on the condition of the railroad plant, specifically to assist in such decisionmaking. Input to this data bank with regard to track is provided by an inspection report issued after track inspection has been made by track recorder car, which looks at rail surface, gauge, and cross alinement.

Locomotive and Car Equipment

Canadian railroads are subject to Government-imposed locomotive and car equipment standards. The standards are similar to those promulgated by the U.S. FRA.

One railroad official indicated that a critical difference between the approach of the Canadian railroads to equipment maintenance and that of the U.S. railroads in general is a greater husbanding of capital. In other words, freight cars are not maintained to standard unless they are called into use or unless there is an influx of money that has not been earmarked for other purposes. Generally, motive power units are inspected every 45 days, with a major overhaul every 4 years. Freight car equipment is inspected every 500 miles, with a major repair every 10 to 12 years.

CN instituted a program in the last 4 to 5 years to analyze a 10-percent sample of the rolling stock twice a year. The analysis includes looking at the equipment both by type and by series. The railroad has found that, by constructing a profile of freight equipment characteristics, sufficient leadtime is given to correct problems before they become severe. The railroad believes that the program prevents accidents. In addition to the safety implications of such an inventory, the program provides a data base to the railroad that helps it in allocating its resources.

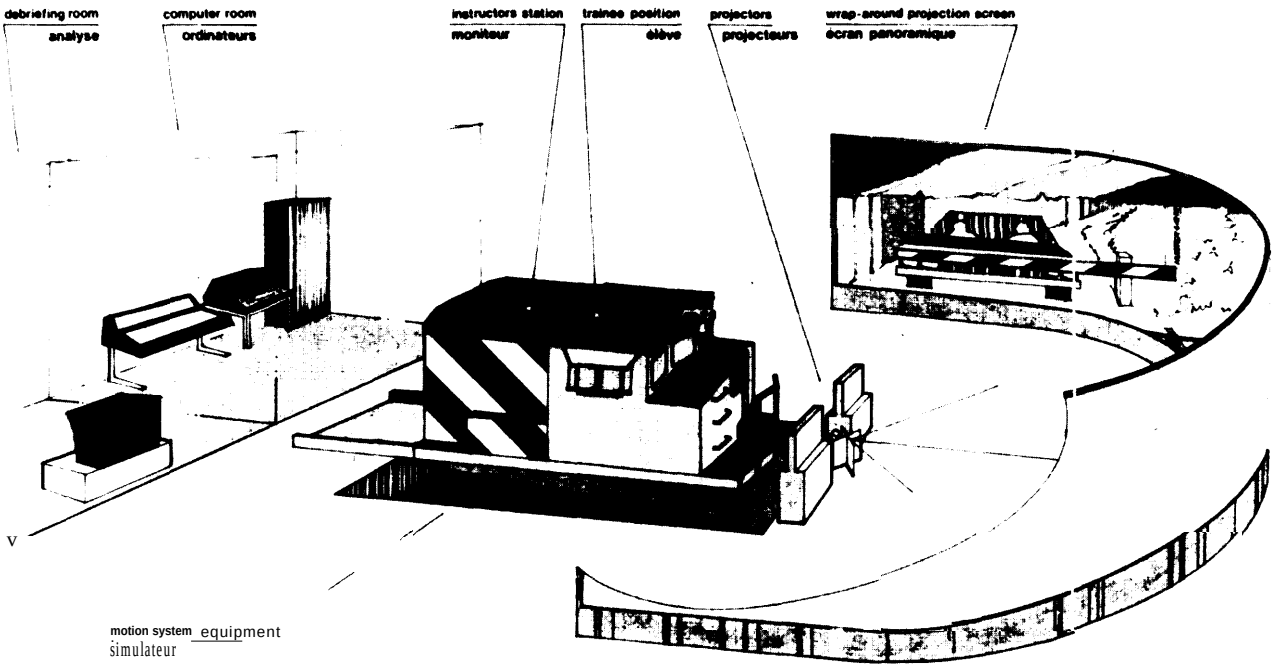
Generally, the equipment used by the Canadian railroads is *very* similar to that used by U.S. railroads. However, the locomotives have certain safety features such as a collision post, expanded area of vision, and personal facilities in the cab that are Canadian-designed. Many Canadian freight cars still have plain bearings

(the failure of which has been related to accidents), but hot box detectors are becoming increasingly common.

As in the case of track, the railroads do not consider it profitable to invest in new equipment for hauling grain. Thus, the Government of Canada itself bought grain hoppers, which the railroads are now using to transport grain. The railroads are responsible for maintaining these cars and replacing them if they are damaged beyond repair.

Training

Both railroads have instituted several different types of training programs for their employees. The training may be skill-oriented with a specific focus on safety aspects or it may be directed toward safety in a more general way. An example of skill-oriented training that has a specific 'safety focus is the engineering training school that CN operates at Gimli. This school attempts to replace informal, on-the-job training that locomotive engineers received in the past with a structured program. The engineers receive a 2-month course of which 1 month is concerned almost exclusively with safety. To aid in making the training realistic and transferable, CN built locomotive simulators that it uses during the training. (CP also has two locomotive simulators, which it uses as training aids for locomotive engineers. The simulators are used also as research tools to determine causes of derailments) After the engineers have completed the training program at Gimli, they must go through a period of on-the-job training and other qualification procedures before they can become engineers. Representatives of CN state that locomotive engineers trained at the school have considerably better safety records with regard to human failure accidents than do engineers not trained at the school .



Locomotive and Train Simulator CN **Simulateur**

The school is located at the site of a former air force base. It has a permanent staff of *28.* An estimated 1,500 employees attend the school each year. In addition to locomotive engineers, training programs are also conducted for telegraphers, train dispatchers, and railroad officers.[3] The school is beginning retraining activities to reinforce and refresh knowledge gained previously by employees. CN estimates that it spends about 1 percent of its transportation budget on its training activities.

An important aspect of training for both railroads is the promotion of safety consciousness among employees. Both railroads give supervisor training courses in safety in order to inform employees about the safety implications of various aspects of employee management and railroad operations. This training emphasizes the responsibility that the railroads assign to supervisors for the safety records of their units. The training efforts result in a greater level of safety consciousness in both general and specific terms. For instance, in its operations and maintenance supervisory safety training program, CN instructs its supervisors in such diverse areas as accident problems, human relations, maintaining interest in safety, industrial hygiene, material handling and storage, and fire protection. ' The supervisors are told, "*Accident prevention and efficient production go together* . . . Implementing the company program, making sure his work area is safe, and that his people work safely, is an integral part of the supervisor's responsibility."[5] CP emphasizes training for first- and second-line supervisors, dispatchers, yardmen, trainmen, and enginemen in order to prevent accidents and promote safety.

Research

Both railroads are engaged to some degree in research activities. The most extensive rail research carried out by any entity—Government or private—in Canada, is conducted by CN. A description of the research activities of the two major railways follows.

CP's research is directed primarily toward the application of new technology to continuing problems, such as research on traction motor performance. It is also reviewing technology for application in the Canadian environment, such as the field trials being carried out on self--steering freight car trucks. In addition, CP has also had some research projects with outside groups such as the National Research Council and various universities.

CN's research program began in 1945 when the railroad established the first rail research in Canada. In 1965, CN built an integrated research facility in Montreal. The bulk of CN's research work now is conducted for the rail division, emphasizing track/train dynamics. In addition, the CN research centre is responsible for quality control of materials. Under this program, *18* inspectors are employed by CN to inspect those materials critical to the operation of the railroad; these materials are inspected in the plant, prior to their delivery to the railroad. (CN also requires that suppliers themselves maintain adequate in-plant inspection and monitors this activity.) The inspection reports are sent to the research centre for analysis to detect any trends that might be developing. Another major activity of the research centre is to conduct failure analysis on all components of the railroad that fail and are involved in an accident. The centre looks for trends as well as for specific aberrations.

At the present time, in addition to the ongoing activities mentioned above, CN is conducting research in the following areas that relate specifically to safety:

- fatigue life of track structures,
- fatigue life of bridges,
- hunting of vehicles,
- radially articulated trucks,
- accident investigation—conducted by hybrid computer to simulate the accident and

[3]The *Uniform Code of Operating Rules* requires that railroad officers be re-examined for proficiency in the rules at periods of 2 (for operating officers) or 3 years. This requirement extends through the hierarchy to the vice presidents for operations.

[4]Other items covered in the course are: instructing safety, personal protective equipment, industrial housekeeping, machine guarding, hand tools, and power tools.

[5]*Canadian National Railways Operations and Maintenance, Supervisory Safety Training Program,* pp. 1-2.

determine what might have occurred under a variety of conditions, and
- alerter for train crew.

Further, in response to specific problems that have arisen, CN research has been conducted to modify six-axle trucks and to address "rock and roll" problems on the track.

Safety Committees and Other Activities

Both railroads have a system of safety committees[6] established in the field by supervisors in the different departments, such as the car department or the motive power department, at the operating level. These committees have been a cooperative effort between labor and management and have been used to promote and to monitor safety practices. In general, the committees do a certain amount of accident investigation, observe jobs performed, and make safety recommendations to management. In addition, for instance, CN encourages its safety committees to conduct safety audits, for which it provides forms. CN uses the audits to monitor the safety programs of the various supervisors. CP has a similar safety audit program.

Both railroads indicated that employee involvement in activities that give them responsibility for their own safety has paid off in terms of fewer accidents. Peer pressure and better communication between labor and management about the potential for accidents are seen as the primary contributing factors to the success of the safety committees.

The railroads have detailed requirements for situations in which protective clothing—such as goggles, protective footwear, hard hats, and gloves—must be worn. The railroads generally either provide the protective equipment for their employees or they contribute to its purchase. In addition, CN maintains a list of suppliers, approved for the safety performance of their products, from which all CN purchases are made. Award programs (e.g., the annual certificate program in which CP recognizes groups of employees who have had no lost-time injuries and the Golden Shoe Club of CN for employees who avoided injury because they were wearing protective footwear) are used to some extent to encourage the use of protective equipment and general safety practices. The railroads also use a variety of safety films, posters, pamphlets, and information sheets to direct the employees' attention toward safety matters in general as well as the importance of wearing appropriate garb for different work situations.

When an employee is involved in an accident, an attempt is made to analyze the reasons for the accident. In some cases, an employee judged to have been negligent, is rebuked or disciplined for having been involved in the accident. However, the approach of the railroads is not merely disciplinary. Its emphasis is to determine ways of preventing accidents in the future.

In addition to the employee-focused safety programs, CP has a program that is aimed at the public. CP rail police visit schools located near railroads to instruct on the dangers of trespassing on railroad property. CP a so has a snowmobile safety program to help reduce snowmobile/train accidents.

Rehabilitation Programs

The Uniform Code of Operating Rules states, "The use of intoxicants or narcotics by employees subject to duty, or possession or use while on duty is prohibited. "[7] The railroads indicated that until recently anyone caught "drinking on the job, " for instance, was summarily dismissed. Today, this is still true for anyone involved in train operations who is found to be under the influence of alcohol or narcotics while on the job. However, several years ago, both railroads recognized that employees with alcohol or drug problems should be assisted with these problems, As a consequence, both railroads have rehabilitation programs in which the troubled employees can get professional help. The railroads are working with the local union representatives to encourage employees with alcohol or drug problems to seek the help that is

[6] The Department of Labour requires the establishment of safety committees if the Department finds them necessary. However, the railroads safety committees predate this legislation.

[7] *Uniform Code of Operating Rules, op. cit* p. 3.

available. Although the programs have been in effect for several years, a representative of one of the railroads stated that it does not appear that alcohol and other drug-related accidents have been statistically reduced since the program's inception.

PARTICIPATION IN REGULATORY EFFORTS

Both CN and CP believe that one of the significant outcomes of the RTC safety inquiry of 1971 was the formation of the tripartite Railway Safety Advisory Committee. This committee provides a forum for management, labor, and Government to discuss mutual problems and to put forward their varying points of view in a nonadversarial situation. One of the major tasks of the Railway Safety Advisory Committee (see chapter V for discussion of committee organization) is to "integrate divergent viewpoints and provide the Railway Transport Committee with a consentaneous exposition of specific actions required for purposes of improving levels of rail safety. "[8] This purpose is carried out to a large extent by a series of technical committees, which report to the Railway Safety Advisory Committee. The Railway Safety Advisory Committee reviews suggested changes in the rules and regulations that come from the committees, in addition to advising generally on railway safety policy.

Both railroads and labor have representatives on each of the technical committees as well as on the advisory committee itself. The railroads recognize that the tripartite forum is one way for the day-to-day concerns of the railroads to be integrated into regulatory policy consideration and so to help ensure that the resulting policies are realistic from a railroad operations point of view.

Nonetheless, while both railroads indicate their support for the committee, they also both indicate that the accomplishments, amount of cooperation, and consensus achieved to date vary with the subject matter. For instance, a proposed revision to the power brake regulation was developed in a technical committee with representatives from labor, railroads, and Government participating. From the railroads' point of view, however, the product was not adequate, and CN and CP, working together, drafted a different proposal that they then submitted to RTC for consideration.[9] In the area of dangerous commodities, however, both railroads believe that significant progress has been made using the technical committee structure and the advisory committee forum. There has been agreement, for instance, about the usefulness of the Hazardous Information Emergency Response (HEIR) form, which suppliers are required to furnish railroads with each shipment of dangerous commodities and which railroads are required to carry. This form gives the railroad employees information about what steps to take if the shipment of dangerous commodities is involved in an accident. The initiative for the HIER form came from a technical committee of the Railway Safety Committee, with the active support of the railroads.

Both railroads seem to view the regulatory process with regard to safety as nonthreatening. Neither railroad expressed the view that it is not adequately consulted or that it does not have adequate opportunity to participate in the formulation of regulatory safety policy. They view their relationship with the Government as largely nonadversarial and view compliance with Government-imposed safety requirements as a serious responsibility. The incentive to comply with various safety requirements is not the avoidance of penalties, since the Government has not and is not viewed as likely to assess major penalties against the railroads; rather, the incentive seems to come from a combination of the knowledge that operations may be shut down if a violation is considered serious enough, and of the respect for what one railroad official referred to as "the law of the land. "

[8] "'Railway Safety Advisory Committee Organizational Structure, " October 1978.

[9] The outcome of the revision to the power brake regulation is still pending. The railroads proposed revision was submitted in the first part of October 1978.

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Chapter VIII

RAILROAD LABOR AND SAFETY

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INTRODUCTION

The majority of Canadian rail labor organizations are represented by a bargaining group called the "Associated Railway Unions. " This organization brings together *18* unions under its umbrella. It represents the largest single bargaining unit in Canada.] The Canadian Railway Labour Association represents the same unions for all purposes (including safety) other than collective bargaining, The Association consists of five major groups. They are:

- nonoperating employees 55,800
- shopcraft employees 18,800
- United Transportation Union
  - —trainmen 14,500
  - —enginemen 1,646
- Brotherhood of Locomotive Engineers 4,6002

The United Transportation Union, the Brotherhood of Locomotive Engineers, and the shopcraft unions are associated with the unions of these names in the United States.

Collective bargaining has existed within the Canadian railroad industry almost since its beginning. Railroad employees were organized along craft lines. For many years they negotiated with railroad management as individual entities. Before 1947', an Act of Parliament compelled labor and management to negotiate periodically.[3] As a result of a series of disputes, centering largely on the subject of wages, and a strike in the 1950's, significant changes in labor-management relations began to occur. A movement toward joint negotiations gained momentum.

The safety of operating employees, locomotive engineers, conductors, and trainmen while operating trains is regulated by the Canadian Transport Commission (CTC). The safety of the rest of the rail employees is under the jurisdiction of Labour Canada. However, the jurisdictional clarity is somewhat clouded by the fact that Labour Canada has jurisdiction over the safety conditions of the operating employees' workplace environment during their off-hours (e.g., while they are laying over on a lon$_g$ trip). Labour Canada also has jurisdiction over the workplace of such employees as dining car employees even when the train is operating.

Labour Canada approaches its responsibilities for developing safety standards as much as it can from a generic point of view by considering problems common to all industries rather than considering problems on an industry-by-industry basis. The Department of Labour is currently in the process of developing a set of regulations that will standardize a minimum level of safety to be applied across all industries under its authority, CTC has not promulgated safety regulations related to the conditions of work for the operating employees under its jurisdiction.[4]

[1] *A Report on Canadian Passenger Rail Services* (Department of Transportation, 1976).

[2] Figures taken from Stephen G. Peitchinis, *Labour-Management Relations in the Railway Industry*. Task Force on Labour Relations, Study 20 (Ottawa: Privy Council Office, 1971).

[3] Ibid. p. 230.

[4] 'The lack of regulation of the safety of those railway employees u rider the jurisdiction of CTC is a current source of disagreemen t between the Department of Transportation and the Department of Labour. The Department of Labour feels that regulations are nec-t'>+] ry and that it should assume the jurisd iction, or a] terna t i ve l y, that the Department of Transporta t ion should adopt its regula - t ions. The unions are supporting the Department of Labour's posi - tion.

LABOR/RAILROAD RELATIONS

The railroad industry has experienced generally good relations between management and labor at the working level.[5] Testifying to this fact is the long-standing existence of a plethora of committees at the local level—including those that deal with safety matters—that have, in many instances, evolved into consultative bodies that negotiate particular local matters with management. Despite the history of cooperation, the unions on the national level believe that the effectiveness of the labor/management committees that have been established to deal with safety problems at the local level would be enhanced by the participation of a Government body with the authority to regulate matters of safety. The Canadian Railway Labour Association believes that a cooperative arrangement in this regard between the Railroad Transport Committee (RTC) and Labour Canada would be beneficial and made the suggestion to RTC.[6] At the present time, according to a national representative of the Canadian Railway Labour Association, a major priority of the unions with regard to railroad operational safety is the upgrading of track.

From a national perspective, it appears that in addition to the historical relationships, two other principal factors affect the way in which the unions and the railroads relate to each other with regard to safety. These factors are described below.

Canadian Injury/Disability Compensation System

The Canadian injury compensation system is a provincial responsibility and each of the provinces has its own compensation law. Thus, there is variety in the way in which the Canadian worker's compensation for injury and illness incurred on-the-job takes place. However, the approach to compensation in each of the provinces is similar. It is premised on a no-fault concept in which the injured employee is entitled to compensation—which is paid for either directly or indirectly by the employer-and in which the injured employee is not permitted to sue the employer with regard to the injury or illness incurred.

The Province of Quebec, for instance, has implemented the no-fault concept to workmen's compensation through assigning wide-ranging responsibility to the Quebec Workmen's Compensation Commission, the five members of which are appointed by the Lieutenant-Governor in Council and serve on a full-time basis administering the claims of injured employees in Quebec. ' The Act provides for certain cooperative arrangements with other provinces when an employee also works in provinces other than Quebec.

[5] Peitchinis, op. cit., p. 317.

[6] Letter from J. F. Walter, Vice Chairman, Canadian Railroad Labour Association, to G. H. Cooper, Executive Director, Railway Transport Committee, Canadian Transport Commission, Jan. 26, 1978.

[7] The Quebec Workmen's Compensation Act illustrates the scope of Canadian compensation law (ch. 159). Within its parameters, provisions are at once detailed as to compensation coverage and requirements and are wide-ranging in the latitude that they afford to the commission established by the law in administering certain provisions, such as that concerning rehabilitation. The law is divided into 15 major parts that treat the following subjects.

a. **Definitions of terms**—defining the scope of the law to include those industries specified as well as those to be added under the law as well as clarifying who the intended participants in the compensation system are.
b. **Compensation**—defining the general conditions under which compensation may be made available and how it is made available.
c. **Fixing of compensation**—defining the benefit scale for survivors as well as for permanent and temporary disability. (For the latter two, compensation usually does not exceed 75 percent of the average annual earnings for the 12-month period immediately preceding the accident.)
d. **Medical aid**—assuring the availability of adequate medical aid to the employee as well as choice of physicians; giving to the commission the latitude to determine all questions as to the necessity, character, sufficiency, or duration of medical aid.
e. **Rehabilitation**—giving to the commission the latitude to take what measures they deem necessary in order to aid in getting injured workmen back to work and assist in their rehabilitation and lessening or removing any handicap resulting from their injuries.
f. **Compensation commission**—establishing a five-member appointive commission as a corporation, vested with all the rights and powers generally belonging to corporations. One member to serve as president and one to serve as vice president must be chosen from among the district judges; giving to that commission certain powers, including the ability to reconsider any question at any time within its jurisdiction and the ability to render decisions

(continued)

The claims for compensation benefits are calculated on the basis of the employee's average earnings for a 12-month period preceding the accident; provisions are also made for dependent and survivor claims. In *certain cases,* the commission may authorize lump-sum payments or may advance a 1 u m p sum of compensation that will be due. Generally, however, the compensation is paid on a weekly basis.

For purposes of compensation payment, employers in Quebec are divided into two major groups by the statute. The first major group must contribute, based on a percentage of its annual payroll determined by the commission, to an accident fund. This accident fund is administered by the commission, and when an employee in an industry falling into this first major category is injured, compensation is made from this fund. The second major group is composed of industries in which employers are individually responsible for compensation of injured employees, Although the commission administers the compensation of employees in an industry failing into the second major category, the funds to pay for the compensation are not drawn from the accident fund. Employers in the second major category are also responsible for paying for a portion of the commission's administrative costs. Railroads fall into the second major group of employers and so are individually liable for payment of compensation to injured employees in Quebec.

As a general rule, as is the case in Quebec, the provincial acts cover employees in all industries—that *is,* there is not a specific compensation system solely for employees of a railroad industry. The laws establish provincial workmen's compensation commissions to administer the compensation laws and to decide, within the parameters of the law, how to compensate individual employees. The approach to workmen's compensation that the provincial laws take has been described as constituting an "inquiry system" rather that an "adversary system."[8] In this system, the provincial commissions are given a fairly wide area of latitude with regard to the various benefits that can be made available to the injured employee. Although the degree of

[7](continued)

according to equ it}' and on the rea I meri t s and justice of the case, not being bound to follow the ordi nary rules of evidence Instituting a mecha n ism t or homolga t ion of com m ission decisions by the superior cou rt and establishing such judgments homolgating decisions as f inal and wi t h out appea I Giving to the com m ission broad regula - tory powers wi t h in its area 01 jurisdiction.

g. Contribution by the province providing for assistance by the provincial government in defraying commission expenses an annual sum not exceeding $100,000.

h Accident fund establishing an accident fund to be funded by contributions by employers in those industries iden t if ied u rider the first ma jor group of i ndustries set forth in this law. Contributions are made based on a percent age of a n nua l pay roll; t hey may not be un i form for a ll i ndustries i n the ma jor group or a ny ot her subgrou p, but are, instead, determined by t he commission.

1. Statements to be furnished by employers requiring reports of actual and antic ipated payrolls for the preceding and u pcoming years to be made to the commission by all employers in industries i n the f irst major group.

j. Assessments—requiring the commission to assess a contribution to cover the compensation for injured employees in the appropriate category of industry, to maintain a reserve fund, to meet commission administrative expenses, and for other purposes.

k. Industrial diseases establishi ng that a n employee is eli - gible for compensation when a d iseased ue to the nature of any em ployment in which he was engaged a t a n y t ime wi t h in 12 mon t hs previ ous to the date of hi< disablement; establishing the c onditions u rider wh ich the compensa t ion wI I I be made.

I, Preventive associations – establishing the right of em ployers in i ndustries i n the first group t o t orm them- WI ves i n t o a group for purposes of accident preven t ion a nd may, wi t h certain condi t ions, prescribe rules that \\. i II be binding on all employers in the particular class in indust ry

m. Contribution by employers in industries in Schedule II reel L] i ring the com m ission to assess payments to meet i t s costs from the emp loyers i n the second major group i n a manner sim ilar to tha t i n which funds are obtained for the accident t und.

n. General provisions – excludi ng the industries of farming or domestic serv Ice from coverage u rider the Act; setti ng down certain requi rements as to su i ts for the recovery of fines provided for by the Act: and establishing that fines received belong en t i re] y t o the commission and a re to form part of the accident fund.

o. Compensation to blind workmen- defining blindness and setting forth c ondi t ions for reimbursement b y t h e Ministry of Finance, u rider certa i n condi t ions, for compensation payable by reason an accident to a blind work men

In addition to these ma jor sections, there are three schedules appended to the law. The t irst schedule sets forth those industries in which employers must contribute to the accident fund. The second schedule sets forth t hose i nd List ries in which the employers a re individual 1 y responsible for pa ying compensation The t h i rd sched - u le sets t ort h a description of va rious d iseases and the processes leading to them.

[8]*A Report on the Feasibility of Comparative Study of FELA With Alternative Compensation Systems,* prepared for the Association of American Railroads by Richard J. Barber Associates, Inc., Jan. 14, 1975, p. 30 ff.

latitude provided varies from province to province, generally speaking, there is a provision made for the costs of all medical treatment and rehabilitation services, with no arbitrary financial or time limits placed on benefits. Total permanent disabilities are paid for life; there are provisions for survivor benefits; partial and/or temporary disabilities are monitored on a continuing basis by the workmen's compensation commission. In many cases, there are no waiting periods for the benefits to start. [9]

Once a compensation commission has taken over a case, it is responsible for assuring treatment, considering rehabilitation possibilities, providing reemployment counseling, as well as for defining the disability and making decisions concerning income continuation. The degree of disability is generally a medical judgment and since the commission has continuing jurisdiction and since temporary benefits have no time limit, the actual condition of the injured employee can be assessed with a minimum of external factors playing into the judgment. Benefits can be adjusted upward or downward by the commission as the situation warrants. In many provinces, the commissions place a great deal of emphasis on rehabilitation. 10

Since the employee is guaranteed compensation for work-related injury and illness and since the employer is protected by law from suit, the issue of safety in the workplace is not a contentious issue between railroad employees and the railroads. Further, since the railroads are responsible for providing for the compensation of the injured employee, it is in their interest to hear and to respond to concerns about safety and to ensure that safety practices are put into place and observed.

Hours of Service

An employee's hours of service has not been regulated as a safety issue nor has it been dealt with legislatively. Rather it is a matter for negotiation between the labor unions and the railroads. At the present time, the hours-of-service requirements for operating employees, engineers, conductors, and trainmen* in Canada allow employees discretion after 11 hours of service, as to whether they should continue to work without a break. This provision places the responsibility for the safety of employees as it relates to fatigue on their own shoulders.

In negotiating with the railroads, the Associated Railway Unions does not bargain separately with CP and CN; instead, the unions bargain with representatives of both railroads at the same time. In the early 1970's. there were a series of disputes between labor and the railroads, some of which went to arbitration. It was during this period that the unions organized themselves into a single powerful bargaining group. However, the principal concern of the unions has been job security. Safety conditions have not been the subject of a railroad labor dispute per se, although safety was brought out as an issue in a case concerning crew size during this period. [11]

At the present time, the union; participate in many of the railroads safety efforts at the working level. The three major areas in which labor/management cooperation in safe y-related matters has taken place are:

Safety Committees—Unions urge their members to participate and use this forum to understand the nature of the workplace and to pass on the worker's point of view to the management. However, national union representatives have expressed doubts as to whether these committees are optimally effective.

Rehabilitation Programs—The railroads and the unions are working out a relationship whereby the unions at the local level can encourage its members with drug or alcohol abuse problems to seek professional help in one of the rehabilitation programs that the railroads made available.

[9]Ibid, p. 31,

[10]ibid., p 31 ff.

*All other railway employees are governed by the hours of work section of the Canadian Labour Code.

[11]For instance, in a December 1974 arbitration report, Judge Emmett Hall decided that a job security plan based on attrition should be provided for all workers with 8 years seniority. Also, in January 1975, Judge Hall said in another arbitration report that railroads could eliminate the job of rear brakemen on freight crews.

Training Programs—Where training programs have been developed, the unions have supported them even where they have replaced the informal apprenticeship programs for qualification to take on another job. National union representatives would like a greater emphasis on training (see next section).

LABOR/GOVERNMENT RELATIONS

The unions played a major role in the safety inquiry of 1971. Since that time, they have been active participants in the tripartite forum, the Railway Safety Advisory Committee, established by CTC to promote railway safety in Canada. The Canadian Railway Labour Association has membership on the Railway Safety Advisory Committee and member unions have representation on the various technical committees that consider possible amendments to existing standards or possible new standards. By this participation, the unions are able to participate fully in the safety regulation of railroads.

In addition, however, the unions have identified areas that affect the safety of railroad employees and have brought these areas to the attention of CTC. The unions raised many issues at the safety inquiry and have continued to follow and to participate in their resolution. For instance, in January 1978, the vice chairman of the Canadian Railway Labour Association outlined the current safety-related concerns of his Association in a letter to the executive director of the Railway Transport Committee of CTC.[12] Many of the concerns expressed were similar to those expressed during the safety inquiry; other concerns grew from more recent incidents. The listing of the Canadian Railway Labour Association's concerns with regard to the safety of railroad employees included all aspects of railroad safety—the immediate work environment, the operating environment of the trains, and the long-term health of the employees—without attempting to place these concerns in any order of priority. The listing of concerns includes:

1. **Uniform Code of Operating Rules—The association's concerns centered on protecting the integrity of the concept of uniformity and on the adequacy of the rules to address all the safety problems encountered. Specifically, the Canadian Railway Labour Association believed that a revi**sion of the Uniform Code was necessary because of the authority of railroads to issue special instructions that tend to destroy the uniformity of practice intended by the Uniform Code. The association also believed that additional rules might be needed, such as rules to govern movement of insulated track units other than conventional rolling stock. RTC apparently agreed with these concerns and has instituted a review of the Uniform Code. This review is currently taking place under the auspices of the Safety Advisory Committee, with representatives of the three major interest groups participating.

   In addition to believing that the Uniform Code was in need of revision, the association also suggested that certain rules in the Uniform Code—notably rules 40-44, which govern requirements for lights in situations involving unattended flagging of trains–were being disregarded by the railroads. Although the association believed that the rules might be appropriately revised, they also believed that they should be adhered to until the revision had taken place.
2. **Dangerous Commodities—The Canadian Railway Labour Association has suggested that a central computer bank be set up to store coded information about how to handle all existing dangerous commodi-**

[12] The points raised were made in a letter from J. F. Walter, Vice Chairman, Canadian Railway Labour Association, to Mr. G. H. Cooper, Executive Director, Railway Transport Committee of the Canadian Transport Commission, dated Jan. 2,6, 1978. The letter was written subsequent to a meeting between Messrs. Walter and Cooper to discuss Labour's safety concerns and at the invitation of Mr. Cooper.

ties. The association has requested that this suggestion be considered by a technical committee of the Railway Safety Advisory Committee.

3. **Environmental Safety, On-Train Employees**—The association believes that the "on-train" employees should be provided regulations governing heating, lighting, ventilation, and noise control in locomotive cabs and cabooses. They believe further that the adequacy of the working conditions of the "on-train" employees will be guaranteed only after the promulgation of such regulations. In addition, the Association recommended that CTC ensure that the regulations, once developed, be adequately monitored, by augmenting their staff capabilities with the services of the safety and health inspectors available to Labour Canada.
4. **Ditch Lights—The association supported a requirement that certain railroads under CTC's jurisdiction operating on mainline** in mountain territory be equipped with ditch lights. Further, the association believes that ditch lights might be safer at level grade crossings than the revolving lights currently required. '3 The association is undertaking a study of this matter.
5. **Hearing and Sight Restrictions—The association suggested that technology has sufficiently improved today to allow the safe use of hearing aids and contact** lenses by employees involved in train operations. These devices are not currently allowed to be worn. " In addition, the association suggested to CTC that the railroads be required to maintain career records of visual acuity and audiogram tests so that any loss of hearing or vision might be detected at an early date and protective measures taken.
6. Tunnel Ventilation—Labour Canada issued a report in October 1976 in which it stated that tests conducted in tunnels have revealed concentrations of nitrogen dioxide that exceed certain standards of safety. The association has urged that CTC issue regulations that would change the existing requirements.
7. **Minimum Track and Operating Right-of-Way Standards—The association believes that the development** of such minimal standards should have high priority by CTC.
8. **Training Standards, Railroad Employees**—The association has taken the position that training programs for employees involved with the movement of trains as well as employees involved with the inspection and maintenance of rolling stock, track, and signals are safety programs. As such, the association believes, the training programs should meet minimum standards set by RTC. Some steps along these lines have been taken; however, the association suggests **that** RTC should develop a program of apprenticeship training standards for selected railroad crafts. The association also believes that the program should provide a skill certification for the employees.

The unions are also involved in the standards development process for railroad employees under the jurisdiction of the Labour Canada. Labour Canada's policy is to solicit wide participation in the development of standards. Thus, in the past, the unions have had the opportunity to review drafts of standards and to give their comments to the Department of Labour, along with other interested parties.

A relatively new amendment to the Canadian Labour Code has implications for the relationship between the railroad unions and the Government with regard to safety. This provision is administered by Labour Canada for rail employees under its jurisdiction. The provision affirms the right of any worker to refuse to continue to work in an "imminently dangerous situation. "

'3At the present time, Order R-22009 requires CP Rail to install ditch lights on all locomotives used in mainline operation in mountain territory. CN Rail has voluntarily used ditch lights in certain areas and CP Rail intends to install ditch lights voluntarily on all locomotives by the end of 1978.

14The requirements governing use of hearing aids and contact lenses by employees involved in train operations are contained in General Order 0-9.

15The association cited approvingly standards drafted by a Working Group of the Advisory Committee called "Guidelines for a Signal Training Program for Signal Construction, Maintenance, and Inspection Personnel." These standards were approved by the Safety Advisory Committee and RTC in 1976.

Appendixes

Appendix A

Persons Interviewed During Project Research

CANADA

CN Rail

J. L. Cann
Vice President, Operations

R. A. Walker
Chief of Transportation

G. A. Van de Water
Chief Engineer

R. G. Messenger
Assistant Vice President
Operations

W. T. Mathers
Director
Accident Prevention and Safety

R. P. Rennie
Chief of Technical Research

H. J. G. Pye, Q. C.
General Solicitor

CP Rail

E. J. Bradley
Director of Rules, Accident,
and Damage Prevention

Charles Pike
Chief Mechanical Officer

William Stinson
Vice President of Operations

Labour Canada

Roy Elfstrom
Director, Occupational Safety
and Health Branch

Railway Transport Committee/ Canadian Transport Commission

The Honorable D. H. Jones, Q.C.
Chairman

G. H. Cooper
Executive Director

J. H. Green
Assistant Director, Rail Services

E. W. Eastman
Director, Rail Systems

S. K. Rawat
Services Planning and
Regulations Advisor

Rail Systems

G. Gazon
Orders and Regulations
Committee Officer

Safety and Standards

R. Konchak
Analyst, Rail Economic Analysis

R. L. Gray
Director, Task Force
Safety and Standards

E. J. Hase
Director, Safety and Standards

J. E. Reynolds
Assistant Director
Safety and Standards

A. G. Hibbard
Director, Rail Services

L. Stanford
New Accident Investigation
Committee

Konrad Studnizki-Gizbert

Bureau of Management Consulting

J. H. Johri
Assistant Director and Leader for
Rail Safety Study

Canadian Railway Labour Association

Ed Abbot
Executive Secretary

J. L. Walters
Brotherhood of Locomotive
Engineers

UNITED STATES

John Fowler
Committee on Transportation
National Academy of
Engineering

Fred Yocum
Vice President for Operations
United States Railway
Association

Appendix B

Accident Information Requested by the Railway Transport Committee

1. Year, month, and date of the accident;
2. The day of the week, time, and the weather conditions;
3. The railroad, region, area, or division;
4. The location—subdivision, mileage, town, and province;
5. The classification of the accident according to the type of accident, i.e., collision, derailment, etc.;
6. The primary possible contributory accident causes;
7. Associated factors such as speed of train, whether dangerous commodities were involved;
8. The type of train involved, and for crossing accidents, the type of motor vehicle;
9. The estimated cost of damage to railroad property for collisions and derailments;
10. The number of casualties classified as passengers, employees, and others; and
11. The Commission file number, if one was created.

Appendix C

Hazardous Information Emergency Response Form

HAZARD INFORMATION
EMERGENCY RESPONSE FORM
(Not to be used for waybilling purposes)

PLACARD ENDORSEMENT:
DANGEROUS

DATE:

SHIPPER: (preprinted)
ORIGIN : (preprinted

CAR NO.
If compartmentized check one:
A☐ B☐ **ccl**

WEIGHT or VOLUME:
(Approximate)

CONSIGNEE:

DESTINATION:

ROUTING:

COMMODITY:

CLASSIFICATION: Flammable Solid

PLACARD NOTATION:

This is to certify that the above named article is properly classified, described, packaged, marked and labelled, and is in proper condition for transportation according to the applicable regulations of the Canadian Transport Commission.

Shipper's signature . . . . . .

POTENTIAL HAZARDS	
Fire	**Burns very rapidly and intensely, sometimes with flare-burning effect.** **May be ignited by heat, sparks** or open flame.
Explosion	Hazard minimal unless material is finely divided.
Health	Contact with material may cause severe burns to skin and eyes.

IMMEDIATE ACTION INFORMATION	
General	**Keep upwind.** **No unnecessary personnel.** **Identify and isolate hazard area.** **Wear firefighters full protective clothing.**
Fire	**Move exposed containers from fire area, if without risk.** **On small fires, use dry chemical.** **On large fires, use standard firefighting agents.** **Cool containers with water from maximum distance.** **If fire is massive or advanced, withdraw from hazard area and use unmanned hose-holder or monitor** nozzle.
Spill or Leak	Stop leak if without risk. Within hazard area: Eliminate ignition source. No flares, no smoking, no open flames. Collect into clean dry metal container and keep tightly covered. Flush small spill area with water spray.
First Aid	Call doctor. Use standard first aid procedures. In case of contact with material or water solution, immediately flush skin or eyes with running water for at least 15 minutes.

Emergency (Shipper's number or his designate for further emergency assistance.)
Phone:

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