Chapter I

U.S.-CANADIAN RAIL SAFETY: COMPARATIVE ANALYSIS

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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

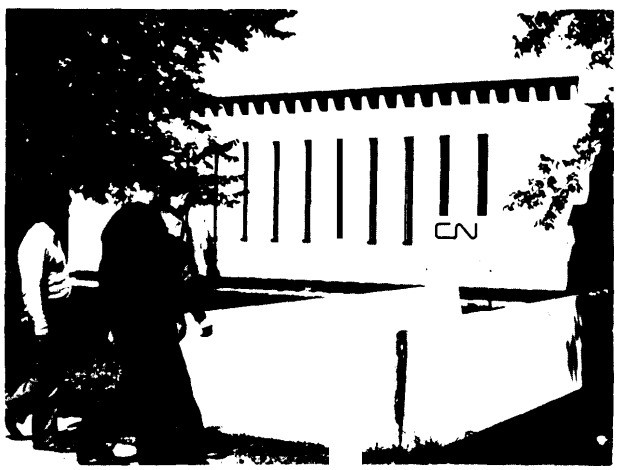

Photo CN Rail

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

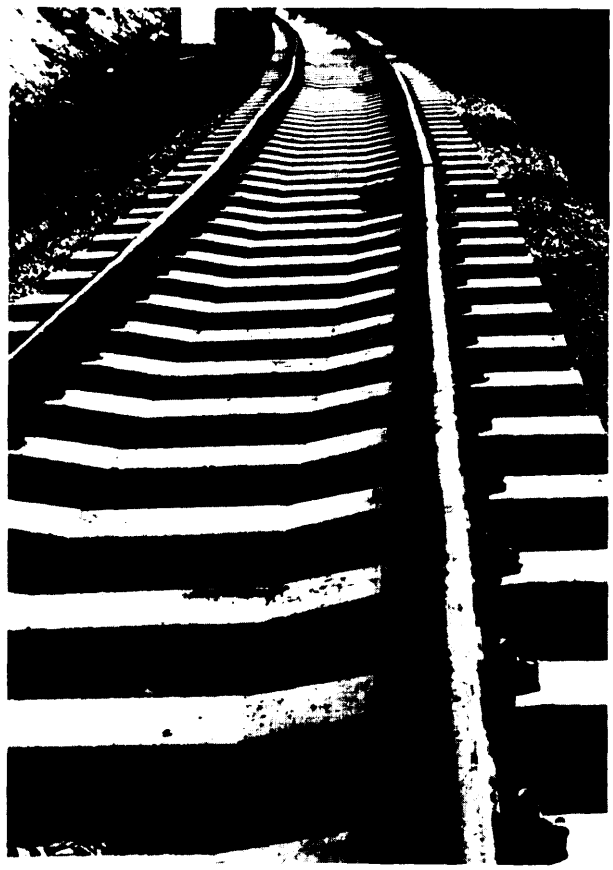

Photo CN Rail

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.