An Evaluation of Railroad Safety

May 1978

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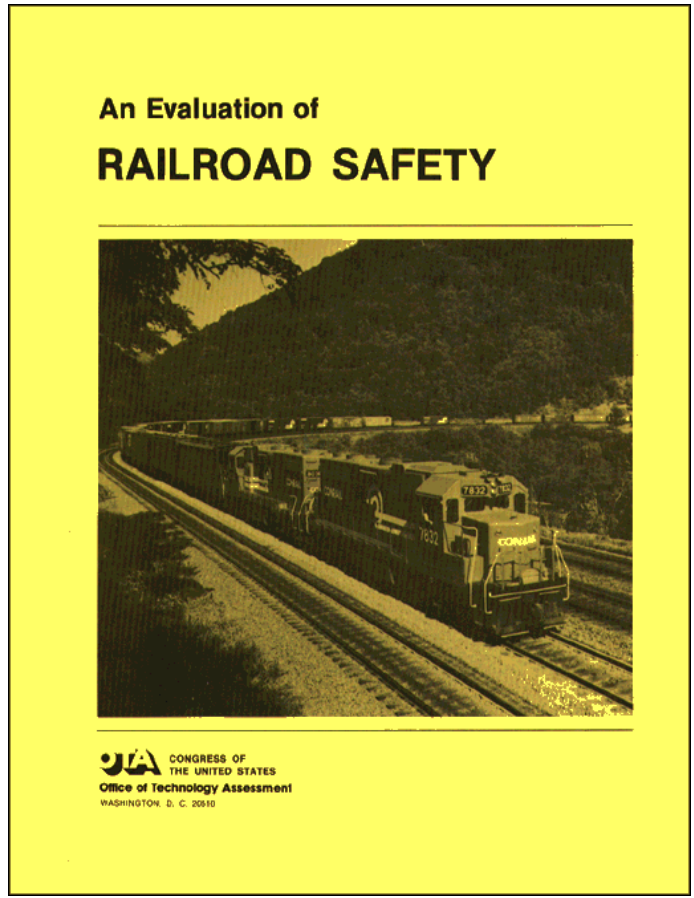

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Washington, D.C. 20515

Gent lemen:

On behalf of the Board of the Office of Technology Assessment, we are pleased to forward the results of the evaluation of railroad safety requested by your committees in the Federal Railroad Safety Authorization Act of 1976.

We believe this evaluation will aid congressional deliberation over proposed railroad safety legislation and hope it will add a constructive dimension to Government treatment of transportation safety policy and programs.

S &v

Sincerely,

Edward M. Kennedy
Chairman

Larry Winn, Jr.
Vice Chairman

FOREWORD

The Federal Railroad Safety Authorization Act of 1976, P.L. 94-348, required the Office of Technology Assessment to evaluate the effectiveness of Federal efforts to improve the safety of our Nation's railroads. This report provides Congress with a comprehensive and systematic review of railroad safety. It should assist in current and future legislative deliberations on railroad safety.

The following pages include: an examination of current accident and cost trends; a review and evaluation of railroad safety laws, regulations, and inspection programs; and an overview of current research, development, and voluntary safety programs. Also included is a discussion of the relationship of safety and economics in the railroad industry and other issues pertinent to today's safety problems.

This report is one of several OTA assessments related to railroad problems and perspectives which have been provided to Congress.

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INTRODUCTION

The Federal Railroad Safety Authorization Act, Public Law 94-348 enacted on July 8, 1976, requested an assessment of railroad safety by the Office of Technology Assessment (OTA). The study objective was to evaluate the effectiveness of the Federal Railroad Safety Act of 1970 and related laws in improving the safety of the Nation's railroads. Eight specific provisions, in addition to those OTA considered important, were to be examined. These provisions included:

1. A cost-benefit analysis of the railroad safety research and development activities under the Federal Railroad Safety Act and related Federal laws;
2. An evaluation of trends with respect to railroad employee injuries and casualties, injuries and casualties to other persons, accidents by type and cause, and such other data as OTA considers necessary to determine any significant statistical relationship between safety laws and regulations, and accident rates;
3. A statistical comparison of railroad accidents reported by each railroad for the 10-year period preceding the date of enactment of this Act;
4. The cost-benefit and effectiveness of accident prevention resulting from the methodology used and practices employed by Federal and State railroad safety inspections under Federal railroad safety laws and regulations;
5. An evaluation of safety inspection activities conducted by the railroad industry;
6. An evaluation and analysis of industry research and development relating to railroad safety and accident prevention;
7. A cost-benefit analysis of the various Federal laws and regulations relating to railroad safety; and
8. The need for additional Federal expenditures for improvements in railroad safety.

This report responds to the eight specific items requested for study in the following manner. Government and industry research and development activities (items 1 and 6) are evaluated in chapter IX. The analysis of accidents and injury trends (item 2) is contained in chapter V; and the evaluation of Federal, State, and industry inspection programs (items 4 and 5) is described in chapter VIII. Chapter VII of the report examines existing railroad safety laws and regulations (item 7). A separate report entitled "Analysis of Federal Railroad Laws Administered by the Department of Transportation and Related Laws" is published as Volume II and is available through the National Technical Information Service (NTIS). The statistical comparison of individual railroads' accident data (item 3) was conducted as background to the study. Due to the voluminous amount of data, this information is not included in this document. And finally, the need for additional Federal action (item 8) is discussed in the congressional options section contained under each of the issues discussed in chapter II.

This document contains the results of the OTA study effort. It provides Congress with an overview of the railroad safety problems and current efforts to improve railroad safety. In addition, this document summarizes significant railroad safety issues and policy alternatives open to Government and concerned parties for improving safety. Suggestions for more detailed research are also identified.

In conducting this study, OTA did not perform a detailed cost-benefit analysis of various railroad safety activities due to a number of data gathering difficulties. For example, it was not possible to identify the total cost of railroad safety programs from the Interstate Commerce Commission Uniform System of Accounts. This accounting system was designed for the purpose of economic rate regulation of railroads, and does not contain detailed safety expenditures. Also, some railroads have internal accounting systems that identify safety costs. However, these systems are not comparable from railroad to railroad. Further, a large portion of safety prevention costs are common costs, and as such cannot be specifically identified. However, even though cost-benefit analyses were not performed, an evaluation of various programs, including research and development, and inspections, as well as laws and regulations, was conducted,

The assistance and expertise of an advisory panel comprised of representatives from Government agencies, railroad management, and railroad labor was extensively utilized by OTA in the formulation, conduct, and review of the study. The contributions of these individuals and members of their respective organizations were significant and extremely important to the outcome of the study. In addition to the advisory panel, numerous other persons associated with the railroad industry, Government agencies, and railroad labor organizations provided valuable information for the study effort.

Techniques used throughout the study included a review and analysis of pertinent safety and railroad literature and interviews with Government, industry, suppliers, and labor officials. A detailed list of the persons interviewed is included in appendix A. In addition, statistical, computer, and economic analyses were conducted when possible. However, study efforts which utilized existing data and analyses were sometimes limited by the inadequacy of information, diffusion of data sources, and numerous changes in the data over time.

The information provided by the contractors, and the advisory panel, and the research and interviews conducted by OTA staff, formed the basis for the final report.

Special thanks and appreciation are extended to the Railroad Safety Advisory Panel, and to Lawrence M. Mann, R. Lawrence McCaffrey, Jr., Judith A. Hermanson, and Constance B. Newman for their outstanding support and assistance to OTA throughout the study effort.

SUMMARY

The major findings of the OTA evaluation of railroad safety activities are presented in this section. The specific findings of the study effort are included in subsequent sections of this summary.

1. For the 9-year period (1966-74), track-caused train accidents per ton-mile increased 106 percent. In 1975, the basis for reporting accidents was changed but the trend of increasing track-caused train accidents continued in 1975 and 1976.
2. The combination of deferred maintenance and increased axle loadings (a factor designed to increase efficiency) appear to relate to the increases in property losses resulting from train accidents. A change in track-related accidents is unlikely to occur until there are positive economic changes in the industry.
3. Total railroad accident costs accounted for 3.5 percent of total industry operating revenues, or $575 million, in 1975. Casualty claims accounted for approximately 45 percent of total safety-related losses, and property and lading damage and loss resulting primarily from train accidents also accounted for approximately 45 percent of safety-related losses in 1975. Clearing wrecks and damage to livestock accounted for the remaining 10 percent of safety-related losses.
4. Over the 10-year period (1966-75), accident costs increased by 38 percent (when adjusted for inflation). Casualty claims increased by 46 percent during the 10-year period, and property and lading losses resulting primarily from train accidents increased by 21 percent.
5. The current railroad safety statutory framework is adequate for addressing safety problems. However, Federal efforts to reduce casualties and property losses have been impaired by the following types of factors:
   - Accident data have not been adequately used in determining the nature, extent or reasons for specific safety problems and in setting priorities for addressing problems prior to the initiation of Federal activity;
   - Measures of effectiveness have not been designed into current regulatory, inspection, and R&D programs;
   - Alternative approaches to the regulatory process, such as incentive programs, have not been systematically considered; and
   - In certain areas, such as rail-highway grade crossings, divided jurisdiction-s among Federal agencies, and among Federal and State agencies, and railroads have impaired administration of safety efforts.
6. A review of Federal regulatory, inspection and research and development activities has indicated the following:
   - In certain cases, a clear rationale has been provided relating standards or rules to the specific hazard they are intended to address;
   - The inspection programs resulting from the 1970 Safety Act do not have had no affect on the accident rate. Because inspection implementation is based on existing regulation, current inspection programs and strategies have not effectively dealt with the safety problems they are perceived to address; and
   - A majority of effort (Government and industry) has been directed at the accident problem resulting primarily in property losses. Less emphasis has been placed on the casualty problem and no strategy has been adopted which has been directed toward the causes of the casualty problems.
7. Increased cooperation in addressing railroad safety problems among all concerned parties and Government agencies should provide substantially greater opportunity for sizable reduction in property losses and in casualty losses. There is a positive trend in cooperative efforts on the

casualty problem as demonstrated in recent R&D efforts. Because of the complex nature of the railroad system, continued cooperation among concerned parties is essential if further efforts to reduce safety losses are to occur.

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Chapter I

RAILROAD SAFETY FINDINGS

Chapter I
RAILROAD SAFETY FINDINGS

INDUSTRY OVERVIEW

The railroad safety problem at the turn of the century was characterized primarily by injuries and fatalities; today property loss and damage are also important.

The railroad predominance in intercity passenger and freight transportation at the turn of the century has been substantially eroded over the decades by changes in transportation technology and in the economy, and by Government policy toward various transportation modes. The impacts upon the rail industry have been several. First, they have caused a substantial reduction in the railroads' share of intercity passenger common carrier traffic from 77 percent in 1929 to 6 percent in 1977. Second, while the railroads' total freight traffic (freight revenue ton-miles) increased by 257 percent from 1929 to 1975, rail share of the intercity freight market dropped from 75 percent in 1929 to 37 percent in 1975. Finally, railroad employment dropped by 71 percent from 1929 to 1975. Thus, with fewer passengers and fewer employees but more freight, the rail safety problem has changed its dimensions from being primarily a casualty problem to being both a casualty and a property loss and damage problem.

The decline in the financial condition of the rail industry has resulted in less money being available for maintaining and improving fixed plant in recent decades.

The rate of return after taxes on railroad investment declined from **5.3** percent in **1929** to 1.2 percent in 1975. Railroads have been greatly impaired in obtaining or generating necessary capital as a result of this extremely low rate of return. Moreover, the rail industry has suffered such low earnings from rail operations that it has been unable to generate internally the funds necessary to maintain and improve its track and fixed facilities. Estimates of industry-deferred maintenance have been approximated at $6.6 billion.[1] The combination of these two factors, low rate of return and low level of internally generated resources, has resulted in the industry's estimated need for $14.5 billion[2] (exclusive of Conrail) as the total amount needed to normalize the industry track maintenance level, and to make necessary capital and track improvement over the next 10 years.

Railroad safety laws at the turn of the century were directed at specific safety problems; recent railroad safety laws have provided broad grants of authority to Federal agencies.

In the early 1900's, the railroad safety laws enacted by Congress were designed to address specific safety problems or to implement certain proven safety technologies or practices. Examples of the early legislation include the Locomotive Inspection Act, the Hours of Service Act, and the Safety Appliances Act. The more recent safety laws, such as the Federal Railroad Safety Act of 1970 and the Hazardous Materials Transportation Act have provided the Department of Transporation (DOT) broad regulatory and administrative powers for dealing with "all areas of railroad safety."

[1] Richard J. Barber, Assoc., The *Railroads, Coal and the National Energy Plan: An Assessment of the issues,* 1977, p. 52.

[2] ICC Ex Parte 271, September 1977.

ACCIDENT AND COST DATA

The safety of the railroad industry as shown by available accident data* may be viewed from two perspectives: the safety of people and the safety of property.

- **The safety of people is measured by the number of casualties (injuries and fatalities) and the cost of resulting claims.**
- **The safety of property is measured by the loss of and damage to railroad equipment, track, and roadbed (estimated), and the lading (actual). This loss and damage occurs primarily in collisions, derailments, and other train accidents.**

Safety of People

There was a general decline of casualties during 1966-74' * of 29 percent for total fatalities and 19 percent for total injuries, as shown in table 1, although some fluctuation did occur during these 9 years. Generally, the casualty trends decreased from the initial year to a low point in either 1972 or 1973 and then increased in 1974.

—During the 9 years, injuries to employees constituted the largest percentage of total injuries (74 percent) while fatalities to persons other than employees, passengers, and trespassers constituted the largest percentage of total fatalities (65 percent). This latter group was made up primarily of persons killed in grade-crossing accidents.

After adjustments in employee casualties by man-hours of employment, fatalities remained the same during 1966-74 and injuries increased slightly.

* Unless otherwise specified, the data used in this study were obtained from the Federal Railroad Administration's accident data file.

** Public Law *94-348* requested accident data for the 10 years preceding July 1976. The data for 1975 have not been used in this report for purposes of comparison with the data of preceding years because of the substantial changes in the FRA reporting requirements in 1975, which make direct comparison infeasible.

Table 1 .—Casualties Resulting From Class I and II Railroad Accidents (Unnormalized)

	Employees		Passengers		Trespassers		Other*		Total	
Year	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries
1966.	168	18,651	23	1,244	678	702	1,815	4,955	2,684	25,552
1967.	176	18,055	12	1,054	646	696	1,649	4,718	2,483	24,523
1968.	150	18,116	11	1,329	628	663	1,570	4,500	2,359	24,608
1969.	190	17,255	6	862	627	674	1,476	4,565	2,299	23,356
1970.	172	16,285	8	489	593	646	1,452	3,907	2,225	21,327
1971	123	14,191	16	536	551	607	1,320	3,638	2,010	18,972
1972.	133	12,973	47	680	537		1,228	3,691	1,945	17,930
1973.	161	13,511	6	503	578	614	1,171	3,577	1,916	18,245
1974.	144	16,002	7	574	565	674	1,192	3.568	1,908	20.818
Total	1,417	145,079	136	7,271	5,403	5,862	12,873	37,119	19,829	195,331
Percent total	7.1	74.3	0.7	3.7	27.3	3.0	64.9	19.0	100.0	100.0

● Other includes all persons not included as employees, passengers or trespassers. (This group was made up primarily of casualties resulting from grade-crossing accidents.)

SOURCE: Compiled by OTA from Federal Railroad Administration data.

—During the 9-year period, the major causes of employee injuries were

Major cause	Percent of total employee injuries
Getting on or off trains.	16.6
Construction and maintenance of cars and locomotives	12.2
Construction and maintenance of track, ties, and rail	8.9
Stumbling, slipping, and falling (not on train)	7.9
Coupling and uncoupling.	5.6
Flying or falling objects, burns, etc. .	4.8

—During the 9-year period, the major causes of employee fatalities were:

Major cause	Percent of total employee fatalities
Struck or runover at places other than public rail-highway crossing*	26.7
Various causes of collisions, derailments, and other train accidents	17.9
Coupling and uncoupling.	7.0
Stumbling, slipping, and falling (while on train).	5.8
Getting on or off trains.	5.2
Construction and maintenance of cars	3.7

*Includes those employees killed while walking or working along track.

Of all the employee categories, the transportation group (trainmen and enginemen) accounted for 55 percent of employee injuries and 54 percent of employee fatalities. The yard brakemen and yard helpers, a subset of trainmen and enginemen, have by far the largest problem as measured by the combination of frequency and severity of injuries.

Safety of Property

There was a general increase in train accidents'and a corresponding increase in their costs over the period 1966-74, as shown in table 2.

Table 2.—Train Accidents and Associated Costs (Unnormalized)

Year	Train accidents	Loss and damage to track roadbed, equipment, and lading (million$-current$)
1966.....	6,793	117.6
1967.....	7,294	118.0
1968.....	8,028	140.3
1969.....	8,543	161.7
1970.. .. .	8,095	158.4
1971.....	7,304	144.8
1972.....	7,532	140.3
1973.....	9,698	188.4
1974.....	10,694	243.2

SOURCE: Compiled by OTA from Federal Railroad Administration and Association of American Railroads data.

When train accidents are adjusted for the monetary threshold** and normalized for changes in ton-mileage, the increase in train accidents is 16 percent over the 9 years.

When the loss and damage to track, roadbed, equipment, and lading is adjusted to constant 1975 dollars, the increase is 25 percent.

While train accidents in each of the four contributing-cause categories* * * all increased between 1966-74, the largest and most rapidly increasing contributing cause was track. (Table 3.)

Table 3.—Train Accidents by Contributing Cause (Unnormalized)

Cause	Train accidents 1966	Train accidents 1974
Human factors	1,999	2,236
Equipment	1,843	2,175
Track	1,428	4,264
Miscellaneous	1,523	2.017
Total	6,793	10,694

SOURCE: Compiled by OTA from Federal Railroad Administration data.

* A train accident is defined as an accident arising out of the movement or operation of trains and resulting in more than $750 estimated damage to equipment, track, *or roadbed*, regardless whether a reportable death or injury occurred.

** The $750 monetary threshold must be adjusted for inflation to properly analyze train accidents.

*** Cause categories as defined by FRA.

—When train accidents are adjusted for the monetary threshold and normalized by changes in ton-mileage, the increase in track-caused accidents was 106 percent during 1966-74, whereas there was no change in miscellaneous-caused accidents and approximately a 15-percent decrease in both equipment- and human-factor caused accidents.

The most significant area of loss and damage to property resulted from track-caused train accidents on mainline track rather than on branch-line or yard track.

—The two most significant causes of track-caused train accidents, based on accident frequency and severity, were mainline rails (broken railend, split **heard,** split web) and mainline line and surface (improper super-elevation, improper alinement, improper surface of track, soft track).

Two factors that appear to be related to increased track-caused accidents are increased axle loadings and the level of deferred maintenance.

—There has been an increase in axle loadings over the last several years. Part of this has resulted from the introduction of higher capacity cars, specifically the 100-ton freight cars. This factor would logically have a negative impact on safety due to increased wear and tear on the roadbed unless the roadbed, is maintained to allow for these changes.

—It has been estimated that approximately $6.6 billion of maintenance was deferred through 1975. The practice of deferring maintenance will logically have a negative impact on safety at existing or increasing levels of use of the track and roadbed. Thus, a substantial improvement in railroad safety is largely dependent on the industry's financial ability to maintain its track, roadbed, and equipment.

The largest and most rapidly increasing class of train accidents over the period *1966-74* was derailments. (See table 4.)

—When the numbers in the table are adjusted for the monetary threshold and normalized for changes in ton-mileage, derailments increased over *40* percent during the 9 years, while collisions decreased by approximately *15* percent.

Defects in track were the largest and most rapidly increasing single cause of derailments during 1966-74. (See table 5.)

Table 4.—Train Accidents by Class (Unnormalized)

Year	Derailments	Collisions	Other	Total train accidents
1966	**4,447**	**1,552**	**794**	**6,793**
1967	4,960	**1,522**	**812**	**7,294**
1968	5,487	**1,727**	**814**	**8,028**
1969	5,960	**1,810**	**773**	**8,543**
1970	5,602	**1,756**	**737**	**8,095**
1971	5,131	**1,529**	**644**	**7,304**
1972	5,509	**1,348**	**675**	**7,532**
1973	7,389	**1,657**	**652**	**9,698**
1974	8,513	**1,551**	**630**	**10,694**

SOURCE: Federal Railroad Administration.

Table 5.— Derailments by Contributing Cause (Unnormalized)

Year	Track	Equipment	Human factors	Misc.	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**

SOURCE: Federal Railroad Administration.

Safety of Both Peopleand Property

While train accidents have contributed to virtually all of the loss and damage to property, as reported to the Federal Railroad Administration (FRA) they resulted in only l,569 fatalities (7.9 percent of the total fatalities) and 7,887 injuries (4.0 percent of the total injuries) during 1966-74.

Tank-car accidents must also be viewed as both a safety of people and a safetyof property problem.

—During 1969-75, there were 44,432 derailments reported. Of these derailments, more than 500 involved uninsulated pressure-tank cars, of which more than *170* lost some or all of their lading. Of these occurrences, several accidents resulted in **20** deaths, **855** injuries, and **45** major evacuations of approximately **40,000** persons.[3] Although specific costs are not available, it has been estimated that accidents involving these tank cars have resulted in approximately **10** percent annually of all damage to railroad property, but damage to third-party property and loss of lading could not be isolated for this study.

Cost Analysis

Total costs resulting from railroad accidents rose *38* percent (using the Consumer Price Index to adjust costs to constant 1975 dollars) and increased from **2.4** percent of operating revenues to *3.5* percent during *1966-75. (See* table *6.)*

—The costs resulting from casualties to persons and total property loss and damage each represented 40 to 50 percent of the total industry railroad accident costs over the lo-year period.

—While the number of casualties generaI1y decreased, the dollar value of claims resulting from casualties increased, and at a greater rate than that of the increase in costs resulting from total loss and damage to property.

—The increase in the aggregate costs of casualty claims reflects the fact that the cost per claim has increased at a rate which is greater than the rate of decrease in the number of casualties. Further research is needed to determine the reasons for the increase in cost per claim.

The total cost of railroad safety programs cannot be identified.

—The uniform system of accounts does not isolate such costs.

—Although some railroads have internal accounting systems that identify such costs, these systems are not comparable from railroad to railroad.

—Because a large portion of the safety prevention costs are common costs, they

[3] 42 Fed. Reg. 46312 (Sept. 15, 1977).

Table 6.—Railroad Accident Costs
(Dollars in millions)

Accident cost category	Accident cost 1968 Current $	1968 1975$	1975 1975$	Percent change
Casualty claim a	$108.5	$179.9	$282.2	+ 45.8
Total loss and damage of property	119.2	197.6	240.0	+ 21.4
Damage to railroad property b	(99.0)	(164.1)	(177.4)	+ 8.1
Damage to livestock%	(1.5)	(2.5)	(1.9)	-26.8
Freight ioss and damage a.	(18.7)	(31.0)	(60.7)	+ 95.9
Clearing wrecks a	23.0	38.1	73.2	+ 92.1
Grand total	$250.7	$415.6	$575.4	+36.4
Operating revenues	$10,654.7		$16,401.9	

a lnterstate Commerce Commission, *Transport Statistics in the United States, Railroad Companies, 1966-75.*
[b]FederalRai *I road Administrate* ion, *Accident Bulletin Summary and Analysis of Accidents on Railroads in the United States, 1966-75.*

SOURCE: Compiled by OTA from Federal Railroad and Interstate Commerce Commission data.

cannot be identified, even if an appropriate accounting system were available, without arbitrarily allocating such costs among safety and other operating purposes.

Data Base

Analysis of the FRA data base by the Association of American Railroads (AAR) has provided some useful insights into the safety problem.

For example, preliminary analyses have been conducted on railroad accidents occurring to both people and property.'[5] Further effort based on this work should be undertaken to understand more fully the railroad safety problems and to identify specifically the reasons why accidents are occurring. Also, individual railroads have conducted safety analyses of their specific operations. The transfer of information from these types of analyses to other railroads could be improved.

The accident data base collected by the FRA provides a large amount of significant information but has limitations for the following reasons:

—A substantial number of accidents, are classified in the undefined category of "other." Therefore, their specific causes cannot be determined. Although the revision in the 1975 cause code attempted to deal with some of this problem, the condition still exists. A revision was again made in 1977, but it is too early to determine the success of these changes.

—Due to the change in cause codes, the data are not comparable before and after 1975 and make analysis of trends encompassing years before and after 1975 impractical.

—The changes in reporting requirements for the 1975 data had the effect of greatly increasing the number of injuries reported to FRA. This occurred because the reporting threshold for injuries, measured in days

4A. E. Shulman and C .E. Taylor, *Analysis of Nine* Years of *Railroad Accident Data* 1966-1974, Association of American Railroads, April 1976.

[5] A.E. Shulman, *Analysis of Nine Years of Railroad Personnel Casualty Data 1966-1974*, Association of American Railroads, November 1976.

disabled, increased from "more than one day" to "one or more days. " Also, the inelusion of "occupational illness" and "receiving medical attention from a physician" increased the number of reportable accidents.

Notwithstanding the limitations of the accident data base, FRA analysis of the data and its use in guiding regulatory and enforcement activities appear to be inadequate.

—Although FRA does perform sorting and tabulations of accidents by various means which aid in identifying some of the problem areas, more in-depth analyses of data are necessary to assist in determining causes and potential problems.

SAFETY LAWS AND REGULATIONS

The existing Federal safety laws, taken as a whole, provide sufficient statutory authority to deal with the existing hazards of railroad operations.

The early safety laws—aimed at specific railroad hazards—are supplemented by the Federal Railroad Safety Act of 1970, which provides regulatory and administrative powers applicable to "all areas of railroad safety. " Likewise, the Hazardous Materials Transportation Act supplements earlier laws dealing with hazardous materials by providing the Secretary of Transportation with broad regulatory and administrative powers to deal with the hazards posed by the transportation of hazardous materials.

Repeal of the early safety laws and enactment of their substantive provisions as regulations would not have a beneficial impact on safety, although certain provisions of those laws appear to impair their execution unnecessarily.

The early safety laws do not, in general, place undue rigidity upon treatment of the particular hazards to which they are addressed. To the extent the laws are obsolete, their existence does not impair safety or cause other substantial harm. Thus, the effort necessary to change the substance of these laws would likely exceed the benefits of such a change and would distract attention from other important safety issues. However, there are two provisions which impair the execution of these laws:

- The definition of time on duty and similar details in the Hours of Service Act have spawned much litigation and might have more appropriately been the subject of a grant of rulemaking authority to the Secretary; and
- The limited enforcement power available under most of the early safety laws hinders action against habitual violators of those laws or the regulations thereunder.

Generally, the response to a particular safety hazard has been to adopt a law or regulation to require or prohibit certain action and thereby eliminate the perceived cause of that hazard. That response has been typically made without adequate consideration of alternative responses such as cooperative programs, collective bargaining and arbitration procedures, and adoption of incentive programs.

The Federal Railroad Safety Authorization Act of 1976 provides two particularly good and not atypical examples of this response—the provisions regarding the location of crew quarters and the requirement for rear-end markers. In each case, a solution to a hazard was mandated by law. The law required further detailed regulation in advance of consideration of alternative courses of action, or a clear understand-

ing of the extent of the hazard and its significance relative to other hazards. In making this response without full consideration of alternative approaches, unnecessary inflexibility and inefficiency are built into the overall safety program and emphasize an adversarial rather than cooperative approach to safety.

The uncertainty as to what authority, if any, the Federal Railroad Administration has with respect to occupational safety and health hazards, combined with persistent but unsuccessful challenges to the authority of the Occupational Safety and Health Administration (OSHA) to regulate such hazards in the rail industry, has resulted in a gap in administration and enforcement of a program to deal with those hazards.

There is no gap in statutory authority to deal with occupational safety and health hazards since OSHA has such authority and can exercise it to the extent FRA does not. However, FRA has failed to exercise any substantive jurisdiction in this area (other than reporting requirements), in part, because its legislative authority to do so has been seriously questioned. In addition, OSHA has been hampered in administering its program on railroad property because of continued litigation as to its authority, although every appellate court that has considered it has sustained OSHA'S power in this regard and now OSHA is able to carry out its program in most jurisdictions. Moreover, OSHA and FRA have never reached agreement as to how responsibility for treatment of occupational safety and health hazards should be divided.

In exercising its rulemaking power, FRA does not articulate adequately the relationship between its regulatory objective and the requirements of the rule, nor does it establish measures for later determining the effectiveness of its rule.

A reading of the preambles and the docket to FRA's rules generally indicates the nature of the hazard to which the rule is addressed. However, there is usually no indication as to why the requirements of the rule were established as the best means for dealing with the hazard in question. While in some instances this relationship between the hazard and the rule is self-evident, particularly where performance standards are used, often there is no indication in the preambles or the docket as to why a particular standard or requirement will best eliminate or reduce the hazard. Moreover, neither the rules nor their preambles or other related information provide any measure that can be used to determine the effectiveness of the rules in dealing with the hazards to which they are addressed.

Analysis of five significant rulemaking proceedings* involving FRA over the last 7 years indicates the following:

—FRA has worked closely with the industry in formulating and amending its rules, but it has maintained a degree of independence and balance in resolving major issues that is consistent with its role as a regulator;

—The public record (meaning the agency docket) generally does not indicate the specific reasons for FRA's resolution of the issues raised in the proceeding;

—In most cases, the public record contains only superficial cost-benefit analysis of the rules;

—The public record in most proceedings does not show any use of pertinent accident data in formulating the rulemaking objective and selecting the appropriate means for obtaining that objective (e.g., there is no analysis to show that a Federal blue signal (flag) protection rule would meet a particular safety hazard of significance or that the particular requirements of that rule will have any impact on safety);

*Track safety standards, State participation rules, power brake rules, blue signal protection rules, and tank car specifications.

—Most of these rulemaking proceedings took a considerable period of time (over 5 years in one case from advance notice of proposed rulemaking to final action), but FRA was not usually the sole or even main cause of this delay. The time each proceeding took was the result of a variety of factors including the complexity of the problem addressed, the degree to which data with respect to the problem and the solution were available, the degree of controversy among special interest groups, the level of congressional and other public involvement, and the growth and maturity of FRA as a rulemaking agency. Recent legislation has limited FRA to 1 year for completing any regulatory act.

The likelihood that the tools for enforcement of Federal safety laws and regulations will be effective in inducing compliance is hampered by (a) the excessive time taken to collect monetary penalties, (b) the failure to make effective use of the emergency order power or any use of the power to issue compliance orders, and (c) the favorable treatment accorded bankrupt or financially weak carriers.

The time between occurrence of a violation and enforcement of a penalty, usually a fine, averages approximately 16 months, with many taking 2 years or more. This clearly reduces the impact of the penalty as a deterrent to violation of safety requirements. Moreover, FRA has issued only seven emergency orders since 1970 and has never issued an order directing compliance. These powers, particularly the latter, could be far more effective in correcting habitual violations than collection of civil fines. Bankrupt or financially weak carriers were treated more leniently in enforcement of civil fines, a policy consistent with the need of those carriers to conserve funds. This reduces the incentive of those carriers to apply limited resources to correct conditions that are violative of Federal safety requirements.

INSPECTION ACTIVITIES

The accident rate does not appear to have been affected by the increased inspection activity.

In assigning a significant portion of its safety resources to its inspection programs, the FRA appears to be operating on the assumption that Federal inspection programs can help to reduce the accident rate. However, the relationship of the inspection programs to accident prevention/reduction is difficult to define—given the number of variables that must be considered and the fact that adequate measures of effectiveness do not appear to exist. While it would not be expected that accident reduction would be the sole measure of the effectiveness of inspection programs, lacking other measures, it provides one relevant benchmark for assessing the effectiveness of the inspection efforts. Increased and/or continuing accident rates that coexist with increased inspection personnel may indicate that Federal inspection does not provide a significant incentive to comply with railroad safety standards.

The allocation of inspection funds/personnel does not appear to coincide with the accident pattern.

From the information available to this study, it is not apparent what basis the FRA has used for assigning levels of effort in the five inspection program areas that have been established. Although track accidents account for the largest number of train accidents and the largest amount of property damage, the resources allocated to this inspection effort at the Federal

level are only half those allocated to the motive power and equipment inspection program. On the other hand, while a significant number of fatalities to employees appears to occur as a result of human factors, the inspection effort for operating practices is allocated approximately one-tenth the funding and half the personnel allocated the motive power and equipment inspection program. Human factors are not sufficiently understood, so that increased inspection of those operating practices may not necessarily be an improvement. There appears to be some shifts in resource allocation, with motive power and equipment decreasing and the other programs increasing; nonetheless, the basis for the shifts, their magnitude, and their timing are not clearly related to the accident pattern.

There does not appear to be a way, at present, of determining the effectiveness and the continued desirability of the State Participation Inspection Program.

The State Participation Inspection Program has been controversial from its inception, with the States and the FRA differing in several respects as to how it should be implemented and what the respective roles/responsibilities of the States and the FRA should be. Several additional factors have complicated participation from the point of view of individual States; these factors include lack of an entity having appropriate jurisdiction, lack of funding, lack of sufficient railroad mileage to warrant and/or qualify for participation, lack of qualified inspectors, and reluctance to be tied to Federal funding. Although these factors have played a part in the development of this program, it is not possible to say to what extent they have affected its implementation. As with other inspection efforts, adequate measures of effectiveness for the State Participation Inspection Program do not exist; however several observations are pertinent:

—Rate of entry of States into the program was not as rapid as was originally anticipated.

—Current State participation regulations promulgated by the FRA permit State participation inspection efforts against only two standards: track and equipment.

—States have, by statute, virtually no enforcement power of their own.

—Participation of States is uneven, i.e., not all States are participating and some are participating in one program and not the other.

The adequacy of the FRA inspection strategy, the adequacy of the present standards upon which inspections are based, and the possibility of approaches other than inspection having greater leverage in promoting safety in certain areas presently covered by the standards, have not been appropriately addressed in the administration of the FRA safety program.

A significant component of the FRA safety program relies on the concept of inspection. An inspection program proceeds on the assumption that the standards against which it inspects are correctly conceived and that compliance with them will enhance safety. It also proceeds upon the assumption that the inspection program's ability to detect noncompliance and to cause the assessment of penalties is sufficient to make noncompliance with the standards unattractive. However, some noncompliance exists and indications are that selective noncompliance with railroad safety standards occurs for three general reasons:

1. A number of the standards lack credibility due to the perception that: a) their sometimes cumbersome requirements are not always related directly to safety; b) their tendency not to differentiate between potentially serious defects and other defects; and c) in some cases, enforcement of the standard is not always feasible.
2. It sometimes costs the railroads less to pay

a PenaltY when a violation has been detected or to risk having to pay a penalty than to stop service.

3. Some railroads are not financially able to comply across-the-board with all the requirements of all the safety standards.

RESEARCH **AND DEVELOPMENT**

Railroad safety-related research and development activity (Government* and industry) has placed more emphasis on reducing the causes of property damage than reducing the causes of human casualties.

The major research and development efforts during 1973-76 were directed at track structures and rolling stock which, except for tank-car design research, can be expected to have a greater impact upon the safety of property than on the safety of people. Those efforts received a far greater amount of funding applied to research and development activity than those directed at major causes of human casualties.

Of the research and development activity directed at casualties, greater attention has been focused on grade-crossing accidents and hazardous materials problems, with less attention being directed toward employee casualties.

Most of the research and development activity directed at casualties has been focused on tank-car design because of its potential for a catastrophe and on grade-crossing accidents because of the high number of fatalities and severe injuries associated with these accidents. Relatively less attention has been given to railroad employee casualties.

Moreover, very little research has been done to identify the chief contributing factors to employee casualties. For example, even though there seems to be some recognition that alcohol or drug abuse may be factors in railroad accidents, as evidenced by the growing number of industry programs dealing with such abuse, there has been little research effort to determine the extent to which alcohol and drug abuse are safety problems.

Railroad safety research and development appears to have been most successful in terms of its adoption and utilization by the affected parties when all interested parties are involved in the formulation and implementation of the research and development effort.

The research on tank-car design, glazing of locomotives and cabooses (not completed), and locomotive cab interiors has been conducted with the involvement of all interested parties and has been, or is expected to be, very successful in terms of the use of the benefits of this research by those parties. Conversely, past efforts at standardizing operating rules (only in part a research effort), establishing railway employee medical standards, and analyzing the tasks of certain railroad employees were characterized by a lack of cooperation among interested parties and in general have not been successful.

*Does not include funds spent by the Federal Highway Administration (FHWA) on demonstration projects.

HAZARDOUS MATERIALS

The Department of Transportation and the railroad industry have taken major steps to deal with one of the most serious problems associated with hazardous materials by issuing the October 17, 1977, tank-car regulations.

In 1974, roughly 65 percent of tank cars loaded with liquefied petroleum gas, sulfuric acid, anhydrous ammonia, and liquid caustic soda were involved in the accidental release of hazardous materials. The Department of Transportation and the industry acted on data indicating the serious nature of the problem by conducting research and development and then proposing and making final regulations covering specifications for tank cars such as shelf couplers, thermal protection, and tank head shields. The effective date of the regulation was October 17, 1977, calling for cars built after December 31, **197'7,** to comply. Further, under that regulation, retrofitting of existing tank cars would be completed by January 1, **1982.**

This action should reduce the problem associated with hazardous materials significantly, provided that there is effective monitoring to ensure compliance with the regulation. However, FRA should ensure the effectiveness of the regulatory action in reducing accidents.

Additional analysis of the risk and exposure associated with the transportation of hazardous materials should be conducted to anticipate future problems.

Accident data and trends were important in initiating regulatory activity which led to the tank-car standard. Accident data should always be one tool of the regulatory process. But that alone is not satisfactory. It is critical to effective regulation, to ensure safety, that the exposure of people and property to hazardous materials be determined.

RAIL-HIGHWAY GRADE= CROSSINGS

Although accidents and fatalities associated with rail-highway grade-crossings have been decreasing, the problem continues to be a serious safety matter.

Table 7 gives grade-crossing accident data for **1965-75.**

Although the numbers are decreasing, the problem remains serious basically for two reasons:

1. Grade-crossing accidents continue to be the major cause of fatalities in railroad operations, accounting for approximately 65 percent of the fatalities resulting from all types of railroad accidents.
2. The desirable rate of improvement (i.e. 3,000 yearly protection installations over the next 10 years and an annual reduction of 500 fatalities) in grade-crossing accident problems, which was indicated by the Department of Transportation in its 1972 Report to Congress, has not been met for a variety of reasons, including delays in funding until mid-1974.

The environment for solving the rail-highway safety problem is complicated by divided jurisdictions, which is a barrier to effective treatment of the problem.

The divided jurisdiction and responsibilities result from the following:

Table 7.— Rail-Highway Grade-Crossing Accidents

Year	Number of accidents	Accidents per billion vehicle miles	Killed	Injured	Total casualties	Casualties per accident
1965	**3,820**	4.3	1,534	3,801	5,325	1.39
1966	**4,097**	4.4	1,780	4,043	5,823	1.42
1967	**3,932**	4.1	1,632	3,812	5,444	1.38
1968	**3,816**	3.8	1,546	3,774	5,320	1.39
1969	**3,774**	3.6	1,490	3,669	5,159	1.36
1970	**3,559**	3.2	1,440	3,336	4,776	1.34
1971	**3,392**	2.9	1,356	3,332	4,688	1.38
1972	**3,379**	2.7	1,260	3,285	4,545	1.34
1973	**3,379**	2.6	1,185	3,283	4,468	1.32
1974	**3,268**	2.5	1,220	3,249	4,469	1.36
1975*	N/A	N/A	978	4,168	5,146	N/A

•1975 figures are not comparable to previous years due to changes in reporting requirements. Peat, Marwick, Mitchell & Company, Inc. (Task IV) projected the number of fatalities in 1976 to be 1,124, based on 6-months of data.

SOURCE: Compiled by OTA from Federal Railroad Administration and Association of American Railroads data.

–The Federal Highway Administration apportions funds to States by a statutory formula, reserving the right of the Federal Government through local offices to disapprove certain State-funding strategies. States may use these funds for a variety of safety activities concerning grade-crossings.

—Jurisdiction over railroad-highway intersections resides exclusively in the States, where responsibility is often divided among several State agencies.

—Railroad companies have the responsibility for the design, installation, and maintenance of train-activated warning devices to be installed only by railroad employees or by private contractors employing members of the railroad union authorized to make such an installation.

The divided jurisdiction becomes a barrier to effective treatment of the problem because:

—It is used to explain why measures of effectiveness of specific actions necessary to properly direct future resources have not been developed. Federal Highway Administration officials have not sufficiently analyzed the contribution Federal dollars have made to the reduction of collision injuries and deaths.

—It allows confusion on the issue of who should provide and pay for the protection or other improvements.

—It makes the assurance that new technology is transferred to all entities requiring solutions to grade-crossing problems difficult.

Technology and interdisciplinary efforts have provided some solutions to the rail/highway safety problem, but the basic problem is the rate of adoption of the solutions.

Solutions Exist. Among the solutions identified are the automatic warning devices. According to a California study, the automatic warning devices are quite effective in reducing vehicle-train accidents and casualties at public railroad-highway grade-crossings. That stud, concluded that the installation of automatic crossing gates can be expected, on the average, to result in 70-percent fewer vehicle-train accidents per year and an additional 48-percent fewer casualties per accident.0

[a]California Public Utilities, *The Effectiveness of Automatic Protection in Reducing Accident Frequency and Severity at Public Grade Crossings in California*, June 1974.

Operation Lifesaver, a multidisciplinary approach to grade-crossing safety, operates on the premise that a successful grade-crossing safety program depends on engineering, education, and enforcement. In the opinion of Illinois Cornmerce Commission officials, from the single performance measure—fatalities—the program was a success. [7]

Barriers Exist. The analysis of each grade-crossing in terms of the costs and benefits of various protections, separations, passive controls (motorist awareness activities), or "no action" coupled with the allocation of necessary resources has not been and does not appear to be the strategy the States are following presently.

It may be most difficult to fund all necessary activities, given the costs of the various alternatives. One study showed the installation of flashing lights in 1975 to be $16,250 while cost of the installation of the automatic gates would be $27,290. That same study did not make the comparison between the protection devices and grade separation but other analyses have indicated that grade separations would be 27 times more expensive than the warning devices. [8]

In addition to the complicated jurisdictional problem discussed above, there is a barrier to implementation of the solutions brought about by the legislative authority of the Federal Highway Administration. Under FHWA's authority, the Federal formula for funding does not take into account the number of grade-crossings in a State or the number of fatalities per grade-crossing.

OTHER RAIL-SAFETY PROGRAMS

Activities such as use of safety committees, safety incentive programs, and alcohol and drug abuse programs may be effective in improving rail safety—in addition to Federal standards, inspection, and enforcement. However, little is known about the effectiveness of these programs, because measurable goals and objectives have usually not been established.

A variety of nonregulatory programs conducted by railroads, unions, and Government have the potential of contributing in a substantial way to improving railroad safety. The types of programs are:

—Information and education programs (industry and Government) which include training and public and employee awareness programs;

—Safety committees, some of which are organized by specific railroads to deal with their safety problems, and others which are organized at the national level to deal with safety problems;

—Incentive programs which provide local and national awards to railroad employees and to railroads for good safety practices; and

—Alcohol and drug abuse treatment programs which are designed to provide information and counseling to rail employees.

Even though many of these programs have existed for some time, there are gaps in the understanding of their effectiveness.

—There are differences in the methods and techniques used in railroad training

'Illinois Commerce Commission, Illinois, Railroad Grade Crossing Safety Council, "Operation Lifesaver, " July 1977.

'Texas Transportation Institute Study, November 1970,

programs- some programs emphasize on-the-job training, others emphasize classroom training. There are no convincing studies as to which, if any, method or methods are more effective than the others.

—The safety committees appear, in concept, to be a good approach to solving the safety problems by the cooperative efforts of some stakeholders. Some studies of the effectiveness of the committees indicate concern about the continuity of the activities and meaningful participation of all in safety-policy decisions. [9]

---Alcohol" abuse programs were found to be cost-efiective in a 1976 Naval Weapons Support Center survey. Similar cost-effective studiea were not apparent in other programs dealing with human problems affecting salety -- such as drug abuse and dif - ficult family situations.

The railroads and unions should be more involved in activities required to solve **safe-** ty problems.

If it is preferable to have less Government involvement in rail-safety matters, which is not the present trend, then the railroads and the unions will have to take on more of the burden in solving the safety problems. A critique of their present efforts indicates the following short corn i ngs:

—The unions have minima] data collection and analysis activities, even though they gather some employee complaint information and review FRA and AAR data. A part of the problem relates to the reluctance of railroad management to share safety information, such as claims data, for fear it will be used against them. Although railroads themselves and the AAR are involved in data collection and analysis, there is some evidence that, for example, in the hazardous materials area, the data are not being used to determine the probability of risks associated with many hazardous materials.

—Except in the research and development activities, there is little evidence that safety committees have a measurable impact on the solution of rail safety problems.

—Neither the railroads nor the unions appear to have developed sufficient programs to meet the safety problems of railroad employees.

SAFETY CONCEPTS

The increased demand for protection against railroad accidents matches the increasing demand for safety in all industries.

Society continues to demand higher levels of safety in all its activities. In the evolution of the concept of safety in the workplace, the first major responses to the safety problems in the 19th century were under common law where the injured worker was protected if the employer was proved to be at fault. The next major phase of activity, after the laws were passed requiring employers to provide safe tools, was the passage of the Workmen's Compensation Laws-which placed a definite responsibility upon the employer. In more recent times, safety in the workplace has evolved to provide other protections under laws such as the Occupational Safety and Health Act. The demand for the level of safety has evolved to a higher level today in all workplaces, including railroads. In addition, this evolutionar, process has affected the safety of the public interacting with the railroad system.

[9] Thomas A, Kochan, Lee Dyer, and David Dipsky, The *Effectiveness of Union Management Safety and Health Committees,* W. E. Upjohn Institute for Employment Research cited in Peat, Marwick and Mitchell study (Task IV).

The bases for all safety questions are trade-offs between the acceptable levels of risk, the benefits, and the costs.

The individual and society as a whole make determinations as to the optimal balance which can and shouId be achieved between the value of different levels of safety and the cost of providing those levels. It is agreed that critical to decisions about safety is a determination about the probability and severity of accidents associated with a product or activity. It is also understood that the acceptable levels of safety are not decided upon in a vacuum but rather there are considerations of their efficacy, and the distribution of hazards, costs, and benefits. In order to understand the hazards involved, a variety of factors may be considered. Among these are:

> the extent to which the action is voluntary or involuntary; whether the effect is immediate or delayed; whether alternatives exist; whether the risk is certain or not known; whether the action is essential or a luxury; whether the action is or is not occupation-related; whether the hazard is common or dread; whether the risk will be to average people or unusually sensitive people; whether the activity will be as intended; and whether the consequences are reversible or irreversible. 10

There is the need to apply methods of analysis (including cost/benefit) of alternative solutions to safety problems.

Once there is an understanding of safety problems, the next step is the identification of alternative solutions and the selection of the solution which best addresses the problem. The selection that is made among the alternatives must be based on a weighing of their costs and benefits. Thus, it is necessary that methods of conducting cost/benefit analyses be developed and applied specifically for safety-related matters. It is important to note that in developing such cost/benefit analysis methods, the complex issue of the value of human life is raised among others. *

The bases for determining acceptable levels of safety in the future may change.

Decisions about safety in the future will continue to be based in part on risk, efficacy, and the distribution of the hazards, benefits, and costs. But there may be additional considerations—given the effect of such activities as changing patterns of governmental involvement with the railroads, changes in technology, the concern about the environmental impact, and the possibility of new types of hazardous materials.

10 William w. *Lowrance, Of Acceptable Risk (Drawing* from Chauncey Starr and others), William Kaufmann, Inc., Los Altos, Calif., 1976.

* Some judgment of the value of life is implicit in every safety decision. The methodology dealing with the value of life and safety improvement in a form amenable to analysis using the conceptual apparatus of economic theory has been treated recently by M.W. Jones-Lee in The Value of *Life.* That methodology may be effective in quantifying the costs of injuries and fatalities and in quantifying the benefits of reduced injuries and fatalities. In any event, methods need to be developed to facilitate the conduct of safety analyses of alternative solution's to safety problems.

Chapter II

ISSUES

Chapter II
ISSUES

INTRODUCTION

Certain issues which impact future Federal railroad safety policy choices have emerged during the course the this study. At tent ion to these issues in policy formulation is significant because of the effects on the level of safety as well as economic implications for all of the stakeholder groups (i.e., group having a definable interest in these problems). *

For purposes of this report, an issue is defined as an area of controversy. Therefore the following statements included as issues in the report will, in all likelihood, be argued upon by concerned stakeholders. These statements of issues should not be construed as recommendations by the Office of Technology Assessment (OTA).

1. Should future Government policy be directed toward the specific reportable causes of train accidents, as the regulations, inspection, and enforcement programs are now directed, or toward the possible underlying reasons (i. e., heavier axle loadings, deferred maintenance, and the general economic health of the industry)?
2. How should the purposes and criteria for administering the inspect ion programs be more clearly defined and the standards upon which such programs are based be more adequately designed to meet the given safety problems they are to address and to determine appropriate inspection and enforcement levels?
3. How should differences over primary responsibility for occupational safety and health of railroad employees between the Occupational Safety and Health Administration (OSHA) and the Federal Railroad Administration (FRA) be resolved to enable more effective administration of the program ?
4. So that grade-crossing safety can be improved, What must be done to resolve jurisdictional problems regarding responsibility for implementation of rail-highway grade-crossing programs?
5. Should State participation in Federal railroad safety programs and policy be modified or eliminated?
6. What needs to be done to increase cooperation among stakeholders so various problems within the industry, now working counter to safety, can be resolved —and thus permit a more systematic approach to railroad safety?

It is not clear from analysis of Government involvement in railroad safety activity that these issues have been or are being addressed in existing policy formulation .

This chapter presents the selected railroad safety issues. Policy alternatives, researcch questions, and options are outlined pertinent to the issues.

As a part of the issues formulation, OTA outlined a list of 33 questions which were given to the Railroad Safety Advisory Panel. Panel responses to these questions are included in appendix E.

*The identified stakeholder groups include: the public, railroad management, railroad labor, railroad shippers, suppliers of railroad equipment, and Government agencies.

ISSUE 1

Should future Government policy be directed toward the specific reportable track causes of train accidents, as the regulations, inspection, and enforcement programs are now directed, or toward the possible underlying reasons (i.e., heavier axle loadings, deferred maintenance, and the general economic health of the industry)?

Over the 9-year period 1966-74, track-caused train accidents increased over 100 percent. A substantial amount of the property damage reported resulted from these accidents.

Many railroads have been unable to generate the capital necessary to maintain and/or improve their track and fixed facilities. Estimates of industry-deferred maintenance were approximated at $6.6 billion in 1975. The combination of deferred maintenance and heavier axle loading appear to be major reasons underlying the increases in track-caused train accidents.

Current Federal emphasis has focused on researching and regulating the technology or technological problems associated with these types of accidents. To date, efforts to reduce train accidents, specifically track-caused, through regulation, inspection, and enforcement have been largely unsuccessful. However, as also shown, the extent to which such efforts have prevented accidents is not known and currently cannot be measured. It should be noted that it appears that hazardous materials dangers may continue as long as track problems are a primary cause of train accidents.

Policy Alternatives

1. **Government** safety policy should continue to be primarily directed toward the specific cause of the train accidents, such as track problems, rather than addressing operational practices such as heavier axle loading or the economic problems of the industry which result in deferred maintenance.
2. Government safety policy should be broadened to address both specific accident causes and underlying operational factors. However, Government safety policy should not address the industry economic problems.
3. Government safety policy should be broadened to address the specific causes of train accidents and the underlying industry operational and economic factors impacting such accidents.
4. Government safety policv should address only specific accident causes, and Government economic policy should be coordinated with safety policy to ensure that the underlying operational and economic factors impacting train accidents are addressed.

Research Questions and Needs

1. Further research needs to be conducted to specifically identify the relationship between track-caused train accidents, operational practices (i.e., heavier axle loadings), deferred maintenance, and the economic health of the industry. Specific variables which should be examined and correlated for individual railroads include the level of maintenance provided, the types and locations of train accidents, the extent and effectiveness to which railroads employ the practice of “slow ordering” as a means to offset potential accidents, increased axle loadings, the specific financial resources of the railroad, and the density of traffic movements along specific routes.
2. Research should be conducted to determine the relationship of the financial resources of the industry to its injuries and fatalities, especially those occurring to employees.
3. Research intended to determine optimal Government safety and economic policy should be explored. Specifically, findings relative to capital needs, and routes with

greatest traffic density should be analyzed in connection with significant safety problems to determine optimum use of Federal expenditures or resources.

Congressional Options

- Oversight hearings may be conducted for the purpose of discussing with industry and labor the relationship of train accidents and industry economic problems.
- Congress may conduct oversight hearings with the Federal Railroad Administration to explore questions and methods for systematically addressing the train accident problems and their underlying causes.
- Congress may request the establishment of an explicit agenda designed to plan and enumerate specific priorities for research and development related to train accidents.
- Congress may direct future economic policy or assistance to identify safety accident performance on heavily travelled routes as a part of criteria for optimization of Government financial assistance.
- Congress may require future Government safety policy to clearly identify specific and underlying causes of train accidents prior to implementation of programs.
- Congress may initiate expansion of its safety policy to incorporate measures to address the underlying causes of train accidents.

ISSUE 2

How **should the purposes and criteria for administering the inspection programs be more clearly defined and the standards upon which such programs are based be more adequately designed to meet the given safety problem they are to address and to determine appropriate inspection and enforcement levels?**

A primary tool of Government railroad safety efforts has been regulation. Both the early safety laws and more recently the FRSA of 1970 place emphasis upon regulation as the means for achieving adequate levels of safety in the railroad environment. The regulations under these Acts establish standards for track and equipment as well as operating, inspection, and reporting requirements for railroads and their employees. In order to determine industry compliance with these regulations, the Government has established a system of inspecting facilities, equipment, and operating practices. The FRA's current position is that this inspection force has the responsibility of monitoring the compliance of railroads rather than detecting all defects. The railroads have the major responsibility for detecting defects and the FRA inspection program is intended to serve as a disincentive to noncompliance. Where violations of regulatory requirements are found, certain enforcement action ensues, which usually results in a fine.

This study indicated that there is no statistical evidence to show that an increase in the level of Government inspection activity will produce an improvement in railroad safety in terms of a reduction of casualties or property loss and damage. However, this study has also found that the regulatory programs on which the inspection and enforcement efforts are generally based—and indeed the inspection programs themselves—do not contain measures of effectiveness, nor do the regulatory standards clearly show how the standard will impact a given safety problem. Therefore, an assessment of the effectiveness of inspection activity in terms other than their relationship to the accident rate has not been possible. For instance, it is not possible to say whether Federal inspection has prevented accidents to any significant extent. Further, there is no statistical evidence to show that increased monetary penalties will result in an improvement in railroad safety. Finally, this study was unable to determine what basis was used by the Government in assigning inspection and enforcement efforts to particular regulatory programs.

Policy Alternatives

1. **Reallocate and/or increase/decrease** inspection and enforcement resources with

respect to each regulatory program based on a consideration of (a) the relative importance of that program in terms of the frequency and severity of the safety hazard to which it is directed, (b) the effectiveness of inspection in determining and motivating compliance, and (c) a rate of inspection effort for ensuring industry compliance that is based on a determination of the likelihood of a defect or deficiency being discovered.

2. Maintain current FRA policy—with the possibility for reallocation and/or increase/decrease of resources—by establishing standards for inspection and enforcement that maximize industry inspection efforts Further, use Government inspection and enforcement activity only to the extent necessary to assure that the industry is complying with the Government's requirements.
3. Reallocate and/or increase/decrease Federal inspection and enforcement resources with respect to each railroad, based on the historical compliance by individual railroads with the particular regulatory program. Require each railroad to pay a proportion of the costs of Government inspection and enforcement activity conducted on its facilities based on the level of compliance discovered.

Research Questions and Needs

1. What are the best measures of effectiveness of inspection and enforcement activity for each regulatory program?
2. On what, if any, regulatory programs do inspection and enforcement activities have little or no effect, or have an effect that is substantiall, smaller than the cost of that activity?
3. The goals of any inspection program may take at least two forms: (a) to motivate compliance by their enforcement potential, or (b) to detect defects and ensure compliance by the intensity of the inspection effort. The question as to which approach would be most effective, given the railroad safety picture, is one that should be answered before any major restructuring of the inspection effort is undertaken. The exploration of this question should include an analysis of the resources necessary and the relationship of inspection to the problems at hand.
4. In what ways, if any, should the penalty structure be adjusted so as to complement the inspection strategy adopted by the Government? For example, if the inspection strategy is designed to monitor compliance in reliance upon the deterrence of penalties, should the penalties be established at higher levels? On the other hand, if the inspection strategy is designed to be so pervasive as to discover most defects and deficiencies, should the penalties be relatively low, to assure there are sufficient funds to take corrective action? Finally, should there be an alternative penalty structure that could be used in cases of flagrant noncompliance to account for differences among railroads in their ability to pay the penalties?

Congressional Options

- Permit FRA to collect from railroads a portion of the annual inspection and enforcement costs incurred for each railroad for all regulatory programs.
- Permit FRA to apply the penalties collected to the costs of inspection.
- Require FRA to adjust the inspection and enforcement effort devoted to each program to the frequency and severity of the hazard at which the program is directed.
- Require FRA to determine (to the extent it has not already done so) the extent to which industry inspection efforts (with, possibly, the involvement of rail labor) can support Government inspection efforts.
- Require FRA to establish measures of effectiveness of inspection and enforcement ef -

forts relative to compliance with safety regulations.

ISSUE 3

How should differences over primary responsibility for occupational safety and health of railroad employees between the Occupational Safety and Health Administration (OSHA) and the Federal Railroad Administration (FRA) be resolved to enable more effective administration of the program?

At the present time, there is no apparent agreement between the FRA and OSHA about primary responsibility for occupational safety and health programs for railroad employees. Statutory authority allows OSHA to exercise jurisdiction where FRA does not; however, OSHA's limited attempts to exercise authority have been challenged in court. The FRA issued an advance notice of proposed rulemaking in March 1975 and a proposed rule on July 15, 1976, on the subject of Railroad Occupational Safety and Health Standards. These proposals, in effect, would have eliminated OSHA jurisdiction completely from any work place associated with railroad operations and would have permitted FRA itself to take over OSHA's function.

In a letter to the Railway Labor Executives Association, however, Secretary Adams indicated that he was taking steps to resolve the matter moving away from FRA's position in its proposed rule. He stated that the FRA would be responsible for administration and enforcement of all existing railroad safety laws and regulations; that OSHA would be responsible for all health conditions of railroad employment, including those associated with railroad operations; and that OSHA would be responsible for all safety conditions not covered by FRA. Nonetheless, the statement does not resolve the problem that has complicated the matter from the outset, that is, how to distinguish between safety and health and how far each agency's jurisdiction extends. Furthermore, although Secretary Adams has taken this step to clarity the situation, there has not yet been a memorandum of understanding entered into between the FRA and OSHA indicating their agreement as to this matter. On March **14, 1976,** the FRA published a notice in the Federal Register, which cancelled the FRA proposed rulemaking of 1976. To date, the apprent division between the two agencies has been as follows: OSHA having responsibility for safety and health in the maintenance shops, office buildings, and the like and FRA having responsibility for safety with in a broad interpretation of the "rail operating environment. "

Policy Alternatives

1. Assign responsibility for all aspects of the occupational safety and health of railroad employees to OSHA.
2. Assign responsibility for- all aspects of the occupational satefy and health of railroad employees to FRA,
3. Continue the division of responsibility, with clarification of the specific responsibilities belonging to OSHA and FRA.
4. Make a new division of responsibility for the occupational safety and health of railroad employees between OSHA and FRA.
5. Place the responsibility for occupational safety and health of railroad employers with the railroads.

Research Questions and Needs

1. What constitutes occupational safety and health and how does that impact on the operations of the railroad? This definition would be useful if it related specifically to the industry, taking into account the interaction of employees with various aspects of the operations.
2. What is the extent to which (occupational safety and health, by whatever definition, is a problem railroad empolyees? A study would be helpful in understanding the particular nature of the problems before decisions as to appropriateness of expertise may be final 1 v made.

3. What is the precise nature of the disagreements between OSHA and FRA? Are there similar problems in other industries, and what has been their resolution?

Congressional Options

- Amend the Federal Railroad Safety Act to clarify congressional intent as to occupational safety and health of railroad employees.
- Require FRA and OSHA to resolve the difficulties between them within a specified period of time and report back to Congress on their resolution.
- Require FRA and OSHA to measure their resolution of the problem by assessing occupational safety and health data trends for railroad employees over a specified period of time and to report back to Congress.
- Amend the laws to prevent Federal intervention in matters 'concerning the occupational safety and health of railroad employees.

ISSUE 4

So that grade-crossing safety can be improved, what must be done to resolve jurisdictional problems regarding responsibility for implementation of rail-highway grade-crossing programs?

Accidents at grade crossings account for approximately 65 percent of the fatalities arising from railroad operation. Recognizing the magnitude of the problem, Congress provided 90 percent funding, under the Federal Highway Safety Acts of 1973 and 1976, to States for safety improvements to railroad-highway crossings. However, installation Gf the protective devices and the expected decrease in fatalities have been impeded by several factors: (1) the Federal Highway Administration apportions the funding to States by statutory formula, which is not based on either number of grade crossings or accidents, but reserves the right to disapprove certain State-funding strategies; (2) jurisdiction over the highway-grade crossings resides exclusively with the States, but this jurisdiction is, in many cases, divided among State agencies; and (3) installation and maintenance of train-activated warning devices may be done only by railroad employees or by private contractors employing members of the railroad union authorized to do so.

Although both technology and resources exist to solve the problem, they have not been successfully applied on a large enough scale, to date, because of jurisdictional problems concerning responsibility.

Policy Alternatives

1. Give all responsibility for highway-grade crossings to the States. Have partial funding available from the Federal Government, with discretion granted to the States as to how it is to be utilized at grade crossings.
2. Place all responsibility for highway-grade crossings with the Federal Government and have it allocate resources according to " its assessment of the priorities.
3. Give all responsibility for highway-grade crossings to the railroads, and have partial Federal funding available.
4. Leave the responsibilities as they are Presently defined; but clarify the nature of the particular roles and the circumstances of the role for each of the concerned parties—i. e., Federal, State, and railroad.

Research Questions and Needs

1. **A study to determine the characteristics of the "most dangerous"** grade crossings based on exposure and previous history at individual grade crossings would aid in determining what, if any, priority-setting should be done at the Federal level and what, if any, specific direction/guidelines should be provided to States and railroads.

2. If there is to be an increasing volume of train traffic and an increase in unit trains, as appears possible with a renewing interest in coal as an energy source, what implications will such increases have for grade crossing safety?

Congressional Options

- Establish goals for the reduction of highway/railroad grade-crossing accidents.
- Amend the statute to define more clearly the roles of various participants in the program.
- Direct the Federal Highway Administration to confer with the States and the railroads and report back to Congress within a specific time period on a clarified understanding of their roles.
- Direct the Federal Highway Administration to develop priorities and/or criteria for determining priorities and measures of effectiveness for the program and to report back to Congress within a specified period of time as to the effectiveness of the program. The measures should relate at least in part to the accident data.

ISSUE 5

Should State participation in Federal railroad safety programs and policy be modified or eliminated?

In the Federal Railroad Safety Act of 1970, Congress provided for a program in which States could participate in the inspection activities of the FRA in order to ensure compliance with Federal safety standards. This program has been controversial from its inception, with the States generally differing with FRA on how the program should be implemented and on the States' rights regarding the program. The FRA believed that it was responsible under law to ensure that participation by the States would be consistent with Federal inspection standards and policy. Thus, it set forth, by regulation, criteria with which States have to comply in order to be able to participate.

States—with NARUC (National Association of Regulatory and Utilities Commissions) as one of their most vocal representatives—maintained that they had been guaranteed participation as a right under the law and that FRA was not correct in circumscribing the possibilities for State participation in this way. Nonetheless, the FRA regulations set forth requirements for participation; these requirements include the qualifications that State inspectors must meet. Inspector qualification has been one of the most contentious questions between FRA and the States. FRA maintains that a high level of experience is necessary; the States have argued that it is not necessary and that, furthermore, they are not able to find qualified people. Further, they would not be able to pay them if qualified. At the present time, the State Participation Inspection Program is limited to inspection programs for track and for freight car equipment (excluding safety appliances). There are currently 28 State inspectors and 8 inspector trainees in the equipment inspection program. There are 20 States participating in the track program and 8 States participating in the equipment program. Participation by States has not been large. Although the State inspectors are bound by the same standards and policy as the Federal inspectors, they are responsible to the States rather than to the FRA. Further, by statute, the States have enforcement power only if the FRA fails to act within 180 days. The State inspectors, like the Federal inspectors, must recommend enforcement action to FRA in Washington, where the decision is made on whether or not to take action.

Policy Alternatives

1. Expand the State Participation Inspection Program to include other aspects of the FRA inspection effort.
2. Leave the State Participation Inspection Program as it is presently constituted.
3. Leave the State Participation Inspection Program as it is presently constituted but

expand the States' rights under the program.

4. Discontinue the State Participation Inspection Program.

Research Questions and Needs

1. In order to make a judgment about the desirability of the State participation Inspection Program, an evaluation of its effectiveness, as currently implemented, should be carried out. What measures of effectiveness should be established so as to allow generalizations based on "facts" rather than "impressions?" What inspector qualification in relation to the tasks that he/ she is expected to perform should be required.

2 What are the State's views of the program and their reasons for either participating or not participanting?

3 What would be the effectiveness of the penalty structure and the enforcement policy of FRA (e.g., with regard to compromising penalties), if the States had enforcement powers?

Congressional Options

- Amend the statute to confer greater powers to the States.
- Repeal the State participation provision.
- Direct FRA to establish measures of effectiveness for the State Participation Inspection Program, assess the program against these measures, and report back within a specified period of time with alternative courses of action.

ISSUE 6

What needs to be done to increase cooperation among stakeholders so various problems within the industry, now working counter to safety, can be resolved—and thus permit a more systematic approach to railroad safety?

As indicated by the study findings, Government safety programs are currently placing differing emphasis on problems of casualties and property losses. However, there is a lack of understanding concerning the causes of these problems, the rationale for current programmatic emphasis, or the appropriateness and effectiveness of the mechanisms currently utilized by Government to address today's safety problems.

Railroad safety stakeholders generally have strong beliefs about the proper role of Government, the specific safety problems which should be addressed, and the various mechanisms Government should utilize to address these problems. Moreover, the concerns of the stakeholder groups regarding Government safety policy have economic as well as safety implications. The positions of the various groups have often run counter to one another and have been characterized by a lack of cooperation. (There are several recent signs toward a positive trend in cooperation.) The result of the conflicting views, opinions, and approaches to safety by all groups has been that Government's approach to safety generally has been impaired. Inadequate attention has been placed on accident data, measures of effectiveness have not been designed into the programs, alternative approaches to safety problems have not been systematically considered, and jurisdictional problems between and among various agencies have arisen.

Policy Alternatives

1. Establish a new method for addressing safety problems which creates an environment for cooperation; which sets priorities based on accident data analysis including accident severity, frequency, and cost; which examines alternative mechanisms for addressing safety problems; which establishes clear measures by which safety standards and programs can be evaluated; and which clearly identifies the appropriate agency or organization responsible for administration of safety programs.

2. Continue the existing method utilized to address safety problems wherein specific problems raised by given stakeholder groups are identified and addressed.

Reward Question and Need+

1. A clear and comprehensive determination and definition of the factors and criteria necessary to establish a systems approach to safety should be studied.
2. Research determining the extent economic and market forces may provide solutions to safety problems should be conducted.
3. To what extent, and by what specific means, should cost/benefit analyses be used to evaluate all approaches to safety problems.
4. What are the underlying factors or causes contributing to safety problems today? How much do we know about these factors?

b. What specific types of levels of safety problems are inherently more amenable to solution through incentive programs? Through mandatory requirements?

6. What transferable knowledge is available from other transportation modes or other industries with respect to levels of cause for safety problems and/or mechanisms deployed to address these problems?
7. What are the specific types of incentive mechanisms available to Government, and where or how have they been successfully applied?

Chapter III

THE CONCEPT OF SAFETY

Chapter III
THE CONCEPT OF SAFETY

This chapter presents a discussion of contemporary concepts of safety and the evolution of the treatment of safety in the workplace.

The term "safety " has been defined as: "the state of being tree from danger or more practically the use of methods and devices that reduce, control role, or prevent accident s." That definition, however, does not provide the necessary explanation of the concept of safety. Two question must be considered in order to understand the concept.

- On what basis does society make judgments about the acceptable levels of safety?
- Who influences or **makes the determinations as to acceptable levels of safety?**

In order to place the discussion of these issues in the proper context, below is a brief historical review of safety problems and society's response to those problems.

Safety Problems. The introduction of power machinery in England in the 18th century brought to society a higher probability of accidents and personal injuries than it had ever had in the past. The new machinery had moving gears, cutting blades, and automatic power-operation which both enriched the human condition and presented new risks of injury. These risks of accident and injury were brought to the workplace and the home, as well as other environments. As technology has become a more integral part of our lives, so have the accompanying risks. Many of the accidental deaths in the United States, which have exceeded 100,000 each year since 1963, represent the human safety problem and its technological implication>.

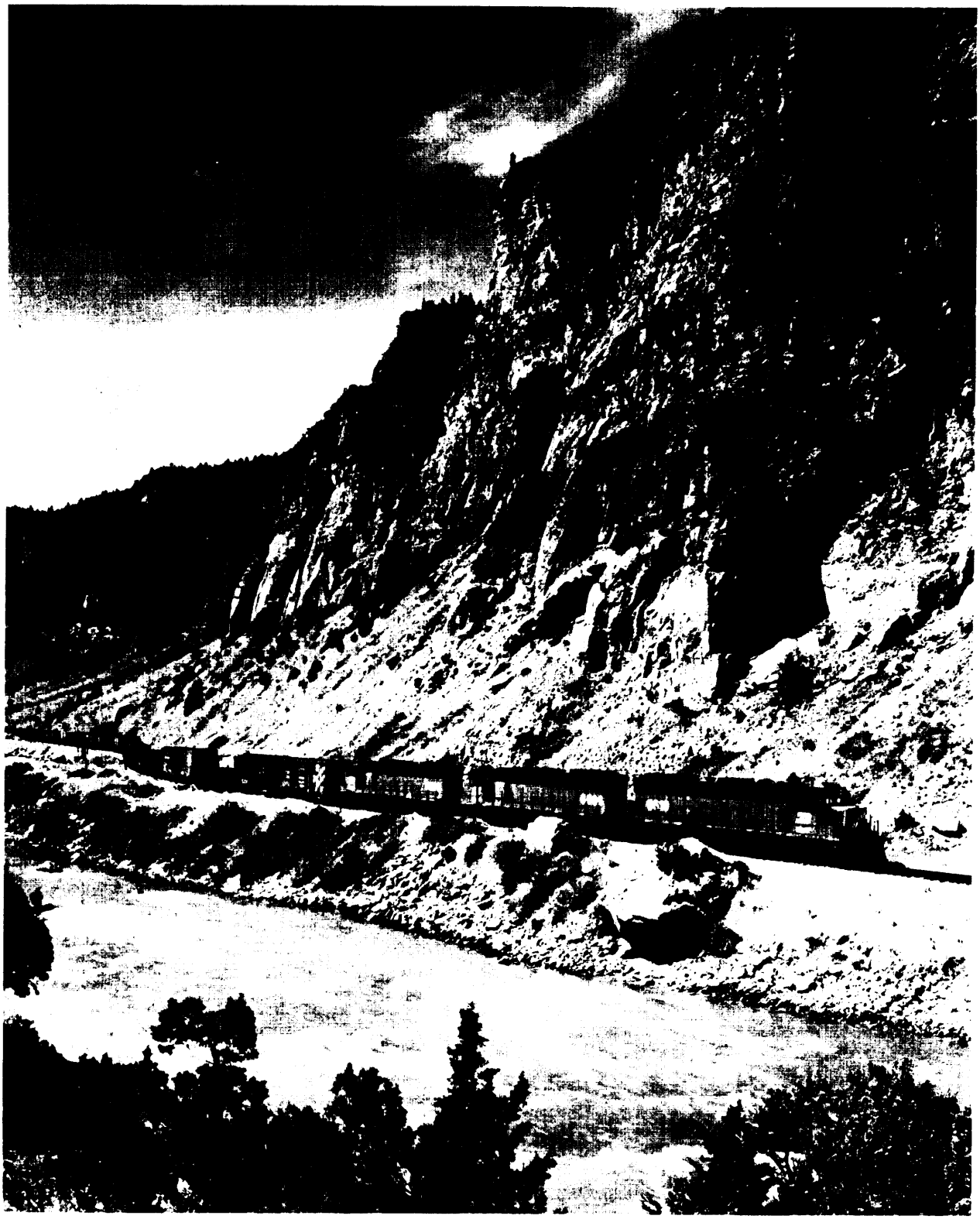
SOCIETY'S RESPONSES TO THE SAFETY PROBLEMS

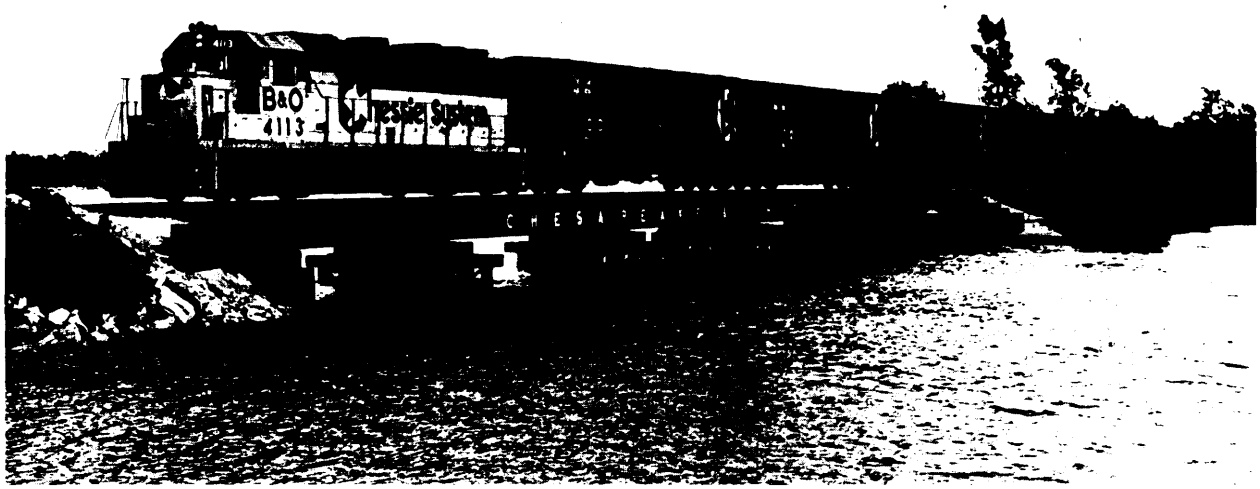
A review of history reveals that society has responded various ways to the problems of safety. Some of the responses were a function of the era; others a function of the nature 01 the safety problem. Society's first response to the safety problems of the workplace were under common law -- w'here the injured worker was prtected if the employer was proven *to* be at fault when the worker sued the employer. The next major rsponse of society was of the type of protection provided by the laws passed first in England and then in the United States requiring employers to Provide safe tools and in other respects maintain safe working conditions. And even then the three doctrines of the common law which supplied the employer with an adequate defense against suits brought for injured employees were:

1. The "felIow-servant" rule under Which an employer was not liable for an injury resulting from the actions (careless or negligent) of fellow employees:
2. "Contributory negligence" Which provided that the employer is not liable if the worker's own negligence contributed injury;
3. "Assumption of the risk" which included the theory that an employee accepted the customary risks of an occupatition when taking the job.

The next phase of activity relative to safety in the workplace was the passage of Workmen's Compensation Laws which placed a definite responsibility upon the employer, whether or

[1]William W. Lowrance, *Of Acceptable Risk*, William Kauffman, 1976, served as a primary resource for this discussion.





Railroad systems throughout the United States are vital to our Nation's supply network.



Photos Courtesy of Association of American Railroad

not negligence could be proven. Maryland was the first State to pass such a law in 1902.

Following passage of the workmen's compensation laws, there came a variety of other laws regulating safety in the industrial setting—such as the Occupational Safety and Health Act passed in **1970.** Society's primary responses to promoting domestic safety have been insurance programs, building and fire control codes, information and education. The history of society's response to the railroad safety problems will be discussed in chapter IV of this report. Safety has always been a consideration in railroad location, design, construction, and maintenance, although the success of these safety efforts has varied. Accidents and injuries associated with the operation of railroads have occurred for which private sector safety efforts have not sufficed. Hence, Government has intervened in railroad safety matters since 1893, with the passage of the Safety Appliances Act.

A review of the evolution of society's response to safety suggests the following:

- Human activity involves risks.
- Certain risks are acceptable and others unacceptable.
- Of the unacceptable risks, a portion can be reduced by technology, while another portion can be reduced by information and education. The balance is beyond the present state of the art.
- In some circumstances, where the marketplace does not reduce the risks sufficient to satisfy the needs and desires of the public, Government intervenes.

The basis for determining acceptable levels of safety and what interests are involved in the decision making process are discussed below.

ON WHAT BASIS DOES SOCIETY MAKE JUDGMENTS ABOUT THE ACCEPTABLE LEVELS OF SAFETY?

When the safety of a product or activity is in question, the risks from exposure have to be measured. The measurement is conducted by making the following inquiries: a) what are the conditions of exposure (who will be exposed, to what, and how)?; b) what can be the adverse effects?; and c) what will be the relationship between the exposure and the adverse effects (how much adverse effect results from how much exposure)? In deciding what are acceptable levels of safety, understanding the answers to the questions above is only the first step in the analysis. Next comes the important step of determining the risks, i.e., probability of harm and its severity (for example, how many people run the risk annually of being injured or killed at a highway grade-crossing). The analysis then requires the crucial step of judging safety or the acceptability of risks. This last step in the analysis is a normative, political activity, while the other explorations are more scientific. In judging safety or the acceptability of risks, Lowrance suggests the considerations which influence the decisions should include:

> The extent to which the action is voluntary or involuntary; whether the effect is immediate or delayed; whether alternatives exist; whether the risk is certain or not known; whether the action is essential or a luxury; whether the action is or is not occupation related; whether or not the hazard is common; whether the risk will be to average people or unusually sensitive people; whether the activity will be as intended; and whether the consequences are reversible or irreversible.

With information and analyses of risks, the decision process should move to a consideration of efficacy, costs, and the distribution of risks, benefits, and costs. In the analysis, efficacy, or the measure of the probability and intensity of

beneficial effects, is weighed against the risk or the probability and severity of adverse effects. What is included in the *cost* analysis is not universally agreed upon. It is not limited to financial burden, but can also include such intangibles as individual freedom. The matter of cost assessment raises the complex issue of the value of human life. A methodology dealing with the value of life and safety improvement in a form amenable to analysis using the conceptual apparatus of economic theory has been treated recently by M. W. Jones-Lee in *The Value of Life*. In determining the nature of the *distribution of risks, benefits, and costs* among the questions to be answered are: Who pays for safety solutions? Will those paying benefit? Will those at risk benefit?

What is suggested then is that once there is an understanding of safety problems (risk~), t }11' next step is the identification of alternative)1 solu- I ions and the selection of the solution which best addresses the problem, The selection that is made among the alternatives must be based on a weighing of their costs and benefits. Thus, it is necessary that methods of conduction cost/benefit analyses be developed and applied specifically for safety-related matters.

Decisions about safety in the future will continue to be based in part on risk, efficacy ,and the distribution of the hazards, benefits, and costs. But there may be additional considerationtions -considering such activities activities as changing patterns of governmental involvement will the railroads, changes in technology, the concern about the environmental impact, and the possibility of new types of hazardous materials.

WHO INFLUENCES OR MAKES THE DETERMINATIONS AS TO ACCEPTABLE LEVELS OF RISK?

"Acceptable levels of risk of accident or injury" decisions involve value choices and hence cannot be reduced to universals. Different people with different stakes in the decisions may come to different conclusions. The decisions per force are made by a variety of interests. The list of stakeholders in railroad safety matters includes: railroad management, railroad labor, suppliers, rail shippers. the general public (users and nonusers of the rail services), and Government at all levels. Government is included because it too has a stake in what safety decisions are made because those decisions affect its authority. All of the stakeholders are capable of influencing safety decisions i n varying degrees. Often the decisions are made through traditional marketplace operations. But often is the legal order that defines the particular factors that must be taken into account. The legal order is manifested through legislation, executive and administrative orders, and judicial decisions. Further, it is the legal order which from to time determines the relative weight to be accorded to various of the factors/bases discussed above.

WHAT CONCLUSIONS CAN BE DRAWN ABOUT THE CONCEPT OF RAIL SAFETY?

As is true of the concept of safety generally, the concept of rail safety varies with the time, the issue, the role of various stakeholders, and the status of technology and customary practice. The level of acceptable risks of accident and injury is on a continuum where public values and attitudes toward risks as well as benefits change. Fifty years ago society tolerated 2,568 fatalities associated with grade crossings. In 1972, a Department of Transportation report suggested the goal of an annual reduction in fatalities of 500 persons from an annual fatality rate of over 1,200. What influences have changed in the acceptable level of risks associated with grade-crossings? Consider the following:

Society has made a determination that the frequency and severity of injuries at the 1938 level and the frequency of fatalities are not now acceptable given:

a. the present technology
b. the cost of accidents and fatalities
c. the willingness of society to pay an additional price for a new solution to the problem.

This explains the concept of safety vis-a-vis grade-crossings. However, it can be said that the demand for railroad safety generally continues to evolve to higher levels.

Chapter

HISTORICAL INDUSTRY AND SAFETY OVERVIEW

Chapter IV
HISTORICAL INDUSTRY AND SAFETY OVERVIEW

Federal concern for railroad safety has occurred primarily in two phases. The first phase takiing place during the early part of this century with the enactment of a series of safety laws designed to address specific problems of the times. The second phase occurred in this decade with the enactment of several laws granting broad regulatory and administrative authority to Federal executive agencies to address all areas of railroad safety.

The nature and dimensions of the railroad satety problem evolved from the earlier period to the present. A combination" of factors within the industry and in the society have both caused and resulted in the evolution of safety. Among these factors are: railroad economics and the changing nature of the U.S. economy and the transportation system; the physical plant and the technology utilized by the industry; railroad employment trends and labor-management relations; and the various levels of legal and regulatory structures affecting the industry.

This chapter presents a brief, historical overview of the evolution of and factors impacting railroad safety. It provides a general summary of how the early safety problems were addressed by Federal laws.

EARLY PHASE OF RAILROAD SAFETY ACTIVITY

During the early phase of railroad safety history, the casualty problem dominated Federal and public concern. According to the data contained in the in the Interstate Commerce Comminssion (ICC) Accident Bulletins from 1902 to 1911, the casualty problem for both passengers and employees was quite severe. During the 9-year period at the turn of the century, a total of 33,761 employees and 4, 146 passengers were killed, and 403,259 employees, * and 113,410 passengers were injured. Table 8 reflects the casualty problem for 1902-11.

Several factors were probable contributors to the excessive railroad casualty problem in the early 1 900's.

- Railroads were the predominant mode of "modern" intercity transportation at the turn of the century. Railroads provided both freight and passenger transportation services which were rapidly expanding at the time. By 1900, over 190,000 miles 01 track were in operation and another 47,000 miles had been laid by 1910.1 In 1890 over 520,400 passengers were carried by rail [1]. By 1922, this number had expanded to over 537,300,000 passengers. [2]
- Around the turn of the century, rail road employment was steadily rising. In 1890, there were approximately 750,000 railroad employees; in 1900, there were 1,0 18,000;

*In 1910, reporting requirements for employee injuries changed, making the previous data incompatible with that collected from 1910 forward. The figure listed shows total employees injured during 1902-03.

[1] *The Railroads: the Nation's First Big Business.* Edited by Alfred D. Chandler, Jr. (Harcourt, Brace: World, Inc., New York; 1965) p. 13-14.

[2] Ibid., p. 14 and *Railroad Transportation, A Statistical Record 1921-1963.* Association of American Railroads, 1965 p. 24.

Table 8.—Railroad Casualty Data: 1902-11

	Employess			% of total work force		Passengers	
Year	Killed	Injured	Total work force a	% Killed	% Injured	Killed	Injured
1902	2,793	35,790	1,189,000	.23	3.01	271	6,323
1903	3,520	42,568	1,313,000	.27	3.24	442	7,855
1904	3,053	42,094	1,296,000	.24	3.25	526	9,002
1905	3,588	51,170	1,382,000	.26	3.70	369	10,514
1906	4,132	59,244	1,521,000	.27	3.90	539	12,112
1907	4,218	64,930	1,672,000	.25	3.88	571	14,324
1908	2,514	49,537	1,436,000	.18	3.45	337	11,643
1909	2,843	57,926	1,503,000	.19	3.85	333	13,593
1910	3,778	(b)	1,699,000	.22	..	441	12,766
1911	3,322	(b)	.	.-	-.	317	15,278
Total	33,761	403.259	..	..	.-	4.146	'1 13.410

a Alfred Chandler, *Railroads. The Nation First Big Business.*

b Reporting requirements for employee injuries changed in 1910, making date incompatible with 1902-09 time period.

SOURCE: Interstate Commerce Commission Accident Bulletins: 1902-11.

and in 1910, there were 1,699,000 employees .[3] As evidenced by the passage in **1907** of the Hours of Service Act, railroad employees were working extended consecutive hours at the turn of the century.[4]

- Railroad technology, as well as specific technologies which would improve safety, were evolving at the time and were not fully in place. As early as 1879, it was noted that certain technologies such as interlocking and electric signal systems, the Westinghouse brake, and new forms of car design would improve safety and were available. [5] However, it was not until later, in part as a result of Federal laws, that these and other improved technologies were universally adopted. Moreover, though the technologies utilized in rail operations were evolving, they were less than optimum from a safety perspective. Hence, a serious time lag existed in the application of safety technologies.

These factors describe several characteristics of the railroad system at the turn of the century which contributed to the casualty problem. While the severity of the casualty problem served as a dramatic, if not psychological, catalyst to stimulate public and congressional concern, other factors may have facilitated adoption of the early laws:

- At the turn of the century, the railroad labor movement was gaining voice and influence in the political and social system. Railroad labor unions, as national organizations, were formed between the 1860's and the 1890's. Although early efforts to form a unified railroad labor organization failed in the late 1800's, by the early 1900's railroad labor unions were becoming clear economic and political forces in the railroad system.'
- The Interstate Commerce Commission (ICC) was already established and functioning as a Government regulatory agency with specific authority for railroad economic regulation, While the ICC was responsible for railroad rate regulation, they were also aware of the status of rail-

[3] Chandler, p. 16.

'*Interstate Commerce* Commission *Activities: 1887-1937,* Superintendent of Documents, Washington, DC, 1937. p. 121.

'Charles Francis Adams, *Railroad Accidents,* (G. P. Putnam's Sons; New York, 1879). p. vi.

'Chandler, p. 129-132.

road safety problems and had initiated some accident data gathering as early as 1888.[7]

Therefore, as a result of the severity of the casualty problem, growing public and labor concern, and the availability of Government mechanisms, and technological and other solutions, Congress enacted a series of safety laws during the first part of this century.

From 1893 to approximately 1921, a number of railroad safety laws were adopted. These laws were limited in scope, and were drafted to address particular known aspects of the casualty problem at the time with specific measures or remedies. The ICC was given responsibility for the implementation and enforcement of these laws.

The scope of the early railroad safety laws covered a range of areas and problems and essentially created a system of addressing many phases of the safety problem. Examples of the early laws are:

—The Accident Reports Act, which established the system of collecting accident data on injuries and fatalities and documenting accident causes. The system today is essentially that established in 1900;

—The Hours of Service Act, which established the maximum number of allowable hours of service for two classes of employees: those engaged in or connected with the movement of trains (with a maximum of 16 consecutive hours of service in a 24-hour period); and those connected with train dispatching and train ordering (with a maximum of 9 to 13 hours on duty in a 24-hour period); [8]

—The Ash Pan Act, which prohibited use of locomotives equipped with ash pans that could not be dumped without employees going under the locomotive for that purpose;

—The Safety Appliances Act and amendments, which instituted mandatory requirements for the, then available, improved brake systems and automatic couplers, and which required standardization of the location and specifications for appliances such as handholds and grab irons necessary for employees' use.

—The Block Signal Act, Safety Testing Authorization, and the Signal Inspection Act, which allowed for the research and which later required the implementation of automatic signaling systems, interlocking and other devices which would promote safety in operations;

—The Locomotive (Boiler) Inspection Acts, which required railroads and Government to inspect and test locomotives to avoid over-running of the locomotives and boiler explosions resulting from low water levels in the steam engine boilers;

—The Transportation of Explosives and Hazardous Materials Act, which revised the 1866 law;' and,

—The Federal Liability Act, which addressed the employee injury, disability, and claims problem where industry negligence was proven.

Several significant observations and conclusions can be made from these laws. First, the focus of most of these laws was usually upon a limited, well-defined safety problem, and the grant of authority was intended to deal with the particular problem. Several examples were:

—The Hours of Service Act, which dealt with the problem of overworked railroad employees and the safety hazard they presented to themselves and others by their excessive work;

–The Ash Pan Act, which was prompted by the serious injuries and deaths incurred by employees emptying and cleaning ashes from locomotives not equipped with ash pans; and

[7] *ICC Activites,* p. *125,*
[8] Ibid, p. 121-122.
[9] Ibid, p. 12-12.

—The Safety Appliances Act, which focused on problems resulting from the lack of standardization and uniformity of railroad equipment. These laws authorized the ICC to issue rules prescribing the specifications for application of safety appliances such as handholds or grab irons. These laws also required standardization and implementation of updated brakes and couplers.

A second observation regarding the earlier laws is that Congress often found the solution to a particular safety problem in available technology and mandated the use of that technology by all carriers. The Safety Appliances Act, for example, prescribed the use of automatic couplers which reduced the likelihood of employee injuries caused by coupling. The Signal Inspection Law authorized the ICC to prescribe particular types of devices to help reduce train collisions.

A third observation is that these early laws basically relied on the same enforcement mechanism—monetary civil fines plus, in most cases, inspect ion and /or reporting requirements. Most of the laws carried a penalty of $100 to $200 per violation and several of the early laws had criminal penalty provisions. Several laws required inspections and, in some cases, reports to or for the Government of the carriers' inspection activity (Locomotive Inspection Act) or of accidents or equipment failures (Locomotive Inspection Act, Accident Reports Act, Signal Inspection Law).

Another observation about the early safety laws is the approach used in the laws for granting authority to the Government, In comparison to the more recent safety laws, the early laws are narrowly drawn. This was consistent with the focus of Congress on specific safety problems at the time.

Finally, it should be noted that each of these laws was applicable only to "common carriers" as that term is used in the Interstate Commerce Act. This was to be expected since that Act had originally established the scope of the Government's regulation of rail transportation. However, by using the term "common carrier, " these laws are not applicable to certain forms of rail transportation, such as industrial railroads and rapid-transit systems.

Table 9 shows the dates of enactment of these early laws and their amendments. Although not a precise measure, the fatality rate for employees and passengers (table 10) showed a marked decline by the *1920's.* * This reduction appeared to be, in large part, due to the requirements and activities resulting from the early safety laws.

Table 9.—Early Safety Laws and Amendments

Year	Law	Citation
1893	Safety Appliances Act. .	45 U.S.C. 1-7
1903	Safety Appliances Act. .	45 U.S.C. 8-10
1906	Block Signal Systems . .	45 U.S.C. 35
1907	Hours of Service Act . . .	45 U.S.C. 46-66
1908	Federal Employer's Liability Act.	45 U.S.C. 51-60
1908	Ash Pan Act.	45 U.S.C. 17-21
1908	Safety Devices Testing Authorization	45 U.S.C. 36-37
1908	Transportation of Explosives.	18 U.S.C. 831-835
1909	Transportation of Explosives and Other Hazardous Materials .	—
1910	Accident Reports Act. . .	45 U.S.C. 13-60
1910	Safety Appliances Act. .	45 U.S.C. 38-42
1911	Locomotive Inspection Act	45 U.S.C. 22-34
1920	Signal Inspection Law. .	49 U.S.C. 26

Between 1920 and 1968, there were only a few important enactments concerning railroad safety. First, in 1937, the Signal Inspection Law was largely rewritten to broaden the ICC's powers concerning the systems and devices covered by this law. Second, there was the 1958 amendment to the Safety Appliances Act regarding adoption of the Association of American Railroad's rules for inspection, maintenance, and testing of power brakes. A third significant

*Due to the *1910* change in employee injury reporting requirements, the injury figures are not compatible with the earl, data.

Table 10.— Railroad Fatalities 1923-31

	Employees			Passengers
Year	Killed	Total work force	% of total killed	Killed
1923	1,836	1,879,770	.10	102
1924	1,367	1,777,391	.08	121
1925	1,437	1,769,099	.08	139
1926	1,502	1,805,780	.08	130
1927	1,395	1,760,999	.08	56
1928	1,166	1,680,187	.07	59
1929	1,269	1,686,769	.08	72
1930	882	1,510,688	.06	38
1931	615	1,278,175	.05	30
Total	11,469	15,148,858	0-.08	747

SOURCE Railroad *Transportation A Statistical Record, 1921-63 P. 33*

amendment was the 1960 revision of the Transportation of Explosives Act, which became known by its U.S. Code designation "Explosives and Other Dangerous Articles." This revision broadened the law significantly by expanding (a) the types of materials covered by the Act to include radioactive materials and etiological agents and (b) the types of carriers covered by the Act to include private-contract and for-hi re carriers. It also centralized the authority for regulation of the transportation of such materials in the ICC. The fourth important amendment was the 1960 amendment to the Accident Reports Act, which led in the following year to certain revisions in the requirements for reporting an accident.

In 1965 and 1966, all of the various railroad safety functions that had been vested over the years in the ICC were transferred to the Department of Transportation. This primarily occurred by means of the Department of Transportation Act, which centralized all transportation safety functions, among other things, in one executive department—thereby splitting the safety and economic regulation of each mode.

Several amendments to the early laws were enacted prior to the more recent Federal railroad safety activity. Table 11 shows the chronology of Federal railroad safety activity and the ancillary laws which impacted railroad safety problems.

Table 11 .—Chronology of Railroad Safety Legislation and Related Laws

Year	Law
1893	**Safety Appliances Act**
1903	**Safety Appliances Act**
1906	**Block Signal Systems**
1907	**Hours of Service Act**
1908	**Federal Employer's Liability Act**
1908	**Ash Pan Act**
1908	**Safety Devices Testing Authorization**
1908	**Transportation of Explosives**
1909	**Transportation of Explosives and Other Hazardous Materials**
1910	**Accident Reports Act**
1910	**Safety Appliances Act**
1911	**Locomotive Inspection Act**
1920	**Signal Inspection Act**
1937	**Signal Inspection Amendments**
1958	**Safety Appliances Amendment**
1960	**Explosives and Other Dangerous Articles**
1966	**Federal Claims Collection Act**
1969	**Hours of Service Amendments**
1970	**Railroad Safety Act and Hazardous Materials Act**
1970	**Occupational Safety & Health Act**
1972	**Noise Control Act**
1973	**Highway Safety Act**
1973	**Passenger Assistance Act**
1974	**Transportation Safety Act**
1976	**Railroad Revitalization and Regulatory Reform Act**
1976	**Railroad Safety Authorization Act**
1976	**Highway Safety Act Amended**

RECENT RAILROAD **SAFETY ACTIVITY**

The recent phase of Federal concern for railroad safety has occurred largely within this decade. The characteristics of today's safety problem and the industry factors surrounding it are different from the problems at the turn of the century, As contrasted to the earlier phase, today's railroad casualty problem is of smaller dimensions and of a different type, yet of no less

significant concern. However, the other recent predominant problem area is the increasing property and lading loss and damage resulting from train accidents. This is of significant concern to industry and Government, given the current economic condition of the industry.

A number of factors both internal and external to the industry occurred throughout the century which directly and indirectly impacted the shift and evolution of the railroad safety problem. Chief among these is the change in the industry's economic health. Among the factors which have impacted the changes in the safety problem are:

- Over time, the railroad's dominance in intercity passenger transportation has eroded. As a result of the introduction of the automobile and the airplane, a dramatic reduction in passenger travel by rail has occurred. Today, only 6 percent of intercity passenger traffic is by rail (table 12). Hence, rail passenger traffic, no longer constitutes a large percentage of persons exposed to the railroad environment.
- The introduction of the automobile and increased automobile usage have resulted in the shift in the casualty problem, as evidenced by the level of grade-crossing accidents.
- As a result of the economic decline of the industry and the increased efficiency of technology, railroad employment has declined dramatically since the early *1900's.* As previously indicated, railroad employment in 1910 was 1,699,000, whereas in 1975, it was 487,789. From 1929 to the present, employment declined by approximately 71 percent and total man-hours worked decreased by approximately 79 percent (table 13). During 1950-75, employment declined by approximately 60 percent and total man-hours worked decreased by about 67 percent. However, labor wages as a percent of operating revenues remained relatively constant over the 25-year period (table 14). The net effect of the reduction in employment and total hours worked was a decrease in the exposure of railroad employees to the railroad environment, a factor which may have resulted in a decline in the absolute number of casualties (injuries and fatalities).
- Another factor which has impacted the potential for casualties is the increase and changes in the hazardous materials shipped by rail. At the turn of the century, the hazardous materials problem was characterized almost solely by weapons and other

Table 12.—Volume of Intercity Passenger Traffic

Millions of Revenue Passenger-Miles and Percentage of Total (except private)

Year	Rail-roadsa	%	Buses	%	Air carriers	%	Inland water-ways	%	Total (except private)	Private automo-biles	Private airplane	Total (in-eluding private)
1929	33,965	77.1	6,800	15.4		-	3,300	7.5	44,065	175,000	—	219,065
1939	23,669	67.7	9,100	26.0	' = 3	2.0	1,466	4.3	34,938	275,000	—	309,938
1944	97,705	75.7	26,920	20.9	2,177	1.7	2,187	1.7	128,989	181,000	1	309,990
1950	32,481	47.2	26,436	38.4	8,773	12.7	1,190	1.7	68,860	438,293	1,299	508,472
1960	21,574	28.6	19,327	25.7	31,730	42. ?	2,668	3.6	75,319	706,079	2,228	783,626
1970	10,903		25,300	74.3	109,499	77.7	4,000	2.3	149,702	1,026,000	9,101	1,184,803
1974	10,475	; : ;	26,700	15.1	135,469	76.7	4,000	2.3	176,644	1,143,440	11,000	1,331,044
1975b	10,075		25,000	14.2	136,432	77.7	4,000	2.3	175,507	1,164,000	11,500	1,351,007
1976b	11,000	; : :	25,000	13.2	150,000	78.9	4,000	2.1	190,000	1,236,000	13,000	1,439,000

a Railroads of all classes, including electric railways, Amtrak and Auto-Train.

b These are preliminary estimates and are subject to frequent adjustments.

NOTE: Air carrier data from reports of CAB and TAA; Great Lakes and rivers and canals from Corps of Engineers and TAA; some figures for 1974, 1975, and 1976 are partially estimated by AAR and TAA.

SOURCE: AssociatiorJ *ot~n?erlcan /?ai/roads Factbook,* 1977 edition, p. 36.

Table 13.—Railroad Employment Characteristics

Year	Average number employees	Total hours worked (straight and overtime) (000's)	Average annual compensation per employee	Average hours worked per employee, per year
1929	**1,686,769**	4,411,490	$ 1,743	2,610.4
1939	**987,943**	2,489,689	1,886	2,514.8
1950	**1,220,784**	2,877,495	3,785	2,358.6
1955	**1,058,216**	2,503,418	4,719	2,361.7
1960	**780,494**	1,840,590	6,270	2,359.7
1965	**639,961**	1,319,582	7,490	2,061.8
1966	**630,895**	1,294,928	7,734	2,055.4
1967	**610,191**	1,224,800	8,085	2,007.9
1968	**590,536**	1,200,506	8,654	2,034.8
1969	**578,277**	1,173,501	9,274	2,023.3
1970	**566,282**	1,146,445	10,086	2,047.2
1971	**544,333**	1,082,642	11,023	2,004.9
1972	**526,061**	1,051,771	12,213	1,984.5
1973	**520,153**	1,041,214	13,627	2,002.3
1974	**525,177**	1,042,119	14,235	1,966.3
1975	**487,789**	947,279	15,324	1,933.2
Decline in the number of employees: 1929-75 = 719'o 1950-75 = 60%		Decline in man-hours worked: 1929-75 = 79% 1950-75 = 67%		

SOURCE: *Railroad Transportation.' A Statistical Record, 1921063,* p. **32;** *Statistical Record Addendum, 1965-75.*

Table 14.—Employment Costs and Railroad Operating Revenues (in millions)

Year	Operating revenues ($000,000)	Labor cost* ($000,000)	% of laborcost to total operating revenues
1929	**6,280**	**2,674**	**42.3**
1939	**3,995**	**1,762**	**44.1**
1950	**9,473**	**4,379**	**46.2**
1955	**10,106**	**5,064**	50.1
1960	**9,514**	**5,126**	**54.0**
1965	**10,208**	**5,122**	**50.1**
1966	10,655	5,258	49,3
1967	10,366	5,345	51.6
1968	10,855	5,583	51.4
1969	11,450	5,838	51.0
1970	11,992	6,250	52.1
1971	**12,689**	**6,488**	**51.3**
1972	**13,410**	**7,047**	**52.6**
1973	**14,770**	**7,881**	**53.4**
1974	**16,923**	**8,597**	**50.8**
1975	**16,402**	**8,583**	**52.3**

*Includes wage compensation, health and welfare benefits, payroll taxes. Excludes pensions.

SOURCE: *Railroad Transportation: A Statistical Record 1921-63,* p. *20;* and *Addendum for Years 1965-75,* p. 12.

types of explosives. Today, the types of hazardous commodities shipped have changed dramatically, in addition to the amounts shipped (see chapter X).

Of more recent concern is the significance of the property and lading loss and damage problem. The primary factor contributing to the increase in this problem is the economic condition of the industry. Several factors have led to the economic decline and thereby have influenced the property safety problem.

- Over this century, the amount of freight transported by railroads has increased. However, the introduction and growth of the trucking industry and the increased usage of water carrier for freight shipments effectively reduced railroad dominance in the transportation system. In 1929, railroads carried 75 percent of the freight, whereas today they carry only 37 percent (table 15). Moreover, restrictive Govern-

Table 15.—Intercity Freight Transportation Characteristics
Millions of Revenue Freight Ton-Miles and Percentage of Total (including mail and express)

Year	Rail-roadsa	0/0	Trucks	70	Great Lakes	'/0	Rivers & canals	%	Oil pipe-lines	70	Air	'/0	Total
1929	454,800	74.9	19,689	3.3	97,322	16.0	8,661		26,900	4.4	3		607,375
1939	338,850	62.4	52,821	9.7	76,312	14.0	19,937	;:?	55,602	70.2	12		543,534
1944	746,912	68.6	58,264	5.4	118,769	10.9	31,386	2.9	132,884	12.2			1,088,266
1950	596,940	56.2	172,860	16.3	11,687	10.5	51,657	4.9	129,175	12.1	3;:		1,062,637
1980	579,130	44.1	285,483	21.7	99,468	7.6	120,785	9.2	228,626	17.4	778		1,314,270
1970	771,168	39.8	412,000	21.3	114,475	5.9	204,085	10.5	431,000	22.3	3,295	0.2	1,936,023
1974	855,582	38.6	495,000	22.3	107,451	4.9	247,431	11.2	506,000	22.8	3,580	0.2	2,215,044
1975b	759,000	37.3	443,000	21.7	99,171	4.9	243,039	11.9	488,000	24.0	3,430	0.2	2,035,640
1976b	796,000	36.7	490,000	22.6	102,000	4.7	250,000	11.6	525,000	24.2	4,000	0.2	2,167,000

aRai [roads of ali classes including electric railways, Amtrac, and Auto-Train.
bThese are pre[iminary estimates and are subject to frequent adjustments.
SOURCE: *Association of American Rai/roads, 1977 Factbook, p.36.*

ment regulatory policy interfered with the railroads ability to effectively compete with the other freight transportation modes.

- Railroads' rate of return on net investment has generally declined in recent times, although it has varied by ICC districts (the southern and western regions have a higher rate of return than the eastern district (table 16). By 1975, the rate of return was only 1.2 percent, compared with 5.3 percent in **1929.** The low rate of return, when combined with increased competition, restrictive Government economic policy, and noninnovative management practices resulted in the industry's inability to generate needed external or internal sources of funds. As a result, railroads have had to look for means of reducing expenses. One such method adopted by the industry was the reduction in track and roadway maintenance. Estimates of industry-deferred maintenance (in 1975 dollars) have been approximated between **$6** billion and $7

Table 16.—Railroad Rate of Return

Year	Net investment (millions)	Net railway operating income (millions)	Rate of return (total)	Net income* (milllons)	Rate of return Eastern District	Rate of return Western District	Rate of return Southern District
1951	25,055.2	942.5	3*76%	693.2	3.47	3.76	4.74
1955	26,760.9	1,128.0	4.22	927.1	4.19	3.86	5.45
1960	27,452.5	584.0	2.~3	444.6	1.80	3.15	4.17
1985	26,040.6	981.5	3.69	814.6	3.32	3.87	4.16
1970	28,049.7	485.9	1.73	226.6	clef.	3.02	4.50
1975	29,297.3	W65.2	b350.7	al.59 bl.20	a186.9 W4.4	clef.	2.65	3.98

•Ordinary Income (before extraordinary and prior period items).
aold ICC basis.
bN$_{ew}$ ICC (GAAp) basis, after provision for deferred taxes and (after 1973) including equity in undistributed (XiVIltlCJS of affiliates

SOURCE: Railroads—1977 and Beyond, A Congressional Symposium (background material), House Interstate and Foreign Corn merce Committee, December 1977. Taken from Interstate Commerce Commission Transport Statistics.

billion.l" Moreover, as stated in AAR testimony before the ICC, an estimated $14.5 billion (1975 dollars, exclusive of Conrail) is needed over the next decade for fixed facilities to achieve a normalized level of maintenance and track additions and betterments to other roadway facilities. " The net effect of lack of capital has been deferred maintenance and reduction to improvements in fixed plant.

Certain railroad technology and equipment characteristics have changed in the last 25 years. Although the diesel engine was first introduced in the late 1920's, it was not universally adopted until the early *1950's.* By 1955, there were 24,786 diesel engines in service (table 17). The introduction of the diesel had several significant impacts: it improved efficiency; and it reduced the need for the additional person in the cab, both factors having the potential for improving the economic situation of the industry. However, as previously noted in table 14, while employment declined over this same period, wages remained a relatively constant percentage of total operating revenues, thus offsetting the reduced labor force brought on by the diesel engine. Other areas for reduction of expenses and improved efficiency and productivity were sought out. One measure adopted was the gradual increase in freight car capacity, which may have been made possible by the addition of diesel power. The average freight car capacity was 53.7 tons in 1955 and 72.9 tons by 1975 (table 17). This increased to 73.5 tons in 1976. The net result of the heavier car capacity was heavier axle loadings, The gradual increase in axle-loadings combined with the practice of deferred maintenance in recent decades has had the end result of faster wear and deterioration of track and roadbed, a factor

'"Richard J. Barber Associates, The *Railroads, Coal and the National Energy Plan: An Assessment* of *the Issues, 1977, p. 52,*

11September 1977-Statement of R.E. Briggs on behalf of the AAR, before the ICC, p. *35.*

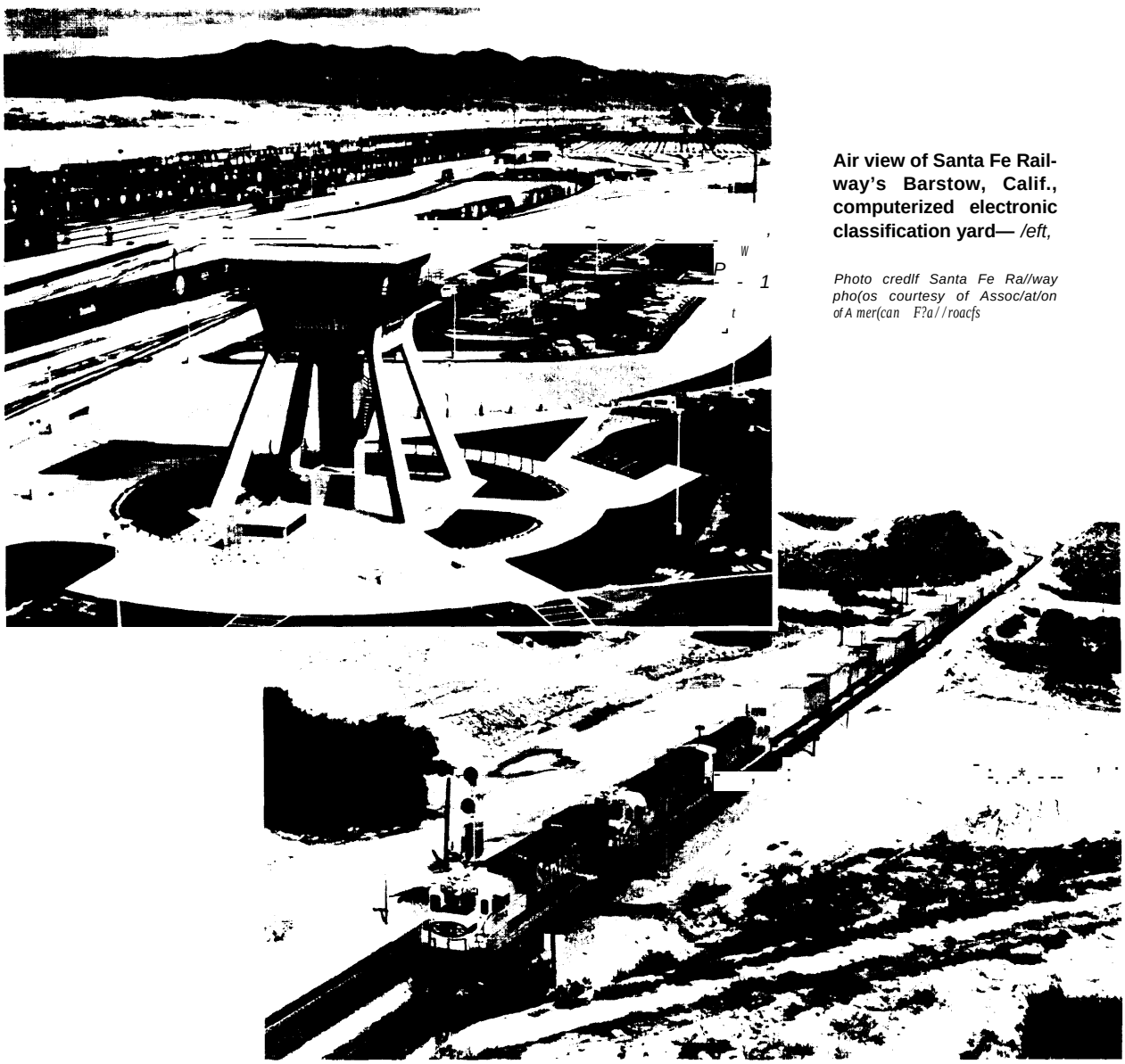
Table 17.—Railroad Technology Utilization

Year	Locomotives			Freight equipment	Average freight car capacity	Passenger cars
	Diesel	Steam	Electric			
1929	22	56,936	601	2,610,662	46.3	61,728
1939	510	41,117	843	1,961,705	49.7	45,479
1951	17,493	21,747	780	2,046,600	52.9	42,406
1955	24,786	5,982	627	1,996,443	53.7	36,871
1960	——	— .	——	——	——	——
1961				——	55.7	——
1962	28,104	51	434	1,850,688	56.3	25,566
1963	27,946	36	429	1,814,193	56.8	24,602
1964	27,837	34	393	1,796,264	58.3	23,057
1965	27,389	29	362	1,800,662	59.7	21,327
1966	27,481	25	344	1,862,499	61.4	20,016
1967	27,309	21	321	1,822,381	63.4	18,610
1968	27,019	21	305	1,800,375	64.3	15,384
1969	26,714	21	276	1,791,736	65.8	12,426
1970	26,796	13	268	1,784,181	67.1	11,177
1971	26,897	13	250	1,762,135	68.4	8,670
1972	27,070	13	252	1,716,937	69.6	7,589
1973	27,550	12	238	1,710,659	70.5	7,189
1974	27,857	12	215	1,720,573	71.6	6,848
1975	27,846	12	213	1,723,605	72.9	6,471

•Includes Amtrak's Auto-Train.
SOURCE: AAR 1977 Fact book.

which may have contributed to the rise in track-related accidents and the subsequent increase in the property damage problem.

In treating the more recent railroad safety problems, Congress has enacted laws designed to address all areas of railroad safety. Unlike the specific measures adopted at the turn of the century, the recent laws have given broad regulatory and administrative powers to the various executive agencies. Examples of these laws are the Federal Railroad Safety Act of 1970 and the Transportation of Hazardous Materials Act. (Discussion of the recent laws and regulations resulting from those laws is provided in chapter VII.) The evolution of the railroad safety problem reflects the evolution of the industry at large. As the safety problems have shifted in dimension and scope, so has treatment of the problems through the legislative and administrative processes.



Air view of Santa Fe Railway's Barstow, Calif., computerized electronic classification yard— */eft,*

Photo credlf Santa Fe Ra//way pho(os courtesy of Assoc/at/on of A mer(can F?a//roacfs

Chapter V

RAILROAD SAFETY PICTURE

Chapter V
RAILROAD SAFETY PICTURE

This chapter presents an analysis of railroad accident data and the findings of such analyses as they relate to railroad safety. The data used in this study are based on accident information reported to the Federal Railroad Administration and include data collected between 1966-74. * A discussion of the reporting requirements, the uses of the data, and associated data problems are presented in appendix B.

The safety of the railroad industry as shown by available accident data may be viewed from two perspectives: the safety of people and the safety of property. The safety of people is measured by the number of casualties (injuries and fatalities) and the cost of resulting claims. The safety of property is measured by the loss of and damage to railroad equipment, track, and roadbed (estimated) and the lading (actual).

SAFETY OF PEOPLE

An analysis of the overall casualty data during 1966-74 shows that **95.6** percent of all injuries and fatalities resulted from train service and nontrain accidents.** As shown in table 18, injuries and fatalities resulting from all railroad accidents generally declined during this period, with the exception of a slight rise in injuries and an increase in fatalities resulting from nontrain accidents in 1974.

Total fatalities during the period have decreased by **28.9** percent. In absolute terms, fatalities declined from a high of **2,684** in 1966 to a low of 1,908 in 1974, exhibiting a continuous decline throughout the 9-year period. Injuries in the same 9-year period declined by 18.5 percent. In absolute terms, there were **25,552** injuries in 1966. Injuries then decreased through 1972 to a low in that year of 17,930. Total injuries then increased during 1973 to 20,818 in 1974.

The FRA has established five major classes of persons in reporting casualties. These include employees on duty, employees not on duty, passengers, nontrespassers, and trespassers. For this analysis the employees, both on duty and not on duty, were combined into one class. Also, the nontrespassers were designated as "other" for this analysis and included all persons not included as employees, passengers, or trespassers. This group was made up primarily of casualties resulting from grade-crossing accidents. Of the total casualties in the railroad environment for the 9-year period **(19,829** fatalities **and 195,331 injuries), as** shown in table 19, injuries to employees constituted the largest percentage of total injuries (74.3 percent) while fatalities to persons in the "other" category constituted the largest percentage of total fatalities **(64.9** percent).

*Public Law 94-348 requested accident data for the 10 years preceding July 1976. The data for 1975 have not been used in this report for purposes of comparison with the data of preceding years because of substantial changes in the FRA reporting requirements in 1975, which make direct comparison impractical.

* *Through calendar year 1974, the FRA divides railroad accidents into three major types: Train accident, Train service accident, and Nontrain accident. Train Service and Nontrain accidents will be mainly discussed as they relate to the safety of people (and are defined below) while Train accidents will be discussed in the next section as they relate to the safety of property.

Train Service Accident—an accident arising out of the movement or operation of trains *and resulting* in a reportable death or injury but less than $750 damage to equipment, track, or roadbed.

Nontrain Accident—an accident resulting in a reportable casualty (injury or fatality) but not caused directly by the operation or movement of trains.

Table 18.—Casualties by Type of Railroad Accident

Year	Train accidents			Train service accidents			Nontrain accidents			Total railroad accidents		
	Fatalities	Injuries	Accidents	Fatalities	Injuries	Accidents	Fatalities	Injuries	Accidents	Fatalities	Injuries	Accidents
1966	**214**	**900**	**6,793**	2,387	16,489	16,839	83	8,163	8,152	2,664	25,552	31,764
1967	170	754	7,294	2,238	15,868	16,240	75	7,881	7,846	2,483	24,523	31,380
1966	142	1,293	8,028	2,141	15,500	15,934		7,815	7,765	2,359	24,608	31,727
1969	203	1,173	8,543	2,011	14,986	15,388		7,197	7,170	2,299	23,356	31,101
1970	210	627	8,095	1,936	13,878	14,419	79	6,822	6,812	2,225	21,327	29,326
1971	171	694	7,304	1,792	12,171	12,562	47	6,107	6,068	2,010	18,972	25,934
1972	171	777	7,532	1,704	11,507	11,825		5,646	5,632	1,945	17,930	24,989
1973	149	758	9,698	1,704	11,946	12,384	1:	5,541	5,538	1,916	18,245	27,620
1974	139	911	10,694	1,692	12,878	13,185	77	7,029	7,017	1,908	20,818	30,896
Total	**1,569**	**7,887**	**73,981**	**17,605**	**125,243**	**128,776**	**655**	**62,201**	**62,000**	**19,829**	**195,331**	**264,757**

SOURCE: Compiled by OTA from Federal Railroad Administration data.

Table 19.—Casualties Resulting From Class I and Class II Railroad Accidents

	Employees		Passengers		Trespassers		Other*		Total	
	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities	Injuries
1966	**168**	18,651	**23**	1,244	678	702	**1,815**	**4,955**	2,684	**25,552**
1967	**176**	18,055	**12**	1,054	646	696	**1,649**	**4,718**	2,438	**24,523**
1968	**150**	18,116	**11**	1,329	628	663	**1,570**	**4,500**	2,359	**24,608**
1969	**190**	17,255	**6**	862	627	674	**1,476**	**4,565**	2,299	**23,356**
1970	**172**	16,285	**8**	489	593	646	**1,452**	**3,907**	2,225	**21,327**
1971	**123**	14,191	**16**	536	551	607	**1,320**	**3,638**	2,010	**18,972**
1972	**133**	12,973	**47**	660	537		**1,228**	**3,691**	1,945	**17,930**
1973	**161**	13,511	**6**	503	578	R	**1,171**	**3,577**	1,916	**18,245**
1974	**144**	16.002	**7**	574	565	674	**1,192**	**3,566**	1,908	**20,818**
Total	**1,417**	**145,079**	**136**	7,271	5,403	**5,862**	**12,873**	**37,119**	19,829	**195,331**
Percent total	**7.1**	**74.3**	*0.7*	3.7	27.3	**3.0**	**64.9**	**19.0**	100.0	**100.0**

● Other includes all persons not included as employees, passengers or trespassers. (This group was made up primarily of casualties resulting from grade-crossing accidents.)

SOURCE: Compiled by OTA from Federal Railroad Administration data.

With respect to fatalities, trespassers were the second highest in number with **5,403 (27.3** percent); employees ranked third overall with 1,417 (7.1 percent); and passengers had the least amount of fatalities with 136 (0.7 percent). Of the total injuries, the "other" category registered the second highest number with 37,119 (19.o percent); passengers ranked third with 7,271 (3.7 percent); and trespassers had the fewest injuries with 5,862 (3.0 percent).

Trends toward a general decline in fatalities among trespassers and "other" were evidenced over the 9 years. Trespasser fatalities declined by **16.7** percent from 1966 to 1974 and except for a rise in 1973 showed a continuous decline. "Other" fatalities declined by 34.3 percent from **1966** to 1974 and continuously decreased to a low point in 1973 before exhibiting a slight rise in 1974. Although the absolute number of fatalities decreased from **1966** to 1974 for both employees and passengers, fluctuations were evident during this time.

Injuries declined for all four categories during 1966-74, but in no case were there continuous decreases registered during this period. Employee injuries declined by **14.2** percent from **1966-74** and generally decreased to a low point in **1972** before showing an increase through 1973-74, Although the absolute number of injuries decreased from **1966** to 1974 for passengers, trespassers, and "other," fluctuations were noted during this time.

EMPLOYEE ACCIDENT ANALYSIS

During 1966-74, 146,496 employee casualties resulting from all railroad accidents were reported, with **145,079** of those being employee injuries and 1,417 employee fatalities. Also during this time, the total hours worked by employees decreased from **1,346** million man-hours in **1966 to 1,099** million man-hours in 1974 (– 18.4 percent). To properly analyze the employee casualties, they must be adjusted for the changes in hours worked. When the numbers of employee fatalities and injuries are normalized for these changes in the hours worked, the following resulted:

Employee Fatalities Million Man-Hours

1966	1974
0.125	0.131

Employee Injuries Million Man-Hours

1966	1974
13.86	14,56

Thus, after normalizing, there was no identifiable change in employee fatalities while employee injuries slightly increased.

Employee casualties were further analyzed by cause of accident to determine why various injuries and fatalities were occurring to employees. This analysis generally combined the cause codes of both train service and nontrain accidents to identify those activities which were resulting in a major portion of the injuries and fatalities to employees. The results of this analysis of employee injuries during 1966-74 are shown below:

Employee Injuries (By major cause of accident)

Mujor cause	Percent of tottii *employee injuries*
Getting on or off trains.	16.6
Construct ion and maintenance of cars and locomotives	12.2
Construction and maintenance of track, ties, and rail . . .	8.9
Stumbling, slipping, and tailing (not on train)	7.9
Coupling and uncoupling. ., ...	.5. b
Flying or falling objects, burns, etc. .	4.8

The single major cause, "getting on or off trains," exhibited the highest percentage of all employee injuries with **16.6** percent. This major cause includes 44 subcauses, all associated with getting on or off cars or locomotives. Most of these subcauses relate to equipment component defects, slipping or falling for various reasons, and other miscellaneous reasons. However, most of these injuries were related to slipping and falling and miscellaneous reasons. The second leading contributor to employee injuries was "construction and maintenance of cars and Locomotives," with **12.2** percent. This cause code was made up of two nontrain accident causes ("construction and maintenance of cars" and "construction and maintenance of locomotives") and is largely comprised of those man-machine interface activities conducted while servicing and maintaining equipment. The major cause "construction and maintenance of track, ties, and rail," resulting in **8.9** percent of the total employee injuries, includes similar man-machine interface activities that relate to servicing and maintaining track and roadbed.

When the major causes of employee fatalities are analyzed for 1966-74, the results are:

Employee Fatalities
(By major cause of accident}

Major cause	*Percent of total employee fatalities*
Struck or runover at places other than public rail-highway crossing.	20.7
Various causes of collisions, derailments, and other train accidents	17. Q
Coupling and uncoupling. . . .	7.0
Stumbling, slipping, and falling (while on train).	5.8
Getting on or off trains.	5.2
Construction and maintenance of cars	3.7

The largest single major cause of employee fatalities was "struck or runover at places other than public rail-highway crossings," with **26.7** percent. This major cause includes those sub-

causes relating to employees killed while walking or working along the track. The next major cause resulting in 17.9 percent of all employee fatalities was due to "various causes of coHisions, derailments, and other train accidents." A total of **254** employee deaths (17.9 percent of all employee fatalities) resulted from this cause over the 9-year period. A breakdown by number of employee deaths shows that 166 employees died in collisions, **65** died in derailments, and the remaining **23** died in other train accidents. The third major cause of employee fatalities, "coupling and uncoupling," with **7.0** percent of the total employee fatalities, was comprised of various man-machine activities involved in coupling and/or uncoupling locomotives and cars as well as coupling and/or uncoupling air hoses, steam hoses, and safety chains. Three major causes exhibited themselves with respect to both the employee fatalities and employee injuries listings. These included:

- "Getting on or off trains,"
- "Construction and maintenance of cars," and
- "Coupling and uncoupling."

The major cause "stumbling, slipping, and falling" also was seen in both listings. However, the employee injuries listing included "stumbling, slipping, and falling" in conducting activities not on the train, while the employee fatalities listing included "stumbling, slipping, and falling" in conducting activities while on the train.

An analysis of the employee problem by job classification was conducted by the Association of American Railroads to determine if any casualties were occurring to employees within specific job categories. This analysis resulted in the employee category "transportation (train and engine)" accounting for over 55 percent of the employee injuries and over 54 percent of the employee fatalities. The safety problem of injuries and fatalities occurring to the transportation group (train and engine) compared with other job categories, is shown below:

Total **Employee Injuries**

lob categories	Percent of total *employee injuries*
Executives, officials, and staff assistants	0.1
Professional, clerical, and general	3.4
Maintenance of way and structures	14.0
Maintenance of equipment and stores	15.4
Transportation (other than train, engine, and yard)	5.5
Transportation (yardmasters, switchtenders, and hustlers)	6.5
Transportation (train and engine)	55.1
	100.0

Total Employee Fatalities

Job categories	*Percent of total employee injuries*
Executives, officials, and staff assistants	1.1
Professional, clerical, and general	2.0
Maintenance of way and structures	23.2
Maintenance of equipment and stores	**15.9**
Transportation (other than train, engine, and yard)	2.6
Transportation (yardmasters, switchtenders, and hustlers)	0.8
Transportation (train and engine)	54.4
	100.0

A ranking procedure was then used to investigate the safety problem of the individual job classifications within each job category. This procedure was based on a combination of accident frequency (measured by the number of accidents per year) and the severity (measured by the median days disabled per accident). When this procedure was used to rank the individual job classifications during the 9 years from 1966 through 1974, yard brakemen and yard helpers were ranked first by far in every year. Section "men" ranked second in 8 of the 9 years. Because of analyses of this type, yard brakemen have been selected for further study by the AAR to determine the reasons why these employees are involved in over 50 percent of the total employee injuies and fatalities.

'A. E. Shulman, Analysis of Nine Years of Railroad Per**sonnel Casualty Data** 1966-1974, Association of American **Railroads, November** 1976.

TRAIN SERVICE AND NONTRAIN ACCIDENTS

As previously stated, over 95 percent of all injuries and fatalities from 1966-74 resulted from train service and nontrain accidents, The next two sections examine these two types of railroad accidents which contribute to virtually all of the injuries and fatalities,

Train Service Accidents

During the period 1966-74, the absolute number of train service accidents decreased from 16,839 to 13,185 (–21.7 percent). However, during this time train service accidents resulted in 64.1 percent of all injuries and 88.8 percent of all fatalities resulting from railroad accidents. A substantial number of these train service accidents were rail-highway grade-crossing accidents and are fully discussed in chapter X. When the injuries resulting from rail-highway grade-crossing accidents are excluded from the injuries resulting from total train service accidents, almost **90** percent of the remaining injuries occurred to railroad employees. During the 9-year period, train service employee fatalities accounted for **4.6** percent of total train service fatalities, while train service employee injuries accounted for **67.1** percent of total train service iniuries. Of the total employee injuries (145,079) and fatalities (1,417), 57.9 percent of the employee injuries and 57.5 percent of the employee fatalities resulted from train service accidents (table **20).**

During the 9-year period, employee injuries resulting from train service accidents decreased from 10,814 in 1966 to 8,870 in 1974 (– 18.0 percent). This decrease was not continuous and exhibited a low of 7,426 in 1972. During the same period, employee fatalities resulting from train service accidents decreased from 98 in 1966 to 81 in 1974 (– 17.3 percent). However, as shown in table **20, fluctuations** occurred throughout these 9 years. Figure 1 shows the rate when employee injuries resulting from train service accidents are normalized by changes in employment hours worked.

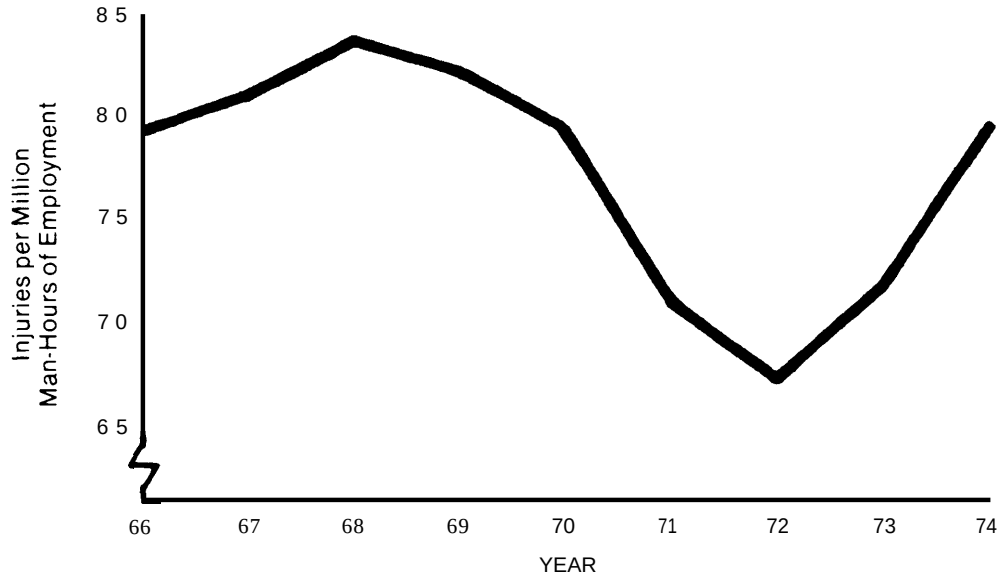
Normalizing the train service emploYee injuries over the 9 years had the effect of changing them from an 18-percent decrease to a slight increase of approximately O.5 percent.

Table 20.—Train Service Accidents

	Train service accidents	Train service injuries	Train service fatalities	Train service employee injuries	Train service employee fatalities
1966	16,839	16,489	2,387	10,814	**98**
1967	16,240	15,888	2,236	10,467	**117**
1968	15,934	15,500	2,141	10,580	100
1969	15,388	14,986	2,011	10,186	**98**
1970	14,419	13,878	1,936	9,633	**84**
1971	12,562	12,171	1,792	8,104	**71**
1972	11,825	11,507	1,704	7,426	
1973	12,384	11,946	1,704	7,968	**: :**
1974	13,185	12,878	1,692	8,870	**81**
Total	128,776	125,243	17,605	84,048	815

SOURCE: Compflied by OTA from Federal Railroad Adminstration data.

Figure 1.—Train Service Employee Injuries Normalized by Million Man-Hours of Employment, 1966-74



Source A E Shulman C E Taylor Analysts o(Nine *Years of Fta//road Ace/dent Data 19667974,* Associat[on of American Ra{l roads, April 1976

The severity of the employee injuries (measured by the frequency of accidents and median days disabled) resulting from train service accidents was analyzed by the AAR.[2] The results indicated that the increase in employee injuries from **1972-74** was not the result of an increase in more severe injuries, but an increase of less severe injuries.

Employee casualties resulting from train service accidents were further analyzed by cause to determine the reasons why various injuries and fatalities were occurring to them. The results of this analysis for employee injuries during the period 1966-74 are as follows:

Employee Injuries in Train Service Accidents (By major cause category)

Major cause	Percent *of* total *train service employee injuries*
Getting on or off trains.	27.0
Stumbling, slipping, and falling (not on train)	13.3
Coupling and uncoupling.	9.5
Flying or falling objects, burns, etc. .	8.1
Operating switches	6.6
Operating hand brakes.	5.3

Analyses conducted by the AAR[3] further considered the various cause categories of train service accidents and ranked them (based on frequency and severity) for the 9 years. "Getting

2A. E. Shulman, C. E. Taylor, Analysis of Nine Years of Railroad Accident Data, 1966-1974, Association of American Railroads, April 1976.

[3]A. E. Shulman, C.E. Taylor, Analysis of Nine Years of Railroad Accident Data, 1966-1974, Association of American Railroads, April 1976.

on and off trains" ranked first in every year while "stumbling, slipping, and falling" (not on cars or locomotives) ranked high in all 9 years. Other causes to rank high were "struck at places other than public rail highway crossings, operating hand brakes, and operating switches. "

When employee fatalities resulting from train service accidents were analyzed by major cause for the period **1966-74,** the results were as follows:

Employee Fatalities in Train Service Accidents
(By major **cause category)**

Major cause	**Per-cent** of *total train service employee fatalities*
Struck or runover in places other than public rail-highway crossings	33.6
Coupling and uncoupling. . .	8.8
Stumbling, slipping, and falling (while on train), ...	7,3
Getting on or off trains.	6.5
Contacting fixed structures while on train	5.4

Appendix C presents the trends of each major subclass of train service accidents for all Class I railroads during 1966-74. As seen from these graphs, all the subclasses of train service accidents showed decreases during 1966-74, except those related to coupling and uncoupling and operating switches. Although one subclass of train service accidents (rail-highway grade-crossing accidents) also decreased during these 9 years, as discussed in chapter X, they continue to be a serious safety matter.

Nontrain Accidents

During the period 1966-74, the number of nontrain accidents decreased from 8,152 to 7,o17 (– 13.9 percent). These numbers decreased continuously to 5,538 in 1973 and then sharply increased in 1974. Nontrain accidents resulted in 31.8 percent of all railroad accident injuries and 3.3 percent of all railroad accident fatalities. During the 9-year period, nontrain employee fatalities accounted for 51.9 percent of the total nontrain fatalities, while nontrain employee injuries accounted for 91.9 percent of the total nontrain injuries. Of the total employee injuries (145,079) and fatalities (1,417), 39.4 percent of the employee injuries and 24.0 percent of the employee fatalities resulted from nontrain accidents (table 21).

During the 9-year period, employee injuries resulting from nontrain accidents decreased from 7,412 in **1966** to **6,625** in **1974 (– 10.6** percent). There was a continuous decrease to a low point of 5,156 in 1973 and then and increase to 6,625 in 1974. During the same 9 years, employee fatalities resulting from nontrain accidents decreased from 49 in **1966** to 37 in **1974 (– 24.5** percent). However, fluctuations oc-

Table 21 .— Non train Accidents

	Non train accidents	**Non train** injuries	**Non train** fatalities	**Non train employee** injuries	**Non train** employee fatalities
1966.	8,152	8,163	83	7,412	49
1967.	7,846	7,881		7,130	37
1968.	7,765	7,815	; :	7,100	42
1969.	7,170	7,197	85	6,574	47
1970.	6,812	6,822	79	6,289	42
1971	6,086	6,107	47	5,700	21
1972.	5,632	5,646	70	5,199	40
1973.	5,538	5,541	63	5,156	25
1974.	7,017	7,029	77	6,625	37
Total	62,000	62,201	655	57,185	340

SOURCE: Compiled by OTA from Federal Railroad Administration data.

curred throughout the 9 years. When the employee injuries resulting from nontrain accidents are normalized by changes in employment hours worked, the rate of employee injuries is as shown in figure 2.

Normalizing the nontrain employee injuries over the 9 years has the effect of changing them from a 10.6 percent decrease to a 9.4 percent increase. The severity of the employee injuries (measured by the frequency of accidents and median days disabled) resulting from nontrain accidents was analyzed by the AAR.[4] The results indicated that the increase in the number and rate of nontrain employee injuries during 1973 and 1974 was the result of an increase in less severe injuries and not as a result of more severe injuries.

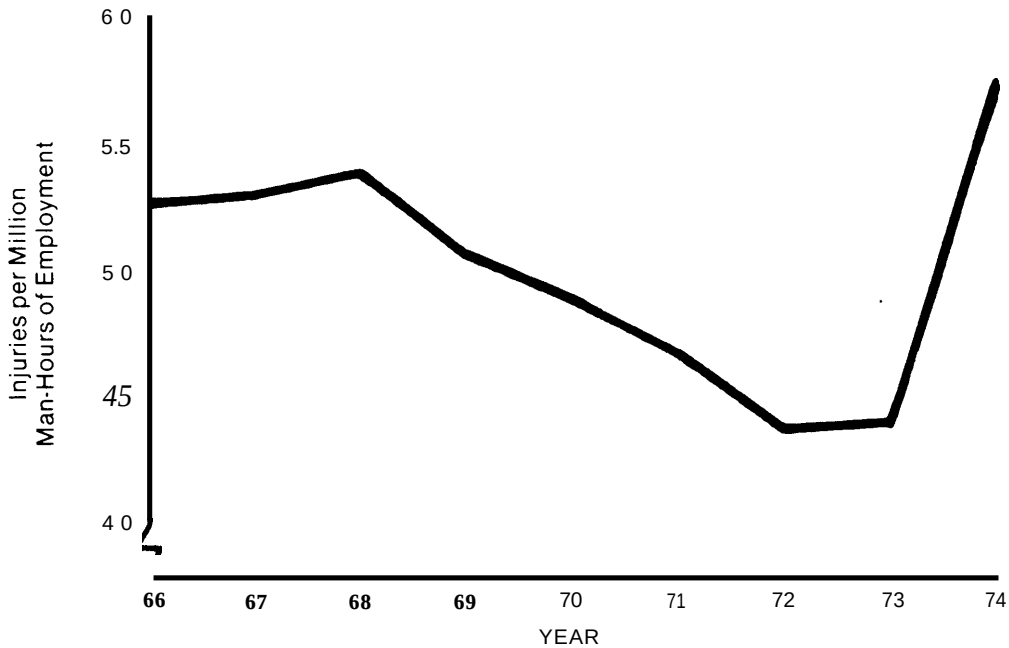
Employee injuries resulting from nontrain accidents were then analyzed by cause to determine the major reasons why various injuries and fatalities were occurring to them. The results of this analysis for the 9-year period are shown below:

Employee Injuries in Nontrain Accidents (By major cause category)

Major cause	*Percent of total nontrain employee injuries*
Construction and maintenance of cars	22.7
Construction and maintenance of locomotives	9,2
Construction and maintenance of track, ties, and rail	23.2
Miscellaneous nontrain causes	24.1

[4] A. E. Shulman, Analysis of Nine Years of Railroad Personnel Casualty Data, 1966-1974, Association of American Railroads, November 1976.

Figure 2.— Nontrain Employee Injuries Normalized by Million Man-Hours of Employment, 1966-74



Source A E Shulman, *Analysis of Nine Years of* Railroad *Personnel Casualty Data 19661974* Associaction of American Railroads, April 1976

A similar analysis of employee fatalities resulting from nontrain accidents by cause for 1966-74 resulted in the following:

Employee Fatalities in Nontrain Accidents (By major cause category)

Major cause	*Percent of total non train employee fatalities*
Construction and maintenance of cars	17.9
Operation and maintenance of track motor cars	11.8
Miscellaneous nontrain causes	11.8
Operation of miscellaneous vehicles on public highways.	11.1
Construction and maintenance of bridges, tunnels, and culverts .	**8.1**

The two major causes, "construction and maintenance of cars" and "miscellaneous nontrain causes, " accounted for **29.7** percent of nontrain employee fatalities and **46.8** percent of nontrain employee injuries.

Appendix C presents the trends of each major subclass of cause of nontrain accidents for all Class I railroads during 1966-74. Again, these graphs show the significant contribution of nontrain accidents by the two causes "construction and maintenance of cars" and "miscellaneous nontrain causes. " When the major causes of nontrain accidents were normalized by changes in employment hours, the two largest contributors to nontrain employee injuries were again "construction and maintenance of cars" and "miscellaneous nontrain causes. " Although many of these subclass causes exhibited fluctuations throughout the 9-year period, those related to track improvement (construction, servicing, and maintenance of ties, tie plates, and fasters; CS&M of rail; and CS&M of motor cars and roadway machines) increased 20, 65, and 61 percent, respectively.

The analysis of nontrain accidents indicated that many of the specific causes identified within the major cause categories did not offer adequate reasons why certain accidents were occurring which resulted in death and injury to employees. Many of these accidents seem to result from a breakdown in the interaction between man and machine. However, more study seems warranted to determine the reasons behind and causes for these accidents. Special or in-depth analyses are needed to develop means for better understanding and alleviating these safety problems.

SAFETY OF PROPERTY

As previously stated, the safety of property is measured by the loss of and damage to railroad equipment, track, and roadbed (estimated) and the lading (actual). This loss and damage occurs primarily in collisions, derailments, and other train accidents. This section examines the types of railroad accidents which contribute to virtually all of the property and lading damage* but only to a small portion of the injuries and fatalities.

Train Accidents

During the period 1966-74, the absolute number of train accidents** increased from 6,793 in 1966 to 10,694 in 1974 (+ 57.4 percent). These train accidents resulted in 4.0 percent of all injuries and 7.9 percent of all fatalities resulting from railroad accidents. Moreover, they resulted in virtually all the loss and damage

*There is some lading damage that occurs which results from other than train accidents (i.e., spoilage, improper handling, etc.) This lading damage was not considered in this study.

* *Train Accident—an accident arising out of the movement or operation of trains and resulting In more than $750 damage to equipment, track, or roadbed whether or not a reportable death or injury occurred.

to track, roadbed, equipment, and lading (see table 22).

Table 22.—Train Accidents and Associated Costs

Year	Train accidents	Loss and damage to track, roadbed, equipment, and lading [million-current$]
1966.....	6,793	117.6
1967.....	7,294	118.0
1968.....	8,028	140.3
1969.....	8,543	161.7
1970..,..	8,095	158.4
1971.....	7,304	144.8
1972.....	7,532	140.3
1973.....	9,698	188.4
1974.....	10,694	243.2

SOURCE: Compiled by OTA from Federal Railroad Administration and Association of American Railroads data.

As previously noted, train accidents are defined as those arising out of the movement or operation of trains and resulting in more than **$750 damage** to equipment, track, or roadbed, whether or not a reportable death or injury occurs. This monetary threshold of $750 established in 1956 was not revised to take inflation into consideration until 1974. At this time, the reporting threshold was increased to $1,750 and subsequent increases were established for the years 1957-74. Since the monetary threshold had remained constant during this time and did not increase with inflation, there was an overreporting of train accidents. Therefore, adjustments to the total number of reportable train accidents were required, which reduced these total numbers. Figure 3 presents the results of adjusting train accidents for inflation. This adjustment resulted in reducing the number of train accidents from 6,793 to 5,604 in 1966 and 10,694 to 7,491 in 1974.

Although inflation had an impact on the number of train accidents reported, the changing operating practices over the 9-year period also impacted the change in the number of train accidents. There has been much discussion as to what is an accurate measure of the railroads' operating practices. Several have been identified: ton-miles, train-miles, and car-miles. From the standpoint of freight movement, ton-miles seems to be the best indicator. With respect to the crew and passenger movement, train-miles or car-miles may be more appropriate. Since the major business conducted by the railroads is the transportation of goods, ton-miles was the measurement used in this study for analysis of changing operating practices with respect to train accidents. When the train accidents as shown in table 22 were adjusted for the monetary threshold and changes in operating practices, the increase in train accidents over the 9-year period was 15.9 percent.

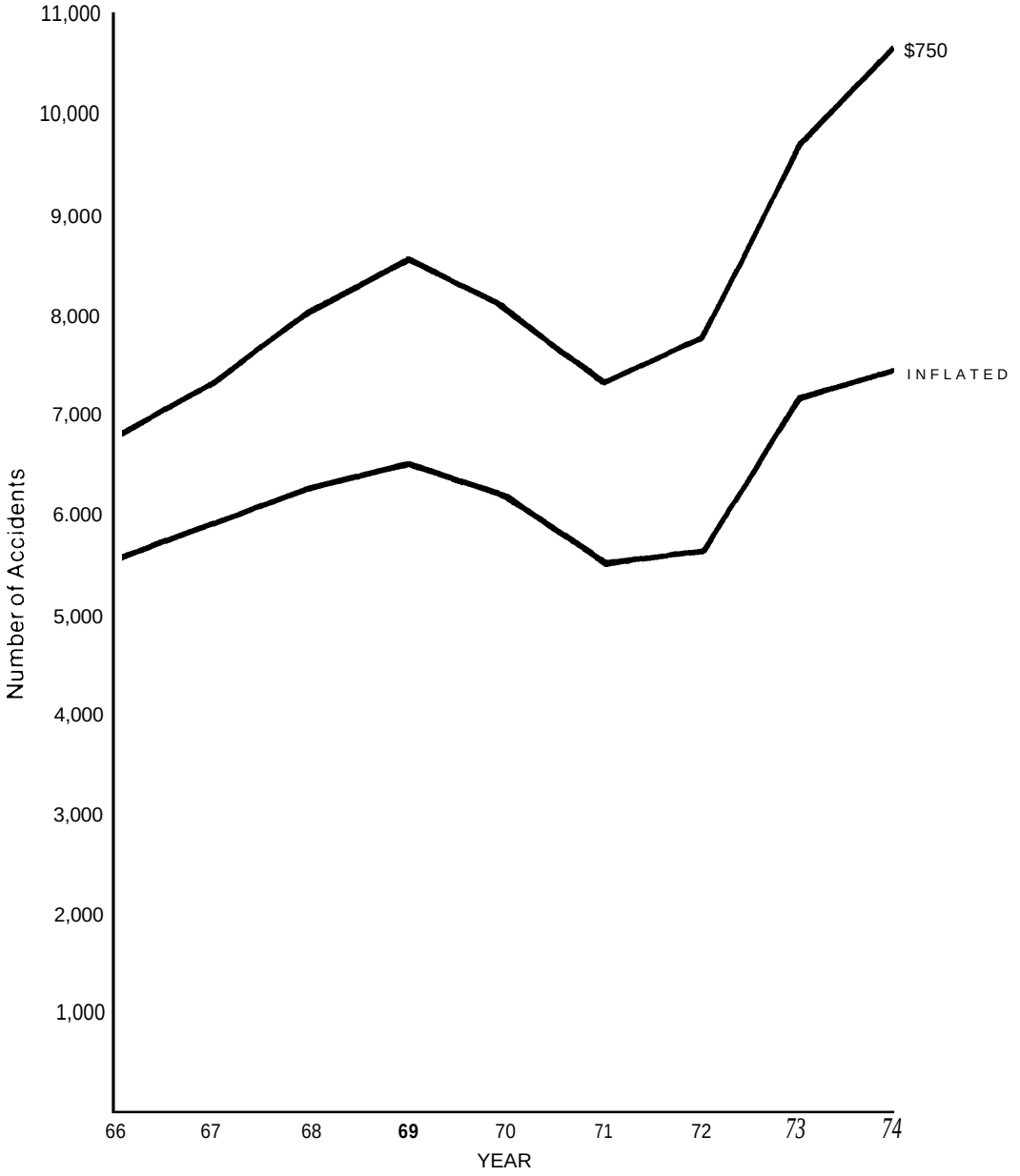
Table 22 also shows that the loss and damage to track, railroad, equipment, and lading in-



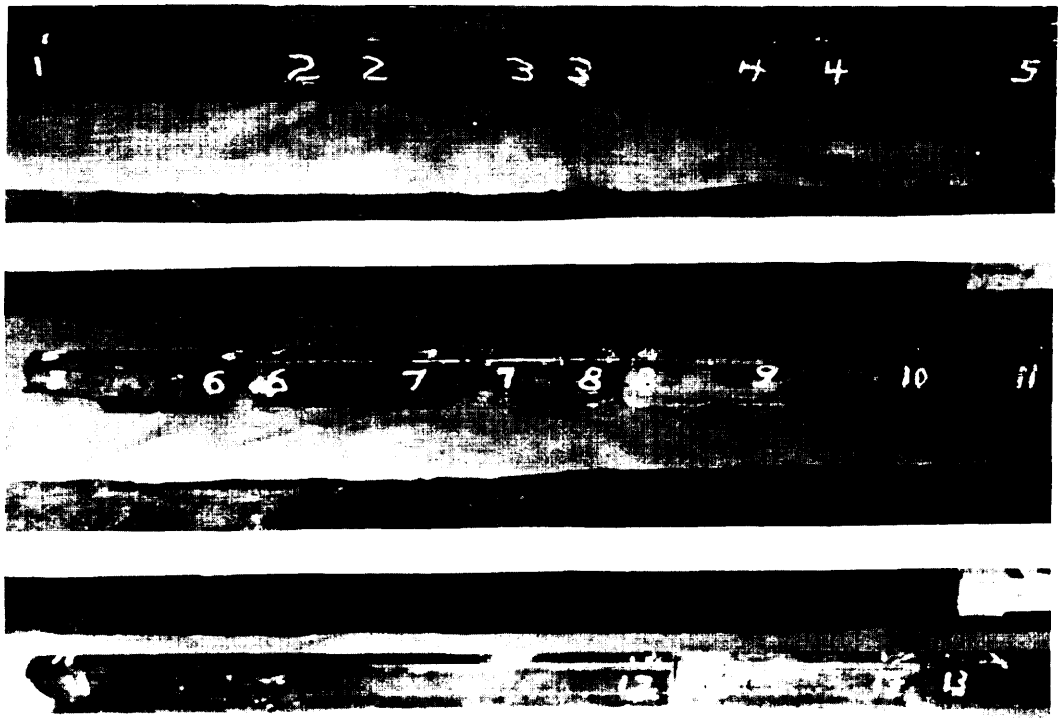
Photo: Courtesy of Federal Railroad Administration

Transverse fissure resulting in broken rail; cause of the Harve, Mont. derailment, November 26, 1976.

Figure 3.— Number of Train Accidents at Thresholds of $750, Inflated, 1966-74



Source A E Shulman C E Taylor, Arra/y.s/s o/ A/me Years of R8(/road Acc/derrf Data 1966-1974, Association of American Ral I roads, April 1976



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creased in current dollars from $117.6 million in **1966** to $243.2 million in 1974. When those dollars are adjusted to constant 1975 dollars, using the consumer price index, the increase over the 9 years is 25 percent.

During the 9-year period, train accident employee fatalities accounted for 16,2 percent of total train accident fatalities, while train accident employee injuries accounted for 47.5 percent of total train accident injuries. Of the total employee injuries **(145,079)** and fatalities (1,417), only 2.6 percent of the employee injuries and 17.9 percent of the employee fatalities resulted from train accidents (see table 23).

The FRA has established four major contributing cause categories to train accidents. These include: human factors, equipment failures; defects in way or structures; and miscellaneous. Table 24 shows that in absolute numbers, human factors-caused train accidents increased by 12. o percent, equipment-caused train accidents increased by 18.0 percent, defects in way and structures-caused train accidents increased by **198.6** percent, and miscellaneous-caused train accidents increased by 32.4 percent.

When these train accidents are adjusted for the monetary threshold and normalized by changes in ton-mileage, the increase in track-caused accidents is seen to be 106 percent from 1966-74, whereas there is no change in miscellaneous-caused accidents and approximately a 15-percent decrease in both equipment and human factors-caused accidents.

Of the four major contributing-cause categories, track-caused accidents nearly doubled as a percentage of total train accidents during the 9 years, increasing from 21.0 percent of the total in 1966 to 39.9 percent of the total in 1974. Figure 4 shows the percentage of the four cause categories within these 9 years and is based on the number of train accidents at the inflated thresholds. While the remaining three contributing causes declined as a percentage of total train accidents, the track cause as a percentage of total train accidents increased by 83.5 percent.

An analysis of train accidents by contributing cause was conducted by the AAR. This analysis applied a ranking index (based on the frequency of train accidents and the median dollar damage) to each major contributing-cause category in the train accident data over the 9-year period.[5] With respect to track-related train accidents, the two most common causes were mainline rails (broken railend, split head, split web) and mainline line and surface (improper superelevation, improper alinement, improper

[5] A. E. Shulman, C.E. Taylor, Analysis of Nine Years of Railroad Accident Date, 1966 1974, Association of American Railroads, April 1976.

Table 23.—Train Accidents

Year	Train accidents	Train injuries	Train fatalities	Train employee injuries	Train employee fatal i ties
1966	6,793	900	214	417	21
1967	7,294	754	170	446	22
1968	8,028	1,293	142	427	8
1969	8,543	1,173	203	482	45
1970	8,095	627	210	354	
1971	7,304	694	171	372	31
1972	7,532	777	171	336	16
1973	9,698	758	149	419	42
1974	10,694	911	139	493	25
Total	73,981	7,887	1,569	3,746	254

SOURCE. Compiled by OTA from Federal Rail road Administration data.

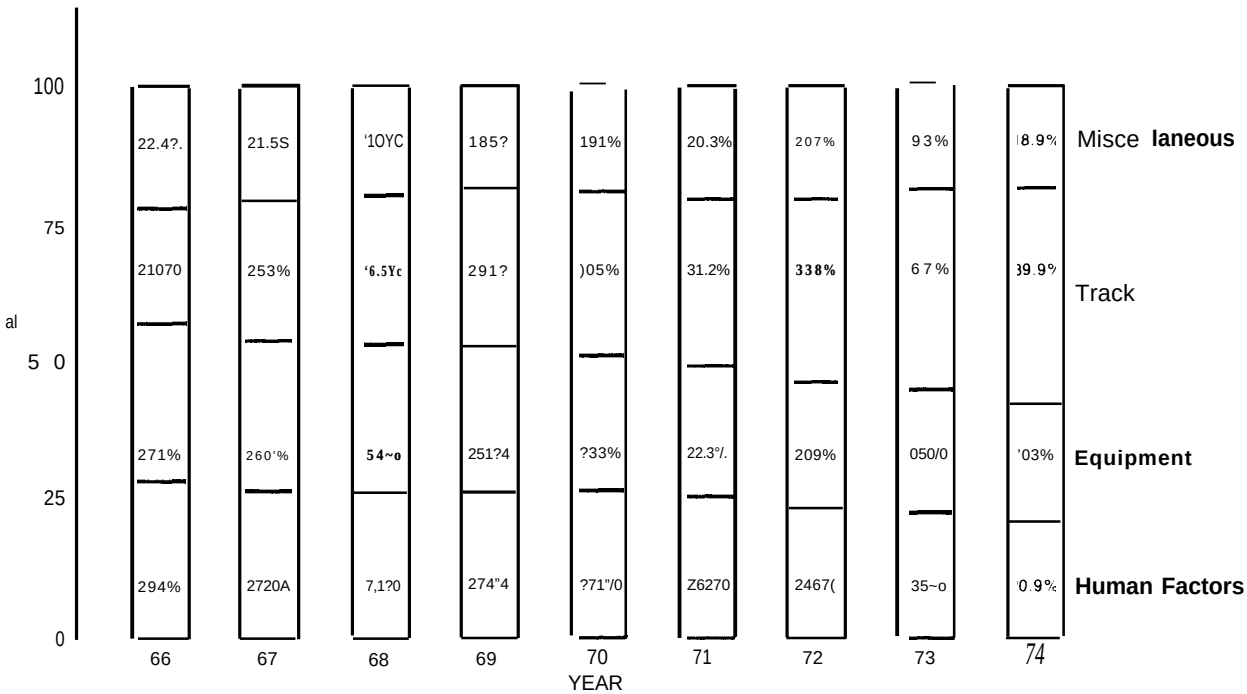
Table 24.—Train Accidents by Contributing Cause

Year	Human factors	Equipment	Track"	Miscellaneous	Total
1966.	1,999	1,843	1,428	1,523	6,793
1967.	1,987	1,897	1,844	1,566	7,294
1968.	2,174	2,042	2,128	1,684	8,028
1969.	2,339	2,142	2,483	1,579	8,543
1970.	2,191	1,890	2,470	1,544	8,095
1971.	1,912	1,630	2,276	1,486	7,304
1972.	1,853	1,577	2,544	1,558	7,532
1973.	2,282	1,992	3,556	1,868	9,698
1974.	2,238	2,175	4,264	2,017	10,694

'The track column is the same as Defects in way and structures.

SOURCE: Federal Rail rOad Administration.

Figure4.— Percentageof Human Factors, Equipment, Track,and MiscellaneousTrainAccidents, inflated Thresholds, 1966-74



SOURCE. Complied by OTA from Association of American Railroads data

surface of track, soft track). These causes ranked first and second throughout the 9-year period, indicating the seriousness of these types of problems.

With regard to equipment-caused accidents, the analysis showed that the two most common causes were axles (journals broken, overheating, cold) and trucks (side bearing missing or defective, improper clearance), Throughout the analysis period, the axle-caused equipment accidents had the highest frequency except for 2 years. However, based on the frequency/severity (severity being measured in median dollar damage) index, it ranked far ahead of the other equipment causes for 7 out of the 9 years. A recent study has identified car dynamics as a major cause of train accidents (specifically derailments) and has passed journal bearing defects as the major equipment cause. [b] Car dynamics (components related to ride stability other than wheels, couplers, and draft gear have shown a steadily upward trend in both the number of equipment-caused derailments and the dollar damage caused by these derailments (figure 5).

With regard to human factors-caused train accidents, the leading causes varied from year to year, but the most common were "failure to secure hand brakes," "absence of man on or at leading car being pushed," and "excessive speed." The cause code "failure to secure by hand brake" ranked first in 6 years and second in the remaining 3 years. Although it is difficult to determine why this cause code ranked so high throughout the 9 years, operating practices, ineffective training, personal problems, or employee apathy may be contributing factors to these types of human factors train accidents. This may indicate that more effort in the area of human factors research and development should be undertaken. A handbrake study by AAR is presently underway which includes human factors analyses.

Within the miscellaneous cause codes, nine different causes were ranked in the top five categories within the 9-year period. In 7 of the 9 years, the number of accidents in the category "accident investigated —other ascertained cause" exceeded the number of accidents in any other cause code within the miscellaneous category. With no discrete cause codes available, the investigation of these types of accidents in determining countermeasures becomes exceedingly difficult. The number of cause codes within the miscellaneous causes was reduced in the 1975 reporting requirements. However, because of the problems that still exist with the data, it is too early to determine the degree of success.

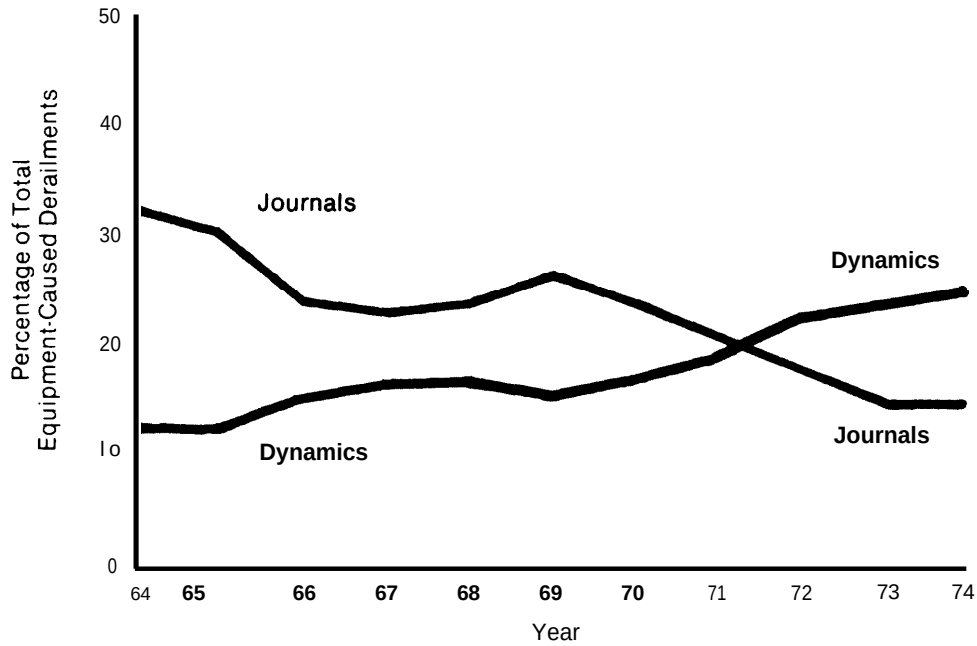
A further investigation by the AAR of the damages resulting from train accidents due to the four contributing causes revealed that track-caused accidents accounted for the largest percentage of dollar damage per million gross-ton miles (MGTM).[7] Since there had been an increase in track-caused accidents over the 9-year period, further investigation of track-caused accidents on mainline, branchlike, and yard track was conducted. The results of this analysis are shown in figure **6.** As the monetary threshold is increased from **$750** to $10,000, the percentage of yard-track accidents greatly decreased while those on the mainline track increased by 87.4 percent. The percentage of track-caused branchlike accidents remained fairly constant. This indicates that a large portion of the yard-track accidents resulted in low-cost accidents, while the mainline track accidents resulted in the higher cost accidents.

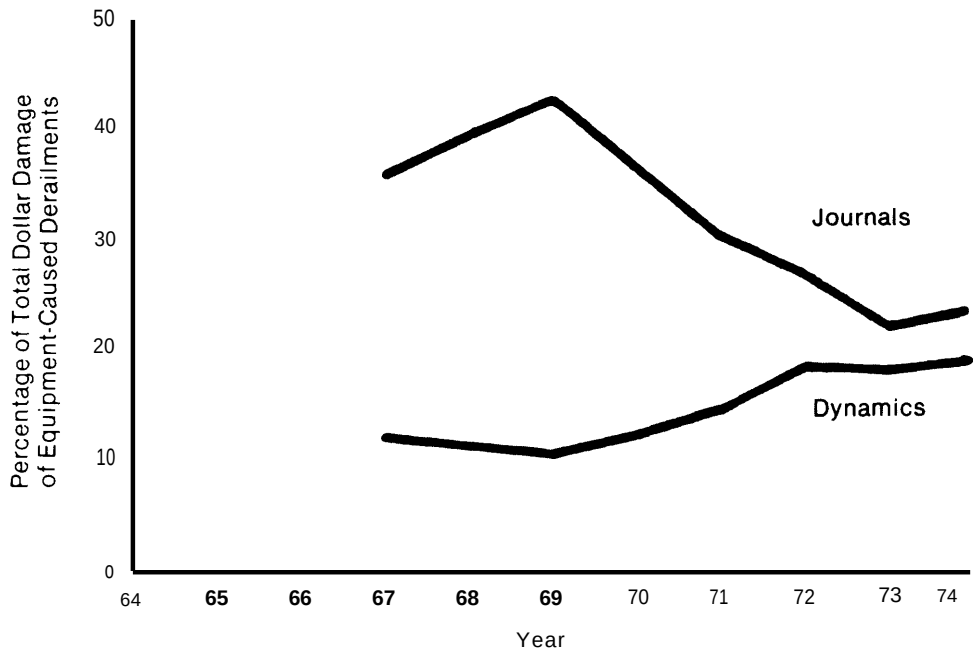
Much has been discussed concerning the reasons behind the increase in track-related train accidents exhibited over the past years. One of these reasons for this increase maybe the financial capability of the railroads themselves. For example, a railroad on the verge of financial collapse may be inclined to divert some of planned maintenance funds from certain areas to reduce losses. Furthermore, the poor financial health of a railroad may have an impact on

'Report No. FRA/FORD'77/18, Wayside Derailment Inspection Requirements Study; J.L. Frarey, R.L. Smith, and A.I. Krauter.

[7] A. E. Shulman, C.E. Taylor, Analysis of Nine Years of Railroad Accident Data, 1966-1974, Association of American Railroads, April 1976.

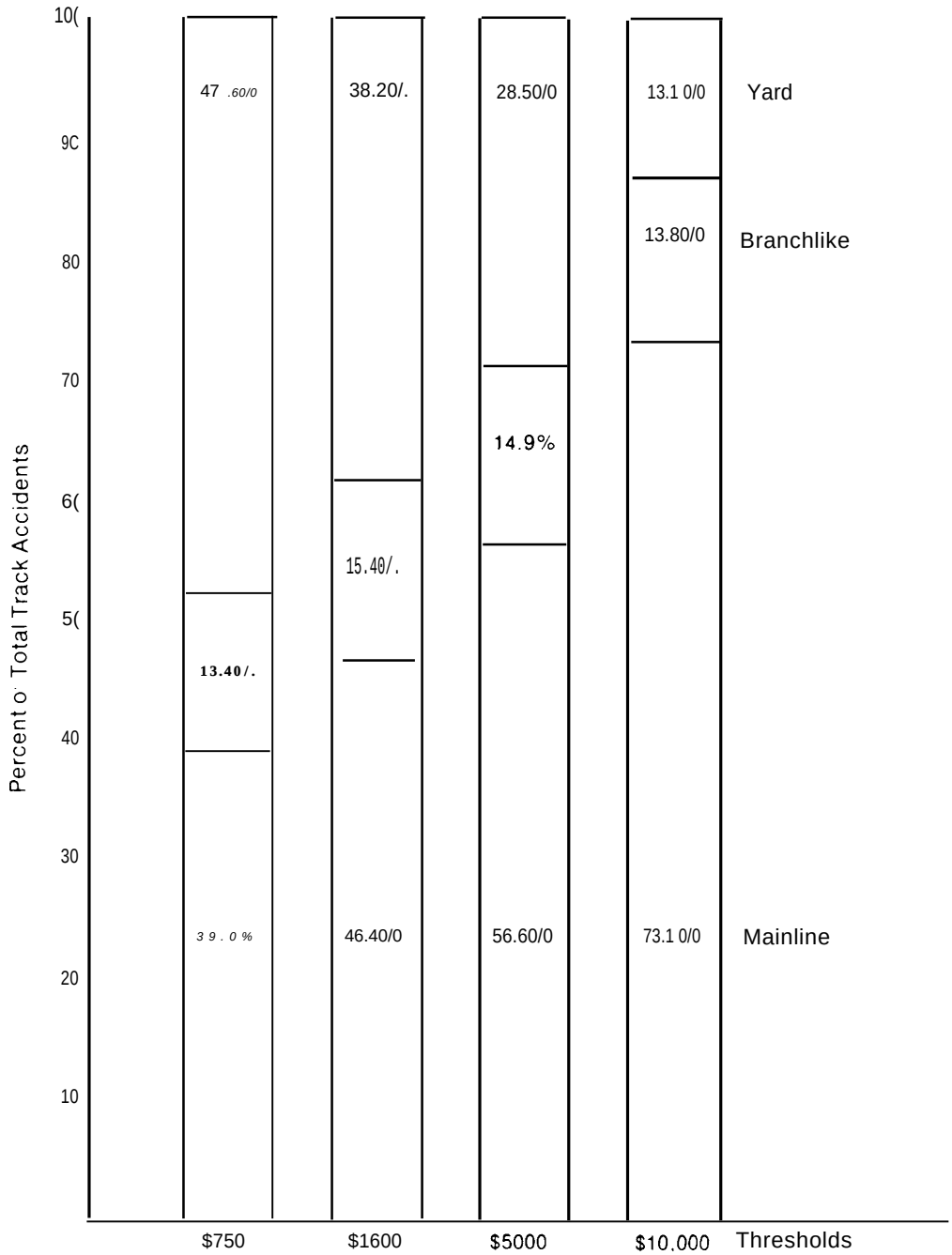
Figure 5.— How Increase in Use of Detection Systems and Incidence of Roller.Type Bearings Has Dropped Journals Below Car Dynamics Group (Bolsters, Side-Bearings, Sills, etc.) as Major Source of Derailments





Source Progressive *Railroading,* November 1977 p 71

Figure 6.— Percent of Mainline, Branchlike, and Yard Track Accidents at Various Thresholds, 1973 Data



Source A E Shulman C E Taylor Ana/vsls of Nine *'fears O(Ra//road Acc/den(Dala* f966 1974 Assoclaf (on of Amer(can Rail roads April 1976

the morale of the employees. With regard to track-caused accidents, there may be a tendency to reduce the amount of effort expended in the yard track programs and, if possible, place these efforts elsewhere, since most yard track accidents have been shown to result in lower cost accidents as measured by equipment, track, and roadbed loss and damage. This point is strengthened by a statement presented in the **1975** FRA Annual Report:8

> As the country's economic woes have increased, the financial condition of many of the Nation's rail carriers has steadily worsened. The rail industry continues to be victimized by spiraling operating costs and sharp declines in traffic which have produced steep revenue losses and financial deficits. In an interim attempt to stem these ever-increasing operating deficits, many of the Nation's railroads have resorted to deferring some of their planned maintenance programs, thereby diverting these funds to reduce the shortfall in revenues. The practice of deferring maintenance has resulted in a steady deterioration of the rail industry's physical plant, reflected in recent years by an alarming increase in the number of track and equipment-related accidents. A substantial improvement in rail safety is therefore largely dependent on the rail industry's financial ability to maintain their physical plants.

A recent study estimated that approximately $6.6 billion of maintenance had been deferred by the railroad industry through 1970s.[9] The practice of deferring maintenance will logically have a negative impact on safety at existing or increasing levels of track usage and roadbed.

With respect to determining what impact the financial standing of a railroad has on its safety picture, the AAR conducted an analysis of track-caused train accidents for bankrupt and nonbankrupt roads during the period **1966-74. 10** The results showed that the absolute number of track-caused accidents was lower for the bankrupt roads than for the nonbankrupt. However, when normalized by MGTM, the track-related train accidents for the bankrupt roads were much higher than those of the nonbankrupt roads (figure 7). This analysis indicates that there appears to be a positive relation between the financial health of the railroads resulting in various levels of deferred maintenance and track-caused train accidents.

Another possible reason behind the increase in track-related accidents may be the usage of heavier cars, which result in higher axle loadings and a damaging effect on track. Over the period 1966-74, the average freight car capacity increased from 61,4 to 71.6 tons. 11 "Moreover, revenue ton-miles increased from 738.4 billion in **1966** to 851.0 billion in 1974 (+ 15.2 percent), while the freight car miles increased from **30.4** billion in **1966** to **30.7** billion in 1974 (+ 1.1 percent). Using this information to determine the increase in revenue tons/freight car, this value increased from 24.3 tons in 1966 to **27.7** tons in 1974. According to the *Yearbook of Railroad Facts, 1977*,[12] of the **28,5** billion freight car miles on Class I railroads in 1976, 55.5 percent were made by loaded cars. If it is assumed that this percentage was similar in both 1966 and 1974, the increase in revenue tons/freight car over the 9 years is 14.1 percent, The use of heavier cars and the increase in track-related accidents has led to increased research by both AAR and FRA.

These two factors, the level of deferred maintenance and the increased axle loadings, appear to be related with increased track-caused train accidents.

The FRA has designated train accidents into three major classes. These include derailments,

'Annual Report by the President to the Congress on the Administration of the Federal Railroad Safety Act of 1970, 1975,

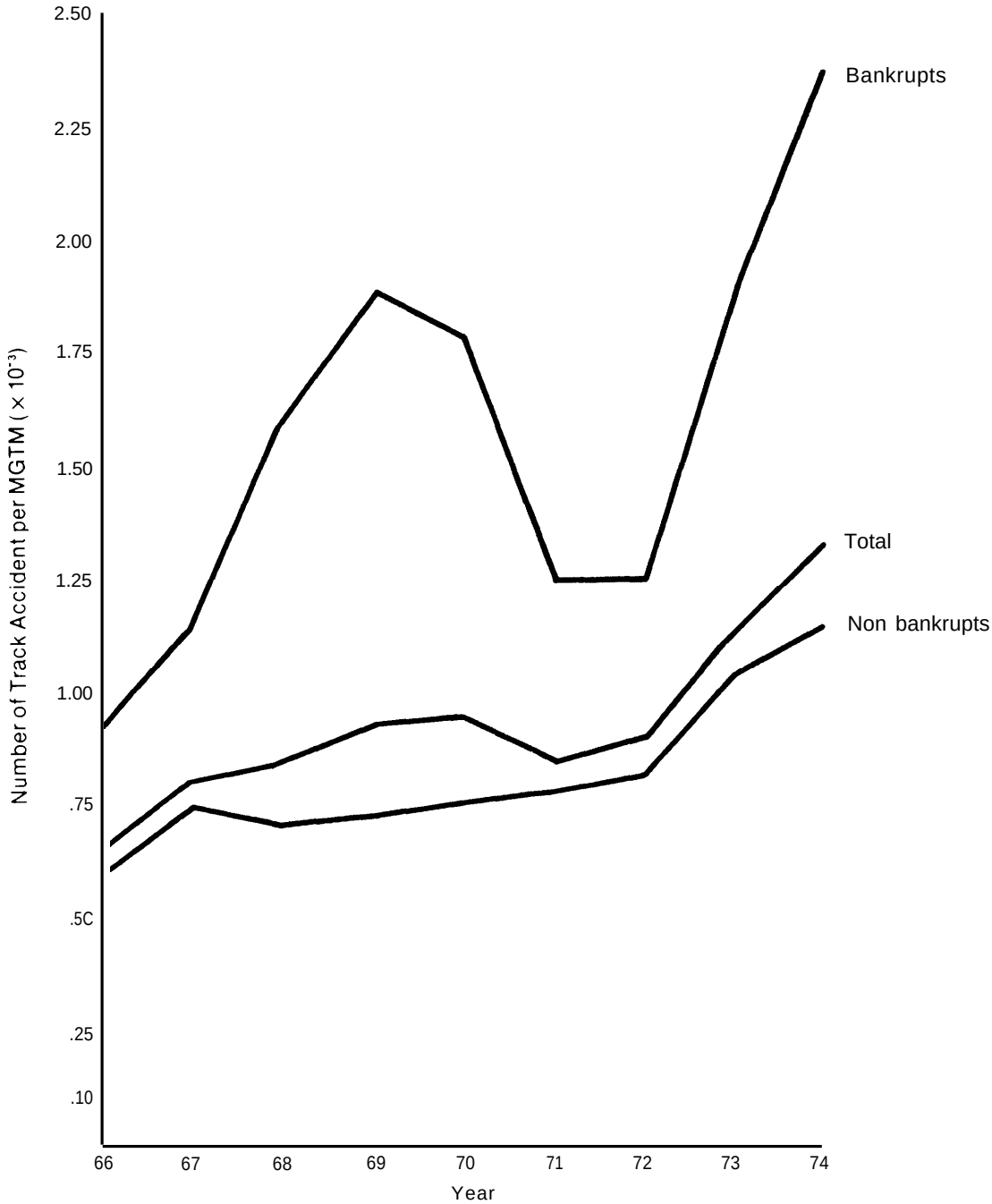
"Richard J. Barber, Associates, The Railroads, Coal and the National Energy Plan: An Assessment of the Issues, 1977.

[10] A.E. Shulman, C.E. Taylor, Analysis of Nine Years of Railroad Accident Data, 1966-1974, Association of American Railroads, April 1976.

[11] Yearbook of Railroad Facts, Association of American Railroads, 1977 Edition.

[12] Ibid.

Figure 7.—Track Accidents Normalized by Million Gross Ton-Miles: Total, Bankrupt and Nonbankrupt Roads, 1966-74



Source A E Shulman, C E Taylor Analysis of Nine *Years of Railroad Accident Data* 1966 1974 Association of American Rail roads, April 1976

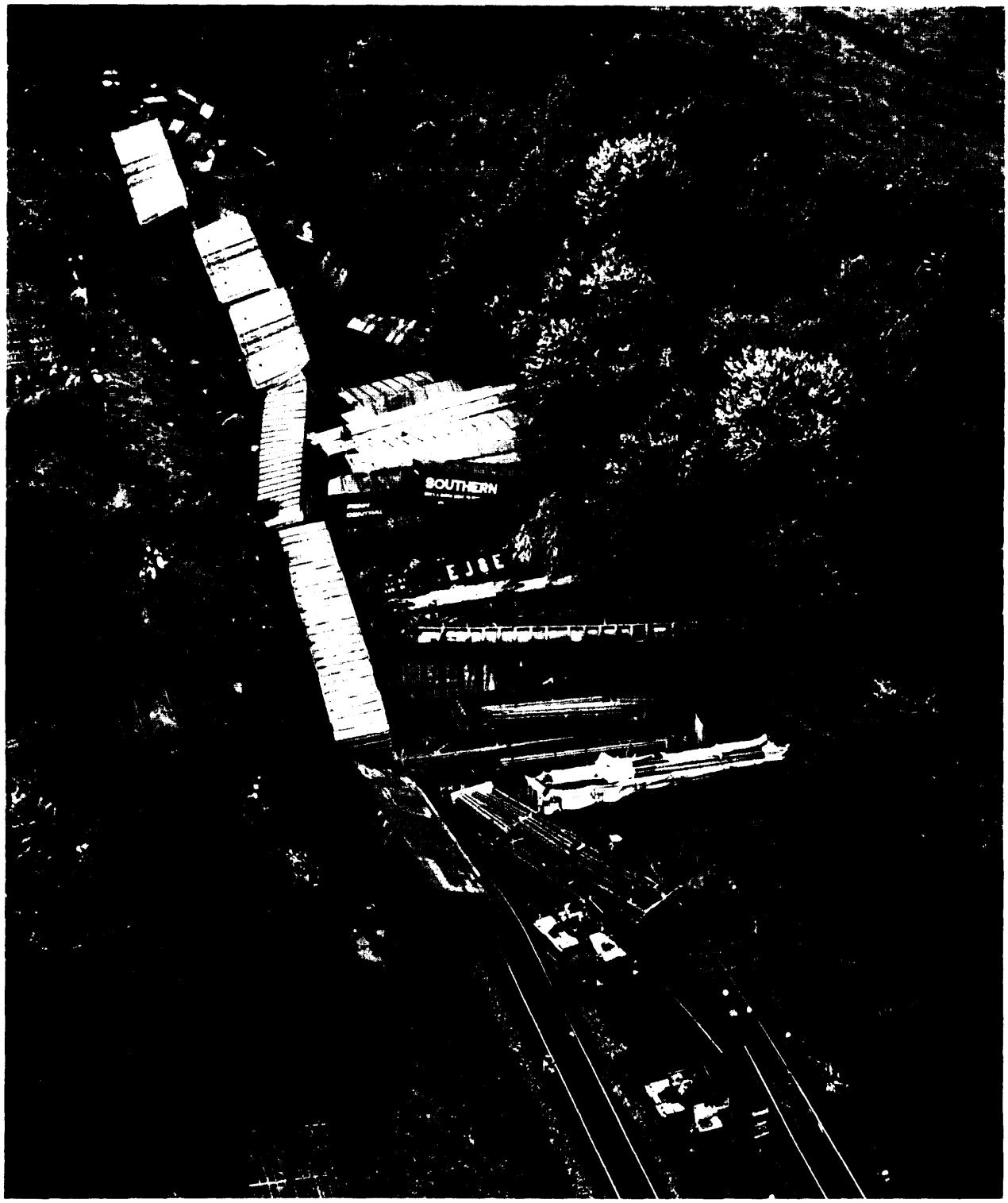


Photo: Courtesy of National Transportation Safety Board

Conrail derailment, Leetonia, Ohio, June 1975. Human error.

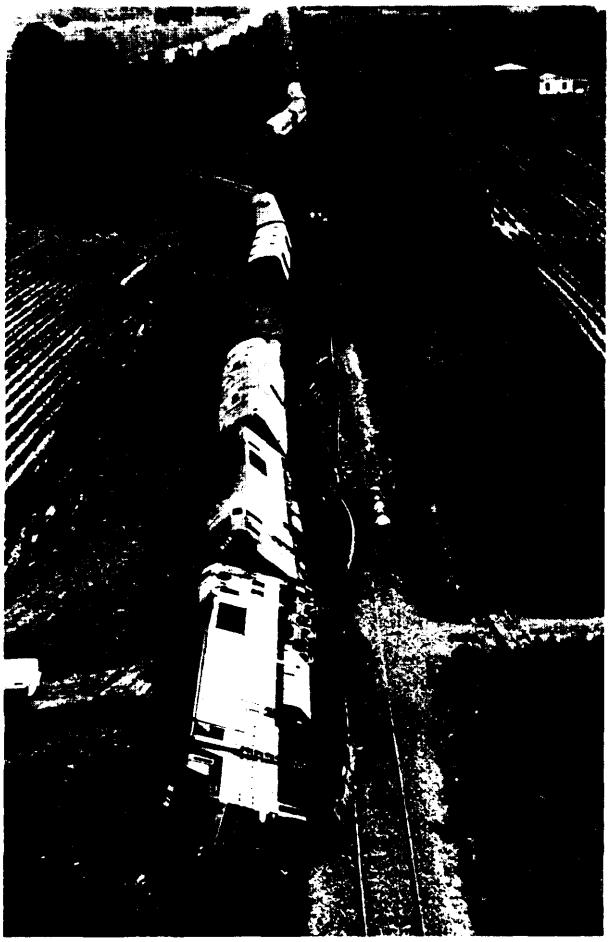


Photo Courtesy of National Transportatuib Safety Board

Amtrak derailment, Goodman, Miss., June 1976. Bad track.



Photo Courtesy of National Tramper/af/on Safety Board

New Haven, Ind.; Head-on collision of two Norfolk & Western Railway trains; October 1976. Human error.



Photo Courtesy of National Transportation Safety Board

Louisville and Northern; Tank car derailment; Pensacola, Fla., November 1977; Leaking anhydrous ammonia.



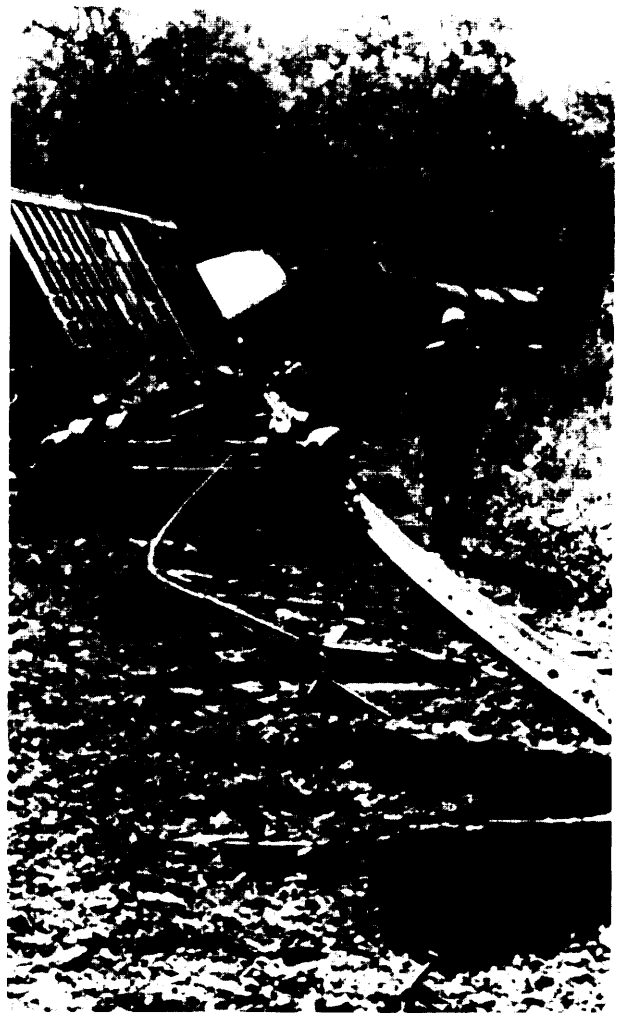
Photo Courtesy of *ST LOUIS Post Dispatch*

East St. Louis, Ill.; Tank car puncture in switching yard; 1972; Carrying propylene.

collisions, and other train accidents. Table 25 presents train accidents by these three classes over the 9-year period 1966-74. It can be seen from the table that while the number of collisions remained the same over the 9 years, the "other" train accidents have decreased by 24.7 percent, and derailments increased by 91.4 percent.

When these classes of train accidents are adjusted for the monetary threshold and normalized for changes in operating practices (ton-mileage) during the 9 years, collisions decreased by approximately 15 percent, while derailments increased by over 40 percent.

One type of derailment which has recently received much attention is that involving tank cars. The potential disaster resulting from a tank car derailment could significantly affect not only the railroads' physical property, but also the health and well-being of the public as well as possible damage to third-party property. As an example, during 1969-75, there were 44,432 derailments reported. Of those derailments, more than 500 involved uninsulated pressure-tank cars, of which more than 170 lost some or all of their lading. Several major accidents resulted in 20 deaths, 855 injuries, and 45 major evacuations of approximately 40,000 persons. Although specific costs are not available, it has been estimated that accidents involving these tank cars resulted in approx-



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"42 Fed. Reg. 46312 (Sept. 15, 1977).

Table 25.—Train Accidents by Class

	Derailments	Collisions	Other	Total train accidents
1966	4,447	1,552	794	6.793
1967	4,960	1,522	**812**	7;294
1968	5,487	1,727	**814**	8,028
1969	5,960	1,810	**773**	8,543
1970	5,602	1,756	**737**	8,095
1971 ..., ...	5,131	1,529	**644**	7,304
1972	5,509	1,348	**675**	7,532
1973	7,389	1,657	**652**	9,698
1974	8,513	1,551	**630**	10.694

SOURCE: Federal Railroad Administration.

imately 10 percent annually of all damage to railroad property. Damage to third-party property and loss of lading could not be isolated for this study. Since this area presents a potential danger to both people and safety, further efforts must be taken to ensure that the safety of people and property are realized with respect to tank car accidents. (See chapter X.)

Because derailments exhibited significant increases over the 9 years, they were selected for further analysis by contributing cause. Table 26 shows the total number of derailments by contributing cause for the years 1966-74. This table indicates that the cause "defects in track" was the 1argest and most rapidly increasing single cause of derailments during the 9-year period.

Appendix C presents the trends for each major subclass of derailments for all Class I railroads during 1966-74. As seen from these graphs, derailments due to defects in track, bridges, switches, and signals, or other defects in roadway; derailments due to negligence of employees, and nonclassified derailments all increased significantly.

Table 26.— Derailments by Contributing Cause

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*

SOURCE: Federal Ral Iroad Admlnlstration



Photo: Courtesy of National Transportation Safety Board

Oneonta, N. Y.; Delaware & Hudson; Tank car derailment; February 1974. Equipment failure.

Chapter VI
COST ANALYSIS

Chapter VI
COST ANALYSIS

This chapter investigates the railroad industry expenditures in two areas: accident incident costs and safety prevention costs. Cost data are generally available from four sources, including the Interstate Commerce Commission Uniform System of Accounts, the internal accounting systems of the railroads themselves, the Association of American Railroads, and the Federal Railroad Administration. One of the problems with the Uniform System of Accounts is that it was designed for the purpose of economic (rate) regulation of railroads, and as such, does not contain detailed safety expenditures. The internal accounting systems utilized by the railroads provide detailed costs by activities that aid management in performing the planning and monitoring functions of the railroads. Unfortunately, most of the existing accounting systems yield relatively sparse information concerning railroad safety expenditures. Furthermore, since there is no standard format of internal accounting systems, safety expenditure categories among railroads are not comparable.

RAILROAD INDUSTRY ACCIDENT COSTS

Costs to the railroad industry resulting from accidents present a monetary loss that cannot be retrieved and as such cannot be used to upgrade or improve the industry itself. Therefore, it is in the interest of the railroads to determine the reasons behind these accidents in an effort to minimize accident expenditures while maximizing the railroads' safety and improving the overall financial condition of the industry.

SOURCES OF ACCIDENT COST DATA

The two major sources of railroad accident cost data are the Interstate Commerce Commission (Uniform System of Accounts —USOA) and the Federal Railroad Administration. Each Class I line-haul railroad, Class I switching and terminal railroad, and Class 11 railroad is required to file yearly financial reports with the ICC. These reports are intended to aid the ICC in regulating the railroad industry. A third source of industry accident cost data is the Association of American Railroads. Various member carriers, representing approximately 95 percent of the United States, Canadian, and Mexican mileage, submit accident cost data to the AAR more detailed than those required by the ICC. The fourth source is the internal accounting systems of the various railroads.

The costs to the railroad industry resulting from railroad accidents include three major categories and a total of five specific categories. These include:

- Injuries to persons.
- Loss and damage of property:
  - — Damage to railroad property,
  - — Damage to livestock on right-~of-way,
  - — Loss and damage of freight.
- Clearing wrecks.

These costs are further explained and analyzed in the following sections.

L)

Injuries to Persons

This category includes the costs of injuries to railroad employees and to persons other than railroad employees. These costs include direct claims expense estimates of probable liability, compensation for injuries or death, transportation, legal, and witness fees.

Damage to Railroad Property

Damage to railroad property (including equipment, track, and roadbed only) was reported to the FRA when the damage exceeded $750.

Damage to Livestock on Right-of= Way

All railroads are required to report costs of damage to livestock on right-of-way to the ICC in their annual report. These costs include direct expenses and related employee salaries, expenses, office rent, and probable liability.

Freight Loss and Damage

As with injuries to persons and damage to livestock on right-of-way, railroad companies report freight loss and damage to the ICC. However, the amount of freight loss and damage specifically relating to accidents maybe much less than those costs furnished to the ICC. For example, freight loss and damage costs are also reported to the AAR but divided into various cause categories. 1 These include the following:

Cause category	*Percent of total freight Loss* and *damage, 1976 data*
Shortage, packaged shipment	1.78
Shortage, bulk shipment	**4.07**
All damage not otherwise provided for	**53.24**
Defective or unfit equipment	**3.40**
Temperature failures	**5.06**
Delay	**2.54**
Robbery, theft, pilferage	**5.26**
Concealed damage	**0.69**
Train accident (lading only)	**20.69**
Fire, marine, and catastrophes	**1.76**
Error of employees	**0.94**
Vandalism	**0.64**
	100.00

The percentage of the total, obtained only for 1976, gives an indication of the contribution of each cause to total freight loss and damage. The train accident cause is seemingly the only cause specifically relating to railroad accidents and therefore the only cause cost item which should be included in the category "Freight Loss and Damage" for this analysis. Over the 10 years 1966-75, lading damage resulting from train accidents as a percentage of total freight loss and damage increased from 11.2 percent to 19.4 percent and, as previously shown, increased to **20.69** percent in 1976. Another interesting note is the miscellaneous category —''All Damage Not Otherwise Provided For'' —which represented over 50 percent of the total freight loss and damage in 1976. This miscellaneous category impedes the development of measures for identifying specific causes which could then be analyzed for reducing these types of freight loss and damage costs.

Clearing Wrecks

This last item includes all labor in wrecking service, lading and transferring lading from wrecked cars, building and removing temporary tracks, cost of train service, and other supplies and expenses. These costs are not included in the damage costs reported to FRA in the accident reports.

I Association of American Railroads, Operations and Maintenance Department, Freight Claim and Damage Prevention Division, Chicago, Ill. (Annual Summary).

ACCIDENT COST TRENDS

Table 27 presents a 10-year summary of costs to the railroad industry resulting from railroad accidents for the period 1966-75. This table reveals that total industry accident costs rose approximately 130 percent during this period, as expressed in current-year dollars. Furthermore, as a percentage of operating revenues, total accident costs rose from **2.4** percent to **3.5** percent during this 10-year period. As shown in table **28,** the total accident cost in 1966 expressed in constant 1975 dollars, and based on the consumer price index, was $415.7 million, while in 1975 it was $575.4 million (+ 38.4 percent). While the number of casualties generally decreased, the dollar value of claims resulting from casualties increased, and at a greater rate than that of the increase in costs resulting from total loss and damage to property (45,8-percent increase versus a 21 .4-percent increase). The increase in the aggregate costs of casualty claims reflects the fact that the cost per claim increased at a rate which is greater than the rate of decrease in the number of casualties. Based on data available for this study, it is difficult to determine the reason(s) for this occurrence. Thus, it is recommended that further research be conducted in this area. The increased costs for the other major categories, expressed as the percentage increase or decrease from 1966-75 in constant **1975** dollars, are presented in table 28.

Some concern may be raised about the use of the consumer price index to deflate all of the various cost categories into constant 1975 dollars. Deflating all accident costs with an inaccurate index may lead to more distortions in the data than if the data were left in current-year dollars. For example, the "Damage to Railroad Property" and "Clearing Wrecks" categories were also deflated using two other indices, the AAR index of material prices and wage rates and the FRA reporting threshold index. As indicated in table **28,** expenses incurred by railroad companies for damages to property rose 79.3 percent between 1966-75 in current dollars. Using the AAR index of material prices and wage rates index to adjust the costs of damage to property to 1975 dollars, there is a decrease of 17.3 percent. This compares to an increase of 8.1 percent for damage to railroad property when the consumer price index is used to adjust the costs to 1975 dollars. When the FRA index is used, the costs over the lo-year period for this category show a 15.7-percent increase. Furthermore, no matter what index is used in these calculations, the increase or decrease in costs is not continuous, but fluctuates greatly from 1966-75.

Since the AAR index includes many items which are not directly related to the repair of equipment, track, and roadbed, it is possible that the material prices and wage rates index has overstated price increases for repairs to damaged property, thereby understating expenses incurred by railroads for damages to property. On the other hand, the percentage distribution of 40 percent labor and 60 percent materials used in the development of the FRA threshold index number may have tempered price increases for repairing damages to property. The price of labor rose considerably higher than the price of materials for the 10-year period 1966-75. Since labor prices have been weighted less in the FRA index, this index understates the true price increase for repairing damage to property and thereby overstates expenses incurred by railroad companies in the repair of damage to equipment, track, and roadbed.

Another example of the problems in using various indices for deflating costs is presented with respect to the category "Clearing Wrecks. " Again using the consumer price index to adjust costs to 1975 dollars, table 28 shows that these costs increased 92,1 percent, compared with an increase of 218.6 percent in current dollars. When these costs are adjusted to 1975 dollars using the AAR and FRA indices, the increase in costs is 46.8 percent and 105.5 percent respectively. Again, these costs fluctuated from year to year, as did the costs of damage to railroad property.

Table 27.—Costs to the Railroad Industry From Railroad Accidents, 1966-75
(Current year dollars)

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Injuries to persons[a] (includes casualties and injuries to employees and to persons other than employees)	108,492,202	115,077,3[illegible]4	123,07[illegible]	145,927,369	154,764,738	[illegible]	1[illegible]	2[illegible]	24[illegible]	[illegible]
Loss and damage of property										
Damage to railroad property[b]	98,960,779	96,650,250	114,344,312	129,547,904	121,625,278	109,784,045	107,520,340	49,361,172	87,700,347	177,398,202
Damage to livestock on right-of-way[a]	1,525,072	1,531,166	1,396,076	1,561,802	1,775,979	1,995,000	1,779,000	2,357,000	2,388,000	1,851,000
Loss and damage, freight[c]	18,683,312	21,372,369	25,992,260	32,144,849	36,782,768	35,022,182	32,761,662	38,988,647	55,475,358	60,705,703
Total loss and damage to property	[illegible]	[illegible]	[illegible]4[illegible],732,648	163,254,555	160,184,025	146,801,227	142,061,002	190,706,8[illegible]	[illegible]	[illegible]
Clearing wrecks[a]	22,980,542	25,223,989	30,500,907	36,869,886	41,035,214	38,4[illegible]7,000	40,664,000	61,747,000	78,305,000	73,206,000
Grand total	250,641,907	259,855,033	295,305,305	346,051,8[illegible]0	355,988,97[illegible]	350,582,227	358,931,002	463,273,8[illegible]9	565,640,105	575,400,905
Operating revenues (000's)	10,654,666	10,366,041	0,854,678	1[illegible]	[illegible],991,658	12,689,0[illegible]	[illegible]	[illegible]770,081	16,922,841	16,401,860
Percentage of operating revenues	2.4	2.5	2.7	3.0	3.0	2.8	2.7	3.1	3.3	3.5

[a]Interstate Commerce Commission, *Transport Statistics in the United States, Railroad Companies, 1966-76.*
[b]Federal Railroad Administration, *Accident Bulletin, Summary and Analysis of Accidents on Railroads in the United States,* 1966-75.
[c]Association of American Railroads, Annual Summary of Freight Loss and Damage.

Table 28.—Railroad Accident Cost
(Dollars in millions)

Accident cause category	1966 Current $	1966 1975$	1975 1975$	Percent change Current $	Percent change 1975$
Injuries to persons.	$108.5	$179.9	$262.2	+ 41.7	+ 45.8
Total loss and damage of property .	119.2	197.6	240.0	+ 101.4	+ 21.4
Damage to railroad property.	(99.0)	(164.1)	(177.4)	+ 79.3	+ 8.1
Damage to livestock	(1 .5)	(2.5)	(1.9)	+ 21.4	-26.8
Freight loss and damage	(18.7)	(31 .0)	(60.7)	+ 224.9	+ 95.9
Clearing wrecks.	23.0	38.1	73.2	+ 218.6	+ 92.1
Grand total	250.6	415.7	575.4	+ 129.6	+ 38.4
Operating revenues.	10,654.7		16,401.9		

SOURCE: Compiled by OTA from Federal Railroad Administration, Association of American Railroads, and Interstate Commerce Commission data.

The applicability of the AAR indices to adjust the costs of clearing wrecks to 1975 dollars may be suspect in view of the fact that many railroad companies hire outside contractors to perform this service. As such, changes in the level of railroad wage rates may not reflect changes in actual labor costs of clearing wrecks. In spite of this fact, the actual cost of clearing wrecks appears to have risen between 1965 and 1975. This may be the result of an increase in certain types of accidents and/or increased labor costs.

Although there has been discussion about the usage of various cost indices in adjusting costs, to put the total railroad accident costs in perspective, the consumer price index was used to adjust the various costs to constant **1975 dollars.**

Table 29 presents the breakdown of various railroad accident costs (previously shown in table **27)** as a percentage of total railroad accident costs by year. As seen, the cost of injuries to persons averaged approximately 45 percent of total railroad accident costs, with a high of 49.1 percent in 1972 and a low of 41.7 percent in **1968.** The "Total Loss and Damage to Property" category has also been approximately 45 percent of total railroad accident costs, ranging from a low of **39.6** percent in 1972 to a high of 48.0 percent in 1968. The cost of clearing wrecks rose gradually from 9.2 percent in 1966 to 13.8 percent in 1974 and then fell to 12.7 percent in **1975.**

Table 29.—Percentage of Total Railroad Accident Costs

	1966	1967	1968	1969	1970	1971	**1972**	**1973**	1974	1975
Injuries to persons.	43.3	44.3	41.7	42.2	43.5	47.2	49.1	45.4	42.7	45.6
Total loss and damage to property	**47.5**	**46.0**	**48.0**	**47.2**	**45.0**	**41.9**	**39.6**	**41.1**	**43.4**	**41.7**
Damage to railroad property	**(39.5)**	**(37.2)**	**(38.7)**	**(37.4)**	**(34.2)**	**(31.3)**	**(30.0)**	**(32.2)**	**(33.2)**	**(30.8)**
Damage to livestock	**(0.5)**	**(0.6)**	(0.5)	(0.5)	(0.5)	(0.6)	(O.5)	(o.5)	(o.4)	(o.3)
Freight loss and damage .	(7.5)	(8.2)	(8.8)	(9.3)	(9.1)	(10.0)	(9.1)	*(8.4)*	*(943)*	*(10.6)*
Clearing wrecks.	9.2	9.7	10.3	10.7	11.5	11.0	11.3	13.3	13.8	12.7
Grand total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Compiled by OTA from Federal Railroad Administration, Association of American Railroads, and Interstate Commerce Commission data.

RAILROAD INDUSTRY PREVENTIVE COSTS

For the purpose of determining railroad industry expenditures in the areas of safety prevention, the available database includes the Interstate Commerce Commission Uniform System of Accounts and individual railroad internal accounting systems. The Uniform System of Accounts was designed for the purpose of economic (rate) regulation of railroads and, as such, does not contain detailed safety expenditures.

Internal accounting systems utilized by railroads provide detailed costs by activities that aid management in performing the planning and control functions. Examination of internal accounting systems is a most effective way of identifying the level of industry expenditures in the accident/incident and safety area. However, one of the problems encountered in examining various railroad internal accounting systems is that only those safety expenditures that are directly attributable to each railroad's safety functions can be identified. This occurs because a large portion of safety costs are common costs. The common cost problem occurs whenever multiple outputs result from a set of inputs. When this is the case, all of the inputs contribute, in common, to the production of all of the outputs, and there is no way of uniquely assigning an increment of inputs to an increment in a particular output. Alternatively, reducing the level of a particular output, say safety, will not reduce the input requirements and, therefore, the costs. For example, signal systems contribute both to safety and to operational efficiency, and it is not possible to logically allocate a portion of signal costs to each of these functions.

Another problem associated with identifying safety expenditures is the lack of standard accounting systems. Even in instances where railroads have responsibility accounting systems, the basic structure of the system and the particular chart of accounts may not be sufficiently comparable to permit a detailed and comprehensive analysis of safety expenditures. Since some of the railroad responsibility accounting systems are based on a functional organization of accounts, while others are based on an objective organization, this difference in organization severely limits the comparability of the accounts. Although all railroads are required to maintain a specific set of accounts for purposes of reporting to the ICC, these accounts yield very little information about railroad safety expenditures.

Thus, the total cost of railroad safety programs cannot be identified because:

- The uniform system of accounts does not isolate safety program costs.
- Even though some railroads have internal accounting systems that identify such costs, these systems are not comparable from railroad to railroad.
- Because a significant portion of safety prevention costs are common costs, they cannot be identified. Furthermore, these costs could not be identified, even if an appropriate accounting system were available, without arbitrarily allocating such costs among safety and other operating purposes.

Chapter VII

SAFETY LAWS AND REGULATIONS

Chapter VII
SAFETY LAWS AND REGULATIONS

PURPOSE OF CHAPTER

This chapter describes briefly and generally the structure of the Federal laws and regulations relating to railroad safety and analyzes that structure to determine its strengths and weaknesses in terms of its affect on rail safety. In particular, this chapter indicates the extent to which gaps or overlaps exist in necessary rail safety powers, and the impact of the rulemaking process upon the substance and effectiveness of the rules produced by that process.

STRUCTURE OF FEDERAL RAILROAD SAFETY LAWS

Chapter IV describes the evolution of Federal railroad safety laws from those addressing specific problems with specific solutions to laws covering all areas of railroad safety and providing broad regulatory and administrative powers to deal with the safety problems of those areas. The structure provided by these laws for executing safety programs is built primarily on the power to regulate activities or conditions affecting safety, with concomitant powers to conduct inspections to ascertain whether the laws and regulations are being complied with, and to enforce compliance by means of assessing monetary penalties or taking other legal action. These powers are the centerpiece of the Federal Railroad Safety Act (FRSA) of 1970 (45 U.S. C. ~421 et seq.), as well as of many of the early safety laws.

Supplementing the regulatory, inspection and enforcement powers are powers to collect accident information, inspect railroad accidents, conduct research and development, and conduct testing, evaluation, and training. Under the early safety laws, these supplementary powers were typically not granted, although the Interstate Commerce Commission could exercise some of these powers from other authority provided under the Interstate Commerce Act (see sections 12 and 20). The FRSA remedied this situation by providing all of the administrative powers necessary to carry out comprehensive rail safety programs (45 U.S. C. 437). Similarly, the Hazardous Material Transportation (Haz Mat) Act (49 U.S. C. $1801 et seq.) provided the Secretary with such powers in support of the regulatory program with respect to the transportation of hazardous materials.

The early safety laws applied only to "common carriers" as that term is used in the Interstate Commerce Act. This, of course, was to be expected since that Act had established the scope of the Government's regulation of rail transportation. However, this limitation excludes application of these laws to railroad systems that are not involved in interstate commerce, such as industrial railroads, rapid transit systems, and commuter railroads. The FRSA provides authority of broader application since it reaches "all areas of railroad safety" (4s U.S. C. $431(a)). The legislative history of the FRSA indicates that it was intended to encompass not only "common carriers" but also every other means of rail transportation (House Rept. No. 91-1194, p. 16), although recent litigation has cast some doubt about the applicability of the FRSA to rapid transit (see *Chicago Transit Authority v. Flohr et al,,* 7th Cir., No. 77-1137, Dec. 16, 1977, pet. for rehearing pending). Similarly, recent legislation concerning transportation of hazardous materials has expanded the applicability of Federal laws on that area to cover not only ship-

pers and carriers of hazardous materials, but also manufacturers of the containers and packages in which such materials are transported (49 U.S.C. ~1804(a)).

The next section addresses the extent to which there are gaps or overlaps either in the placement of rail safety authority or in type of authority conferred. It indicates situations where two agencies are each attempting to exercise certain powers with respect to the same subject matter area, as well as situations where no agency exercises a particular necessary power, or an agency's power is not sufficiently broad to accomplish the intended objective.

PLACEMENT OF AUTHORITY

Three areas have been identified as being the subject of concurrent powers: accident investigations, hazardous materials regulation, and occupational safety and health. In all other areas of rail safety, the FRA has exclusive jurisdiction, although States are permitted to participate in a limited aspect of the exercise of that jurisdiction (see chapter VIII).

Accident Investigations

Historically, the ICC had the power under the Accident Reports Act to "investigate all collisions, derailments, or other accidents resulting in serious injury to persons or to the property of a railroad . . . and to make reports of such investigations, stating the cause of the accident, together with such recommendations as it deems proper" (45 U.S. C. 40). In 1966, the power to determine the cause or probable cause of railroad accidents was transferred to the National Transportation Safety Board (NTSB) by section 5 of the Department of Transportation Act. All other powers under the Accident Reports Act were vested through the Secretary of Transportation or the Federal Railroad Administration. Section 5 was repealed in 1975, when NTSB was made an independent agency, and it retained the power to make the probable cause determination for all transportation accidents.

In addition to its limited powers under the Accident Reports Act, FRA has as part of its general administrative powers, under the FRSA, the power to conduct investigations. However, the same section (45 U.S. C. 437) grants to NTSB the authority "to determine the cause or probable cause and report the facts, conditions and circumstances relating to accidents investigated . . ." by FRA, which authority can be delegated to any office in DOT with the approval of the Secretary.

The NTSB is required by its own enabling act to investigate and determine the "facts, conditions and circumstances and the cause or probable cause or causes of any . . . railroad accident in which there is a fatality, substantial property damage, or which involves a passenger train. . ." (49 U.S.C. 1903 (a)(l)(C)). While there is some difference between the kinds of accidents NTSB is required by its statute to investigate and the kinds of accidents it is authorized by rail safety laws to investigate, it has the exclusive power to determine the cause or probable cause of the accident. FRA, on the other hand, has residual investigatory powers permitting it to investigate for its own purposes, or at NTSB'S direction.

The rationale for establishing NTSB to carry out the investigation function was that there should be vigorous investigation of accidents in all modes of transportation, and continual analysis of the regulations and programs of the agencies charged with safety responsibility (49 U.S.C. 1901). The primary objectives of an NTSB accident investigation were to obtain an independent determination of the cause or probable cause of an accident and to make recommendations as to how similar accidents can be prevented (49 U.S. C. 1903 (a)). Even though the

safety agency for the mode in question (FRA for a railroad accident) might also investigate the accident, such an investigation would be for a different purpose, such as determining whether its rules had been violated. That agency may be unable to render an objective assessment of the causes and conditions surrounding the accident to the extent that such causes and conditions might reflect unfavorably upon the policies and personnel of that agency.

Thus, though there is an overlap in power to investigate railroad accidents between FRA and NTSB, NTSB plays a singular role. It's purposes are to provide unbiased reports of what happened and why with respect to railroad accidents and to provide objective analysis of how to reduce the likelihood of recurrence of transportation accidents and to make the transportation of persons as safe and free from risk of injury as possible, However, in carrying out such a charge, there is the risk that, by reason of a somewhat myopic focus on safety, its reports and recommendations will fail to recognize or provide the means to evaluate the tradeoffs inherent in safety choices. For example, its recommendation might encompass solutions to safety problems that have costs grossly in excess of the benefits to be derived. Such a failure would offset one of the major benefits of its existence—to provide views that are unencumbered by a constituency or program bias as to the most cost-effective actions that can be taken to improve rail safety.

Hazardous Materials Regulation

There are two basic statutes concerning the transportation of hazardous materials. The first, an outgrowth of a 1908 law amended most recently in 1960, is essentially a criminal statute prohibiting transportation of certain hazardous materials except in accordance with DOT regulations. The second was the Haz Mat Act, which substantially expanded the powers with respect to transportation of those materials. This Act also placed all of the responsibilities and duties concerning transportation of hazardous materials with the Secretary. However, it does require the Secretary to consult with the ICC before issuing any regulation as to the routing of hazardous materials.

In delegating these powers and duties, the Secretary has made an important distinction. Everything under these laws with respect to railroads which pertains to investigations, records, inspections, penalties and specific relief, and consultation with the ICC is to be carried out by FRA (49 CFR 1.49 (f), (s) and (t)); everything else (primarily establishing policy and issuing all hazardous materials regulations, exemptions, and registration certificates) is to be carried out by the Materials Transportation Bureau (MTB) (49 CFR 1.53 (e) and (g)), which is performing the same function for other modes. The reasons for this division are that it maximizes the likelihood that there will be parallel treatment of the handling and transportation of hazardous materials among all modes. In addition, it minimizes the duplication of staff functions and applies particular modal experience where it is most needed. Thus, an FRA inspector who is very familiar with railroads and their equipment would be most capable of carrying out the hazardous materials inspections or investigations. On the other hand, there is also opportunity for conflict where the specific expertise of hazardous materials does not concur with the specific expertise of railroads, and such conflicts, to the extent they might occur, would do so in the development of particular railroad regulations concerning hazardous materials.

Occupational Safety and Health

The FRSA and the Occupational Safety and Health (OSH) Act of 1970 (29 U.S. C. 651 et seq.) were each considered and adopted by Congress at about the same time, but originated in separate committees. While the potential conflict of these two statutes as applied to the rail industry was obvious, there is very [ittle legislative history as to how Congress envisioned this conflict being resolved. What little legislative history there is points to the following allocation: the Occupational Safety and

Health Administration (OSHA) of the Department of Labor would be responsible for (a) all aspects of health regulation in the rail industry and (b) those aspects of safety regulation which do not relate to rail operations. FRA would be responsible for those areas of safety which do relate to or involve railroad operations.

The conclusion with respect to health arises primarily from (1) the fact that neither health nor safety, though not mutually exclusive terms, can reasonably be read to include the other, and (2) the fact that Congress, being aware of this distinction in this context, did not seek to add health to FRA's jurisdiction. (See text of S. 3061 and H.R. 14417 of 91st Congress, bills considered contemporaneously with the bill that ultimately became the FRSA, which specifically excepted "occupational safety and health of employees not engaged in railroad operations" from FRA's jurisdiction; and hearings before the Subcommittee on Transportation and Aeronautics of the House Committee on Interstate and Foreign Commerce on H.R. 7068, 14417 and H.R. 14478, 91st Cong., 2nd Sess., p. 37.) The conclusion with respect to safety and the distinction between "occupational safety" and "all areas of railroad safety" arises from a discussion in the Senate Committee Report accompanying S. 1933, the Senate version of the FRSA concerning the term "railroad operations:"

> Within an individual railroad company or corporate structure the bill is intended to have application to those matters *reasonably related to the safe movement and operation of rail equipment.* Matters not peculiar to the basic purpose of a railroad company (i.e. providing transportation by rail) are not intended to be considered as an area of railroad safety. For example, the safe operation of a lathe while it could be relevant to railroad safety is primarily a matter common to the lathe operation both inside and outside of the railroad industry" (S. Rep. No. 91-619, p. 6). (Italics added.)

Thus, there appears to be an intended limitation upon the scope of FRA's jurisdiction that is not inconsistent with the scope of the jurisdiction granted to OSHA.

It must be emphasized, however, that there is very little legislative history concerning the scope of the FRSA with respect to occupational health and safety, which makes conclusions concerning congressional intent somewhat tenuous. Moreover, none of the court decisions concerning the OSH Act as applied to the rail industry have decided the issue of whether FRA had the statutory authority to regulate occupational health and safety, although that issue has never been raised in a manner that required the court to decide it.

The OSH Act, on the other hand, is devoid of any history relating specifically to the railroad industry. However, it does have a provision which is designed to avoid jurisdictional gaps or overlaps:

> Nothing in this chapter (OSH Act) shall apply to working conditions of employees with respect to which other Federal agencies . . , exercise statutory authority to prescribe or enforce standards or regulations affecting occupational safety or health **(29** U.S. C. **653** (b) (l)).

The railroads have contended, in cases challenging OSHA'S authority to inspect or enforce its regulations concerning railroad working conditions, that this provision constitutes an industry-wide exemption because FRA does exercise such authority. Each appellate court that has considered this issue has rejected the railroads' contention and held that OSHA has jurisdiction to enforce its regulations as to employee working conditions not covered by an FRA rule. *(Bait. & Ohio RR. Co. v. Occupational Safety and Health Review Commission, et al,, 548* F.2d 1052 (D. C. Cir., 1976); *Southern Pacific Transportation Co. v. Usery, et al.,* 539 F.2d 386 (5th Cir, 1976); *Southern Railway Co. v. Occupational Safety and Health Review Commission, et al., 539* F.2d 335 (4th Cir., 1976).

In each of these cases, there was not any FRA rule on the subject matter of the particular violation at issue. Thus, the question of the extent of FRA's authority will not likely be decided until FRA issues a rule with respect to occupational safety and health and a violation of either

that rule or the corresponding OSHA rule is challenged in court. In March 1975, FRA embarked on the rulemaking process in this area with an advance notice of proposed rulemaking (40 F.R. 10693), and took the second step of issuing a proposed rule on July 15, 1976 (41 FR 29155). This proceeding was cancelled on March 14, 1978 (Federal Register, Volume 43, Number 50, p. 10583).

Shortly after the OSH Act and FRSA were passed, OSHA and FRA attempted to reach some agreement as to their mutual jurisdiction and the best procedure for exercising their particular responsibilities. A very limited Memorandum of Understanding was entered into on May 16, 1972, but that letter agreement was rescinded unilaterally by OSHA on December 23, 1974. Since then, the two agencies have worked on a broader "umbrella" agreement but without any success. On August 5, 1977, in a letter to the Chairman of the Safety Committee of the Railway Labor Executives Association, Secretary Adams endorsed a statement of policy prepared by RLEA to the effect that: (1) FRA would be responsible for administration and enforcement of all existing railroad safety laws and regulations; (2) OSHA would be responsible for all health conditions of railroad employment, including among other things such conditions arising in shops and maintenance and repair facilities; and (3) OSHA would cover all safety conditions not covered by FRA under (1) above. In taking this position, the Secretary is clearly receding from regulation of occupational health in the rail industry. However, this statement does not answer the other critical issues as to how far FRA's jurisdiction can extend with respect to safety, and how far the Secretary intends FRA to exercise that jurisdiction. Finally, assuming any type of shared jursidiction, what reporting requirements should reasonably be placed upon railroads by the two agencies?

Thus, notwithstanding an attempt to avoid jurisdictional gaps and overlaps in regulation of occupational safety and health, there clearly has been such a gap with respect to administration of those regulations for railroad employees. This gap has been created in part by the railroads' efforts in contesting OSHA'S jurisdiction (according to OSHA, over the last 4 years almost 40 percent of all OSHA inspections of railroads have been contested and only 11 percent of the fines levied have been collected), in part by what appears to be the low attention given by OSHA to railroad safety, and in part by failure of FRA to assert any jurisdiction in this area. On the other hand, how serious this gap is in terms of employee safety is not known precisely. Available statistics for the 1966-74 period simply do not indicate whether or to what extent the railroad workplace has excessive occupational safety and health hazards, although a substantial portion of the employee casualties appear to have occurred outside of the rail operating environment, indicating that such hazards do exist.

TYPES OF AUTHORITY CONFERRED

The second perspective from which to determine whether there are gaps or overlaps in the railroad safety laws is gained by comparing the scope and effectiveness of each major type of authority conferred—regulatory, research and development, investigatory (including reporting), enforcement, and other types of authority.

Regulatory

As discussed above, the early safety laws granted very specific regulatory authority, whereas the later laws (mainly the FRSA) grant broad regulatory authority. However, the appreach to such a grant of authority differed

among the early laws. In several instances, they require that the regulations simply be the rules of each railroad as modified by the Secretary, rather than a uniform rule originated by the Secretary. (See Locomotive Inspection Act, 45 U.S.C. 28, concerning rules for inspection of boilers, and Signal Inspection law, 49 U.S.C. 25 (c), concerning rules for installation, inspection, maintenance and repair of signal systems and related devices.) In the case of power brakes, the 1958 amendment to the Safety Appliances Act required the Secretary to adopt the rules of the Association of American Railroads for the installation, inspection, maintenance and repair of power or train brakes, and permits amendment "solely for the purpose of achieving safety" (45 U.S. C. 9).

The Locomotive Inspection Act and Signal Inspection law do not present a problem since, even if the FRA is limited in its authority under that law, its authority under the FRSA can cover any gap. However, the limitation on rulemaking with respect to power or train brakes is more troubling. The problem is basically one of vagueness—that is, how does one determine whether a change in those rules is solely for the purpose of achieving safety. In 1971, the United Transportation Union challenged a change in those rules that it felt would reduce safety and, in any event, had as its primary purpose the reduction of the costs of power brake inspections under certain circumstances. The court upheld the rule on the basis of the FRA hearing examiner's finding that it would increase safety, and rejected the contention that the original purpose for the change had any legal effect on the rule. *(United Transportation Union, et al,, v. U. S., et al.,* 337 F. Supp. 410, aff'd 406 U.S. 964 (1972).

While the Government's view of the effect of the rule in that case was upheld, it leaves open and subject to question a considerable area of potential rulemaking. For example, the statutory language and the UTU case would appear to prohibit modifications to the rules for the sake of clarity, removing obsolescence, or adjusting to technological change where the modification did not affect safety per se. Moreover, this standard for rule modification seems to have generated sufficient controversy at least to inhibit the rulemaking process, thereby tending to preserve the status quo. Finally, the use of the term "achieving" is not helpful. The ICC originally interpreted it to permit a modification so long as safety was not lessened, and FRA adopted this same position in September 1968. Others, particularly representatives of rail labor, view this as requiring that the rule modification have a beneficial impact on safety.

It is not clear why Congress singled out the rules for power brakes, among all railroad safety rules, for this unique treatment. At the least, this provision has not contributed, and probably has inhibited, the speed with which such rules are changed to meet changes in industry practice or technology.

In contrast to the early safety laws, the FRSA grants broad rulemaking power in "all areas of railroad safety, " which power is to supplement that of the earlier laws (45 U.S.C. 431. (a)). Thus, to the extent that there were any gaps, whether by reason of applicability or substance, the FRSA was the vehicle to fill these gaps. Indeed, that was its main purpose, particularly in regard to three subject matter areas—track standards, freight car standards, and human factors (e.g. operating rules). Likewise, in the more limited area of transportation of hazardous materials, the grant of regulatory authority has been broadened substantially from the earlier 1908 and 1960 laws by the Haz Mat Act.

However, one gap still remains and that is with respect to regulation of employees' hours of service. While power to so regulate exists under the FRSA, it would not encompass issuing regulations to deal with the problems presented by the Hours of Service Act. That Act provides regulatory power to FRA only for the very limited purpose of determining under what circumstances employee sleeping quarters would be located "within or in the immediate vicinity" of humping or switching operations. It does not even provide the power to require reports or recordkeeping, although FRA has issued such

rules (49 CFR, part 228) on the strength of other authority.

In order to make up for this gap, FRA has issued its "Statement of Agency Policy and Interpretation" of the Hours of Service Act in the form of an appendix to part 228 of Title 49 of the CFR (42 FR 27594; May 31, 1977). Its stated objectives are to: (1) explain FRA's views on the 1976 amendments to the Act, (2) provide notice of FRA's views on issues of construction and interpretation, and (3) provide an educational tool for those subject to the Act. An unstated objective was to give its views as much force of law as possible, which in part accounts for the public process FRA used in promulgating this statement and the fact that it is to be published in the CFR. It's success in this regard will not be known until a violation of its interpretation is contested in court. Courts typically give considerable deference to the views of an agency charged with administering or enforcing a statute, but the possibility of such deference is certainly not equivalent to a regulation in terms of its legal effect. Even if FRA's interpretations have their intended effect, regulatory authority might still be preferable in order to solve the many nitty-gritty fact questions that arise in regard to the Hours of Service Act, and might thereby lessen the considerable amount of litigation that this Act has spawned since 1969.

Inspections and Investigations

The power to inspect railroad properties and to investigate the causes of accidents or complaints is, at least in theory, crucial to obtaining full compliance with rail safety laws, regulations, and orders. Initially, Congress did not grant the ICC sufficient powers to carry out these functions. However, in a series of safety laws beginning in 1908, it extended all of the ICC's investigatory, inspection, and enforcement powers to the rail safety laws (see Ash Pan Act, 45 U.S. C. 19; Safety Appliance Acts, 45 U.S. C. 15; Explosives and Other Dangerous Articles Act, 18 U.S. C. 835 (b); Accident Reports Act, 4.5 U.S. C. 40; and Signal Inspection law, 49 U.S. C. 26 (d) and (g)). In the Locomotive Inspection Act and Signal Inspection law, Congress took a somewhat different approach of requiring the carrier to do its own inspections of locomotives and signal systems, in accordance with its rules as modified and approved by the FRA. In the case of the locomotives, Congress established a specific office in the ICC to conduct these inspections. Thus, for these two laws the inspection system is two-tiered—first the carrier conducting inspections and then the FRA checking the carrier's inspection records and conducting its own spot inspections.

Section 9 of the Safety Appliances Act (45 U.S. C. 9), the power brake provision was amended in 1958 to have the ICC adopt as its rules the AAR rules for maintenance, inspection, and testing of power or train brakes. This amendment was adopted specifically because the ICC lacked the power to prescribe such rules to assure compliance. However, these rules do not have any recordkeeping requirements (such requirements would probably be impractical in this context), and the FRA enforces primarily through unobtrusive spot checking and investigation of complaints.

While the power granted under some of these laws is rather limited, the investigative power granted in the Accident Reports Act covers "all . . . accidents resulting in serious injury to persons or to the property of a railroad . . . ." (45 U.S. C. **40).** Similarly, the Explosives and Other Dangerous Articles law permits the Secretary to conduct investigations as he deems necessary or proper to the exercise of this authority under that law. Thus, even though among the early safety laws there is rather uneven distribution of the power to conduct investigations, the Accident Reports Act and the Explosives and Other Dangerous Articles law provide broad investigatory powers, together with the power to issue subpoenas, administer oaths, require the production of documents and take testimony. However, the investigatory power under the Accident Reports Act does not reach accidents which do not cause serious injury to a person or the property of a railroad, but do cause such injury to the property other than that of a railroad, such as lading or abutting property.

The more recent rail safety laws have also provided broad inspection and investigation powers (FRSA, 4s U.S.C. 431 (a) and (c)), Hazardous Materials Transportation Act (49 U.S. C. 1808 (a) and (c)). In addition, as discussed above, a separate agency— NTSB—has been established primarily for the purpose of conducting investigations of transportation accidents, and in particular must investigate any railroad accident in which there is a fatality, "substantial" property damage, or which involves a passenger train. Thus, with the addition of these laws, taking all of the rail safety laws as a whole, there does not now exist any important deficiency in the power to conduct investigations, although there are differences among the various laws in the scope of the power or duty granted in this regard.

Enforcement *

Three types of enforcement mechanisms are employed by the various rail safety laws: (1) the civil fine; (2) a criminal penalty of a fine or imprisonment or both; and (3) a judicially enforceable administrative order or equitable relief (see table 30). The first type is fairly uniform over all the safety laws, which is a monetary civil fine of $250 to $2,500 per violation (up to $10,000 for OSH Act and Haz Mat Act violations), depending on the seriousness of the violation. This enforcement mechanism is by far the most likely to be used for violation of a safety law, order, or rule, and is also the easiest to impose and enforce. This is because the fine is typically small in size, thus not worth much fight, and can be collected directly by FRA without litigation as a result of the Federal Claims Collection Act (FCCA) of 1966 (31 U.S. C. 951 et seq.). The FCCA, which permits enforcing agencies to compromise and collect their penalties up to $20,000 per violation, is designed to relieve the courts and the Justice Department of the burden that would be imposed if enforcing agencies could not settle their claims.

There is no limitation in the FCCA as to the minimum amount to which a penalty may be compromised. However, as indicated in table 30, Congress has established such a minimum for four safety laws in order to obtain "strict enforcement" of the penalty provisions of those laws. This will result in a higher minimum collection per penalty, although it may not affect the overall enforcement of the laws. This is because in seeking collection without litigation, FRA would still need to compromise at an aggregate settlement figure that, as a percentage of the total amount claimed, provides sufficient inducement to the railroads not to litigate. Previously this has been approximately 7s percent and it is not clear whether that percentage will change as a result of the minimum compromise base.

As to the second type of enforcement mechanisms, criminal penalties, only those relating to hazardous materials have any viability. The authority to collect a civil fine in lieu of a criminal penalty for violation of the Accident Reports Act was added in 1974 precisely because it was almost impossible to get a conviction under that Act due to its trivial nature in comparison to the other matters presented to the Justice Department and the courts. The criminal penalty under the Hours of Service Act relates to only a single noncontroversial requirement and has never been used. The two hazardous materials laws each have criminal penalties that are substantially higher than any of the civil penalties and these are viable and have been used, although there does not appear to have ever been a prison sentence because, among other reasons, only companies and not individuals have been prosecuted, On the other hand, it must be emphasized that criminal prosecution is substantially more difficult to complete successfully than a civil penalty for at least three reasons:

1. If the offense is not egregious (e.g. did not result in a death or serious injury), it is difficult to get the Justice Department (particularly the U.S. Attorney's Office) to

*In the lexicon of railroad safety, the process of enforcement begins at the point inspection and investigation leave off—the finding of a violation.

Table 30.—Enforcement Powers

Law	Civil penalty	Criminal penalty	Other
FRSA	$250-$2,500'	**None**	**Emergency order, injunctive relief, compliance order**
Safety Appliances Acts	$250-$2,500" *	None	None
Locomotive Inspection	$250-$2,500	None	Order out of service (applicable only to boilers)
Accident Reports Acts	$250-$2,500	*$100*	None
Ash Pan Act	$200	None	None
Signal Inspection law	$250-$2,500' •	None	None
Hours of Service	$500	$100-$1 *,000;* **up** to 1 year in prison or both	None
Hazardous Materials Transportation Act	upto$10,000	UP to $25,000; up to 5 years in prison or both	**Equitable relief**
Explosives and Other Dangerous Art icles	None	up to $1 ,000; or 1 year in prison or both ($10,000 and 10 years if death occurs)	None
OSH Act	up to $10,000	up to $20,000 or 1 year in prison or both	Abatement, notice in lieu of citation

● Cannot be compromised below $250 (45 U. SC. 438 (c))
•● Cannot be compromised below $250 (31 U.S.C. 952 note)

give it much attention, given its other workload;

2. The same is true for the court; and
3. Even if the case is brought to trial, the case must be proved "beyond a reasonable doubt" rather than by the "preponderance of the evidence. "

The third type of enforcement, the judicial or administrative order directing certain action, is probably the least used. This power is set forth primarily in the FRSA (equitable relief is available under the Haz Mat Act and there is some order authority under the Locomotive *in*-spection Act) where it takes three forms:

1. The emergency order issued b$_y$ FRA under which a facility or piece of equipment is ordered out of service because it is in an unsafe condition and thereby creates an emergency involving a hazard of death or injury (45 U.S. C. 432);
2. A court order enjoining actions in violation of the FRSA or enforcing rules or orders issued under the FRSA (45 U. S.C. 439); and
3. An order by FRA directing compliance with the FRSA or the rules or orders issued thereunder (45 U.S. C. 437),

This type of enforcement is generally not availab-le for use in obtaining compliance with the early safety laws.

The power to issue orders directing compliance was added in 1974 because previously the FRA could only fine or seek injunctive relief where a carrier was continually violating a law

or rule, unless the violation met the test for an emergency order. If it sought injunctive relief, FRA would have to go through a full judicial process before the relief requested would become mandatory. More importantly, it leaves to the court the determination of the exact relief that would be granted. If FRA issues an order directing compliance, it has control of the terms of that order. If the railroad does not comply, FRA can seek court enforcement, in which case the court simply reviews whether there was a reasonable basis for FRA's order. From FRA's viewpoint, that is a much more favorable procedure than seeking injunctive relief.

Notwithstanding the effectiveness of the emergency order and compliance order mechanisms, these powers have been used very sparingly. Since 1970, only six emergency orders and no orders directing compliance have been issued. This may be due either to the fact that the conditions warranting such enforcement have not occurred with greater frequency, or that FRA has been overly cautious in invoking such authority. Certainly the emergency order by its own terms should be used only where an "emergency" exists, which is likely to be infrequent. However, there is no such limitation for orders directing compliance and there is no apparent reason to indicate why this power has not been used, particularly in cases where a substantial number of violations of a law or regulation have been incurred by a single carrier.

In sum, there does not appear to be any lack of or gap in enforcement authority under the FRSA, but some of that authority may not be employed with sufficient frequency. On the other hand, the early safety laws lack the third type of enforcement authority discussed above and such authority would be useful in enforcing those laws for the same reasons as are discussed above for the FRSA.

Reporting and Recordkeeping

Among the older safety laws, the Accident Reports Act contains the primary authority with respect to reports and recordkeeping. The Hours of Service Act, Ash Pan Act, and Safety Appliances Act have no such powers or requirements, and the Block Signal law is obsolete. The Locomotive Inspection Act and Signal Inspection law have similar provisions requiring the reporting of locomotive boiler and signal system failures respectively (45 U.S. C. 32, 49 U.S. C. 26 (f)), although in the former, the failure must be reported only if it results in an accident causing serious injury or death.

The Accident Reports Act, as the name suggests, requires carriers to report monthly to FRA all accidents resulting in death or injury to persons or in damage to equipment or roadbed. An accident causing damage only to nonrailroad property does not have to be reported under this Act. The report must indicate the nature, cause, and circumstances of the accident.

The FRSA and the Haz Mat Act provide general powers that permit FRA and the Secretary to require such reports or other information as are deemed necessary to carry out those laws (45 U.S.C. 437 (a), 49 U.S.C. 1808 (a) and (b)). FRA has combined its authority under the FRSA with that of the Accident Reports Act to obtain the information in such form and at such times as it needs (49 CFR 225). NTSB also has authority to require the production of reports and other written information by Government agencies and persons engaged in commercial transportation "with respect to any matter pertinent to transportation safety" (49 U.S.C. 1903 (b) (9)). It should be noted that unlike FRA and the Secretary, NTSB is limited as to whom it can require to produce these reports, though it could itself go out and get any necessary information from anyone.

As for reports by Government agencies, FRA is required to submit an annual report on railroad safety to Congress (45 U.S. C. 440). It also is to receive from each State participating in rail safety activities under the FRSA an annual report, as part of the State's annual certification, on the rail accidents in that State and the activities of the State in its participation in rail safety under the FRSA.

Likewise, the Secretary must give Congress an annual report on hazardous materials transportation (49 U.S. C. 1808 (e)). NTSB must give Congress an annual report containing certain specific safety information (49 U.S. C. 1904) and, in addition, must issue "periodic" reports "recommending and advocating meaningful responses to reduce . . . accidents . . . and proposing corrective steps . . ." (18 U.S. C. 1903 (a) (3)). NTSB also must issue a public report on the facts, conditions, and circumstances of each accident it investigates (18 U.S. C. 1903 (a) (2)).

All of this reporting when aggregated constitutes a considerable volume of reports issued each year. This does not include the special reports and studies that Congress requests from time to time. Since all of these requirements were built up over the years, it may be worth examining the extent to which this volume can be reduced without loss of significant information.

Other Authority

As was stated above, the early laws dealt quite specifically with the particular aspect of safety to which the law was addressed, and did not provide broader supplementary powers. To the extent those powers were necessary, they were found in the Interstate Commerce Act (see 49 U.S. C. 12 and 20). However, the ICC did not engage in activities other than those specifically described in that Act. The FRA inherited this same authority.

The FRSA was the first broad grant of authority and provides all administrative powers necessary to carry out the purposes of the Act. The Secretary is specifically authorized to conduct research, development, testing, evaluation, and training (45 U.S. C. 437 (a)). In 1974, as a result of what Congress felt was an overemphasis placed on research and development at the expense of investigation and enforcement, it limited the amount that could be spent from 1975 appropriations for research and development to the amount spent for investigation and enforcement. In 1976, Congress amended the DOT Act to require FRA to have not less than eight regional safety offices. Both of these amendments indicate the willingness of Congress to legislate limitations on FRA's general administrative powers, if in its oversight Congress feels these powers are not being used effectively.

The FRSA also directs the Secretary to undertake a "coordinated effort" to develop and implement solutions to the "grade-crossing problem''(45 U.S. C. 433 (b)). It was felt that in so directing the Secretary, greater attention would be given to grade crossings, the primary responsibility for which is placed in the Federal Highway Administration (see detailed discussion of the grade-crossing problem in chapter X).

The Haz Mat Act grants broad administrative powers to the Secretary and specifically requires the Secretary to: (a) establish and maintain a technical staff sufficient to evaluate issues connected with hazardous materials transportation, (b) establish a control reporting system and data center, and (c) conduct a continuing review of all aspects of hazardous materials transportation. That Act also gives the Secretary the power to require persons involved in the transportation of hazardous materials to register with DOT not more often than once every 2 years. This power was not sought by DOT and has not been implemented.

In sum, the FRSA and the Haz Mat Act have filled in virtually all of the conceivable gaps in authority relating to rail safety. In fact, in the last couple of years, Congress has taken steps to place some limitations on or provide directions for the use of these powers in order to make them more effective. To some extent, this trend presents a problem since the more that flexibility is removed from administration of the rail safety laws, the less capable Government will be to meet changing needs. on the other hand, Congress has been dissatisfied with the way in which these powers have been exercised (or not exercised) and thus has found it necessary to become more specific as to the use of these powers in order to achieve its goals.

The statutory structure, then, appears to be basically complete, with the exception of the need for authority to issue regulations concern-

ing hours of service, greater flexibility in power brake regulation, and the addition of certain enforcement powers to the early safety laws. If anything, the existing weakness is one of redundancy and obsolescence rather than inadequacy. However, as Congress has recently shaped this structure to more specific needs, it has begun to burden it with provisions that in the Iong run could hamper effective administration of the rail safety program.

STRUCTURE OF FEDERAL RAILROAD SAFETY REGULATIONS

The Federal rules and standards pertaining to railroad safety are established by three entities (OSHA has been excluded from this discussion because its regulations do not deal specifically with the railroad environment): the Materials Transportation Bureau with respect to transportation of hazardous materials, the Federal Railroad Administration with respect to rail operations generally, and the National Transportation Safety Board with respect to accident investigation.

The basic scheme of MTB's rules (49 CFR, parts 102 and 171 to 199) is to set forth (a) the list of each explosive and other dangerous article covered by these rules and give its classification (e.g. class A explosive, flammable liquid, etiologic agent, etc.) which reflects its most hazardous characteristic ($ 172.5); (b) the requirements for packaging, marking, and labeling each of these materials depending on its mode of transportation (part 173); (c) the requirements for loading, unloading, placarding, and handling of rail cars containing these materials (part 174); (d) the specifications for particular shipping containers (part 178); and (e) the specifications for tank cars (part 179). These rules are voluminous, minutely detailed, and highly technical. They have been formulated over decades by a joint effort of the regulating agency (now MTB, previously the ICC) and the representatives of all of the various groups affected by these rules (see list set forth in $171.7 (c)), particularly the AAR's Bureau of Explosives. As this scheme indicates, these rules form an independent, sophisticated, and integrated system of restrictions on the transportation of these materials, and as such are considerably different from all other rules applicable to railroad safety. Moreover, they apply not only to the carriers but also to the shippers, packagers, recipients, and other handlers of the materials. Finally, while there is considerable detail relating solely to railroads, there is a much greater amount applicable to other modes, thereby requiring from MTB a multimodal perspective rather than simply focusing on the problems of one mode.

Unlike the integrated structure of MTB's rules, FRA's rail safety rules (49 CFR, parts 209 to 236) cover a series of essentially unrelated matters, reflecting their legislative origins. Part 209 contains FRA's procedures for enforcing the Haz Mat Act and for issuing compliance orders under the FRSA, which were promulgated as a result of the Transportation Safety Act of 1974. FRA's regulations under the Noise Control Act of 1972 appear in Part 210. Part 211 contains the various procedures employed by FRA in its rulemaking and related actions. These were completely revised and reissued at the end of 1976 as a result of the 1976 amendment to the FRSA requiring new procedures with specific time limits for completion of all proceedings to the extent practicable under the FRSA within 12 months (45 U.S. C 430 (d)). While these procedures cover all rulemaking and related actions regardless of whether they are taken pursuant to the FRSA or other laws, FRA stated that it would observe the 12-month time limit for rules promulgated under laws other than the FRSA only "to the extent practicable. "

Part 212 implements the State participation program under the FRSA. Part 213 contains the

track safety standards which were the first rules issued under the FRSA. The companion standards for freight cars are contained in part 215. Both of the parts set forth the specific design and performance standards which constitute the minimum requirements for track and equipment, and also contain the requirements for inspection by the carrier of their track and equipment.

Part 216 describes the procedures for issuing a special notice for repairs or an emergency order. The former are notices issued by Government inspectors that (a) require a railroad to take the locomotive or equipment out of service because it is not in conformity with FRA's rules and is unsafe, and (b) specify the particular repairs that must be made. Such notices may also be issued for track, in which case it requires the carrier to lower the track class, and therefore operating speeds, until the specified repairs are made. The emergency order procedures contained in part 216 pertain only to track.

Parts 217 and 218 contain FRA's requirements concerning operating rules. This subject matter area is the third of the three areas (track, equipment, human factors) which the FRSA was to provide the authority to regulate. Each railroad has its own set of operating rules timetables and timetable special instructions for employees, many of which contain all of the requirements an employee must follow in performing his job (these items are referred to in the aggregate as "operating rules"). Under part 217, these rules, together with any changes that may be made from time to time, must be filed with FRA. This part also requires the railroad to conduct tests and inspections to determine employee compliance with the rules, to establish a program of instruction on the carrier's rules, and to maintain records and report to FRA concerning these tests, inspections, and instructions.

Part 218 contains the specific operating rules adopted by FRA— blue signal protection, yard speed limits, and red flag protection. Each railroad had a pre-existing rule on these areas, but FRA felt it was necessary to have a minimum Federal requirement, and thus adopted these rules after considerable review and discussion by FRA's Railroad Operating Rules Advisory Committee composed of representatives of labor and management and State regulatory officials. Of **a** similar nature are the recently issued rules contained in Part 200 establishing standards and procedures for use of radios, which, though not technically operating rules, regulate certain employee actions in much the same manner as an operating rule. The blue signal protection rule will be discussed in greater detail below.

The remaining railroad safety rules relate primarily to particular laws as follows:

Part	Subject Matter	Law
221	Rearend marking devices	Federal Railroad Safety Authoriza tion Act (Jt 1976 (Amending FRSA)
225	Accident reports, recordkeeping investigations	Accident Reports Act
228	Reports and recordkeeping with respect to ernplo yee hours of service; appendix of interpretations	Hours [>t Service Act
230	Locomotive design and performance standards	Locom(>tivc Inspection Act
231	Safety appliance standards for railroad equipment	Safety Appliances Act
232	Requirements for power brakes and drawbars	Safety Appliance'\ Act
233-236	Requirements for signals and related devices, including reporting requirements and procedures for obtaining approval of a system change	Signal Inspection Law

Each of these parts contains, in addition to its substantive requirements, the applicable inspection, reporting, and recordkeeping requirements that formulate the system for assuring compliance. In some cases, they repeat the statutory penalty for violation of the law or regulation. However, where the law provides a penalty

range, except in the case of the regulations regarding accident reports, no indication is given as to the way in which that penalty range will be applied. Finally, it should be noted that while the law indicated above formed the primary basis of authority for the particular rule, it is usually not the exclusive basis, the FRSA being the source of authority to fill in certain gaps under the older laws. For example, part 225 looks to both the Accident Reports Act and the FRSA for the authority to require the reports and recordkeeping that are broader than that contemplated by the Accident Reports Act.

The NTSB has two sets of rules applicable to the rail environment—those pertaining to giving notice of a railroad accident (49 CFR, part 840) and those pertaining to practice and procedure in surface transportation accident hearings (49 CFR, part 845). There has been some controversy with respect to the former in that NTSB has established a different reporting threshold and required different information to be given than has FRA under its accident reports rules, although both agencies require the report to be made by telephone to the same place. While it is understandable (but not necessarily desired) that there are different reporting thresholds, there does not seem to be any good reason for different information requirements. At the least, this difference presents an unnecessary opportunity for confusion.

Having described this overall regulatory framework, some analysis needs to be given to the rules themselves and the manner in which they were formulated in order to consider their effectiveness in improving railroad safety, Since it was not feasible to conduct an in-depth examination of all of these rules within a short period of time, five subject-matter areas were selected for such an analysis: State participation regulations, tank car specifications, track safety standards, power brake rules, and blue signal protection. These were selected because they reflect different statutory sources, cover different safety hazards, reflect Government-industry-labor cooperation or lack of it, and cover different time periods.

Analysis of Selected Regulations

The results of the analysis of **each** of the five rulemakings are discussed individually, and thereafter the conclusion concerning the rulemaking process generally is set forth.

Track Safety Standards

The track safety standards were undertaken because track was the primary area of concern in rail safety for which there was no existing Government safety program. The FRSA directed FRA to adopt "initial" standards based on "existing safety data and standards" within 1 year of the FRSA. FRA began with the track standards which were issued within 1 **year, continued** with freight car standards which were completed 3 years after the FRSA, and then began consideration of operating rules. The State participation regulations were also issued 3 years after the FRSA.

In the case of the track standards, it was a foregone conclusion based upon the legislative history of the FRSA that track standards were necessary for safety. Therefore, the issues raised by the rulemaking centered essentially on whether the standards FRA was preparing were based on "existing" data and standards as the FRSA required. The AAR provided FRA with its "code of track standards" and its inspection standards. While FRA acknowledged the need for its rules to be based on "existing" standards, it developed its own standards base, in part on the industry standards and in part on performance criteria it had developed. The proposed rule, a mixture of performance and design standards, was criticized by the industry as being "recommended practice" rather than safety minima, and more costly to the industry than the aggregate "benefits" they provide. The final rule contained a number of changes that reduced this criticism, and the result wa~ a rule that has been relatively uncontroversial.

Several observations can be made from examination of this rule. First, in developing the rule, FRA worked closely with the indusTrybut main-

tained a degree of independence that is consistent with its regulatory role. Second, the rulemaking docket is devoid of any substantive treatment by FRA of most major issues. Changes were made from proposed to final rule on the basis of their being "necessary (or unnecessary) for safety. " This conclusory treatment seemed to be primarily a result of the lack of empirical data to support particular standards. Third, the rules were developed without any formal use of accident or other safety statistics, at Ieast as reflected in the public record. Fourth, while various parties submitted at FRA's request some rather simple cost-benefit analyses, there is no indication that FRA used that information, or any such data that it developed, in arriving at the final track standards.

State Participation Regulations

These regulations were issued to implement the State participation program established by the FRSA. The record on the issuance of these rules indicates a basic philosophical difference between FRA and most States on this program. FRA's approach is one of assuring uniform inspection/quality and uniform application of its rules. The States' approach was that the FRSA had created a "right" to participate in the Federal safety program and FRA's stringent re*quirements* for certification and inspector qualifications deprived many States of this "right. " The railroads supported FRA's position concerning the need for qualified inspectors. FRA amended these rules in 1975 to permit use of trainee inspectors under certain circumstances in order to enable more States to participate. However, the basic difference in approach to this program between FRA and the States has not been bridged.

The record of this rulemaking also attests to the independence of FRA in promulgating its rules, notwithstanding the fact that it provided the most interested party, the National Association of Regulatory Utility Commissioners, with a copy of the proposed rules in advance of their publication. It also indicates that a cost-benefit analysis of the rules requirements was not performed. Finally, the rule proceeded from initiation to final action in a relatively short period of time (8 months) owing in part to the limited number of interested parties and to the nontechnical nature of its content.

Blue Signal Protection

FRA instituted rulemaking action on this operating rule with an advance notice of proposed ruIemaking in January 1974. In so doing, FRA was beginning to deal with the third major area of safety hazards—human factors or employee failure. FRA chose blue signal protection because it believed there was very uneven application of the industry rule, known as rule 26, among various railroads and in some cases within a particular railroad, with respect to providing blue signal protection for employees working on, under or between railcars. The result was, according to FRA, confusion and uncertainty and a lack of strict enforcement which can, it felt, lead to tragic consequences. However, the record does not indicate any statistical or safety data basis for undertaking this rule. In response to the Advanced Notice of Proposed Rulemaking (ANPRM), the AAR contended that the existing rule, which had been the industry standard since 1887, was more than adequate, had the flexibility to meet varying situations, and had a good accident history. The labor unions urged FRA to adopt a uniform national rule, rather than a minimum standard that could be supplemented by each railroad to meet its needs, and to provide for locking of switches lined against movement on a track on which a blue signal is displayed.

Eighteen months after issuing the ANPRM, FRA issued a proposed rule, and 9 months later issued the final rule on March 8, 1976. The entire rulemaking record to that point is devoid of any consideration of the costs or benefits or inflationary impact analyses. In handlin g the various issues, FRA seems to have opted *for* strong minimum standards, but excluded rapid transit railroads from the scope of the rule because they were operationally so different from other railroads. While locking of switches

was raised in response to the ANPRM, the docket of the rule does not indicate that it was not raised in response to the Notice of Proposed Rulemaking except with respect to remotely controlled switches in yards, which FRA did require to be locked. Nevertheless, after the rule was final, Congress mandated a revised rule requiring the lining and locking of switches that provided access to track on which a blue signal is displayed.

This revised rule was adopted on January 5, 1977. FRA estimated the costs of the rule to be $9.6 million per year and $450,000 at the outset. Within the constraints placed by Congress, FRA seems to have considered what were the least-costly alternatives. Nevertheless, there has never been any attempt to assess whether the net benefits provided by the rule, particularly the requirements for locking and lining of switches, are in reasonable proportion to the costs of compliance.

Power Brake Rules

As has been discussed above, the FRA rules for installation, inspection, maintenance, and repair of power or train brakes are those established by the AAR as of 1958, and the statute permits amendment of those rules "solely for the purpose of achieving safety" (45 U.S. C. 9). The legislative history of this limitation shows that it was compromise language intended to prevent changes in the power brake rules that would have the effect of limiting the length of trains.

From 1969 to 1971, five changes to the power brake rules were proposed or considered by FRA, primarily at the behest of the industry. Rail labor strongly opposed each of these changes, contending that they were primarily for the purpose of providing the railroads with certain economic savings and could have the effect of reducing safety. However, this position was rejected both by FRA and by the U.S. District Court in a case seeking to overturn one of the changes adopted by FRA. The court found there was evidence that certain changes in the testing requirements would increase safety and sustained the rule. (United *Transportation Union, et al., v. United States, et al.,* 337 F. Supp. 410, *aff'd* 406 U.S. 964 (1972)). FRA ultimately did not adopt several of the proposed changes because it found there was not "sufficient supportive data regarding the impact its adoption would have upon safety" and thus would not meet the statutory test (41 FR 56678, December 29, 1976).

This finding points up the real problem presented by the power brake law: it eliminates any opportunity to change a rule where there is not clear evidence that the change will at least not reduce safety. Such a limitation undercuts completely the usually desirable practice for an agency to review its rules and revise them to eliminate requirements whose burdens exceed substantially the benefits they provide. There is a substantial body of opinion, most of it coming from representatives of railroad management, that some of the power brake inspection rules are make-work provisions that have little or no real impact on safety but have a substantial impact on the efficiency of rail operation. If this were true (and this study has not established that it is), FRA is handicapped in enacting changes that would reduce or eliminate ineffective rules unless there were offsetting changes that would increase safety. For example, it could not eliminate a frivolous test required by the rules at some intermediate point on a train's route unless there were other inspection or testing requirements that could be added which would offset any reduction in safety caused by that elimination. This was the procedure employed in the change which eliminated the requirement of air brake testing on run-through and unit run-through trains at the point of interchange. In other words, FRA is prevented from eliminating power brake rule requirements that, on the basis of today's cost-benefit analysis, it would not adopt unless it at the same time enacts other safety requirements, resulting in a rule which is as equally restrictive as the original rule from a safety viewpoint. It is not clear why power brake rules have been saddled with such inflexibility, and elimination of this statutory limitation would offer a valuable opportunity for FRA to reassess these rules in the light of current safety hazards and operating practices.

Tank Car Specifications

The revisions to the tank car specifications were undertaken in response to a petition made by five tank car builders and to a series of recent accidents involving pressure tank cars transporting hazardous materials. Among the five rules reviewed in depth, this alone forms a model for exercise of rulemaking authority. First, the record indicates a review of safety data to formulate the regulatory objective. Second, the substance of the rule was developed by industry and Government cooperation through the Railroad Tank Car Safety Research and Test Project Committee, In particular, many of the technical considerations were worked out as a result of joint or compatible research. Third, there was a relatively short time period between the petition forrt.demaking (March 15, 1976), the issuance of the proposed rule (November 19, 1976), and the issuance of the final rule (September 15, 1977). Nevertheless, that time period might have been substantially shorter had not the review of the final rule been encumbered by a change in top DOT officers requiring much reconsideration and delay due to reorganization. Fourth, a cost-benefit analysis was performed for both the proposed and final rules and was made available for comment. While one can take issue with the details of this analysis, particularly in evaluating the benefits, it is clear that the significant economic issues were considered. Finally, the preambles to the final rule discuss each of the major issues raised by commenters on the proposed rule and provide some discussion of how these issues were resolved. Of course, even though this rulemaking was done carefully, it is not issue-free, as indicated by the fact that at least five petitions for reconsideration have been filed since the final rule.

In sum, a review of these rulemaking actions indicates that FRA has generally been quite balanced in its formulation of rules, responding to both the industry’s economic concerns and labor’s safety concerns. However, it has, at least until very recently, done little to evaluate the impact of its rulemaking in cost or benefit terms. Further, it provides very little justification for its resolution of issues raised during the proceeding. In particular, it has seldom indicated that any of the safety information it receives or the statistics it develops are used in making decisions on whether and how to regulate a particular safety hazard. In several instances, it also has acted slowly in taking up or completing rulemaking actions, although the causes for those delays were often factors outside its control—such as the degree of controversy among interested parties and the lack of data necessary to evaluate or establish particular requirements.

On the other hand, FRA has encountered substantial statutory burdens in formulating its rules. First, in the case of blue signal protection, it was required to formulate a rule providing a protection (locking and lining of switches) that was never adequately addressed either at the initial rulemaking or subsequently in the testimony before Congress on the provision mandating the protection. The impact of such legislation is to focus the attention of the regulating agency on a particular hazard without benefit of knowing whether that hazard deserves such attention in comparison to other hazards, and to mandate a preventive measure without the benefit of being able to develop cooperatively or otherwise the least-costly alternative to reduce that hazard. Second, the standard required for amendment of power brake rules may prevent a number of changes that would make rail operations more efficient without any significant reduction in safety. This particular limitation seems in fact to be designed to prevent modernization of rules under the guise of assuring safety. Third, the FRSA requirement for a hearing on any rulemaking activity has resulted in virtually nothing in the way of new information, but rather has just been an unproductive time-consuming procedure that must be used. While the requirement was intended to provide parties with a “right” to present their views orally, it has become simply a redundancy since the parties who do participate reiterate their written comments and seldom, if ever, provide any new information.

Chapter

RAILROAD SAFETY INSPECTION PROGRAMS

Chapter VIII

RAILROAD SAFETY INSPECTION PROGRAMS

INTRODUCTION

Inspection has been conceived by the Federal Railroad Administration, the States, the railroads, and their employees as being one of the key components of railroad safety, The theory is that since both empirical and research information exists as to conditions that give rise to accidents, inspection by persons knowledgeable in a particular area will give sufficient warning when such conditions are developing so as to allow preventive actions to be taken or when such conditions have developed to allow corrective action to be taken. Although the theory is easily understood, the implementation of a comprehensive inspection program is impeded by several factors. They include:

- Difficulty of precisely identifying the causal agents in accidents and their correlation with accidents;
- Difficulty of establishing accurate measures of effectiveness for the inspection activity because it must depend to some extent on determining events or conditions that did not occur which otherwise might have; and
- Difficulty of maximizing the resources available from all parties concerned, given their differing mandates, areas of responsibility, and thus approaches to the problem.

Despite the impediments, however, an inspection program that depends upon the interlocking efforts of the FRA, the States, and the railroads is in place. The word "program" is used here in its broad sense, because the efforts of the FRA, the States, and the railroads are not singly conceived and because these efforts do not always coincide as to motivation or authority. These efforts are predicated upon the common assumption that inspections will prevent accidents—although the parties may disagree as to how much inspection (at which levels, by whom, and with what checks) constitutes an adequate effort. Important to the assessment of inspection's "effectiveness" in preventing accidents is that a framework of prescribed Federal regulatory powers and specifications in some way defines many of the inspection efforts. However, at the present time, no clear way of gauging the causal relationship of inspection to accident prevention appears to exist.

The Federal, State, and railroad approaches to safety inspection are focused on specific components of the train and its equipment (including track) and of the railroad's operating practices. Inspectors generally have to comply with a different set of requirements for each component that is the subject of an inspection program and therefore, inspectors tend to be highly specialized and perform only one type of inspection.

Brief overviews of the Federal, State, and railroad programs follow:

Federal Inspection[1]

Federal inspection activities focus primarily on five major aspects of the railroad. These are:

- Track,
- Operating practices,
- s Motive power and equipment,
- Signals and train control, and
- c Hazardous materials.

[1]Federal inspection programs include that administered by the National Transportation Safety Board (NTSB) however, this program is not discussed in detail in this chapter since i t is designed to investigate only serious accidents (including any that involve a fatality). Thus, its program is not one that directly bears on the relationship between a comprehensive inspection effort and the reduction of accidents.

The FRA has enforcement power in each of these areas, with the ability to assess civil penalties ranging from $250 to $2,500 per violation in the first four areas and up to $10,000 in the hazardous materials area, as well as criminal penalties for hazardous materials. Although the aim of the FRA program is accident prevention, it emphasizes the enforcement implications of the inspection system, since it believes that its mandate under the law is to monitor carrier compliance with Federal regulations. The railroad is itself responsible under the law for ensuring that it is in compliance with the regulations and thus also for directly preventing accidents. Therefore, one of the FRA inspector's main functions, when lack of compliance is determined, is to recommend assessment of penalties to the FRA Office of Chief Counsel. The inspection effort represents one of FRA's most significant safety programs in terms of dollars and numbers of personnel assigned to it directly or in support of it.

In FY 1976, for instance, $1,341,964 was expended in direct costs for conducting 1,587,349 individual inspections ranging from record checks to physical inspection of various aspects of the railroads' operations and equipment. During this same time, there were 386 FRA Office of Safety personnel authorized in the field and in headquarters for carrying out the inspection program. Three hundred and sixty of these positions were filled. (See appendix D.)

State Inspection[2]

The potential scope of State inspection activities was redefined by the Federal Railroad Safety Act of 1970 (P.L. 94-458). It contemplated a program in which States would work with the FRA to enforce Federal regulations, with the FRA financing a portion of these activities. The program that has been developed is known as the "State Participation Inspection Program." At present, the program permits the States to inspect in two areas. These are:

Track, and

Motive power and equipment.

Their inspection authority in the motive, power, and equipment areas is limited to freight car safety standards and does not include safety appliance standards. State inspectors are responsible to the States for which they work. Federal authority over them is limited to the State's eligibility (including prescriptions for inspector qualifications) for the State Participation Inspection Program and to the monitoring of the inspection records of performance. The State inspector, like the Federal inspector, recommends enforcement action to the FRA in Washington. Only if the FRA fails to act on the inspector's recommendation within 180 days from the date of the violation does the State have the right to enforce directly under this program.

In FY 1976, the State program is estimated to have cost approximately $341,925 in Federal money, matched by approximately the same amount in State money. These dollars supported the activity of 29 State inspectors and trainees. (See appendix D.)

Railroad Inspection

Railroad inspection activities cover all of the aspects of Federal and State inspections programs. In addition to ensuring compliance with Federal requirements, railroads use the inspection process to serve as an "early warning system." Inspection provides many railroads with information as to where preventive maintenance or modification/redirection of other operating practices may be necessary. The railroad inspection system as it pertains to safety is monitored internally by management, with its effectiveness being gauged by the twin results of preventing accidents and of preventing the necessity for FRA enforcement action. The FRA and State inspectors check on the adequacy of railroad inspection by conducting inspections of their own to ensure compliance with Federal

[2]Since this report is concerned with the implementation of Federal laws, it will not cover any aspects of State inspection effort that are not related to Federal requirements.

standards; however, railroad inspections—both by railroad policy and by Federal regulation—must take place with far greater frequency than FRA or State inspections. Figures are not available on the total costs of railroad safety inspections.

FEDERAL INSPECTION PROGRAMS

The Federal approach to railroad safety has included an inspection component, since the Locomotive Inspection Act was enacted in February 1911 to check boilers for the safety of employees and others. Since that time, the Safety Appliances Act[3] *(45* U.S. C. 1 et seq.), the Power Brake and the Signal Drawbar Act *(45* U.S.C. *9),* the Inspection Act (U. S.C. *26),* the Transportation of Explosives and Other Dangerous Articles Act of 1960 (18 U.S. C. 831-835), the Hours of Service Act (45 U.S. C. 46), and the Railroad Safety Act of 1970 (45 U.S. C. *431)* have been amended or enacted to empower the executive branch to enforce safety regulations promulgated under its authority. Each of the five principal inspection programs carried out by the FRA implements portions of these laws. All of the inspection programs are posited on the ability of inspectors to measure the existing conditions against a standard for which they are inspecting.

Many of the inspection programs were originally administered by the Interstate Commerce Commission but were transferred to the FRA in *1967,* with the establishment of the Department of Transportation. There have been numerous reorganizations and significant personnel increases since 1967. At the present time, FRA inspection programs are located in its eight regions. The headquarters Office of Safety, headed by an Associate Administrator for Safety, has no line authority over the field; each region reports directly to the Deputy Administrator of FRA. The Office of Safety is responsible for planning, developing, and administering an effective and comprehensive program to achieve safe operating and mechanical practices in the railroad industry, including the enforcement of all the Federal laws and related regulations designed to promote safety of railroads, as they relate to employees, travelers, and the general public. [4]In this light, the Office of Safety provides support to the field activities through its Office of Safety Programs, which houses divisions responsible for compliance and enforcement and program guidance, and its Office of Standards and Procedures, which houses divisions covering each of the inspection program disciplines as well as a division which analyzes accident and inspection reports (see appendix D for a schematic representation of the Office of Safety Organization).

At the present time, there are a total of *221* FRA inspectors at outstations. [5](See appendix D for summary by program.) These inspectors are stationed in 31 of the *50* States. The safety inspectors are assigned to one of the five specific inspection programs and work under the supervision of a Supervising Railroad Safety Inspector. While the FRA has placed importance on inspectors having in-depth knowledge/experience in the substance of a particular program, the Supervising Inspector is not required to have similar knowledge in all five programs. However, a Regional Railroad Safety Specialist position has been created in each discipline in each region to provide technical support and guidance.

[3]Originally enacted in 1893, the first Safety Appliances Act, however, did not provide for inspections.

[4]Taken from *FRA Organization Manual,* FRA *1100,23,* p. II-149.

[5]Figures, which include supervisors and specialists, are taken from "Railroad Safety Assessment, Task *III:* Analysis of Federal, State, and Railroad Inspection Programs, " Peat, Marwick, Mitchell & Co., Nov. 30, 1977. (Hereafter referred to as PMM &Co, "Task III"). The four Materials Transportation Bureau inspectors are not included in this figure.

In carrying out the various inspection programs, the FRA emphasizes its monitoring and enforcement role. It does not view its inspection activities as a primary means of ensuring that adequate preventive measures take place, believing, instead, that such a role is more properly the responsibility of the railroads. The FRA carries out inspections that flow from six different purposes. They are:

- Accident investigation (initiated by FRA),
- Emergency situation investigation (initiated by FRA),
- Complaint investigation (initiated by members of the public, including railroad employees),
- Routine planned investigation (initiated by FRA),
- Petition and application investigation (initiated by railroads), and
- Follow-up investigation (initiated by FRA).

The inspections in all of these categories are intended to determine if the railroad has complied with Federal safety standards (and, if not, to make a judgment about appropriate remedial action and/or penalty assessment). However, in the case of "petition and application" investigations, the FRA also is seeking to determine whether an exception to complying with an FRA regulation should be granted to a railroad requesting an exception. Depending on the situation, the FRA investigations may require several hours or several weeks to carry out.' The FRA stresses the importance of cooperating with the railroads in carrying out these inspections. In the case of routine planned inspections, inspectors are instructed to notify the railroads in advance of the inspections. Federal inspectors may inspect for many aspects of the railroad safety regulations on their own; however, they generally are accompanied on their inspections by an employee of the railroad.

[6]The term "an inspection" or "an inspection unit" maybe misleading when used as an output measurement or a way of assessing effectiveness because of the discrepancies that exist between the effort required to examine, for example, a railroad's time log versus that required to inspect freight car equipment.

The FRA accords accident investigations the highest priority. Emergency situation and complaint investigations also are given priority and are generally handled through headquarters in Washington. A control number is assigned and field personnel carrying out the inspections are monitored. The FRA estimates that about 10 percent of its inspections are complaint investigations, which are handled according to the inspector's schedule. However, no matter what the purpose of the investigation, all inspectors are expected to identify those elements present that are likely to cause failures and/or accidents. In addition, general courses, such as "Railroad Inspector Orientation and Accident Prevention" offered by the FRA are designed to provide the inspector with a broader, cross-cutting understanding of the variables in accidents than that offered by his specialized experience. This includes ways to recognize defects and failure modes that could cause accidents, legal implications, human factors considerations, and hazardous materials concerns in any given situation.

The various inspection programs report to the Director of Railroad Safety in the field (see appendix D), but aside from the reporting commonality the programs appear to be carried out in the region independently from one another. There does not appear to be an overall inspection/enforcement strategy that governs the day-to-day activities of the inspectors.[7]

There has been a shift in the inspection activity from FY *1974* to FY *1976.* The reasons for the shifts within some of the individual programs are not immediately clear because of a lack of data to relate these shifts to the accident pattern. For instance, freight car inspection increased by

'Th; approach to each inspection program is discussed under the section dealing with each program that follows. However, it is important to note here that in an April 1975 letter to the Secretary of Transportation the GAO recommended that the development of an inspection /enforcement strategy would strengthen the FRA's inspection program. (See 4/11/75 Eschwege letter to Secretary of Transportation (B-1 S4497(5)). PMM & Co., "Task III" also notes lack of accident prevention strategy in the inspection programs, based on the interviews conducted during the course of the study. pp. 1.5-1.6.

approximately 80,000 units, while motive power inspection decreased by approximately 40,000 (about 50 percent) during the period FY 1974-76. Similarly, inspection of hazardous materials records decreased dramatically from 75,094 in FY 1974 to *4,968* in FY 1976—and less dramatically in all other of its activities. The Signal and Train Control Inspection Program showed decreases in almost all of its activities, while the Operating Practices Inspection Program and the Track Inspection Program showed increases, with the relationship of the individual activities to the total program remaining more or less constant.

Total inspection activity declined slightly during FY 1974-76, indicating that the decrease in motive power and equipment, hazardous materials, and signal and train control inspections had not been offset by the increases in track and operating practices inspections. Because of the difficulty of relating the specific components of the individual inspection programs to the accident data, it is not possible to understand the reasons underlying the timing and the nature of the shifts. However, the increase in track inspections in all likelihood indicates a response to the high number of track-related accidents; similarly, the increase in operating practices inspections may indicate a response to the employee fatality problem. Nonetheless, these two inspection efforts have been allocated one-half as many dollar and personnel resources and one-tenth as many dollar and one-half as many personnel resources, respectively, as those allocated to the motive power and equipment inspection efforts. (See appendix D.)

During this same period, inspection personnel increased from an on-board figure of 185 in FY 1974 to 220 in FY 1976.

Description of Federal Inspection Programs[a]

A brief history and description of each of the five Federal safety inspection programs follows:

[a]Appendix D summarizes the inspection efforts and direct costs for FY 1974-7b.

Track Safety Inspection Program

This program was implemented to enforce standards (49 CFR 213) established under the Railroad Safety Act of 1970 (P.L. 91-458), beginning in 1972 when the first Federal track inspector was hired. The track safety standards prescribe minimum structural requirements and maximum speed limits for track used in interstate freight and passenger service. They were proposed on June *23,* 1971, and became effective for different types of track (depending upon when constructed) in October 1971, October 1972, or October 1973. Thus, for at least part of the time that the track standards were first in effect, FRA had no inspection force to monitor compliance.

The track safety standards were based in large part on industry standards already in use at the time of their promulgation, as well as on state-of-the-art information that FRA had already developed. So compliance with the standards did not pose a difficult technological problem for the railroads. However, FRA was not able to staff fully for several years following promulgation of the regulations. A summary of the numbers of track inspectors follows:

Number of Track Safety Inspectors*

1972	1973	1974	1975	*1976*	1977
	12	38	39	47	45
					3 vacancies

Thus, inasmuch as an inspection program serves as a deterrent, for at least 2 years following the promulgation of the regulations their deterrent aspect had minimal impact.

Since its inception, the track safety inspection program has become increasingly sophisticated, including the use of automated geometry inspection cars and rail flaw detection cars, both of which assist the inspectors and industry in analyzing track geometry for compliance with

‘1’MM & Co., “Tash III, ‘ p. 1, 3.



Track geometry car



Photos. Courtesy of National Transportation Safety Board

Rail flaw car

Federal standards. In addition, the FRA Automated Track Inspection Program (ATIP) provides computerized analytical support to the inspectors to detect and pinpoint the location of any deviation from the track geometry standards that had not previously been detected. Partly as a result of such inspection aids, the number of cited track defects, violations, and penalties assessed and collected appears to be increasing.

Track safety inspectors routinely conduct spot compliance inspections (both with and without the aid of automated track geometry cars) based on such criteria as the deficiencies in carrier records, population density along tracks, and number, frequency, and severity of accidents.

The routine inspection is usually carried out in cooperation with the railroads. The inspector gives advance notice of the inspection—which includes the territory to be inspected, a proposed date for starting the inspection, and an invitation for a railroad representative to accompany him on the inspection. For its part, the railroad usually provides a hi-rail car or motor car to facilitate the inspection process. Even though the advance notice of inspection is given to the railroad, the FRA may consider such an inspection to be a "spot compliance" inspection. If the inspection takes place because of a complaint that has been lodged, the inspector informs the railroad of this fact, but he does not divulge the name of the complainant.

Depending upon the result of the investigation, the inspector may:

- Urge voluntary correction of the defect (usually in the case of defects deemed "not serious"),
- Cite the railroad for violation of the safety standards,
- Furnish the railroad with a Special Notice for Repairs (when the track is found not to comply with speed requirements for the class at which the track is being used), which specifies the train speed that which may be used until repairs are made, or
- Issue a notice of track condition which is precedent to an Emergency Order (when track contains serious defects) removing the track from service until repairs are made.

The effectiveness of the track safety inspection program is particularly important because of the relatively high frequency (compared to other accident categories) with which track-related accidents occur. For instance, FRA's testimony during hearings on the Railroad Safety Authorization Act of 1976 (P. L. 94-348) before the House Subcommittee on Transportation and Commerce indicated that track-related accidents accounted for the largest number of accidents per million train-miles, despite the increasing number of violations cited. FRA indicated, too, that while the total number of train-miles decreased between 1974 and 1975 *(833.3* million in 1974 to 726.1 million in 1975), track-related accidents per million train-miles increased.

For track-related accidents, the increase was not as great as it was for the other categories; however, track-related accidents remained the category of accidents with the highest rate per million train-miles. In 1974, there were 3.5 track-related accidents per million train-miles; in 1975, there were 3.7.10 However, the inconsistency of reported data between 1974 and 1975 must be kept in mind. Similarly, FRA's testimony before the Senate Appropriations Committee for FY 1977, indicated that track-related accidents increased 10 percent in FY 1976 over FY 1075 and would increase an additional 9 percent in 1977 over 1976.1]

During comparable time periods, however, the numbers of FRA inspectors also increased, as did the number of violations reports filed and the number of claims made against railroads for noncompliance with track safety standards.

[10] See Federal Railroad Safety Authorization Act Hearings before House Subcommittee on Transportation and Commerce of the Committee of Interstate and Foreign Commerce.

[1] 'See Department of Transportation and Related Agencies Appropriations Hearings for FY 1 977 before the Senate Commit tee on Appropriate ions.

During FY 1975-76, a total of 549,819 unit inspections were performed covering all aspects of track safety. During this same time period, there were 4,940 track violations reports filed with the FRA. 1˜The number of violations reports filed in FY 1975 outnumbered those made in FY 1976 by 10:1. The reason for this disproportion is not clear since track accidents increased, the track inspection force remained constant, and total number of unit inspections increased slightly during this time period. A possible explanation may be that while inspection units increased, inspections on mainlines, where many of the track-related accidents occur, decreased by 11,429. (See appendix D.)

A summary of the pertinent track safety inspection benchmarks for FY 1975 and FY 1976 follows:

Table 31.—Track Safety Inspection Benchmarks

	FY 1975	FY 1976
Track-related accidents . .	2,719	3,810
(per 1,000,000 train-miles)a	3.7	––
Violations reports filedb. .	4,489	451
Number of inspections conducted	264,655	285,164
Number of inspectors on boardd.	47	45

aHeari rigs, supra. bpfvlfvl & co., "Task V" supra.
cAppendlx D. dAppendix D,

In light of the accident data, it is ironic that during the past several years, FRA has increased the staff of the track safety inspection program, although it still remains about half the size of the motive power and equipment inspection staff. Nonetheless, the increase in track-related accidents does not necessarily mean that the inspection program itself has been ineffective. As with most problems associated with railroad safety, an argument may be made that track conditions are, in part, a function of the financial health of the railroad industry as a whole over the past several years. For instance, each year the cumulative effect of inadequate or deferred maintenance, dating from several years ago, may contribute to the increase in track-related accidents, particularly in the lower speed limit track groups. (Track that is placed in this group may already be in a relatively deteriorated state.) However, the validity of drawing relationships between deferred maintenance and track-related accidents is a controversial issue, and the controversy points, in part, to the difficulty of assessing the effectiveness of the track safety inspection program.

It is possible to understand something of the dimensions of the track safety problem in relation to the inspection program from numbers such as those in table 31, but it is not possible to draw certain conclusions about the relationship of inspection to prevention of accidents—because it is not possible to say with certainty how many of the 4,940 violations reports filed with the FRA during FY 1975-76 in fact prevented accidents. Furthermore, as to those accidents that occurred, it is not possible with the data available to determine how many of those occurred because of a lack of compliance with the track safety standards. Neither is it possible to say which of those would not *have* occurred if the inspection program had been more vigilant. The data available do not allow determination of how many of the accidents occurred because of intervening variables, which the track safety standards were not able to anticipate, such as peculiar track/train interaction due to unusual hazards, for example, climatic conditions. [14]

Operating Practices Safety Inspection Program

The Operating Practices Safety Inspection Program revolves around inspection and enforcement of the Railroad Operating Rules (49

"Unit i> uwd here to dcscritw one type of lnspcctic>n — e.g. , t rach rt'c<~rds, track main 1 ine, track cr(~ssin~s, etc. Thus, It i~ possible Ior one railroadto have been subjected tomore than oneinspectionuni t. Figure is takenfrom appendix D.

"I'hlhl & CO., Task V,pp.VI. 4-5.

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' 'That such conditions could leadto accidents is implicitly acknowledged in the standard's instructionto inspect "as soonas possible" afterflood,storm,or other occurrence.

CFR 217). It requires the filing of current operating rules by railroads with FRA and the filing of the program of instruction for employees in the operating rules, as well as certain tests, inspections, and recordkeeping and the filing of an Annual Report. The Railroad Accident Incident Reporting Requirements *(49* CFR *225)* require railroads to report in a uniform manner those accidents incidents arising out of their operations and Hours of Service Rules (49 CFR 228), which implement the Hours of Service Act (P. L. 91-1 69). It requires that employees work no more than *12* hours in a **24-**hour period (except in the case of emergency accidents, when 16 hours are allowed) and has reporting and record keeping requirements. There has been an enlargement of the Operating Practices Safety Program. The Blue Flag Protection of Railroad Employees, Operation Rules *99, 93,* and Radio Standards and Procedures, all of which set down safety-related practices to be observed by employees, have taken effect in **1976 and 1977 Thus, although they have th**e potential to affect the human factors accident rate, they may not have been in effect long enough. Currenty, there are **42** Operating Practices inspectors onboard making this program about the same size in personnel as the Track Safety Inspection program. (See appendix D.)

All of the regulations that come under the Operating Practices Safety Inspection Program prescribe the general parameters on safety within which railroads must operate. Each railroad is required to do the following in order to remain in compliance with these regulations:

- Maintain a current file at the FRA, which must include a copy of its code of operating rules, its timetables, and its timetable special instructions; and
- File a program of tests and inspections with the FRA and conduct tests and inspections on certain operating employees to determine compliance with its own code of rules, timetables, and timetable special instructions.

The FRA's Office of Safety periodically reviews the operating rules, and its inspectors review the efficiency tests. In addition, FRA conducts periodic inspections of the degree to which the Hours of Service Act and rules are complied with (including employee interviews when there has been an apparent violation) and the degree to which the railroad accident/ incident records are kept as required, including records as to highway grade-crossing accidents/ incidents, rail equipment accidents, incidents, and death, injury, and occupational illness incidents.

With the exception of the records inspection, which has been the basic tool of this inspection program, this set of regulations provides a problematical enforcement issue for the FRA: how to determine whether these basically preventive human-related regulations are consistently observed. Unlike the track-safety regulations, for instance, violations of the regulations take place periodically over time and can or cannot occur, depending on the situation; whereas, once a track-safety violation occurs, it continues to exist until corrective action is taken. Spot-checking is one mechanism that can be used, of course; however, a violation may not be detected if it is not the subject of a spot-check (which must inevitably be a very small sample of all of the work situations in which the operating practices regulations apply) unless an accident occurs or unless a complaint is lodged by an employee.

In the event that a complaint triggers the investigation, the inspector is told the identify of the complainant but is prohibited from revealing this identity to the railroad, unless authorized in writing by the complainant to do so. The investigation that is conducted must rely to a great extent upon the relationship of the complainant's observations (as well as those of other witnesses) to the railroad's records. The inspector must make a determination as to wether the one bears the other out, and, in many cases, the judgment is finally a subjective one. The large majority of complaints filed under the program concern an alleged lack of compliance with Hours of Service requirements.

It is not possible with the data available to make a judgment as to which of the so-called "human factors accidents, which caused the

greatest number of employee fatalities, occurred because of a violation of one of the Operating practices Regulations. However, since there were 462[15] complaints of violations of operating practices regulations in FY 1975, it is apparent that there are some violations. However, as stated earlier, it is too early yet to say whether the Operating Practices Safety Inspection Program, with its newly promulgated regulations as well as additional areas under consideration for regulation, 16 will have a significant impact on this category of accidents and how or whether these new regulations should affect the Operating Practices Safety Inspection Program. What remains clear, however, is that prior to the promulgation of these new regulations, train accidents in the "human factors" category were increasing, despite the inspection activities. 1[7] In FY *1975,* they increased from 1.8 per million train-miles to 2.8 per million train-miles, a larger increase than for any other accident category, However, while the increase in FY 1976 continued, the rate of increase was lower than that for the other categories. Nonetheless, the absolute number of train accidents in this category was second only to track.18

The Operating Practices Safety Inspection Program, as it is now constituted, began with **30** inspectors in FY 1974 and in FY *1976* reached the authorized ceiling of 40. However, the relationship between the increase in human factors accident rate (followed by the tapering off of the rate of that increase) and the safety inspection program is not clear from the information available. It is clear, however, that numbers of violations reports filed by inspectors are increasing along with the accident rate and that the complaint level is remaining constant.

A summary of the pertinent benchmarks in the Operating Practices Safety Inspection Program follows:

Table 32.—Operating Practices Safety Inspection Program Benchmarks

	FY 1975	FY 1976
Human factor accidents . . .	1,678	1,719
(per 1,000,000 train-miles)a	2.8	––
Violations reports filedb. . .	831	1,627
Complaints investigated. .	462 (of which 402 = hours of service)	466 (of which 391 = hours of service)
Number of inspections conducted (records)d . . .	299,154	350,203
Number of inspectors on boarde	29	32

a Hearings, supra. bPMM & CO., "Task V" Supra. cPMM & Co., "Task Ill," p. II-78. 'Appendix D. 'Appendix D.

Motive Power and Equipment Safety Inspection Program

The Motive Power and Equipment Safety Inspection Program covers locomotive inspection *(49* CFR *230* prescribes safety standards for locomotives); safety appliances inspection **(49** CFR **231** prescribes safety standards for automatic couplers, handholds, and grab irons, ladders, car end platforms, handbrakes, and steps on switching locomotives); railroad power brakes and drawbars inspection **(49** CFR **232** prescribes safety standards and inspection criteria for power brakes); and railroad freight car inspection **(49** CFR *215* prescribes minimum requirements for freight cars). Until **1974, there** was no differentiation made between locomotive inspectors and safety inspectors in other areas under this program. Since 1974, however, inspectors under the Motive Power and Equipment Safety Inspection Program have inspected for all standards that it covers. In terms of both personnel assigned to it and total dollar cost of direct inspection activity, this program is the largest; there are currently 91 inspectors on board. (See appendix D.)

Inspectors under this program personally inspect all types of locomotives, cars, and trains

[5] **402** of these complaints concerned alleged hours of service violations, PMM & Co,, "Task III, " p. II. 78.

[6] "The areas under consideration for regulation include railroad employee training standards, employee qualification standards, engineman medical standards, and Federal or carrier certification of railroads. PMM & Co., Task III, p. **66.**

[7] **"See** chapter V of this report for further discussion of employee fatalities.

[8] "See House hearings on Railroad Safety Authorization Act and Senate Appropriations Hearings for FY 1977, supra.

operating within their areas of responsibility. These inspections are designed to determine whether the carriers are inspecting and repairing their locomotives, cars, and trains in accordance with federally prescribed standards. The FRA inspectors, however, generally do not inspect the rolling stock until carrier personnel have had a reasonable opportunity to inspect it themselves. The FRA inspectors may inspect at any time, but, in the event of a train prepared for departure, they generally do not delay the departure for the purpose of performing an inspection. When a defect is found, the inspector may, by written order, remove the defective locomotive, car, or train from service. If a Federal inspector wishes to determine compliance with Federal standards by means of a test, he may request the carrier to perform that test and observe it as it takes place.

Inspectors are instructed to cover all inspection points within their territories "as uniformly as practicable" and to report to Washington on their inspection activities on or before October 1 every year. Each inspector is expected to know his own territory and to be familiar with the condition of rolling stock in that territory. In devising his inspection strategy, he also is instructed to make judgments concerning the relative importance of various inspection points and which of these may require more frequent inspections than others. These inspections are carried out within the context of the overall requirement that nine-tenths of the country's freight cars have mandatory inspections and shoppings every fourth and eighth year. The rest of the freight cars are to be inspected and shopped every 1 and 2 years.

The inspection program also has been used to identify a pattern of defects or failures, such as a higher-than-normal percentage of wheel failures on a specific type of car. When such a pattern is identified, the FRA provides the information to all of its inspectors and cooperates with the carriers and suppliers, as appropriate, to determine the cause of the failures and to prescribe the necessary corrective action.

In 1974, the locomotive and safety appliance inspection activities were combined in the Motive Power and Equipment Program. The ceiling for the locomotive inspection program was 51 and that for the safety appliance program was **64;** when the programs were combined, the new ceiling was 75. However, the operating practices program absorbed most of the extra positions not allocated to the consolidated program, so the absolute numbers of inspectors did not diminish. Since consolidation in *1974,* the Motive Power and Equipment Safety Inspection Program ceiling has been raised to **93,** of which 91 positions have been filled.

Nonetheless, equipment-related train accidents occur about as frequently as "human factor" accidents; however, their increase in FY **1976** over FY **1975** was 4 percent as opposed to **2.5** percent for human factors. This category of accidents, however, may be the one that can be most directly affected by the enforcement of safety standards, since there are fewer possibilities of intervening variables such as climate or human judgment that will directly cause equipment failure .20 If the safety standards are soundly based, then it should follow that compliance with those standards should lower the rate of such accidents caused by equipment failure. In FY *1974,* equipment failures was the second highest category of train accident cause, after track failures, In FY 1975, equipment failures causing accidents increased, but at a lower rate than failures in both the track and the human factors categories. As noted above, however, this slower rate of increase did not continue into FY 1976. The reason for the absence of any apparent downward trend in the equipment-related accident category in light of the inspection program and the increased number of inspectors is problematical. Further, from the figures in table **33,** it appears that there were **58,166** fewer inspections in FY 1976 than in FY 1975, with about the same number of inspectors. The reason for this is not clear.

[19] See Senate Appropriations Hearings for FY 1977, supra.

[20] This statement must obviously be qualified for certain aspects of the program —e. g., power brakes —which set down requirements that depend upon human beings for their implemental ion.

A summary of the pertinent benchmarks in the Motive Power and Equipment Safety Inspection Program follows:

Table 33.—Motive Power and Equipment Safety Benchmarks

	FY 1975	FY 1976
Equipment accidents	1,680	1,736
(per 1,000,000 train-miles)	2.3	--
Inspections conducted. ..	904,560	846,394
Number of inspectors on board.	75	82[d]

[a]Hearings, supra. [b]Appendix D. cPMM & CO., "Task III," p. II.47. [d]Present level is 91, see appendix D.

Signals and Train Control Inspection Program

The Signals and Train Control Inspection Program takes its authority from the Signal Inspection Act *(49* U.S.C. **25),** which is Section **25** of the Interstate Commerce Act, passed in **1920.** The regulations that implement this Act are contained in Signal Systems Reporting Requirements **(49** CFR *233),* Instructions Governing Applications for Approval of a Discontinuance of Material Modification of a Signal System (49 CFR 235), and Installation, Inspection, Maintenance and Repair of Signal Systems, Devices and Appliances (49 CFR 236). These regulations establish criteria for the testing, installation, and maintenance of signal systems so as to minimize the possibility of accidents due to inadequate signals, signal failure, or human error with regard to signals, including automatic block signal systems, interlocking signals, traffic control systems, automatic train stops, train control and cab signal systems, and dragging equipment, slide detectors, and other devices.

The inspection aspect of the Signals and Train Control Inspection Program requires that the carrier must perform all testing of safety devices that might be necessary, but inspection itself may be carried out by the FRA, regardless of whether a representative of the carrier is present at the time of inspection. The inspector must inform the carrier of the existence of any violations of the regulations; however, it falls to his discretion as to whether such unsafe or defective condition should be reported to Washington for prosecution.

Under this program, carried out by **28** FRA inspectors, each inspector is expected to give advance notice of the impending inspection to the railroad. However, unlike the other programs, there are specific requirements as to which items the inspector may inspect only when accompanied by a representative of the railroad and which items he may inspect unaccompanied. The inspector determines what remedial action is necessary and when it should take place. He also inspects, after a reasonable period of time, to ensure that it has taken place. The Signals and Train Control Inspection Program has grown from an authorized ceiling of 17 in FY 1970 to 29 in 1976, of which 20 were on board.

Signals and train control accident statistics often are not broken out and treated separately by the FRA;[21] thus, it is not easy to gauge the frequency of accidents related to signal or train control failure or to relate the declining number of inspections conducted to the accident rate. However, in order to give an idea of the *relative* size of the signal and train control "problems," a summary of the pertinent benchmarks for which information is available follows:

Table 34.—Signal and Train Control Safety Inspection Program Benchmarks

	FY 1975	FY 1976
Signal and train control accidents.	n/a	n/a
(per 1,000,000 train-miles). .	n/a	n/a
Number of violations.	187	139
Inspections conducted. . .	82,522	69,226
Number of inspectors on board[c] ... , ...	28	28

[a]PMM & Co., "Task C" supra. [b]Appendix D. cAppendix D.

[21]Is, for instance, FRA testimony before the Senate Appropriations Committee, supra.

Hazardous Materials Safety Inspection Program

The Hazardous Materials Safety Inspection Program dates from 1908 and the Transportation of Explosives and Combustibles Act (18 U.S. C. $$831-835). In 1960, the Transportation of Explosives and Other Dangerous Articles Act (P. L. 86-710) expanded the definition of those "hazardous" materials covered to include "et iologic and radioactive" materials. The FRA of **1970** further broadened the authority of the Federal Government to deal with the transportation of hazardous materials and increased penalties for violations, which included requirements for a central reporting system for hazardous materials and accidents and an annual review of hazardous materials transportation by the Secretary of the Department of Transportation.

Under Title I of the Transportation Safety Act of 1974 (P. L. 93-633), the Materials Transportation Bureau (MTB) and the FRA both have jurisdiction to inspect for violation of regulations concerning the shipping of hazardous materials. MTB has jurisdiction over container manufacturers and intermodal shippers of hazardous materials; the FRA has jurisdiction for the enforcement of regulations governing railroad transportation of hazardous materials.

The MTB regulations are found at *49* CFR, 171-179. They set down requirements for handling cars containing hazardous materials. The cars must be placarded with signs that indicate the type of hazardous material they are carrying; the signs are specified in the regulations. [22] The hazardous materials covered by these regulations are as follows:

- explosives,
- gases,
- flammable liquids,
- flammable solids,
- oxidizers,
- poisonous materials,
- radioactive materials, and
- corrosive materials.

"See chapter X for a discussion of the hazardous materials program development t.

The inspection program, as the division of jurisdiction implies, is divided between the MTB and the FRA, with the MTB primarily responsible for container manufacturer inspection and the FRA responsible for railroad tank car inspection. The MTB has 4 inspectors nationwide and the FRA has 14. However, FRA recognizes the need for more inspectors and has requested an increase. At the present time, the FRA estimates that approximately 15 percent of the time of inspectors of other skills is spent on hazardous materials work. Thus, FRA contemplates relieving this burden and improving the efficiency of the hazardous materials safety inspection program by creating—in the long term—a stronger force of hazardous materials inspectors per region. 23

Hazardous materials inspection activities have increased significantly during the past several years, following the increasing amount of hazardous materials shipped by rail. The AAR estimates that 1.04 million carloads of hazardous materials are shipped annually through approximately 50,000 rail shippers' facilities. [z,]

These figures suggest that, given the present inspection level, the Hazardous Materials Safety Inspection Program is designed to spot-check compliance, with potentially high penalties for noncompliance and recordkeeping checks serving as a general disincentive to noncompliance. This inspection program differs from the others in that it is concerned with the involvement of hazardous materials in accidents and not with their causing railroad accidents. In a certain sense, the program is designed as an insurance program in light of the potential for extreme damage and injury posed by many of these materials. If an accident due to defective equipment, human error, or any other cause occurs, the hazardous materials program is intended to ensure that the hazardous materials do not compound the seriousness of the accident. Thus, the inspection strategy of this program might have

23 PNIM & Co,, "Task III" working papers.

24The number of carloads shipped is an elusive figure. The FRA has estimated that 0.9 million are shipped every 2 years. See PMM & Co., "Task 111", p. II-59.

been expected to be somewhat more intensive than the other programs. On the face, given the number of inspectors on board and inspections conducted, this does not seem to be the case. That the same number of inspectors made about twice as many violations reports from about 10,000 fewer inspections (reflecting primarily a decrease in records inspection) in FY 1976 than in 1975 may be significant in terms of the extent to which violations occur .25 The Hazardous Materials Inspection staff ceiling was raised from an authorized **3** in FY **1970** to *25* in FY 1976. There are now 14 FRA hazardous materials inspectors on board.

A summary of the pertinent benchmarks in the Hazardous Materials Safety Inspection Program follows:

Table 35.—Hazardous Materials Safety Program Benchmarks

	FY 1975	FY 1976
Hazardous materials accidents	——	981
Violations reported b.	234	541
Inspections conducted C.	36,458	26,933
Number of inspectors on board d	18	18

a MTB reports. bPMM & ~0, "Task V" supra. c4MTB and 14 FRA inspectors, see appendix D. dAppendix D.

STATE PARTICIPATION PROGRAM

The Federal Railroad Safety Act of 1970 provided for the participation by States in a cooperative program with the Federal Government to carry out the investigative and surveillance activities related to safety regulations under the Act. States are eligible to participate if a State agency has regulatory jurisdiction over the subject of the regulations and if the FRA enters into a "certification" or "agreement" arrangement with the State. Under "certification," the FRA certifies that the State can carry out certain investigative or surveillance activities in the same way as the Federal Government. There are two stages of certification:

- Initial certification is provided for up to **3** years, during which time the State may develop its inspector capability to conform with the Federal requirements as to level of effort, and
- Full certification, at which time a State provides at least the minimum level of inspection effort required.

Under an "agreement," the FRA agrees with the State to cooperate in certain areas if the State is unable to qualify for or is not desirous of obtaining full certification. Federal funding for up to **50** percent of the allowed, safety inspections costs is available to States participating in the program.

To date, the FRA has promulgated regulations to implement the State participation program[2'] and four other sets of safety regulations under the *1970* Act. The additional four regulations are on: track safety, railroad freight car safety, railroad operating rules, and railroad accidents/ incidents reports, classification, and investigation. The FRA has promulgated procedural regulations to include two of these programs in the State participation program: track safety inspection and railroad freight car safety (equipment *only). As in* Federal inspection programs, the State participation program contemplates specialized inspectors for each of the included regulations.

The FRA began the State participation program in FY 1974, when Federal funding became available. The interest and level of State participation, however, has not been as high as might have been expected. By December 1977, **21** States were certified. The growth pattern of the State participation program follows:

[25] See appendix D.

26 CFR 212

Growth of State Participation Program

Date	*Number of States27*
7 74	5
3 '75	12
10' 77	19
12 '77	21

The reasons that States have not participated in greater numbers are varied. They include: lack of a State entity having jurisdiction, lack of funding, lack of sufficient railroad mileage to warrant participation, and reluctance to be tied to Federal funding. In addition, the State participation regulation has been controversial with States from the time it was first proposed, largely because of the high qualifications requirements set down by FRA for inspectors hired by States. The States believed that they could not find and/or pay inspectors with the level of experience and qualifications required by the FRA. The FRA, on the other hand, did not want two classes of inspectors for the same things. Thus, the FRA held firmly that the high level of experience was necessary. However, the FRA established the category of inspector trainees to give the States some flexibility in their initial hiring. Furthermore, FRA's Office of Safety Programs, in conjunction with the Office of Federal Assistance, has developed training programs geared to meet the needs of particular inspectors in particular States. Nonetheless, discrepancies between the salaries commanded by Federal inspectors and those that States are able to pay do exist, and some States report that they have had difficulty in hiring inspectors.

At the present time, the State inspection program has *28* track inspectors plus *8* trainees (of an authorized 46 inspectors) and 18 equipment inspectors (of an authorized 18) on board. (See appendix D for distribution of inspectors in relation to the Federal program.) Like the Federal inspect or, the State Participation inspector recommends enforcement action to Washington/FRA. By statute, the State can go to court to prosecute a violation only if the Federal Government fails to act within 180 days from the date of the violation.

In the Track Safety Inspection Program, State inspectors/trainees work in the State participation program in 14 of the 31 States to which Federal inspectors are assigned. In five of these States, the number of State inspectors/trainees exceeds the number of Federal inspectors; in six, State and Federal inspectors are equal in number; and in the remaining three, Federal inspectors outnumber State inspectors. In addition, six States that have no Federal track safety inspectors assigned to them have State inspectors/trainees participating in this program. The basis for the assignment of State track safety inspectors is, by Federal regulation, that one inspector be assigned for every *4,400* miles of track in-State and that each mile of track be inspected once every 2 years.

In the case of the freight car equipment standards, there is greater overlap of Federal and State inspectors: only one State that does not have Federal freight car equipment inspectors assigned to it is participating. Six of the remaining eight States have fewer State inspectors than Federal inspectors, one has the same number and one has more. While problems of coordination may occur as a result of the presence of Federal and State inspectors, the doubling up of Federal and State inspector assignments does not necessarily constitute duplication of effort because Federal inspectors may have inspection responsibility in States other than the ones to which they are assigned. The basis for the assignment of freight equipment inspectors is the assumption that a .5-percent sample of freight cars originated and terminated be inspected annually, which number is divided by a factor developed by FRA that represents the number of inspection points in each State.

One of the attractive features of the State participation program, from many States' point of view, is the possibility of Federal funding for their safety inspection efforts. However, the States must submit extensive information to obtain initial certification and on an annual basis to maintain full certification. Many States have complained about the paperwork involved, but

'"PMM & Co., "Task II I," p, III. .!.

of the States which were critical of the State participation rules at the outset (during the public comment period on the proposed regulation), only two—Wyoming and Kentucky—are not currently in the program.

In order to receive funding, a State must apply for a grant-in-aid from FRA. Up to *50* percent of the direct and allowable indirect costs associated with the safety program can be approved for funding. In applying for this *50* percent funding, the State must declare that:

It will provide necessary funds to finance costs in excess of Federal payments; and

- Aggregate expenditures for railroad safety, exclusive of Federal funds, will not fall below the average level of expenditures during the 2 fiscal years preceding *1970* or previously provided to FRA.

In 1977, the FRA funded State track safety inspection at approximately **$580,000** and State freight car safety inspection at approximately $250,000. These expenditures extended inspection in the track and freight car safety areas by **39** fully qualified inspectors and 6 trainees. (See appendix D for details of funding.)

RAILROAD INSPECTION PROGRAMS

As stated earlier, the FRA envisions that its inspection programs are to ensure compliance with Federal standards rather than to discover defects and directly to prevent accidents. The FRA believes that this latter responsibility belongs properly to the railroads. Furthermore, it has incorporated certain inspection requirements on the part of the railroads into FRA regulations. In addition to the Federal view of their responsibilities, however, the railroads undertake to perform inspections that accomplish a variety of purposes for the well-being of their operation—including safety. Track geometry, signal systems, and car inspections, for instance, all contain both preventive maintenance and safety promotion goals.

Although inspections of railroad facilities and equipment dates back many years prior to establishment of Federal or State standards and regulations, the existence of Federal standards for track cars, locomotives, signal and train control systems, and train operation has resulted in a certain uniformity among railroad inspection programs. This uniformity stems from prescriptions in the regulations that dictate such things as frequency of inspection, length of time employees can be on duty, and the like.

Another phenomenon that has grown in part from the regulatory structure is the similarity between most railroad inspection efforts and the FRA inspection programs. Although divided along the same programmatic lines, the railroad inspection programs nonetheless differ in two key ways from the Federal inspection programs:

- The railroad inspection programs are designed to detect defects before they become serious enough to cause damage or violate the standards; for this reason, together with the Federal Government's requirements, railroad inspection is more frequent than Federal/State participation inspection.
- Frequently, the person charged with the responsibility of detecting the defect is also charged with the responsibility of correcting it.

"These comments are contained in the FRA Public Docket, RSSP-1 and 2.

TRACK

The charts that follo w summarize the required frequency of inspect ons by inspect on program and type:

Track[29]

Class of track	Type of track	Frequency
1,2,3	Main track and sidings	Weekly with at least 3 calendar days between inspections or before use of track, if used less than once a week, or twice weekly with at least 1 calendar day between inspections, if the track carried passenger trains or more than 10 million gross tons of traffic during preceding year
1,2,3	Other than main track and sidings	Monthly with at least 30 calendar days between in spections
4,5,6		Twice weekly with at least 1 calendar day between inspections

In add tion to the above, inspections are made in accordance with the following FRA regulations:

- Each switch and track crossing must be inspected on foot at least monthly, except for track used less than once a month, in which case inspection must be made before it is used.
- A search must be made at least once per year for internal defects in certain classes of rails. If new rail is inductively or ultrasonically inspected and all internal defects are removed before or within *6* months after installation, the next search for internal defects need not be made until 3 years later.
- Special inspection must be made of track involved in a fire, flood, severe storm, or other occurrence which might have damaged track structures as soon as possible after the occurrence.

MOTIVE AND POWER EQUIPMENT[30]

Freight Car Inspection

The general practice in the industry is to inspect freight cars at interchange points, in major *yards* or terminals, and as required by the **500-**mile inspection rule.[31] Cars are inspected visually at these points.

As part of the inspection made of cars at points where cars are placed in trains to detect such defects as those listed above, dates stenciled on the sides of cars are noted to determine if any time limits, as prescribed by FRA and/or the AAR,[32] have expired with respect to car age as well as to such periodic attention as:

- Detail inspection of truck components (wheels, *axles,* bearings, etc.), couplers, cushioning units, center sills, body bolsters, and center plates;
- Single-car testing of air brakes (IDT—or in-date test);
- Cleaning, oiling, and single-car testin$_g$ of air brakes (COT&S—or clean, oil, test, and stencil);
- Replacement of plain bearing lubricators; and
- Lubrication of roller bearings.

29 Track Safety Standards. FRA, Office of Safety, March 1975. (49 CFR 213).

30 PMM& Co., "Task 111, " section IV.

31 *Railroad Freight Car Safety Standards,* Federal Railroad Administration, Office of Safety, June 1975. (49 CFR215).

32 *Field Manual of the Interchange Rules,* Association of American Railroads, Washington, D.C., Jan. 1, 1977, cited in PMM & Co., Task III.

Further, lading on open cars, such as flats and bulkhead flats, is inspected to see that it has not shifted and that it is properly secured, and closed cars are opened for such inspection when there is evidence, such as leaning of the car, that the lading may have shifted.

Cars are usually inspected in train yards by regularly assigned car inspectors either riding slowly on a special cart or walking along each side of a group of cars.

Detail inspection, as well as any necessary repair or replacement of the components is made on a repair track or at a car shop. This inspection is made on high utilization cars within **24** months after construction or reconditioning and within each succeeding 12-month interval, and on other cars within 96 months after construction or reconditioning and within each succeeding 48-month interval.

After cars are assembled for movement in an outbound train, the air brake system is tested for leaks by charging the system and observing **a** gauge to ensure that the air pressure losses remain within limits specified by FRA. Such a test, as well as inspection of the air brake cylinder on each car for excessive piston travel (indicating reduced braking force), also is made at intervals of not more than *500* miles on trains that move more than this distance without being disassembled.

Locomotive Inspection[23]

The locomotive inspection regulations consist of four subparts which govern tests and inspections for the following aspects of Locomotives: (a) boilers and appurtenances; (b) steam locomotives and tenders; (c) other than steam locomotives and appurtenances; (d) multiple-operated electronic units. Each of these subparts requires various tests and inspection intervals for certain of the components that it covers. A summary of those requirements follows:

[33] **49** CFR 230

Locomotive Inspection

	Inspection interval	Test interval
Boilers and appurtenances		
Boiler	4 years (interior) 5 years (exterior)	
	Inspected and tested before put in service and when sufficient number of flues are removed to allow interior to be examined	
Other **than steam** locomotive **and appurtenances**		
Brake equipment/main reservoir		18 months
• Visible insulation and electrical connections	month	
. Nonsteam boilers	Whenever sufficient number of tubes are removed to allow inspection	
Steam locomotives and tenders		
• Stay bolts		1 month
• Steam gauges		3 months
• Safety valves		**3** months
Water glasses and gauge cooks		Before each trip
Multiple-operated electric units	**Every 24** hours when in service	
• Multiple operated electric units/main reservoirs		**2** years
• Train signal system		Before each trip
Insulation		1 year
Visible insulation/electrical connections		1 month

Signal Inspection

Signal mechanisms, switch circuit controllers, and electric locks are visuall$_y$ inspected for broken, missing, or worn parts; and signal mechanisms, electric locks, relays, and lightning arresters are tested in accordance with the manufacturer's specifications. Track switches equipped with a circuit controller connected to the switch point are adjusted, if necessary, to ensure that the control circuits will be open or shunted, or both, when the switch point is not in the proper position. Testing of wire and cable insulation, when dry, consists of measuring the resistance to the flow of electrical current by use of a megohmmeter to determine if the resistance is within the minimum limits allowable by FRA regulations.

Signal Inspection[34]

	inspection interval	Test interval
Signal mechanisms	6 months	2 years
Switch circuit controllers	3 months	**3** months
Electric locks	2 years	2 years
Relays		2 years
Lightning arresters		1 year
Wire and cable insulation:		
Not designed for underground low-voltage use with part underground or in trunking		5 years
Not designed for underground low-voltage use with no part underground or in trunking		**8** years
Designed for underground low-voltage use		8 years
Local signal wiring		8 years
Lead-covered signal power cable		8 years
Underground signal pow;r lines not lead sheathed		5 years

ANALYSIS OF RAILROAD INSPECTION

Many of the railroad employees who are responsible for the various inspections described above also are responsible for their repair. Thus, there is an incentive built into the system for the railroad employee to (a) detect and (b) eliminate any defect discovered, because he is accountable for any failure that takes place whether it be attributed to inadequate inspection or inadequate workmanship. There is no reason for "passing the buck." However, because the same employee is responsible for detection/repair of defects for both operational and safety reasons, it is difficult to ascertain the direct safety inspection costs incurred by the railroads. In fact, in man$_y$ instances, the railroads do not have cost accounting systems that are capable of providing such data.

Although the quality of inspections varies among railroad companies, many defects in railroad facilities and equipment are detected through inspections performed by the railroad inspectors. Furthermore, each railroad's own operating and safety rules require train inspections by various employees in addition to those required by Federal or State regulations. Examples of operating and safety rules that require such inspections are the following, which were extracted from the rules published by one of the railroads interviewed as part of this stud$_y$:

[34] *Rliles, Standar~is, aHd I}zstructiom for Railroad Si,gyal Systms,* Federal Railroad Administration, Bureau of Railroad Safety, November 1969, taken from PMM & Co., "Task III," Section IV.

Operating Rule No. **714.** Employees must, when practicable, observe passing trains and, when unsafe conditions are noticed, endeavor to stop the train and notify the train dispatcher when possible.

Safety Rule No. **160.** Train crews will inspect their train where stopped for operating reasons when time permits .35

Nonetheless, despite the high level of inspection effort required, the continuing high accident rate raises questions both about the extent to which the railroads comply with the inspection requirements as well as about the extent to which inspection can help to avert accidents. The effectiveness of the railroad inspection efforts depends, in part, on the thoroughness of their efforts, their ability to detect "unsafe" conditions, and the degree to which the standards they inspect against provide appropriate safety levels.

Furthermore, determining the relationship between the railroad inspection efforts and the Government inspection programs, as mentioned earlier, is problematical because of the unified operational and safety purposes that inform the railroad's own inspection programs, and because of the unquantifiable "motivational power" of the Federal inspection programs. Even if Federal inspection programs succeed in "motivating" compliance with the inspection requirements, their effectiveness is still contingent on the same three variables as is the effectiveness of railroad inspection programs.

The FRA's ability to motivate compliance through its inspection program, however, depends, in part, on how the railroads view the regulatory requirements and how they view the penalties for noncompliance. Thus, while raising questions about the "content" of the inspection program requirements, questions must also be raised about the effectiveness of the penalty structure. Exploration of these two questions shows that they are intertwined and that they go to the heart of the inspection program.

"PMM & Co., "Task III, " Section IV,

There has been controversy about the penalty structure. Some are strongly of the opinion that penalty levels should be raised (either the minimum, the maximum, or both) in order to make a violation less tolerable financially to the railroads.[36] Proponents of this position would agree with the GAO observation recorded in a 1975 letter to the Secretary of Transportation. Director of Resources and Economic Development Henry Eschwege wrote:

> . . .One FRA inspector we accompanied observed four freight cars with defective airbrakes in a train about to depart. . . He reported these defects to the trainmaster. . . The trainmaster ordered the train to depart with the defective freight cars.
>
> A (railroad) official told us that the trainmaster did not have company authorization to operate freight cars with safety defects; however, a railroader would not necessarily consider defective brakes on a few cars intermixed throughout a large train to be a serious safety defect because the brake power of the remaining cars would be sufficient.
>
> The railroad was subject to a fine in this case, but the FRA inspector said that, because of the small amount of the fine involved (in this case **$250** for each defective car), it was more advantageous for the railroad to pay the fine than disrupt a train which was otherwise ready to leave. 37

Proponents of the argument to raise the penalty for such violations would point to this case as an illustration of the insufficiency of motivation provided by the minimum penalty established by the statute. They would make an economic argument that if it had cost more to move the train under violation than to take it out of service, the trainmaster would have taken it out of service. The FRA, on the other hand,

[36] See, for example, *Hearings on the Federal Railroad Safety Authorization Act of 1976*, supra.

[37] 4-11-75 letter from Henry Eschwege, Director, Resources and Economic Development Division, U.S. General Accounting Office, to the Secretary of Transportation, (B-164497(5))

testified during the hearings on the 1976 Safety Authorization Act that raising the penalties would not in itself promote greater safety. In arguing for the abolition of minimum penalties rather than for their increase, then-Administrator Hall observed, "Simply penalizing a railroad which has very little cash *to* start with does not help in terms of giving that railroad the ability to correct the deficiency ."[38] During those same hearings, railroad officials echoed those sentiments, stating that they were abiding by the safety standards as conscientiously as they could and that if they had to pay increased penalties that would mean taking money from somewhere else.[39] This type of discussion may not do much to illuminate the issue of whether increased penalties would increase railroad motivation to comply with safety standards; however, it does make it clear that "motivation" must be provided within the "real world" of the industry's financial condition and that penalties are but one variable in that world.

From this framing of the issue, it appears that the issue of program content may lie dormant within the controversy about penalties. It is difficult to know how widespread such an occurrence as that cited by GAO is, but if railroads do sometimes make their own judgments about the relative importance of certain safety standards (albeit in conjunction with the existing penalties in mind), then perhaps such judgments indicate something about the nature of the regulations themselves. Are the standards used by both the FRA and the railroads to inspect the appropriate standards? Are they sometimes skirting around the perceived periphery of the safety problem, as indicated in the GAO report? The Association of American Railroads raised a similar concern about the nature of the standards being enforced by the FRA inspection program. In comments to the Office of Technology Assessment on the issues surrounding the subject of railroad safety, the AAR stated its view that the standards are essentially those used by the railroad industry for many years and went on to say:

> In promulgating these regulations FRA has not addressed the following questions: 1) have circumstances developed for which these previously developed recommended standards are no longer appropriate? 2) are these recommended industry standards not generally being observed? If so, has that resulted in additional track- and equipment-related accidents and has that created a safety problem? **3)** were the industry standards ever intended as absolute rules, or as merely recommendations of good—or of financially justifiable—practices? and 4) was there real evidence of widespread "violations" of the industry standards in the first place, such as would make Federal adoption justified?[40]

The first three questions are particularly germane; if the railroad industry itself has questions about the appropriateness of standards for which it is by and large the source, that may be reason enough to look beyond the inspection programs to the substance and the credibility of the standards against which inspections are made and upon which any enforcement strategy must inevitably be based. In this real sense, the effectiveness of the Federal and of the railroad safety inspection programs is interdependent with the regulations and standards on which they are based.

[38] Hearings on the 1976 Railroad Safety Authorization Act, supra.
[39] Ibid.
[40] Association of American Railroads, *Comments on Safety-Related Issues*, submitted to OTA, Dec. 1, 1977, p. 14.

Chapter IX

RESEARCH AND DEVELOPMENT

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RESEARCH AND DEVELOPMENT

The Federal Railroad Safety Act of 1970 marked the beginning of increased Federal interest in railroad safety research and development. The congressional hearings for the Act indicated that accidents caused by human factors, equipment, and track were believed to be the predominant causes of the safety problem. Moreover, the dramatic impact of and the rise in tank car ruptures as well as the significant number of railroad grade-crossing deaths were clearly documented in those hearings. From this setting, the Federal Railroad Administration (FRA) initiated its regulatory and research programs. The Association of American Railroads (AAR) and individual railroads also began to increase research and development activities in the early *1970's.* An overview of the 7-year span of research and development activities conducted by the Government shows the following:

- Government programs related to railroad safety have included: track research program and track safety research; a rolling stock program, including tank car research, equipment component failure research, personnel protection, and other research programs; human factors research; and information and support research programs; grade-crossing research; and automated inspection and surveillance technology programs. Each of these areas has application to safety and has been discussed by the FRA in its various annual safety reports. However, several programs have been funded through agency appropriations for R&D, while others have been funded from R&D monies made available by the **1970** Safety Act. Therefore, distinguishing between the origin of funds for specific safety R&D projects is difficult.
- Part of Government efforts, time, and resources have been devoted to establishing test and research facilities. Included among the facilities was the development of the Facility for Accelerated Service Testing (FAST) Test Track at Pueblo, Colo. Earlier, the industry relied on the AAR Technical Center in Chicago and railroad facilities for much of its research efforts.
- Greater research efforts for both Government and industry have been directed at technological studies of track and equipment R&D, areas which are more related to the property and lading loss and damage problem, rather than to human factors research. Typically, research efforts have been directed at problems with technological solutions, because it is generally assumed that such research has higher payoff and more clearly measurable results than human factors efforts. Government and industry research and development programs have been no exception to this rule.
- Of the research efforts directed at the casualty problem, emphasis has been placed on grade-crossings (where most fatalities occur) and on tank cars (which have the potential for the greatest catastrophe).
- Track-related and equipment R&D programs were scheduled to span the decade before comprehensive research findings were anticipated. In track and equipment research, the lack of scientific data, insufficient understanding of track and equipment life cycles, and lack of knowledge of track and equipment interaction under a variety of operating conditions created the situation where research and development, if it was to be fruitful, had to be directed initially at identifying and understanding the problems, before solutions could be developed.

The emphasis on track and equipment R&D seemed appropriate for both industry and Government programs, given the frequently cited accident rates caused by track and equip-

ment, the **1970 congressional** mandate, and the general technology orientation of most transportation research. Moreover, while FRA was charged with addressing these problems through regulation, it was the expressed goal of the track and equipment research programs that a more scientific basis for those regulations was desirable in the future. * As noted in the early FRA Annual **(1972)** Safety Report:

> Out of the FRA Track Structure R&D will come recommendations covering the level of track maintenance required for safe operation, and concurrent recommendations to the railroads for new track structure with reduced maintenance characteristics. . . . Considerable impact from these programs is anticipated late in the **1970's as** track maintenance standards are defined and railroads act to bring their level of maintenance up to these standards.

- In track structure research, attention has been focused on track stability and life cycle, track maintenance, and, to a lesser degree, on track geometry and wheel rail compatibility, Initial efforts in the track structure program went toward establishing the track-test facility at Pueblo from the high-speed rail R&D appropriations. Subsequently, research has concentrated on track componentry and track stability. The types of track structure efforts have included research on rail structure and stress, rail performance, track maintenance, track durability and geometry, and track-testing. Cooperative efforts between industry and Government have been extensive in these areas. The individual AAR efforts have also been directed in these and other areas of track research. Examples of specific track research projects include track-buckling studies, cross-tie research, and bolt-hole practice studies.[2]
- In the rolling stock program, Government and industry research efforts have concentrated on tank car safety, equipment componentry and failure prevention, and the track-train dynamics program.
- The inspection and detection surveillance research effort has concentrated on automated track inspection, vehicle development, data collection, and analyses utilizing that equipment.
- The human factors research conducted by FRA has consisted of several job analyses, including those of the train dispatcher, engineer, and conductors positions, and a medical qualifications study for selected railroad employees. Participation by all concerned parties in these earlier human factors research efforts was not characteristic of the projects. Generally these projects have not been considered successful, compared with several more recent efforts. Other efforts have included research in locomotive/train handling, cab environment, and on the vandalism problem. In addition, the Office of Policy and Program Development initiated the survey of industry alcohol and drug abuse programs and an industry-wide survey of training programs.
- There have been several cooperative efforts directed at employee problems, which have successfully demonstrated cooperation as a means for obtaining and implementing safety measures directed at the casualty problem. Among projects where management, labor, and Government have worked cooperative y are: locomotive cab research, glazing research; alcohol and drug abuse program inventory; and the St. Louis terminal project, which had safety implications.

*Initial regulations promulgated were based largely on existing practices and existing industry standards. By law, some regulations had to be published within a year of the enactment of the 1970 Federal Railroad Safety Act.

‘1972 *Annual Safety Report to Congress*, Federal Railroad Administration, Research & Development Section.

zı **975, Ninth Annual** *Report on Railroad Technology Program,* FRA, p. 34.

- A trend in cooperative research efforts with labor, management, and Government working together as an effective means for improving safety has become more common in recent times. This is evidenced by cooperative efforts previously mentioned, as well as by the establishment of the Railroad Safety Research Board, whose purpose is to set priorities for safety research based on accident data and the increased understanding resulting from the 1976 accident analyses. Initial efforts resulting from this committee are to be directed toward identifying safety problems related to the yard brakeman, the employee category with the most statistically significant injury rate.

- The only comprehensive research or analysis conducted on the accident data, trends, or causes of accidents has been the *1976* Shulman-Taylor Accident and Casualty Reports conducted by the AAR. (These reports are covered extensively in chapter V.)

- Recent labor/management negotiations have temporarily precluded labor's continued efforts on all cooperative safety committees.

COOPERATIVE PROGRAMS

Throughout the course of this study, repeated attention was called to the need for cooperative efforts in safety research and development, if such research was to be either successful from an analytical perspective or acceptable from the perspective of those who would be affected by it. Technological studies related to track and equipment have typically included railroad and supplier input to the projects. However, only recently have any strides been made toward cooperative efforts in casualty research (the early establishment of the Locomotive Control Compartment Committee is one exception to this). Several cooperative research efforts frequently cited by labor, management, and Government officials include:

—Locomotive Control Compartment Committee.

—Alcoholism Project.

—Glazing Project.

The Glazing Project was established as a result of repeated labor concerns and the resulting legislative initiatives about the problem of objects being thrown at rolling stock and injuring the train crew. Specifically, labor argued that Locomotive engineers were being unnecessarily subjected to bullets and thrown objects. As a result of these concerns, the FRA Office of Safety Research formed a joint labor-management committee to determine the extent of the problem and to research alternative solutions to that problem. Accordingly, the AAR collected data from *52* railroads on missile impacts to railroads rolling stock for a 2-month time period. The following information was collected and analyzed as a result of the effort. "If the data for the 2-month period is assumed to be typical, the following table reflects the problem:"[3]

	Number of incidents	
	Z-month period	*l-year*
Hand-thrown.	*754*	4,524
Guns	109	654
Overhead suspension	9	54
Slingshot	5	*30*

Once the problem had been identified, the FRA research team, in conjunction with the Glazing Project team, conducted field tests of

[3]1nternal Memorandum, FRA Office of Safety Research, Apr. 27, 1977, p. 1.

existing crash-resistant technology to determine performance specifications for glass in the locomotives and caboose. As a result of this effort, performance specifications for glass for new equipment or replacement in damaged equipment were drawn up. The adoption- of these standards is awaiting final approval by railroads early in **1978.**[4]

The Locomotive Control Compartment Committee was established in 1971 as a "labor-Government-industry coalition sharing mutual interest in the study of locomotive crews." Membership on the committee included representatives of FRA, Brotherhood of Locomotive Engineers, UTU, and AAR. While this committee's work is ongoing, its initial efforts began in the early *1970's.* An initial in-depth analyses, and ministudy by FRA on locomotive cab accidents and injuries was conducted and a review of the interior cab design was made. As a result of this analysis, the locomotive suppliers were requested to provide clean mockups of cabs with recommended changes. After the mockups, 17 safety changes and features were adopted. The equipment purchased since that time has reflected these changes.[5]

The Alcohol and Drug Abuse research effort was initiated by the Office of Policy and Program Development of the FRA. The Office of Safety within FRA had initiated proceedings for a regulation prohibiting alcohol use on railroad property. (Rule G, a part of the railroad standard code, prohibits alcohol consumption on railroad property.) Both labor and management objected to the proposed regulation. The Alcohol Research effort is a two-phased project, with Phase I completed. Phase I identified those railroads with Alcohol and Drug Rehabilitation Programs, the type of program being conducted, and the results, if available, of the programs.[b]

At the time Phase I was conducted, there were 20 railroad programs identified. Subsequently, an additional 5 railroads established programs. The success of many of the alcohol rehabilitation programs was unknown at the time of the Phase I study, a factor not uncommon to alcohol research. The types of programs sponsored by railroads ranged from in-house counseling centers to referral programs for community alcohol, drug abuse, and mental health centers. ' Phase II of the alcohol research is designed to identify several model rehabilitation programs. The information is to be disseminated to railroads without alcohol programs. Of significance to the alcohol research effort is the fact that only recently have attempts been made to document the extent of the railroad alcohol problem, while attempts had already been made in the accident data collection process. Although the tendency to mute the usage of alcohol as a safety problem is prevalent in this society, it would appear that an increased understanding of one aspect of the human factors problem might become clear if further research were conducted. Highway fatalities resulting from alcohol involvement are estimated between 35 and **50** percent.[8]

These cooperative research efforts represent some successful efforts toward human factors studies. They have been relatively inexpensive for the results produced. Findings from these efforts have been successfully incorporated into the industry structure. Moreover, the research conducted appears to have been pragmatic, short-term, and responsive to perceived needs at a given time.

'Interview with Dr. William T. Harris, AAR, December 1977.

'Interviews with Mr. Ed McCulloch, Brotherhood of Locomotive Engineers, and Dr. William Harris, November and December 1977.

'Interview with Mr. Theodore Voss, Policy and Evaluation Division, FRA, November 1977.

'A Survey of Alcohol and Drug Abuse Programs in the Railroad Industry, FRA-OPPD-ORD 76-283, conducted by Naval Weapons Support Center, Crane, Ind., November 1976.

[8]*Fatal Accident Reporting System, 1975 Annual Report,* DOT, National Highway Traffic Safety Administration (NHTSA), p. 57 and *Traffic Safety '76,* U.S. DOT (NHTS), p. 16.

RAILROAD GRADE= CROSSING RESEARCH

Federal cooperative efforts on grade-crossing safety research were begun in 1968, when the Federal Highway Administration and Federal Railroad Administration were instructed by the Secretary of Transportation to form a joint national program. In 1972, a report was submitted to Congress outlining the extent of the grade-crossing problem and several alternatives for improving the problem. Since that report, the railroads and Federal Government have inventoried approximately 402,000 to 410,000 grade-crossings or 98 percent of the Nation's grade-crossings. [9] (Discussion of railroad grade-crossing programs is included in chapter X.)

In the last 7 years, research and development efforts on the grade-crossin$_g$ problem have focused on development of equipment, materials, and innovations in barrier protection; identification of and experimentation with equipment and devices for locomotives in preventing or minimizing grade-crossing impacts; collisions and crash-worthiness of vehicles at grade crossings; driver behavior; and analysis and development of computer models to assist States in determining the best complement of equipment for different classes of grade-crossings. FRA expenditures on grade-crossing research during 1973-76 were approximately $3 million, while Federal highway funds for research over the same period were approximately $1.7 million. 10

TANK CAR RESEARCH

The strong emphasis placed on accidents involving hazardous materials during the hearings for the 1970 Railroad Safety Act resulted in quick initiation by the FRA of research efforts to improve tank car design and performance. The AAR also has initiated research on the hazardous materials problem. The FRA, AAR, and Railroad Progress Institute (RPI) then combined research efforts on the problem.

Over a 5-year period, the tank car research effort involved testing for fire protection, examining the conditions of ruptures, and testing a number of hypotheses regarding improvements which could be made in tank car design. The results of the research now incorporated in regulations include: thermal protection systems, safety relief valves of adequate capacity to protect thermally insulated tanks, shelf couplers, and tank head puncture resistance systems.

The effective implementation dates of this research and the regulations vary according to the specific research feature, however, the final date for retrofitting is 1982. The estimated cost to the railroad industry is *$200* million. Federal expenditures for tank car research have been approximately *$5* million.

In addition to research on tank car design, growing concern has been voiced by the industry regarding transportation of nuclear wastes. While the issue has been one of economics, i.e., rates charged by the industry for shipping nuclear wastes and the economic liability of the industry in the event of an accident, discussions also have taken place between railroad industry and energy officials regarding the methods and containers to be used in such transportation and the testing of those containers. To date, the Department of Energy (DOE) has conducted research related to *trans*portation and containerization to be used in rail shipments. Current discussions between the FRA and DOE are focused on potentia} for cooperative testing of these containers. [1]

[9] *1974 Annual Report to Congress on the Administration of the Federal Railroad Safety Act of 1970*, p. 34.

[10] "Telephone interview with Mr. Sid Louick, Federal Highway Administration, January 1978.

[1] Interview with Mr. Lev Peterson, Office of Safety Research, FRA, December 1977.

R&D EXPENDITURES

Federal expenditures for railroad research and development applied to contemporary railroad concerns in the late 1960's and early 1970's were small in comparison with the research dollars being spent today. As shown in table 36, Federal research dollars (FRA) increased dramatically during 1971-76. (Part of this went into construction of the test facility at Pueblo, Colo.) Moreover, safety expenditures for the period 1973-76 rose from $3.6 million in 1973 to $8.0 million in *1976,* or **124.5** percent (not adjusted). Safety R&D expenditures (Federal Railroad Safety Act funds) were approximately $20 million during 1973-76, while overall R&D expenditures related to safety (including FRSA funds) were approximately $47 million (tables 36 and 37). In 1976, safety R&D accounted for 13.1 percent of total R&D.

Industry expenditures for research and development also were quite small in the early 1970's. However, industry resources* from 1973 to 1976 rose by 560 percent, excluding Government contributions, as seen in table 38. In *1977,* safety R&D expenditures accounted for 3.3 percent of the total industry R&D, exclusive of the Government contribution. Definitionally, research placed in other categories by the AAR, typically has been included under safety research in the FRA annual safety reports.

Table 36.—FRA Research and Development Obligations
(Dollars in millions)

	1971	1972	1973	1974	1975	1976
Safety	—		$3,568	$3,406	$5,023	$8,004
General R& D.	$ 1,218	$ 1 ; G 4	43,534	35,045	35,037	53,206
Total*	$1,218	$12,964	$47,100	$38,451	$40,060	$61,210
Percent safety of total.	—	—	7.6	8.9	12.5	13.1

• Includes obligations from Office of Research and Development, Transportation Systems Center, and Office of Program and Policy Development.
SOURCE: Task IV Report, PMM, & Co., for Office of Safety Research, FRA.

Table 37.—Total FRA Research and Development Office Expenditures for Safety-Related Research, * 1973-76
(Millions of dollars)

Program	Expenditure
Track structures research.	$20
Inspection and test support	7
Rolling stock.	14
Human factors & information support.	3
Grade crossing.	3
Total.	& 4 a

● Approximated.
aThis figure includes Federal Railroad Safety Act funds ($20 million) for the 1973-76 time period.
SOURCE: FRA, Office of Safety Research.

Aggregate research and development expenditures of the Federal Government and industry in 1975 represent only .3 percent of industry operating revenues (table 38). Given the discrepancy between industry and Government definitions of safety research and development, it was not possible to establish the relationship of safety 1<L'D to total operating revenues. As

*Industry resources is defined as those monies expended by AAR Research and Test Department; these funds do not take into account individual railroads R&kD budgets, although it includes railroad contributions and RPI contributions to the AAR. This definition of industry R&D applies whenever industry R&D is referred to in this report.

Table 38.—AAR Research and Test Budgets, 1974-77

	1974	1975	1976	1977
R&D (excludes Government contribution; includes suppliers, railroads)*	5,177,200	5,820,577	9,998,147	12,127,700
Government contribution (includes safety)	2,517,000	2,258,700	5,906,000	13,548,900
AAR safety expenditures (excludes Government)	95,000	182,800	420,000	405,550
Total	7,789,200	8,262,077	15,324,147	26,082,150
Percent safety of AAR R&D budget	1.8	3.1	4.7	3.3

•Because of the Research and Test Department budget procedures, the tank car, grade-crossing, locomotive cab, coupler, and track-safety programs have been included in the general AAR R&D column of this table, rather than as a line item safety account. These programs represented $1,616,000 in 1974, $740,000 in 1975, and $558,750 in 1977. There are safety costs inherent i n most R&D projects specifically dealing with technological problems.
SOURCE: *AAR Research and Test Department Biennel Report, 1974-75, 1975-76* draft.

can be seen, the amount of investment by both Government and industry in R&D, though increasing, is still quite small.

Although not exact, comparison of Government safety-related R&D expenditures for track, equipment, and human factors shows that the major thrust of Government research has been devoted to rail and equipment problems. Of the total $47 million which has been expended on safety-related R&D, approximately $12 million has been spent on research most closely related to the casualty problem as shown in table **39.**

The recent AAR accident analyses have caused both Government and industry to begin to rethink their position with respect to safety R&D. As indicated by the accident analyses examined in chapter V, the significant number of employee fatalities and injuries do not occur in track-related accidents. Property damage from train accidents account for 45 percent of total cost claims while casualty claims, the majority of which do not occur because of train accidents, also account for about 45 percent. Therefore, the lack of R&D expenditures on human factors and on the casualty problem, given its equal economic magnitude with equipment and track problems, suggest that some greater attention may be focused in these areas.

While the previous data on Government expenditures indicates a growth in R&D expenditures, prior to this decade such emphasis was extremely limited. Railroads usually adopted technological innovations only after their effi-

Table 39.—FRA Office of Research and Development Approximation of Safety-Related Expenditures, 1973"1976 (Millions of dollars)

Safety-related programs	
Track-structures research	**$20**
Inspection and test support	**7**
Rolling stock	**14**
Human factors & information support	**3**
Grade-crossings	**3**
Total	**$47* ***
Safety research related to casualties	
Grade-crossings	*$ 3.0*
Tank car	*5.0*
Personnelprotection	*1.0*
Human factors	S.4
Total	$12.4
Rolling stock expenditures	
Tank carresearch •	*$ 5*
Equipment component failures	*7*
Personnelprotection••	*7*
Other	*I*
Total	*$14*
Human factors Research	
Task analyses	*$1.0*
Train-handling	*.5*
Locomotive evaluator	*.5*
Cab environment	*.5*
Information support	*.5*
Vigilance and vandalism	*.2*
Alcohol and drug abuse	*.2*
Total	$3.4

'Indicates those programs related to the casualty problem or human factors research.
•● Of the $47 million, $20 million was the result of Federal Railroad Safety Act funds.
SOURCE: FRA Office of Safety Research.

ciency and value were clearly proven and demonstrated to have railroad application. More~jver, specific research usually occurred in conjunction with suppliers and only on an incremental basis. As stated in the 1972-73 AAR Biennial Research and Test Department Report:

> In many fields, especially in track and equipment, the basic principles of design were established by research completed many decades ago. Problems encountered after research was completed were solved by iterative, trial-and-error laboratory and field studies. This approach sufficed during that time that the industry was not required to make rapid changes to accommodate new traffic demands or to respond to competitive and regulatory forces. In the last decade, major changes have been necessary to provide more transportation service and to adapt to safety and environmental regulations. Insufficient research had been performed to anticipate these requirements for change and to provide reasonable alternative solutions. 12

In more recent times, the reasons for the lack of R&D and the slowness with which innovation has occurred are numerous. However, the most apparent causes include: the poor financial condition of the industry at large and its lack of capital; the comparability problems of making new technologies co-equals to those already in usage, particularly in light of the differing life cycles of massive industry equipment and fixed plant; and the management philosophy and practices of the 1950's and 1960's, wherein R&D was not considered a priority in the industry.

Clearly there are several significant points concerning today's railroad research, irrespective of whether it is for the general industry or for safety. Because of the lack of resources, railroad economics have impeded innovation. Innovations which do occur in the present or future must be cost-effective. Finally, there must be a systematic economical method for implementation of research findings before there will be an overall willingness by the industry and interested parties to accept technological or operational change.

[12] *Progress in Railroad Research,* AAR Research and Test Department Biennial Report, 1972-73, p. 194.

Chapter X

HAZARDOUS MATERIALS, RAIL-HIGHWAY GRADE= CROSSINGS, OTHER RAILROAD SAFETY PROGRAMS

Chapter X

HAZARDOUS MATERIALS, RAIL= HIGHWAY GRADE-CROSSINGS, AND OTHER RAILROAD SAFETY PROGRAMS

HAZARDOUS MATERIALS

One dimension of the rail safety problem relates to the shipment of hazardous materials. Generally "hazardous materials" are those substances or materials in a quantity and form which may pose an unreasonable risk to health and safety or property when transported in commerce.[1] According to AAR, some 1.04 million carloads of materials, classified as hazardous, are shipped annually. Other sources indicate the figure is about *2.5* million and that 7.5 percent of the hazardous materials shipped by any carrier are shipped by rail. ' It is conceivable that the 1980's will see other increases in the shipments of hazardous materials, Increasing the volumes of hazardous materials shipped by rail could have an effect on the rate of accidents—injuries, fatalities, and property damage. This concern about the level of safety associated with the shipment of hazardous materials is based on an analysis of past accident data and information.

- Between 1971 and 1974, there was an average of 113 railroad accidents reported to be associated with tank cars each year. Associated with those accidents were 320 injuries, *3* deaths, 12,217 evacuations, and property damage of $10 million.[3]
- During 1974, approximately 8,500 hazardous materials incident reports wet-e filed with DOT's Materials Transportation Board for 550 carriers (all modes). Approximately 7 percent of those were filed by the rail carriers. Two hundred forty-eight reports included 32 fatalities and 900 injuries. Eleven of the fatalities involved gasoline as tank truck (or tank trailer) cargo in 10 different incidents. Seven fatalities and 349 injuries involved one liquid propane gas (LPG) tank car incident at Decatur, Ill. Sixty-nine people were injured at Wenatchee, Wash., in the explosion of a tank car containin$_g$ monomethalamine ammonium nitrate solution. Fifty-four people were injured at Oneonta, N. Y., in an accident involving the derailment of an LPG tank car. Roughly 65 percent of railroad cases involving the unintentional release of hazardous materials involved tank cars loaded with LPG, sulfuric acid, anhydrous ammonia, and liquid caustic soda. ~

'In the first quarter of 1977, among the top 25 hazardous materials shipped by rai1 were: ammonia, caustic soda, liquid propane gas (LPG), sulfuric acid, chlorine, propane, ammonium nitrate, gax~line, phosphoric acid, crude oil, methanol, petroleum distillate, vinyl chloride, butane, motor fuel ant i-knock c{}mpound, bu tad iene, and petr{w leum naphtha. (The measure: carloads: the ~(>urce [>f in-f{~rmat ion: AAR.)

'1'MM & Co,, Task I\'.

[3]1975 FRA Annual Report.

'Ffazardo~E *Matcrzals l)~ci~ic)~t RcpL~rts,* Department of Transportation, hfar. 7, 1975.



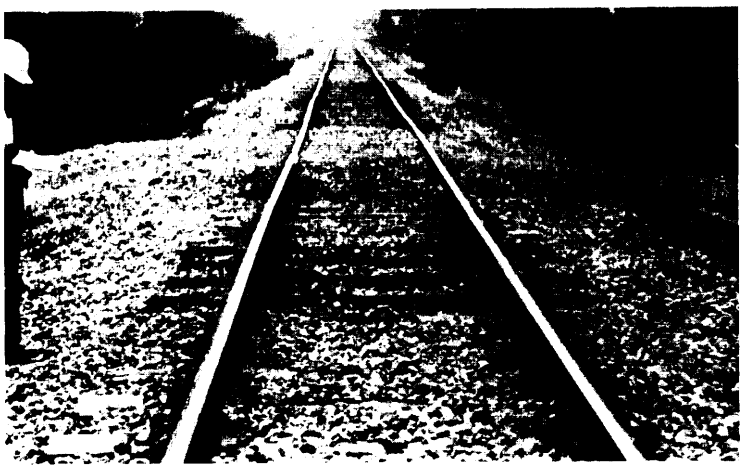
Photo Courtesy of the Association of American Railroads

Arrow points to insulated pressure tank car head shield—designed to avert puncture of tank by coupler after accident has occurred.



Photo Courtesy of Federal Railroad Administration

Tank car torching test— testing ability of insulating material to withstand torching environment.



Amtrak tracks; Meets FRA track standards—Class 4.



Frankfort, Ky.; Tank car derailment; Carrying Hydrocyanic acid; Broken rail; December 1977.



Tank car punctured by coupler at the **Frankfort derailment** shown **above.**

Photos Courtesy of National Transportation Safety Board

RESPONSES TO THE PROBLEMS ASSOCIATED WITH THE SHIPMENT OF HAZARDOUS MATERIALS

Federal Government

Statutory and regulatory responses. The need for a hazardous materials safety program was recognized with the passage of the Transportation of Explosives and Combustibles Act of 1908 (18 U.S. Code, $ 831 to 835). That Act prescribed the conditions under which certain explosives were to be shipped in vehicles and vessels engaged in interstate and foreign commerce. The next major piece of legislation was the Transportation of Explosives and Other Dangerous Articles Act of 1960 (P.L. 86-710), which covered radioactive materials and etiologic agents and extended coverage to the transportation of the denominated materials by private and contract carriers. Chapter VII covers a detailed discussion of the provisions of the controlling legislation. Suffice it to say that what controls now is the broadened authority given to the Department of Transportation under the Transportation Safety Act of 1974. Among other things, that Act provided the authority for: the designation of materials as hazardous materials and issuing regulations for their safe transportation; establishing a program of registration of shippers, and container and packaging manufacturing; and establishing criteria for handling hazardous materials. A Materials Transportation Bureau was established in July 1975 and given the responsibility for coordinating the issuance of regulations and exemptions concerning the shipment of hazardous materials solely by rail; designating materials as hazardous; prescribing recordkeeping requirements; imposing sanctions for violations; and collecting and compiling data.

The Federal Railroad Administration has the responsibility for working with MTB in the development of standards, data collection, inspections, and general administration of the rules.

The regulations covering hazardous materials are discussed in chapter VII. See table 40 for actions required of various parties.

The impact of Federal regulatory action relative to hazardous materials: One activity of the Materials Transportation Bureau is that of requiring all shippers and carriers to file Hazardous Materials Incident Reports citing any and all unintentional release of hazardous materials. The industry response to this requirement indicates that more and more the Department of Transportation is being assisted in developing early warning systems and inspection strategies designed to meet the problem of hazardous materials shipped by rail. During 1971-76, there was an increase in the number of rail carriers reporting incidents. Tables 41 and *42* show the number of reporting carriers and the number of Hazardous Materials Incidents Reports submitted between *1971* and 1976. As can be seen for rail carriers, there **was a** rapid increase in the number of reporting carriers and the number of reports submitted. The increase between 1971 and *1976* of reporting rail carriers was 80 percent. The MTB believes that the increased reporting results from increased awareness of the reporting requirements.

Pressure tank cars have been involved in accidents since *1918.* Since 1969, there has been a growing concern expressed about the involvement of uninsulated pressure tank cars in serious railroad accidents. These concerns led to the issuance of regulations, effective October 19, 1977, calling for cars built after December 31, 1977, to comply; further, the regulations required retrofitting of existing tank cars. In dealing with the tank-car-safety problem, the Department of Transportation first sponsored research and development to provide the necessary analysis of the problem of puncture and rupture of pressure tank cars involved in an accident environment.

The Department of Transportation has issued

Table 40.—Actions Required To Ensure Safe Rail Shipment of Hazardous Materials*

Actions	Container manufacturer	Shipper	Rail carrier	Consignee	Federal inspectors
Packaging *and* ***Loading***					
Assure that the material is properly formulated ($173.22)**		x			
properly classified (173.22)		x			
properly packaged (5173.22)		x			
Assure that the shipping papers correctly describe the materials (s173.427)		x			
Assure proper placement and loading of packaged goods and bulk goods ($1 73.31), (§174.525)		x			
Assure the proper packaging of intermodal shipments such as portable tank and highway trailers; and assure proper loading of the same ($173.32)		x			
Assure proper placarding of the rail cars ($174.548)		x			
Train officers, agents, and employees as to shipping requirements		x			
Inspection					
Ensure compliance with the railroad equipment and safety standards			x		
Ensure compliance with the DOT hazardous materials regulations			x		
Ensure receipt of properly executed shipping papers ($174.510)			x		
Understanding FRA and MTB regulations requiring the proper handling of rail cars			x		
Training personnel in FRA and MTB regulations			x		
Audit shipper rail carrier operations to ensure compliance					x
Incjdent/Accjdent Handling					
Supply information on how to control the problem	x				
Supply notice of certain hazardous materials incidents (~171 .15 and 171 .16)			x		
Unloading					
Safely and completely unloading materials and in the case of tank cars securing valves ($174.560)				x	
Removing placards ($174.562)				x	

● SOURCES: 49 CFR 173ff. Black, W. F. *Transporting, Load/rig and Unloading Hazardous Materials Using Railroad Transportation* Technical Paper No, MS 75-660, Society of Manufacturing Engineers, 1975, p. 2,

●● The citations provided are applicable sections of 49 CFR.

Table 41 .— Number of Carriers Reporting to MTB

Mode	Reporting Carriers 1971	1972	1973	1974	1975	1976*	Total	Percent of total
Air carriers	3	11	15		31	40	50	
Hwy carriers (for-hire)	233	323	353	3%	392	600	700	6 :
Hwy carriers (private)	54	58	73	82	116	200		22
Rail carriers	28	35	35	40	44	43	75	7
Water carriers.	10	8	7	17	23	40	50	4
Total	328	435	483	551	606	930	1,125'	* See note

•Estimated.
••● Total number of different reporting carriers during the 6-year period—not the addition of numbers for each year. (For example–carrier XYZ submitted reports in each year but as the "total" reporting carriers, XYZ is only one reporting carrier— not six.)
SOURCE: Materials Transportation Bureau, from PMM & Co., Task IV.

Table 42.—Number of Reports Submitted to MTB

Mode	Reports Submitted 1971	1972	1973	1974	1975	1976*	Total	Percent of total
Air carriers	5	32		155	152	150'	550	41/4
Hwy carriers (for-hire)	1,633	3,613	5 , 6 :	7,254	8,988	9,900'	36,550	83
Hwy carriers (private)	258	352	450	361	903	950'	3,300	71/4
Rail carriers	346	337	412	617	617	981 '	3,400	71/'
Water carriers.	13	10	12	26	32	50"	150	I/~
Total	2,255	4,344	6,016	8,413	4,750	11,898	44,000	See note**

•Estimated.
••● See note in table 41.
SOURCE: Materials Transportation Bureau, from PMM & Co., Task IV.

a series of regulations covering hazardous materials. Specific topics covered are: general handling and loading, handling of placards, explosives, gases, flammable liquids, flammable solids, oxidizers, poisonous materials, radioactive materials, and corrosive materials. The National Transportation Safety Board has had some concerns about the effectiveness of the regulatory activity, specifically:

- NTSB recommended that the Secretary of Transportation reassess the regulations applicable to the packaging, loading, storing, and transportation of military munitions. (Report issued April 2, 1975.)
- NTSB recommended that the Secretary of Transportation publish guidelines describing methods available for conducting safety analyses that would facilitate the discovery of detonation risks and standards to be met. (Report of March 3, 1976.)
- NTSB recommended that the Secretary of Transportation establish regulations for quality specifications and quality control procedures in the manufacturing, packaging, and loading of detonable hazardous materials.

Accident data and trends were important in initiating regulatory activity which led to the tank-car standard. Accident data should always be one tool of the regulatory process. But that alone is not satisfactory. It is critical to effective safety regulation to ensure that the exposure of people and property to hazardous materials be determined, and this is not being done systematically. The impact of the inspection efforts is discussed in chapter VIII. See table 43 for accidents involving hazardous materials.

Training efforts. Both the MTB and FRA have ongoing training programs in the area of transporting hazardous materials. Workshops

Table 43.—Accidents Involving Hazardous Materials, Spills, or Explosions, All Accidents

Cause	1966	1967	1968	1969	1970	1971	1972	1972	1973	1974	Total
Negligence of employees			1	3	5	3	3	3	3		21
Defects/failures of equipment			1	4	4	4	4	5	3		25
Defects in track or structures				1	4	1	1	3	2		12
Miscellaneous causes			18	24	41	28	28	37	32		208
Total			20	32	55	36	36	48	*40*		*267*

*Miscellaneous causes include: Improper loadlng, negligence of nonemployees, malicious acts of nonemployees, forces of nature, rail-highway grade-crossing accidents, coupling or uncoupling locomotives or cars, stumbling, slipping, falling, caught. etc.

" Not available.

SOURCE: FRA Accident Data Base from PM M & Co., Task IV.

and seminars have been conducted to educate shippers, carriers, and local authorities. These sessions focus on increasing the "general awareness" level of those involved in shipping hazardous materials and most are offered at no cost to the industry. The Transportation Safety Institute offers an in-depth, multimodal training program for shippers and carriers and emergenc}' service personnel. It is generally recognized as a very strong hazardous materials program.

The Railroad Industry

Today the railroad industry is involved in inspection, data collection, and training. Up until 1967, the AAR had responsibility (as an agent of the Federal Government) for furnishing technical input for regulations, furnishing laboratory service, and monitoring container development. [5]

Some of the industry's inspection activities are through the AAR's Bureau of Explosives, which has inspectors on railroad property and at shipper facilities inspecting for compliance with the hazardous materials regulations. As far as data collection is concerned, in 1975 the AAR developed a system which identifies hazardous shipments by rail. AAR believes the system is accurate within 1 percent of the total volume shipped (49 series STCC).

The railroad industry—individual railroads and the AAR—is very much involved in training programs. [6] One type of program is designed to ensure that employees understand Federal laws, rules, and regulations pertaining to the proper handling and inspection of hazardous materials. Railroad personnel interviewed as part of the assessment indicated that their training programs were monitored by the safety departments of the railroads. They also indicated that they coordinated their hazardous materials training programs with FRA, MTB, and AAR. The latter two organizations provide much OF the training literature. In addition, AAR's Bureau of Explosives offers training to rail and shipper employees on the handling of hazardous materials.

'Since the passage of the Transportation of Explosives Act in 1908, the Federal Government has depended on the Bureau of Explosives, AAR, to furnish technical input, and so forth, for the Government. Over 200 delegations of authority were issued to carry out those functions. In 1967, the general counsel of the Department of Transportation ruled the delegations of authority illegal.

'Another type of activity is that of providin~ information in any transportation emergency involving chemicals. The CHEMTREC service Provided by the manufacturing chemists association is an example.

RAIL-HIGHWAY GRADE-CROSSINGS

The Problem

As of December 31, 1975, there were over 219,000 locations where public roads crossed railroad tracks. In 1975, there were over 11,000 vehicle-train collisions at the public grade-crossings, resulting in over 9700 deaths and 4,100 injuries. In each of the years between 1965 and 1975 over 1,100 people were killed and some 3,200 injured at grade-crossings.

Grade-crossing accidents continue to be the major cause of fatalities in railroad operations, accounting for approximately 65 percent of the fatalities resulting from all types of railroad accidents during 1965-74.

Federal Government Responses to the Grade= Crossing Safety Problems

The Federal Government has been involved in providing financial support for projects to eliminate hazards at railroad/highway intersections since the establishment of the Federal-Aid Highway Program in 1916. Prior to the passage of the Federal Highway Safety Act of 1973, a U.S. Department of Transportation Report to Congress (August 1972) observed that the total number of grade-crossings warranting improvement indicated that at least 3,000 protection installations should be made annually for the next 10 years at an expenditure of about $75 million a year. It was anticipated that completion of those improvements would eliminate nearly 4,000 motor-vehicle train collisions annually and save some 500 lives per year. [7]

The Federal Highway Safety Act of **1973** had as one of its goals the elimination of hazards at highway-railroad grade-crossings. Section 203 of that Act requires each State to maintain a survey of all railroad-highway crossings and to identify those that may require separation, relocation, or protective devices. The Act provides 90 percent Federal-aid funding for safety improvements to railroad-highway crossings on any Federal-aid highway system, except interstate, and requires at least half of the funds to be available for protective devices. At a minimum, each State must provide signs for all railroad-highway crossings. (See table 44 for indication of eligible activities.)

The Highway Safety Act of 1976 amended Section 203 by authorizing specific funding for grade-crossing improvements in the Federal-aid highway system.

The rail-highway safety programs are complicated by divided jurisdictions and responsibilities, which include:

- The Federal Highway Administration apportions funds to the States by a statutory formula, reserving the right of the Federal Government through local offices to disapprove certain State funding strategies. States may use these funds for a variety of safety activities concerning grade crossings.
- Jurisdiction over railroad-highway intersections resides exclusively in the States, where responsibility can be divided between several agencies.
- Railroad companies have the responsibility for the design, instal1ation and maintenance of train-activated warning devices to be installed only by railroad employees or by private contractors employing members of the railroad union authorized to make such an installation.
- The existence of differing responsibilities, vis a vis the installation of warning devices, between the States and the railroad companies results in the necessity for State/railroad contracts to be executed prior to the installation of the devices.

'U.S. Department of Transportation, Report to Congress, *Railroad-Highway Safety, 1972.*

Table 44.—Grade-Crossing Safety Programs

Program	Items funded*				
	Engineering ••				
	Protection	Elimination	Surface	Education	Other
Federal					
Federal Highway Safety Act of 1973					
&203	X	X	X		
$230 (repealed)	•	•	•		
Federal-Aid Highway Program					
23 U.S.C. 130	X	X	X		
23U.S.C. 163		X	X		
23U.S.C. 219		•	•		
23U.S.C. 322	X•	X•			
23U.S.C. 402	X•	X•	X•		X• training
State***					
Total funding of safety program	•	•	•	•	
Matching Federal funds***	X	X	X	X	
Support of Operation Lifesaver (education and enforcement)				X•	X • enforcement
Maintenance	•	X	X		
Industry					
Installation	X	X•	X•		
Maintenance and operation	X	X•	X•		
Construction		X•			
Support of Operation Lifesaver				X•	
Training of public officials					X supplier seminars
Unions					
Support of Operation Lifesaver				X	

'Items funded for on system indicated with an "X"; for off Federal-aid system with an"-".

● *"Protection" Includes installation of automatic devices; elimination includes grade separation; and 'surface" means surface improvements.

● **Some of the programs (where States match Federal funds) service off Federal-aid system crossings. Further, only some of the States, not all, have these programs.

The divided jurisdiction becomes a barrier to effective treatment of the rail-highway grade-crossing problem because:

—It is used to explain why measures of effectiveness of specific actions necessary to properly direct future resources have not been developed, Federal Highway Administration officials have not sufficiently analyzed the contribution Federal dollars have made to the reduction of collision injuries and deaths.

—It allows confusion on the issue of who should provide and pay for the protection or other improvements.

The impact of Section *203 programs* (problems and successes). As of the end of FY 1977, Federal-aid funds totalling *$86* million had been obligated for projects on the Federal-aid system. Funding of the "off-system" program began in FY 1977, and as of September *30, 1977, $17* million had been obligated.

The direct contribution the Federal dollars have made to the reduction of collision *injuries* and deaths is unknown. Federal Highway Administration officials contend that such an analysis would be most difficult—almost impossible—to make, given the divided jurisdiction and responsibilities between the Federal

Government/State government and the railroads. In other words, FHWA officials have not been able (and believe it to be impossible) to determine the extent to which the goals of the 1972 report will be met after the 10-year period has elapsed. What is known is as follows: a) The current number of projects funded each year is estimated to be between 1,200 and l,500; b) the greatest reduction in fatalities within the 1965-75 period was 242 between 1974 and 1975 (see table 45). These numbers seem low if the goal of **30,000 installations and 5,000** less deaths is to be met by *1983.* A number of problems and barriers to an effective program have been suggested above.

Table 45.— Fatalities for All Grade-Crossings

Calendar year	Killed
1965	1,534
1966	1,780
1967	1,632
1968	1,546
1969	1,490
1970	1,440
1971	1,356
1972	1,260
1973	1,185
1974	1,220
1975	978
1976	1,168

SOURCE: Rail-Highway Grade-Crossing Accidents (*Incidents Bulletin,* FRA.)

One additional problem with the program couldbe the manner in which the funds are apportioned to the States. The formula does not take into account the number of grade-crossings in a State or the number of fatalities per grade-crossing, hence producing in some instances results which are not optimal. However, Federal Highway Administration officials note existing strategies and controls which direct the Federal dollars to the priority problem areas. This is so, they contend, because each State is required to have a method of prioritizing all crossings which must be based on a hazard index, onsite inspections, and accident history.

One other possible problem with the pace of the program could be that the railroads are reluctant to install automatic systems because of the potential liability where the systems may not be fail-safe.

Table 46 describes additional federalIyfunded programs and states what is known about their impact.

State Government Programs Designed To Meet the Grade-Crossing Safety Problems. Jurisdiction over grade-crossing improvementis basically at the State government level. State governments fund safety projects primaril, through the use of Federal funds, although some States have special funds for: a) railroad-highway intersection improvement projects; and/orb) the maintenance and operation of the protection. Often, the State officials having responsibility for grade-crossing activities initiate safety projects without specific regard to the funding source. This is not necessarily a positive feature, because the State officials have varying authorities under the different funding mechanisms, and their present strategy may not be the most cost-effective. The *1972* report to Congress noted the following:

> The net effect of the current division of responsibility and authority among the private and public interests involved at the State and local level results in a fragmented approach to grade-crossing safety. Where there is divided public responsibility, frequently none of the involved public agencies have either legal authority or sufficient resources to make more than token progress in dealing effectively with the problem. The need for national coordination of an issue that affects the Nation's railroad and highway systems is apparent.

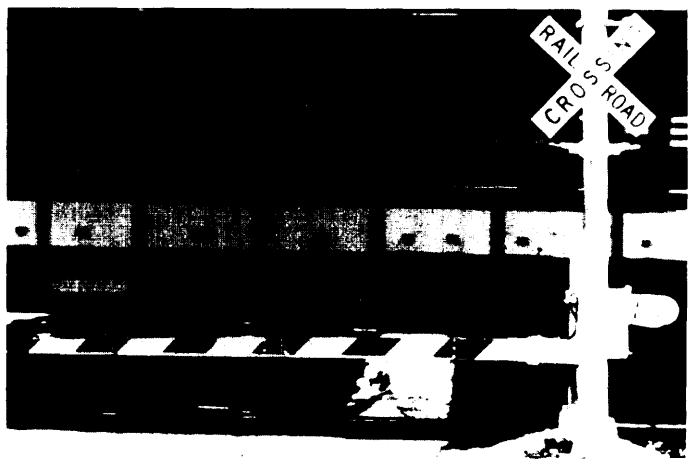
The States were expected to participate in the National Railroad-Highway Crossing Inventory and Numbering Project. State officials interviewed noted that the Federal data collection system was not as effective in assisting them in planning for safety, because there was no provision for sending accident statistics to the States on a timely and regular basis.

The States' priority-setting activities are the key to solving the highway-grade-crossing safety problem. The U.S. Department of Transpor-

Table 46.— Federal Government Grade-Crossing Programs

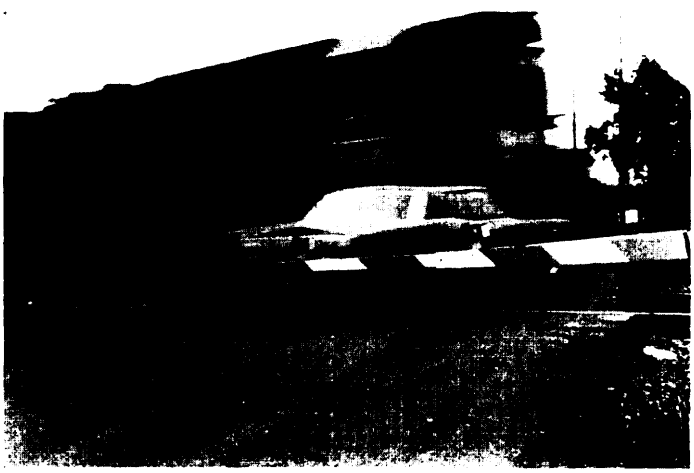
Program	Description and Status	Impact (problems and successes)
Railroad-Highway Crossing Demonstration Projects (Section 163, Federal-Aid Highway Act of **1973, amended by the** 1976 Act).	Section 163 authorized demonstration projects in 12 cities for the purpose of protecting or eliminating certain public, ground-level, rail-highway **crossings, relocating railroad lines,** and constructing overpasses **and** underpasses. This 1973 provision contemplated 95/5- or 100-percent Federal funding. The 1976 Act authorized four additional projects and provided for 70/30 matching ratio for the additional cities.	A total of $30.9 million had been appropriated for this program through 1977, of which *$12.8* **million had been obligated** by the end of the transition quarter. Three of the projects are under construction; all other projects are in the preliminary engineering stage.
Federal-Aid Highway	The entire cost of construction of projects for the elimination of hazards, including the separation or protection of grade-crossings and the relocation of highways may be paid, and under certain circumstances, 100-percent Federal funding may be allowed.	
23. U.S.C. 219	The Secretary is authorized to make project grants to States for the construction and improvement of any off-system road for such purposes as the correction of safety hazards, or the elimination of high-hazard locations.	
23 U.S.C. 402	Funds are authorized to carry out State highway safety programs including training programs.	
Federal-Aid Safer Roads Demonstration Program **(Section 430, Highway** Safety Act of 1973) 23. U.S.C. 405	This program required identification of projects for the correction of gated **hazards on all roads** off the Federal-aid system and the systematic correction of the hazards. The law provialed 90 percent Federal-aid funding.	Of the more than $72 million obli- in FY **1976, nearly 40 percent** was spent on railroad projects (correcting hazards at rail-highway grade-crossings).
	Repealed by the Federal-Aid Highway Act of 1976, Sec. 135 (c) of FHWA 1976 (now a part of the section 203 program).	According to the 1977 Highway Safety Improvement Program Report, the program was slow getting started. States were reluctant to place these programs in a priority category and had not identified problem areas to move construction.
Rail Crossings Demonstration Projects 23 U.S.C. 322	Two demonstration projects were authorized: one, to eliminate public, ground-level, rail-highway crossings along the Northeast Corridor, except those of low-hazard potential (which could be protected by warning devices); the other, to consolidate and relocate lines bisecting Greenwood, S.C. Railroads were required to pay 10 percent of the cost of the project.	The Penn Central was not able to **contribute its 10 percent of the cost of the Northeast Corridor Pro ject, which delayed the project. Eventually the States involved agreed to cover the railroad's share. Delay also was caused by meeting the environmental requirements, holding public hearings, and making design changes. The total cost estimate for this program** has more than doubled since 1970 due to design modifications and inflation.





Scenes of typical grade-crossings found through. out the Nation. The photo below depicts a near accident involving a car and train.

Photos Courtesy of fhe Assoc/af/on 01 American Ra//roads



tation has developed a computer model to assist State departments of transportation in determining the optimum allocation of funds and types of equipment based on accident rates, traffic densities, and terrain. The extent to which that model or similar models are being used and whether it is sufficient to make a significant impact on solving the safety problem have *not* been determined.

Industry Programs Designed To Meet the Grade-Crossing Safety Problems. Industry efforts fall into the following five categories: a) data collection and analysis; b) operation and maintenance of warning devices; c) installation of warning devices; d) information and education; and e) participation in joint industry and Government activities such as Operation Lifesaver. There is limited information available on the railroads' expenditures for these types of activities, One railroad interviewed for this study indicated that at one point they collected grade-crossing accident statistics, but when financial difficulties came, they funded only crossing improvements and other operations. Based then on the sample of this study, the railroads' data collection activity is limited. Some of the railroads do participate in a "near-miss" program, in which railroad employees complete a "near-miss" or "failure to stop at grade-crossing" report. FoIlowing the submission of such reports to local authorities, the motor vehicle owner in question is contacted and warned. In general, railroads maintain grade-crossing devices if the device is activated by the train. There are instances where the railroads have participated in funding the installation of the warning devices. An example of industry participation in information and education activities is the rail industry suppliers' grade-crossing program, involving the conduct of seminars "to educate State transportation authorities on the latest available grade-crossing systems."~

Joint Programs and Efforts Designed To Meet the Grade Crossing Safety Problems. One major joint program is Operation Lifesaver, Operation Lifesaver is based on the premise that a successful grade-crossing safety program depends on engineering, education, and enforcement. The Operation Lifesaver program, operating at the State level, consists of public and private agencies' efforts to fund and conduct an integrated effort to "improve, accelerate and continue effective grade-crossing programs. " Participants in the program may on occasion, depending upon the State structure, include State departments of transportation, public utilities, and education; unions; railroads; and civic organizations. The engineering aspect of the program is generally supported by Federal/State funds and consists of some type of protection devices, and their operation and maintenance. Education activities could consist of safety movies used in the schools, on TV, and in commercial movie houses. The enforcement activities are carried on by State and local public officials. One problem with the Operation Lifesaver program is that none of the agencies involved and contacted during the study had published a thorough analysis of the costs and benefits of the program. From the single performance measure, fatalities, the program was a success in the opinion of Illinois Commerce Commission officials. But that same State did not publish an analysis of the accident rates or nonfatality injury rates as they relate to Operation Lifesaver activities, as compared to other grade-crossing projects.

Federal Highway Administration officials note also that Operation Lifesaver is effective only so long as it is in existence. The engineering, education, and enforcement activities must be on a continuing basis; there cannot be a one-time "awareness" campaign which makes lasting impact. Again, the weakness with this conclusion is the lack of evaluative studies to support it.

"Railway Progress Institute.

ANALYSIS OF SPECIFIC GRADE-CROSSING SAFETY ACTIVITIES

Relative Effectiveness of Automatic Warning Devices

According to a California study, automatic warning devices are quite effective in reducing vehicle-train accidents and casualties at public railroad-highway grade-crossings in California. ' That study concluded that the installation of automatic crossing gates can be expected, on the average, to result in 70-percent fewer vehicle-train accidents per year and an additional 48-percent fewer casualties per accident. Automatic gates were considered to be superior to other types of warning devices because they have a visual and auditory impact on driver response. The gates help in solving the problem of inadequate sight distance or general inability to see or perceive an approaching train. The gates aid in preventing accidents caused by traffic or rail volumes; accidents caused by trains operating on multiple tracks; and accidents caused by distractions and other road hazards. Automatic devices probably will not prevent vehicle-train accidents caused by complete driver inattention, excessive vehicular speed, violations of the law, or poor driver judgment. A study of activity between 1960 and 1970 indicated the following relative accident frequencies:

	Accident frequency	*Accident deaths*	*Severity injuries*
Crossbucks.	1.00	1.00	1.00
Flashing lights.	.33	.54	.57
Automatic gates	.13	.25	.46

'California Public Utilities Commission, *The Effectiveness of Automatic Protection in Reducing Accident Frequency and Severity at Public Grade Crossings in* California, 1974.

Cost Variations in Grade= Crossing Safety Activities

It was determined that in California (1975) the cost of installing flashing lights was $16,250; $27,290 for automatic gates, and $190 for crossbucks. The maintenance and operation cost for flashing lights is *$500* annually; $1,000 for automatic gates. On an incremental basis, then, in California in *1975* it cost $2,190 **a** year more for flashing lights than crossbucks and $1,670 more for automatic gates.

The Texas Transportation Institute analyzed the relative cost of installing warning devices versus grade-separation. In 1970 figures, the total program would have cost $120 million for installation of the necessary warning devices in Texas and about $4.5 billion for a complete grade-separation program.

Elements Necessary for an Effective Grade-Crossing Safety Program

The report on the California experience concludes that the greater-than-average success in grade-crossing safety resulted from sufficient financial support for the installation and maintenance of the warning devices; the well-managed State government effort to provide the analytical support for crossing-improvement decisions; and strong safety efforts on the part of financially healthy railroads. 10

'°R. G. Kennedy, *A Review of the California Railroad-Highway Grade Crossing Program,* Consad Research Corporation, Pennsylvania, 1974.

Federal Funding of Grade-Crossing Activities

Tables 47 and 48 indicate program costs and results. Although many argue that this is not the proper way of analyzing the effectiveness of the Federal grade-crossing effort, the facts speak for themselves:

In FY 1974 and 1975, $38.2 million was obligated and 717 projects initiated under Section 203. Using the goal 3,000 projects initiated at $75 million, suggested in the *1972* Department of Transportation grade-crossing report, the program would have required a 47-percent increase in activity to meet that goal.

Table 47.—Summary of Program Costs and Results

1. Section 203 costs
   a. Obligated funds
      • FY 74: $4,323,420
      FY 75: $33,928,498
   b. Authorized funds
      FY 76: $48,150,329
      . FY 77 (section 203, 1973 Act): $81,226,152
      FY 77 (section 203, 1976 Act): $17,688,814
2. Section 203 results
   a. FY 74 and 75—717 projects
   b. FY 76: 903 projects authorized
3. Section 230 costs
   a. Obligated funds
      FY 74, 75: $26,180,800
      FY 76: $27,917,750
4. Section 230 results
   FY 74,75: 953 projects
5. Section 322 costs
   a. Obligated funds
      As of January 31, 1977: $12.5 million
6. Section 322 results
   48 public crossings and 3 grade stops
7. Section 163 costs
   As of transition quarter: $12.8 million
8. Section 163 results
   5 projects are under construction
   13 projects are in the engineering phase
9. Section 210 funds
   Obligated FY 74 and FY 75: $65,450
   Obligated FY 76: $1,661,250
10. Section 209 funds
    Obligated FY 74 and FY 75: $731,300
    Obligated FY 76: $449,950

SOURCE: PMM & Co., Task IV Report.

Table 48.—Title 23 Costs

	costs		Results		
Fiscal vear	Federal funds	Total funds	Crossings eliminated	Structures reconstructed	Crossings protected
1965.	$ 85,848,377	$215,096,245	421	35	319
1966.	65,384,470	195,646,396	377	45	250
1967.	40,298,099	162,370,184	398	48	295
1968.	49,157,015	175,690,265	319		276
1969.	48,059,294	178,826,058	282	: 1	221
1970, ... , ...	20,952,022	143,249,929	242	43	167
1971	29,948,764	152,882,583	246	40	178
1972.	157,632,238	189,380,439	233	31	224
1973.	194,174,814	226,695,715	214	36	165
1974.	110,626,804	142,133,552	134	41	275
1975.	179,070,554	204,562,810	112	40	211
1976.	156,801,293	184,366,905	183	91	365
Transition quarter. .	47,146,825	54,089,292	46	18	118

SOURCE: PMM & Co,, Task IV Report,

OTHER RAILROAD SAFETY PROGRAMS

This study of railroad safety is concerned primarily with certain basic activities: data collection and analysis by Federal Government agencies; standards setting; inspection; and enforcement of Federal Government rules and regulations. There are, however, other activities which support railroad safety efforts. Among those activities are training, incentive programs, and employee assistance programs. (See table 49 for list.) The purpose of this chapter is to describe those types of programs and, where possible, to discuss the program's costs and impact.

The first types of programs to be discussed are the railroad Safety Operations Programs. These are voluntary efforts initiated by the railroads which often encompass the establishment of safety operating practices and their enforcement, and some forms of data collection and analysis. Although the safety operations-type programs are initiated and implemented generally by the railroad companies, some unions have initiated similar activities. For example, some unions collect and analyze safety information which comes in the form of employee complaints. As a part of railroad companies' safety operation programs, operating rules are published to establish and avoid conflicts in operating procedures. Some of the railroads participating in the study interviews indicated that, in addition to publishing operating rules, safety rules often are published separately for each department, covering such items as transportation, communication, signal, and mechanical safety.

Violation of the operating rules often covers sanctions imposed by the railroad companies—such as warning notices or possible dismissal. Inasmuch as the railroads require employees to apply the operating rules to their actions, enforcement of those rules exists.

Another activity of the railroads is data collection and analysis over and above that required by the Federal Government. As was indicated above, some of the unions collect complaint information, but generally, unions' data collection activities are limited. The interviews conducted in conjunction with the study revealed that the unions do not have internal procedures to collect extensive safety-related data. Although national union leaders receive and review some FRA and AAR data, these are not used other than as general background information by unions for their general advocacy activities. Some railroad management is reluctant to share safety information with the unions for fear the data, such as claims data, will be used against them.

Information and Education Programs are another general category of safety efforts and include: a) training programs, and b) awareness programs, for both the public and employees. Railroads, unions, and Government are all involved in some type of training program. The methods and techniques of railroad training programs vary. Some of the railroad programs emphasize on-the-job training, others emphasize classroom training, while others use combinations of the two. One of the railroads involved in the study interviews described its training program to include:

> At a center built specifically for training, the program includes classroom work as well as actual practice in work functions and safety pertaining to jobs such as switchmen; brakemen; firemen; repairmen; and inspectors of cars, locomotives, and track and signal systems. Prospective locomotive engineers are given practice in train operation in a variety of operating situations through use of a train simulator. Upon satisfactory completion of training at the center, employees are given on-the-job training at their assigned locations by supervisors and other experienced personnel before being assigned to a specific job. Included in the overall program for the prevention of injury is training in the proper execution of such physical tasks as lifting

Table 49.— Railroad Safety Programs

Program sponsor	Program type: Safety operations: Operating practices	Safety operations: Enforcement	Safety operations: Data analysis	Information and education: Training	Information and education: Awareness: Employee	Information and education: Awareness: Public
Railroads	x	x	x	x	x	x
Unions			x*		x	
AAR			x	x	x	
Federal Government			x	x	x	x
Joint				x	x	x

Program sponsor	Safety committees: Specific raiiroad	Safety committees: National	Safety committees: Incentive programs
Railroads	x		
Unions		X	
AFAR			
Federal Government		x	
Other			X.Hairriman Memorial Awards Institute
Joint		x	

Program sponsor	Personnel management and assistance: Recruitment &promotion	Personnel management and assistance: Protective clothing	Personnel management and assistance: Alcohol &drug	Advocacy
Railroads	x	x	x	x
Unions				x
AFAR				x
Federal Government		x		
Joint				.X.-.... ;l:l;:::l:;:ll1 1llll1ll:Jll

heavy objects, throwing track switches, and getting on and off cars and locomotives.11

Another railroad indicated that new employees are given on-the-job training by supervisors and other experienced employees until such time as they are judged by the supervisors to be qualified for aspecific job.

Most of the current training in the railroad industry is achieved under union contract agreements. The unions generally support apprenticeship or other forms of on-the-job training where employees learn and earn at the same time.

Several agencies of the Federal Government recently developed training programs and materials to be used for training both Government and railroad employees. One trainin$_g$ program is that of the Transportation Safety Institute (TSI) established in 1971 to foster and promote the development and improvement of transportation safety by designing and conducting resident and nonresident trainin$_g$ programs responsive to modal and intermodal requirements. One of the goals of TSI is to reduce the number of transportation accidents in the United States. The types of courses offered by TSI are: railroad accident investigations; rail transportation of hazardous materials; locomotive inspection; and railroad track safety standards. The major users of the TSI courses are the Federal Railroad Administration inspec-

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tors and, to some extent, State employees involved in State participation programs.

Federal Railroad Administration inspectors for locomotives, cars, and signal systems also receive formal classroom training in courses related to their particular discipline. These courses are offered by suppliers of railroad equipment. In order to keep pace with technological developments, FRA inspectors attend these courses related to their particular discipline on a 2-year cycle.

A different type of information and education activity can be classified as "awareness" programs. Railroads, unions, and Government have initiated some types of programs for employees as well as the public. One railroad used innovative safety materials from the Japanese National Railroad to stimulate employee safety awareness. Examples of other railroad awareness activities directed at employees are:

- Posters showing employees in unsafe situations as well as descriptions of accidents related to human error or negligence resulting in injuries and/or fatalities.

Specific safety rules selected for review at the direction of supervisors.

In addition to specific railroad activities, the Association of American Railroads publishes posters, the "Safety Talk" bulletin, and various booklets and bibliographies on safety.

The unions also have been involved in "awareness" activities. One union organized a regional safety meeting to include such topics as: identification of safety hazards; establishment of folIow-up safety activities; and collective bargaining on safety matters. The Brotherhood of Locomotive Engineers has sponsored regional conferences attended by FRA representatives to discuss locomotive inspection procedures and hours of service.

The Federal Government has been involved in "awareness" activities through the industrial education program conducted by the Federal Railroad Administration's Office of Safety. Through that program, safety law seminars and conferences are held for personnel in the railroad industry. The purpose of these seminars is to bring to local railroad safety officials an understanding of the existing Federal safety laws, standards, and regulations. In addition to the seminars, which have been held in cooperation with the AAR, the American Short Line Railroad Association, and the Railway Labor Executives Association, the FRA has made available to the railroads a list of movies which describe specific aspects of the FRA safety laws and interpretations of those laws.

The railroads have been involved in such public awareness activities as:

- Lectures given at schools to impress upon children the dangers associated with crossing or standing on tracks when trains are approaching, playing around railroad yards, and placing objects on tracks that might cause derailment.
- Instructions to personnel of customers in the proper handling of freight car parts, such as doors, loading hatches, and outlet gates.
- Informing the public through the media of accidents; particularly those involving hazardous materials.

Safety Committees are used to conduct certain safety activities. Some are organized by specific railroads and cover the safety issues of that railroad. Others, national in scope, concern safety issues more universal in nature. In any event, the safety committees represent different interests. The railroad companies' safety committees are generally composed of employee representatives and supervisory personnel. These committees meet periodically to discuss timely safety issues, allow employee representatives to report existing unsafe conditions, and report on correction of previously reported unsafe conditions. Minutes of meetings are generally required to be sent to supervisors and safety department officials. Further, some railroads have formed safety committees composed of the heads of various departments, such as safety, transportation, maintenance of way, etc. These committees meet periodically to con-

sider and often act upon specific safety problems.

Certain unions are involved in safety issues through participation in various joint committees where representation could be from the Government, railroads and suppliers, railroad and supplier associations, researchers, and the like. An example of such activity is the Locomotive Cab Committee, where the union representing locomotive engineers, AAR, suppliers, and FRA are working together to develop significant safety improvements for locomotive cabs.

Incentive Programs have a role in promoting safety. The railroads design incentive programs to recognize employees who maintain good safety records. Examples of specific incentive efforts are as follows:

- One program provides for a specified number of employees to be named annually from among all employees who have worked that year without an injury. The winners are awarded cash prizes.
- Another program provides an annual safety award-to be made by the president of the company to the personnel supervised by a vice-president having the lowest number of injuries per 100,000 man-hours worked.

A national contest is sponsored by the E. H. Harriman Memorial Awards Institute. The competition provides for line-haul railroads to be grouped according to man-hours worked per year. In each category, awards are made for outstanding safety performance. Separate awards are made to switching and terminal companies.

Personnel Management and Assistance Programs are other types of safety efforts. These programs include: a) recruitment, selection, and promotion activities; b) protective clothing programs; and c) alcohol and drug abuse programs.

First, a discussion of the manner m which the personnel management system is used to promote safety efforts. Certain railroads attempt to predict an employee's future safety record and use that prediction to determine whether to hire or promote the candidate. The prediction is based on: the prospective employee's work experience and education; physical examinations; and in some cases mental aptitude tests.

Another safety effort suggested in connection with personnel management activities is certification of locomotive engineers and the withdrawal of certification in the event an engineer is charged with a specified number of violations, depending upon severity of operating and/or safety rules violated. Railroads generally support certification as a means of eliminating "seniority-tenured" engineers who are not otherwise qualified. Unions are opposed to it because of the potential labor conflicts that it could promote and also the possibility of too much management influence over who is or is not to be certified.

Safety is often ensured through the use of protective clothing. Special clothing and/or devices are required (by regulations in some instances and by the railroads in others) when employees are performing certain work functions or while working in certain areas. Examples of such requirements include the use of goggles, a respirator when spray painting, and hard hats under certain circumstances.

During the past 10 years, many railroads have implemented alcohol and drug abuse programs in recognition of the fact that the abuse of alcohol and drugs does contribute to some railroad accidents. These programs go beyond the railroads' initial response to the problem, which was to issue a rule similar to Rule G of the Association of American Railroads Standard Code of Operating Rules. It stated that "the use of alcoholic beverages or narcotics by employees subject to duty is prohibited. Being under the influence of alcoholic beverage or narcotics while on duty or their use or possession while on duty is prohibited. "

In 1976, a survey conducted by the Naval Weapons Support Center indicated the following about the railroad alcohol and drug abuse programs:

- *Program Policy:* General 1 y the older programs in existence (5 to 10 years) limit treatment to alcoholism problems, while

recent programs address other human ailments (drug abuse, marital counseling, etc.) in addition to alcoholism. A majority of the programs operate with labor involvement in program activities and control.

- *Program Design:* Programs emphasizing treatment for alcoholism tend to-be based on patterns established by Alcoholics Anonymous. Employees often volunteer for the program, although the most likely circumstance would be where an employee is referred by the supervisor. The vast majority of the programs surveyed separate the alcohol/drug abuse program from disciplinary proceedings. However, reinstatements of employees with a problem are more likely if there is successful program treatment.

Advocacy is another way of ensuring the promotion and implementation of safety. The railroads and the unions serve as advocates for safety before Congress, the Government agencies, and each other.

Railroad and Union Safety Organization

Within the railroad companies, safety programs appear to be carried out through a variety of organizational arrangements. Among 21 major railroads which explicitly have a chief safety officer (according to the July-August 1977 issue of *The Official Railway Guide), 15* were situated in the operating department, where employees' risk-exposure is presumably highest, and 5 were situated within the personnel department, where safety had been designated as an independent function.

Every railroad company interviewed as part of the study (and all others on which information is available) has safety officials assigned to its headquarters staff and many have full-time safety supervisors assigned at major operating locations. In addition to the full-time safety staffs, which may have as many as 15 individuals, every line and staff observer also is charged with enforcing and carrying out the safety programs sponsored and funded by management. The industry's official attitude is that every railroad employee or official is responsible for safety awareness and safety enforcement.

Unions also are organizing safety activities. One union contacted as part of the study interview reported the recent creation of a position of Vice-President for Education and Safety to coordinate and direct the union's safety programs.

Findings as to Program's Costs and Impact

Little is known about the extent to which these programs are cost-effective in reducing railroad accidents, because measurable goals and objectives usually have not been established. There are, however, certain findings which should be considered as part of this study. Those findings are discussed below.

Information and Education program50 Assessment interviews indicate that both railroad and union officials are becoming more and more safety conscious. Safety training is so important to one railroad that it offers make-up classes for employees. Those who do not attend the make-up safety classes are removed from service until the classwork is completed. There has been notable participation in some of the awareness programs; for example, joint safety law seminars were attended by 1,100 persons in 1975 and *1,600* in *1976.* As was indicated earlier, there are differences in training methods; there are, however, no convincing studies as to their effectiveness.

Safety Committees. Some union officials have concerns about the effectiveness of union-management safety committees. Union officials in the course of the study indicated that one main reason for the desire of the unions to include safety procedures in contracts with management is the fact that many union-management joint safety processes (committees) are short-lived. A study of this problem cited various steps which can be taken to maintain

the necessary continuity of the joint committees. Among the steps cited were: allow rank-and-file involvement; use the minutes of the committee meetings to develop continuity of action; make monthly joint safety inspections as part of the committee processes; and have union members use the committees, instead of the formal grievance procedure, as a forum for dealing with safety and health problems.

Personnel Assistance Programs (Alcohol and Drug Abuse). The **1976** Naval Weapons Support Center survey of alcohol and drug abuse programs in the railroad industry found that labor involvement in the program results in a higher percentage of individuals volunteering for help. The program costs ranged from $2 to $10 per employee per year in the **20** programs surveyed, with employee treatment costs almost always covered by group health insurance. The study found that the rate of successful intervention averaged *69* percent.

[12]Kochan, Dyer, and Lipsky, *The Effectiveness of Union Management Safety and Health Commission.*

APPENDIXES

Appendix A
PERSONS INTERVIEWED

ASSOCIATIONS

- Association of American Railroads (AAR)

  J. C. Buckingham
  Safety and Special Services

  William Dempsey
  President

  W. J. Harris
  Vice President, Research & Test

  M. B. Hargrove
  Research & Test

  Ken Hurdle
  Economics and Finance

  A. S. Lang
  Assistant to the President
  Staff Studies

  J. E. Martin
  Vice President
  Operations and Maintenance

  J. A. Risendahl
  Safety and Special Services

  Aviva E. Schulman
  Research and Test

  Chuck E. Taylor
  Research and Test

- Railway Progress Institute (RPI)

  Robert A. Matthews
  Vice President

  Rex Wailer
  Project Director
  Grade Crossing Safety

- Short Line Railroad Association

  Howard Craft
  President

FEDERAL GOVERNMENT AGENCIES

Federal Highway Administration

Lucien M. Bolon
Office of Engineering

Jim Carney
Railroad and Utilities Branch
Office of Engineering

Sidney Louick
Office of Highway Safety, Pol"cy Development

James L. Rummel
Office of Highway Safety, Pol Cy Development

- Federal Railroad Administration (FRA)

  Thomas Barbour
  Enforcement Division

  Donald Bennett
  Associate Administrator
  Office of Safety

  W. F. Black
  Hazardous Materials Section
  Office of Safety

  J. Boughers
  Planning & Evaluation Section
  Office of Safety

Federal Railroad Administration (Continued)

J. U. Chrisman
Office of Safety Programs

Ann Cook
State Programs
Office of Federal Assistance

Gene Cox
State Programs
Office of Federal Assistance

E. F. Conway, Sr.
Assistant Chief Counsel
Safety Regulation Division

Stan Ellis
Reports and Analysis Section
Office of Safety

Nancy Fleetwood
Office of Safety

J. T. Furphy
Assistant Chief CounseI
Enforcement Division

Frank Fanelli
Planning & Evaluation Section
Office of Safety

Bruce Flohr
Deputy Administrator (Former)

Robert Gallamore
Deputy Administrator

Richard J. Galvin
Supervisory Specialist, Region III

Tom Harvey
Regional Director of Federal Assistance

W. F. Hell
Acting Regional Administrator
Eastern Region

Bill Johnson
Office of Research & Development

J. A. McNalley
Office of Standards & Procedures
Office of Safety

R. Mowatt-Larssen
Office of Standards & Procedures
Office of Safety

Robert E. Parsons
Associate Administrator
Office of Research& Development

Levitt Peterson
Director, Office of Rail Safety Research

Robert Schramm
Office of Safety

Stephen Urman
Office of Administrator
Railroad Occupation Safety & Health Specialist

Ted Voss
Office of Policy & Program Development

- General Accounting Office (GAO)

Mel Mench
GAO Auditor

William M. Romano
Resources and Economic Development

- National Transportation Safety Board

Elmer Garner
Chief, Rail Division

- Occupational Safety and Health Administration (OSHA)

Bill Cloe
Statistician

William Funcheon
Area Office Administrator, Chicago

Fred Hetzel
Program Analyst

John Hynan
Deputy Associate Solicitor

Owen Ridenour
Inspector

Janet Spruknan
Safety Engineer

Mike Turner
Program Analyst

Barry White
Regional Administrator, Chicago

LABOR ORGANIZATIONS

- Brotherhood of Locomotive Engineers

  Ed McCulloch
  Vice President

- Brotherhood of Railroad Carmen of America

  William Crawford
  Legislative Representative

- Transport Workers Union of America

  William G. Linder
  Executive Vice President & Director
  Education and Safety

  James Sherlock
  President, Local 2001, Railroad Division

  Albert Tereggio
  International Vice President
  Director, Railroad Division

- United Transportation Union

  Robert W. Gruam
  Member

  John W. McGinness
  State Legislative Director, Illinois

  Jack Paradee
  State Legislative Director, Delaware

  Marshall Sage
  Legislative Research Director

  P. W. Simmons
  Assistant Legislative Director, Illinois

  James Snyder
  National Legislative Director

RAILROADS

- Atchison, Topeka and Santa Fe

  Joe McMillan
  Assistant Manager of Safety

  R, D. Shaver
  Manager of Safety

- Burlington Northern

  Abbott Skinner
  Chief Medical Examiner

- Belt Railway Company of Chicago

  J. Overby
  General Superintendent

- **Chessie System**

  William F. Howes
  Vice President
  Casualty Prevention Department

  John Snow
  Vice President
  Legislative Affairs

- **Chicago and North Western Railway Co.**

  Gordon R. Danielson
  Director, Accident Prevention

  William Spellman
  Assistant vice President
  Accident Loss and Prevention

  James A. Zito
  Vice President of Operations

- **Conrail**

  P. M. Brodt
  Safety Superintendent

  J. A. Flood
  Manager, Safety Administration

J. S. Dehl
Manager, Hazardous Materials

W. Hedderman
Chief Safety Officer

M. C. Mitchell
General Superintendent, Safety

B. L. Swieringa
Manager, Training

- **Duluth Missabe—Iron Range Railway Co.**

Charles W. Bailey
Director of Safety & Plant Protection

- Florida East Coast

S. F. Stewart
Manager, Insurance/Safety

- Illinois Central Gulf

H.F. Davenport
Senior Vice President, Operations

Chris Rochford
Executive Representative

- Missouri Pacific

C. S. Baldwin
General Superintendent
Rules and Safety

- Philadelphia, Bethlehem, and New England Railroad

John B. Cornish
Director of Safety and Training

- Rock Island

J. J. Button
Director of Safety and Rules

John D. Mitros
Vice President

William C. Hoenig
Chief Operations Officer

N. Swain
Director of Marketing

- **Seaboard Coastline**

W. C. Basney
Real Property Attorney

H. M. Davis
Assistant Chief Engineer
Communications & Signals

J. C. Foster
Chief of Motive Power

R. D. Liggett
Chief Engineer
Communications & Signals

J. G. McCormick
General Supervisor, Rules

C. S. Stringfellow
Assistant Vice President, Equipment

Waldo Wingate
General Supervisor, Safety

R. E. White
Rules

- **Southern Railroad**

C. Burnham
Director of Safety

Robert C. Fort
Special Representative

Coleman Longworth
Special Projects

- **Southern Pacific**

Bill Denton
Vice President

Dan Flanagan
Government Affairs Representative

Percy Satterwhite
Assistant Manager, Employee Safety

- **Terminal Railroad Association of St. Louis**

J. R. Bowman
Chief Engineer

W. J. Compton
Director of Rules& Safety

STATES

- **Alabama**

  Jimmy Hooks
  Transportation Regional Specialist
  Public Service Commission

- **Connecticut**

  K. D. Faust
  Assistant Chief Engineer
  Public Utilities Commission

- **Delaware**

  E. M. Chesley, 111
  Chief, Regulatory Services
  Department of Transportation

- IIIinois

  Bernard Morris
  Assistant Chief Railroad Engineer
  Commerce Commission

  Ray Morrison
  Chief Railroad Engineer
  Commerce Commission

- **Iowa**

  Les Chesling
  Development & Support
  Highway Division

  Dan Franklin
  Administrative Assistant
  Railroad Division
  Department of Transportation

  L. Holland
  Railroad Division Director
  Department of Transportation

- **Indiana**

  John Dung
  Director of Transportation
  Public Service Commission

- **Maryland**

  T. L. Lovelace
  Assistant Director of Transportation
  Public Service Commission

- **Michigan**

  G. F. Robertson
  Railroad Safety Inspector

  T. J. Trimbach
  Railroad Regulation Section

- **Minnesota**

  Gordon Boldt
  Chief, Railroad Operations Section
  Department of Transportation

  Cecil Selness
  Rail Development Section

- **Missouri**

  John O. Richey
  Office of Safety
  Public Service Commission

- **New York**

  Martin Chauvin
  Chief, Carrier Safety Section
  Department of Transportation

  Richard Wiita
  Director of Railroad Safety

- **Pennsylvania**

  R. A. Peteritas
  Chief Engineer
  Public Utilities Commission

- **Tennessee**

  W. B. Pemberton
  Director, Railroad Division
  Public Service Commission

SUPPLIERS

• Sperry Rail Services

W. J. Gallagher
President

C E. Kennedy
Operations Manager

J. W. Thomas
Quality Control Manager

• Pullman Standard

Bertram Beers
Vice President—General Counsel

Warren Brown
Vice President
Freight Car Service Engineering

William Marshall
Associate General Counsel

Appendix B
ACCIDENT REPORTING INFORMATION

PURPOSE OF ACCIDENT DATA

As indicated in the "Rules Governing the Monthly Reports of Railroad Accidents'"

> "The purpose of reporting to the Federal Railroad Administration accidents and injuries to persons arising from the operation of a railroad is to carry out the intent of Congress as expressed in the Accidents Reports Act, as amended, namely, the disclosure of hazards arising in the provision of common carrier transportation by railroad. "

The reporting required by the FRA can be divided into two periods; reporting prior to 1975, and reporting after January 1, 1975. Changes to reporting procedures were sufficiently large that comparisons of 1975 and later accident /incident stat istics with statistics generated under prior reporting rules are not entirely appropriate for reasons discussed in this appendix,

Description of FRA Reporting Requirements

All Class I and Class II railroads, both line-haul and switching and freight and passenger are required to file monthly reports of accidents involved in all aspects of railroad operations. One of the concerns among various railroad union representatives is the need to have employees participate in the completion of accident reports—particularly with respect to train accidents. With respect to the data reported, the threshold basis for reporting and the organization of the FRA data base changed effective January 1, 1975, so that data comparisons and trend analysis including 1975 data are not comparable to the period 1966-74.

1966=74 Reporting Requirements

Before January 1, 1975, accident reporting thresholds were:

- The death of a person at the time the accident occurs or within 24 hours thereafter;
- An injury to an employee sufficient to incapacitate him from performing his normal duties for more than one day in the aggregate during the 10-day period immediately following the accident (a fatality occurring after 24 hours is reported as an injury and subsequent fatality);
- An injury to a non-employee sufficient to incapacitate him from performing his vocation for more than one day; and
- Damage to railroad track, equipment, or roadbed exceeding *$750* and which also results in a reportable personal casualty, resulting from a collision, derailment, or other train accident.

Under pre-1975 rules reportable accidents were divided into three types:[2]

- Train accidents—which include collisions, derailments, and other train accidents resulting from the operation of trains, locomotives, or cars where damage to equipment, track, or roadbed was in excess of $750, whether or not a reportable death or injur, occurred.

Department of Transportation, Federal Railroad Administration, "Rules Governing the Monthly Reports of Railroad Accidents, " 1968 Revision, Apr. 1, 1967.

[2] Federal Railroad Administration, "Accident Bulletin, Summary and Analysis of Accidents on Railroads in the United States, " No. 143, Appendix.

- Train service accidents—arising from the operation or movement of trains, locomotives, or cars that result in reportable injuries or death, but not in damage to equipment, track, or roadbed of more than $750 (a train service accident with over $750 property damage would be counted as a train accident).
- Nontrain accidents—not directly attributable to the operation or movement of a train, locomotive, or cars, but resulting in reportable casualties.

The pre-1975 Accident Report Form, Form T, is shown as figure B-1. In addition to the filing of monthly accident reports as per Form T, railroads were required to submit a supplement to each Form T for each reportable train, train-service, nontrain injury or death, and highway grade-crossing accident. A verification report (Form V) was to be forwarded to FRA authorities even though no reportable (train, train-service, or nontrain) accident occurred during the month. The responsible reporting officer of each railroad used this form to attest to the number of reportable accidents which occurred during the month, as well as the number of locomotive and motor car miles run during the month.

Under the pre-1975 FRA reporting system, certain accidents/incidents were not to be reported. In addition to not reporting accidents below the thresholds previously mentioned, accidents on or near railroad property that were not attributable to normal operations of a railroad were not to be reported. Additionally, casualties arising from "horseplay" or suicides were not considered reportable.

1975 Reporting Requirements

Beginning January 1, 1975, the Federal Railroad Administration changed accident threshold reporting requirements to be:

- All damage to railroad equipment, track, track structures and roadbed of $1,750 or more is to be reported (reflecting an effort to offset the effects of inflation and the number of "unimportant" accidents reported). This was changed to *$2,300* in 1977 and will be revised every 2 years;
- Every injury to a non-employee, arising from the operation of the railroad, requiring medical treatment or if death results;
- All injuries to railroad employees are to be reportable if they require medical treatment or result in loss of one or more work days, loss of consciousness or transfer to another job or the injury results in a death; and
- Any illness of a railroad employee diagnosed by a physician as arising from the employee's occupation is to be reported.

The new reporting forms for rail equipment accident/incidents, railroad injury and illness summary, and highway grade crossing accident/incident report are shown in figures B-2 through B-4 respectively.

Effects of Changes in the Accident Reporting System

The changes in the threshold reporting outlined above had a significant impact on the number of accidents/incidents reported by the railroads. Some of the changes appear to be subtle, but further explain why numbers of accidents/incidents before and after January 1975, are not comparable:

Train Accidents

- The "old" rules applied the $750 threshold to equipment, track, or roadbed, excluding the cost of clearing wrecks. The "new" rules applied the $1,750 threshold to on-track equipment, signals, track, track structures, and roadbed, excluding the cost of clearing wrecks, but including labor and all other costs to repair or replace in kind. This alteration of included items compromises the use of an inflation index to compare "old" and "new" accident statistics reported as exceeding a dollar threshold;
- Though major cause categories have not been changed, specific cause codes have

Figure B-1.—Accident Report Form

= A R TM EN T O F T RAN SPOR TATION
t .>ERAL RAIL ROAD ADMINISTRATION
BURE AU O F RAIL RO A DS A F E TY

MONTHLY REPORT OF RAILROAD ACCIDENT
(See *instructions* on *reverse* aide,)

FDRM APPROVED
BUDGET BUREAU HO 06 R4008

FORM T

SHEET No.

1. REPORTING CARRIER	2. CARRIER'S FILE NO.	3. FOR THE MONTH OF ----------, 19-----
4. IF "JOINT OPERATION" OR CROSSING COLLISION NAME ROADS INVOLVED.	5. IF "JOINT OPERATION" NAME ROAD WHOSE SUPERINTENDENT IS IN CHARGE OF TRACK.	
6. KIND OF ACCIDENT ☐ TRAIN ☐ TRAIN-SERVICE ☐ NONTRAIN	7. FRA CLASS & SUB CLASS (§ 225.22, 225.23, 225.24)	
8. NEAREST STATION AND NAME OF STATE WHERE ACCIDENT OCCURRED	9. DATE OF ACCIDENT	10. TIME (Use standard) -------- --A.M. ------- -P.M.

11. VISIBILITY AND WEATHER (CHECK APPROPRIATE BOXES)

DAYLIGHT	FOGGY
DARK	RAINING
CLEAR	SNOWING
CLOUDY	SLEETING

12. DAMAGE IN DOLIARS *(Train accidents only)*

NAME OF ROAD	EQUIPMENT	TRACK	TOTAL
	$	$	$
TOTAL			

13. CAUSE *(Briefly)*

14. KIND OF TRACK	15. METHOD OF OPERATION AND SIGNALLING			16. KIND OF EQUIPMENT
MAIN	MANUAL BLOCK	AUTO. BLOCK SIG.	AUTO. TRAIN STOP	LOCOMOTIVE
BRANCH	CONT MANUAL	INTERLOCKING	AUTO. TRAIN CONT.	FREIGHT TRAIN CAR
YARD	TRAIN ORDER	CENT. TRAF. CONT	CAB SIGNAL	PASS. TRAIN CAR

17. KIND OF TRAIN	18. MOTIVE POWER	19. NO. OF CARS	20. TIMETABLE DIRECTION	21. SPEED
P TF LF Y W O	D E RMC O		N S E W	MPH MPH
☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐			

FOR F.R. A USE ONLY

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	F.R.A. use only									

22. DETAILS OF CASUALTIES TO PERSONS

Class of Person (a) (§ 225.50)	Age in case of employee (b)	F.R.A. use only 29 30 31 32 33	Killed or nature and extant of injuries (c) [§ 225.14(a), 225.47(a), 225.47(c)]	F.R.A. use only 34 35 36	Days disability A=Actual P=Probable (d) [§ 225.47(b)]

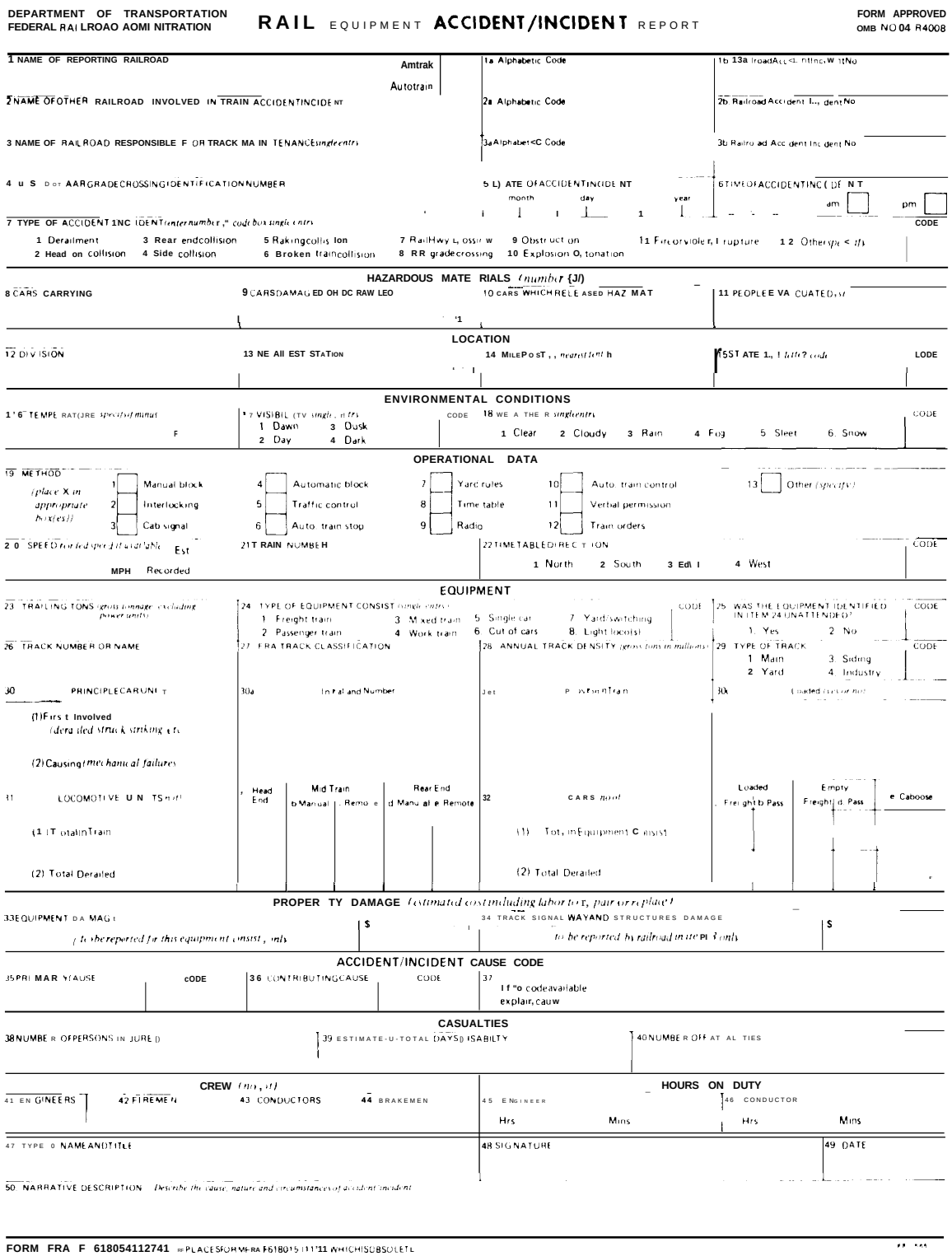
23. FULL DETAIN OF CAUSE, NATURE, AND CIRCUMSTANCES OF ACCIDENT (See 7. Back of Form)

CONTINUE ON REVERSE SIDE OF SHEET IF NECESSARY

SIGNATURE	TITLE

Form FRA F 6180-15 (REPLACES FRA FORM T

Figure B-2



DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

RAIL EQUIPMENT **ACCIDENT/INCIDENT** REPORT

FORM APPROVED
OMB NO 04 R4008

1 NAME OF REPORTING RAILROAD — Amtrak / Autotrain — 1a Alphabetic Code — 1b 13a IroadAcc<1. ntInc,W ntNo

2 NAME OF OTHER RAILROAD INVOLVED IN TRAIN ACCIDENT INCIDENT — 2a Alphabetic Code — 2b Railroad Accident I.., dent No

3 NAME OF RAILROAD RESPONSIBLE FOR TRACK MAINTENANCE *single entry* — 3a Alphabet<C Code — 3b Railroad Accident Incident No

4 U S DOT AAR GRADE CROSSING IDENTIFICATION NUMBER — 5 L) ATE OF ACCIDENT INCIDENT (month, day, year) — 6 TIME OF ACCIDENT INCIDENT (am, pm)

7 TYPE OF ACCIDENT INCIDENT *(enter number, code box single entry)* — CODE
1 Derailment 3 Rear end collision 5 Raking collision 7 Rail Hwy L, ossi w 9 Obstruction 11 Fire or violent rupture 12 Other specify
2 Head on collision 4 Side collision 6 Broken train collision 8 RR grade crossing 10 Explosion Detonation

HAZARDOUS MATERIALS *(number (JI)*

8 CARS CARRYING — 9 CARS DAMAGED OH DC RAW LEO — 10 CARS WHICH RELEASED HAZ MAT — 11 PEOPLE EVACUATED, st

LOCATION

12 DIVISION — 13 NE All EST STATION — 14 MILE POST, nearest tenth — 15 STATE 1., 1 letter code — CODE

ENVIRONMENTAL CONDITIONS

16 TEMPERATURE *specify if minus* F — 17 VISIBILITY *single entry* — CODE
1 Dawn 3 Dusk
2 Day 4 Dark

18 WEATHER *single entry* — CODE
1 Clear 2 Cloudy 3 Rain 4 Fog 5 Sleet 6 Snow

OPERATIONAL DATA

19 METHOD *(place X in appropriate box(es))*
1 Manual block 4 Automatic block 7 Yard rules 10 Auto. train control 13 Other *(specify)*
2 Interlocking 5 Traffic control 8 Time table 11 Verbal permission
3 Cab signal 6 Auto. train stop 9 Radio 12 Train orders

20 SPEED *(rounded speed if available)* Est MPH Recorded — 21 TRAIN NUMBER — 22 TIME TABLE DIRECTION — CODE
1 North 2 South 3 Edl I 4 West

EQUIPMENT

23 TRAILING TONS *(gross tonnage excluding power units)* — 24 TYPE OF EQUIPMENT CONSIST *(single entry)* — CODE
1 Freight train 3 Mixed train 5 Single car 7 Yard/switching
2 Passenger train 4 Work train 6 Cut of cars 8 Light loco(s)

25 WAS THE EQUIPMENT IDENTIFIED IN ITEM 24 UNATTENDED? — CODE
1 Yes 2 No

26 TRACK NUMBER OR NAME — 27 FRA TRACK CLASSIFICATION — 28 ANNUAL TRACK DENSITY *(gross tons in millions)* — 29 TYPE OF TRACK — CODE
1 Main 3 Siding
2 Yard 4 Industry

30 PRINCIPLE CAR UNIT — 30a Initial and Number — Jet Position in Train — 30c Loaded *(yes or no)*

(1) First Involved *(derailed struck striking etc)*

(2) Causing *(mechanical failures)*

31 LOCOMOTIVE UNITS *(not)* — Head End — Mid Train b Manual c Remote — Rear End d Manual e Remote

(1) Total in Train

(2) Total Derailed

32 CARS *(not)* — Loaded Freight b Pass — Empty Freight d Pass — e Caboose

(1) Total in Equipment Consist

(2) Total Derailed

PROPERTY DAMAGE *(estimated cost including labor to x, pair or replace)*

33 EQUIPMENT DAMAGE $ *(to be reported for this equipment consist only)* — 34 TRACK SIGNAL WAYAND STRUCTURES DAMAGE $ *(to be reported by railroad in item 3 only)*

ACCIDENT/INCIDENT CAUSE CODE

35 PRIMARY CAUSE — CODE — 36 CONTRIBUTING CAUSE — CODE — 37 If no code available explain, cauw

CASUALTIES

38 NUMBER OF PERSONS INJURED — 39 ESTIMATE-U-TOTAL DAYS DISABILTY — 40 NUMBER OF FATALITIES

CREW *(not, st)*

41 ENGINEERS — 42 FIREMEN — 43 CONDUCTORS — 44 BRAKEMEN

HOURS ON DUTY

45 ENGINEER Hrs Mins — 46 CONDUCTOR Hrs Mins

47 TYPE O NAME AND TITLE — 48 SIGNATURE — 49 DATE

50 NARRATIVE DESCRIPTION *Describe the cause, nature and circumstances of accident incident*

FORM FRA F 618054112741 REPLACES FORM FRA F618015 (11'11 WHICH IS OBSOLETE

Figure B-3

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

RAILROAD INJURY AND ILLNESS SUMMARY

FORM APPROVED
OMB NO. 04 R4009
SHEET 1 OF _____

1. NAME OF REPORTING RAILROAD	2. ALPHABETIC CODE	3. REPORT MONTH	4. STATE ALPHABETIC CODE	5. COUNTY

6.

I, _____ being first duly sworn, do say upon my oath that
(Name of affiant)

I am _____ of the railroad aforesaid and as such officer of the said railroad it is my duty
(Title of Office held by affiant)

to have supervision over the record of reportable accident/incidents arising from the operation of the said railroad, and that I have caused to be compiled from the said record and to be carefully examined the annexed report of such accident/incidents occurring during the month named at the head of this sheet; and that the said report is true and complete to the best of my knowledge and belief.

Subscribed and sworn to before me, a notary public in and for the State and County aforesaid, this _____ day of _____, 19__.

(Use an impression seal) [L.S.] _____ _____
(Notary Public) (Signature of affiant)

7. MILES RUN DURING MONTH

a. LOCOMOTIVE TRAIN MILES	b. MOTOR TRAIN MILES	c. YARD SWITCHING MILES	d. TOTAL

8.

a. EMPLOYEE MAN HOURS WORKED	b. PASSENGER TRAIN MILES OPERATED	c. NUMBER OF PASSENGERS TRANSPORTED

9. **CASUALTIES** (If additional space is required, use continuation sheet, Form FRA F 6180-55a.)

a. ACCIDENT/ INCIDENT NUMBER	b. TYPE PERSON OR JOB CODE	c. INJURY OR ILLNESS CODE	d. OCCURRENCE CODE	e. AGE	f. NUMBER OF DAYS AWAY FROM WORK	g. NUMBER OF DAYS OF RESTRICTED ACTIVITY	h. CASES WITHOUT LOST WORK DAYS	i. STATE ALPHABETIC CODE

FORM F RA F 6180-55 (12-74) REPLACES FORM F RA F 61130-12 WHICH IS OBSOLETE

GPO 880-963

Figure B-4

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

RAIL-HIGHWAY GRADE CROSSING ACCIDENT/INCIDENT REPORT

FORM APPROVED
OMB NO 04 R4033

1 NAME OF REPORTING RAILROAD — Amtrak / Autotrain	1a Alphabetic Coda	1b Railroad Accident Incident No
2 NAME OF OTHER RAILROAD INVOLVED IN TRAIN ACCIDENT/INCIDENT	2a Alphbetic Code	2b Railroad Accident/Incident No
3 NAME OF RAILROAD RESPONSIBLE FOR TRACK MAINTENANCE *(single entry)*	3a Alphabetic Cad.	3b Railroad Accident/Incident No.
4 U S DOT AAR GRADE CROSSING IDENTIFICATION NUMBER	5 DATE OF ACCIDENT/INCIDENT month / day / year	6 TIME OF ACCIDENT/INCIDENT am ☐ pm ☐

LOCATION

7 NEAREST RAILROAD STATION	8 COUNTY	9 STATE *(two letter code)* COOS
10 CITY *(if in a city)*	11 HIGHWAY NAME OR NUMBER *(if private crossing so state)*	

ACCIDENT/INCIDENT SITUATION

HIGHWAY USER INVOLVED

12 TYPE — CODE
1 Auto; 2 Truck; 3 Truck Trailer; 4 Bus; 5 School Bus; 6 Motorcycle; 7 Pedestrian; 8 Other *(specify)*

13 SPEED *(estimated mph at impact)*

14 DIRECTION *(geographical)* — CODE
1 North; 2 South; 3 East; 4 west

15 POSITION — CODE
1 Stalled on crossing; 2 Stopped on crossing; 3 Moving over crossing

RAILROAD EQUIPMENT INVOLVED

16 EQUIPMENT — CODE
1 Tram *(units pulling)*; 2 Tram *(units pushing)*; 3 Tram *(standing)*; 4 Car(s) *(moving)*; 5 Car(s) *(standing)*; 6 Light loco(s) *(moving)*; 7 Light loco(s) *(standing)*; 8 Other *(specify)*

17 POSITION OF CAR/UNIT IN TRAIN — CODE

18 CIRCUMSTANCE — CODE
1 Train struck highway user; 2 Train struck by highway user

19 — CODE
Was the highway user and for rail equipment revolved m the impact transporting hazardous materials? 1 Highway user; 2 Rail equipment; 3 Both; 4 Neither

ENVIRONMENT

20 TEMPERATURE *(specify if minus)* °F	21 VISIBILITY *(single entry)* — CODE 1 Dawn; 2 Day; 3 Dusk; 4 Dark	22 WEATHER *(single entry)* — CODE 1 Clear; 2 Cloudy; 3 Rain; 4 Fog; 5 Sleet; 6 Snow

TRAIN AND TRACK

23 TYPE OF TRAIN — CODE 1. Freight; 2 Passenger; 3 Mixed; 4 Work; 5 Yard/Switching; 6 Light Locomotive(s)		24 TRACK TYPE USED BY TRAIN INVOLVED — CODE 1 Main; 2 Yard; 3 Siding; 4 Industry
25 TRACK NUMBER OR NAME	26 FRA TRACK CLASSIFICATION	27 NUMBER OF LOCOMOTIVE UNITS
28 NUMBER OF CARS	29 TRAIN SPEED *(recorded speed if available)* Est / MPH Recorded	30 TIME TABLE DIRECTION — CODE 1 North; 2 South; 3 East; 4 West

CROSSING WARNING

31 TYPE *(place X in appropriate box(es))*
1 ☐ Gates; 2 ☐ Cantilever FLS; 3 ☐ Standard FLS; 4 ☐ Wig Wags; 5 ☐ Hwy. Traffic Signals; 6 ☐ Audible; 7 ☐ Crossbucks; 8 ☐ Stop Signs; 9 ☐ Watchman; 10 ☐ Flagged by crew; 11 ☐ Other *(specify)*; 12 ☐ None

32 SIGNALED CROSSING WARNING — CODE
Was the signaled crossing warning identified m item 31 operating?
1. Yes 2. No

33 LOCATION OF WARNING — CODE
1 Both sides; 2 Side of vehicle approach; 3 Opposite side of vehicle approach

34 CROSSING WARNING INTERCONNECTED WITH HIGHWAY SIGNALS — CODE
1 Yes; 2 No; 3 Unknown

35 CROSSING ILLUMINATE BY STREET LIGHTS OR SPECIAL LIGHTS — CODE
1 Yes; 2 No; 3 Unknown

MOTORIST ACTION

36 MOTORIST PASSED STANDING HIGHWAY VEHICLE — CODE
1 Yes; 2 No; 3 Unknown

37 MOTORIST DROVE BEHIND OR IN FRONT OF TRAIN AND STRUCK OR WAS STRUCK BY SECOND TRAIN — CODE
1 Yes; 2 No; 3 Unknown

38 MOTORIST — CODE
1 Drove around or thru the gate; 2 Stopped and then proceeded; 3 Did not stop; 4 Other *(specify)*; 5 Unknown

39 VIEW OF TRACK OBSCURED BY *(primary obstruction)* — CODE
1 Permanent structure; 2 Standing railroad equipment; 3 Passing train; 4 Topography; 5 Vegetation; 6 Highway vehicles; 7 Other *(specify)*; 8 Not obstructed

HIGHWAY VEHICLE PROPERTY DAMAGE/CASUALTIES

40 HIGHWAY VEHICLE PROPERTY DAMAGE *(est dollar damage)*	41 DRIVER WAS — CODE 1 Killed; 2 Injured; 3 Uninjured	42 WAS DRIVER IN THE VEHICLE ? — CODE 1 Yes; 2 No
43 TOTAL NUMBER OF OCCUPANTS KILLED	44 TOTAL NUMBER OF OCCUPANTS INJURED	45 TOTAL NUMBER OF OCCUPANTS *(include driver)*

46 — CODE
IS A RAIL EQUIPMENT ACCIDENT/INCIDENT REPORT BEING FILED? 1. Yes 2. No

47 TYPED NAME AND TITLE	48 SIGNATURE	49 DATE

FORM FRA F 6180-57 (12-74) REPLACES FORM FRA F 6180-13 (10-67) WHICH IS OBSOLETE

GPO 880 562

been completely revised, making comparisons difficult; and

- Where the FRA formerly assigned cause codes from written accident descriptions, railroads are now assigning the most appropriate code from a predefine list.

Personnel Casualties

- The new reporting requirements reduce the number of days off duty from "more than one" to "one or more, " and include casualties where medical treatment is required, even if less than one day of work is lost; and
- The introduction of occupational illness is new, and along with the changes above, make comparisons questionable.

Train Service/Nontrain Accidents

- Under the new reporting system, casualties are no longer classified into Train Service and Nontrain accidents;
- Train Service accidents and Nontrain accidents have been redefined and renamed Train Service incidents and Nontrain incidents;
- Personnel casualties are identifiable only as involving or not involving a moving train or piece of equipment; and
- There has been an addition of "occurrence" codes to replace the former cause codes.

These changes make the separation between train service and nontrain accidents questionable as well as in some cases impossible. Additionally, problems with understanding the new reporting system have led to questions about the accuracy of the number of casualties connected with moving trains or equipment since reporting personnel may not have been (or are) sufficiently familiar with the new reporting system to suffix the occurrence code with a "T" if the accident involved moving equipment. However, as of November 1, **1977,** in the code listing, each occurrence code has now been suffixed with the "T" and has been specifically explained to alleviate the potential for future errors.

Other Changes in 1975

The reporting system instituted in **1975** provides for the reporting of information not previously required. Such information includes the following: type of track; car initial and number: number of cars derailed; number of engineers, firemen, conductors and brakemen; number of cars carrying hazardous materials; number of cars which released hazardous material; number of people evacuated; FRA track classification; and annual track density.

Comparison of Pre-1975 and Post-1975 Accident Reporting Systems

Several changes to the reporting requirements and definitions regarding accidents have previously been identified. Although the intent of these changes has seemingly been to improve the data system, problems still exist which have resulted in noncomparability among data and difficulty in analyzing the data. These are identified below:

- To reduce the delay in filling out the accident reports, the reported damage to track and equipment is still an estimate.
- Prior to 197'5, FRA clerical employees assigned accident cause codes to accidents based on narrative descriptions provided by the railroads. The procedure now requires the railroad to provide the cause code, but as previously stated, some railroad union representatives feel that the employees should be involved in filling out the accident report.
- Although some of the cause codes were eliminated and thus reduced, there is still a substantial portion coded in the accident cause code "other" category. This inhibits the successful analysis of accident data to determine causes.
- Due to the change in cause codes, the data are not compatible before and after 1975 and makes analysis of trends especially for train service and nontrain accidents impractical.

- The changes in reporting rules for the 1975 data had the effect of drastically increasing the number of reportable injuries. This occurred because the reporting threshold for injuries measured in days disabled was increased from "more than one day" to "one or more days" as well as other rule changes regarding the reporting of injuries and fatalities. Furthermore, the inclusion of occupation illness increases the number of reportable accidents.

Although changes were again made to the reporting system in January 1977, problems still exist with attempting to identify certain accident causes. Specifically there has been concern over some of the cause codes in the human error category of train accidents (formerly "Negligence of Employees"). These still do not specifically identify the reason for the accident.

USE OF THE FRA DATA BASE AND RELATED PROBLEMS

Within the Federal Railroad Administration, the Office of Standards and Procedures, Reports and Analysis Division has the responsibility for data base maintenance, Accident/Incident Bulletin publication, and data processing of monthly inspector reports. Sources of data for performing these responsibilities include only monthly accident reports filed by railroads and field inspector reports.

FRA Problems With Use of the Data Base

Although the Office of Standards and Procedures publishes the Railroad Accident Bulletins and other summary listings of accidents, they are not providing an analysis of the accident data. Although the sorting and tabulations of accidents, that are published, aid in identifying some of the problem areas, more in-depth analyses are necessary to assist in determinirtg accident causes and potential problems.

In the area of data reliability, there have been reported difficulties in the transition from the accident reporting system prior to 1975 to the new reporting system. Reporting carriers have occasionally made coding errors or left blank fields while adjusting to the new system. Attempts have been made to reduce these problems by additional inspections of the accident records to increase the accuracy of the data.

Other Users of the Data Base

Through the regional offices, or possibly even independently, States could tap into the system to upgrade their own programs and provide for better planning and measuring performance. Lack of current, timely, relevant data is a handicap to improving State program effectiveness.

Although the railroad's own data base is not constrained by FRA requirements, few roads have developed information retrieval capabilities similar to that being developed by the FRA. Railroad access to a more current data base could be a useful adjunct to their own safety programs and convert an otherwise less meaningful administrative report into a more meaningful data bank for analysis. It could be particularly useful for roads to help identify what other roads are doing in an effort to strengthen their own programs.

Within the FRA Office of Research and Development, these statistics are used to guide research priorities and to delineate categories for more detailed analysis. The same has been done by the Research and Test Department of AAR and the Railroad Research Board.

OTHER DATA BASES AND THEIR APPLICATION

Other sources of accident/incident data investigated in this study included the Association of American Railroads, the Federal Highway Administration, the National Transportation Safety Board, Occupational Safety and Health Administration and the individual railroads. These are addressed below:

Association of American Railroads

The AAR relies almost exclusively on accident reports filed with the FRA– specifically the machine data base which is keypunched from these accident reports— for use in its safety related analyses. In its own studies, the AAR has concluded that the FRA data base is the best source of industry data available. Beginning in **1975,** the AAR has collected train accident data from member railroads. Copies of FRA accident reports are mailed to the AAR and selected data are analyzed. These data and analyses provide information on accident trends to support safety, mechanical, and operational research programs.

The most recent comprehensive analysis of the FRA data base has been performed by the AAR. Two reports entitled, *Analysis of Nine Years* of *Railroad Accident Data 1966-1974* by A.E. Shulman and C.E. Taylor, and *Analysis of Nine Years of Railroad Personnel Casualty Data 1966-2974* by A.E. Shulman provide detailed analysis of accident incident trends in areas of railroad equipment and personnel. As was previously indicated, both of these publications supplied excellent background and analysis of railroad accident and casualty data for this study.

National Transportation Safety Board

Under the Independent Safety Board Act of 1974 (P.L. **93-633),** NTSB investigates and collects data on all railroad accidents that fall into any of the following categories:

there is a fatality;

- damages are in excess of **$500,000; and**
- **a** passenger train is involved.

NTSB has established certain basic criteria on investigations in response to the law and has established certain definitions to interpret the law:

- extensive damage **($500.000** or more)
- passenger accident (accident of passenger train over $10,000 in damage)
- NTSB damage may encompass damage to equipment, tracks, lading, and third party damage (environment)

Two types of investigations are conducted by the NTSB:

- Field—a thorough investigation of an accident culminating in a report.
- Major—usually an investigation of a "catastrophic" accident which may have resulted in a large number of deaths, injuries, or extensive property damage. Such investigations may involve public hearings or depositions and result in a major report with recommendations.

Although NTSB has no enforcement authority, it makes recommendations to the FRA and the railroad industry/manufacturers. With regard to number of investigations, NTSB averages about 12 to 15 major accidents annually and **400 to 500** field investigations.

Federal Highway Administration

The Federal Highway Administration (FHWA) does not collect railroad related accident data. Highway grade-crossing accident data are compiled by the FRA.

Individual Railroads

The data collected by the individual railroads are typically used in identifying target areas for track and equipment inspection and/or main-

tenance activities. The AAR indicates that many railroads also use their accident data to monitor employee casualty trends and evaluate the effectiveness of their safety programs.

Occupational Safety and Health Ad= ministration

OSHA does not collect data on employee injuries/illnesses from internal reports. However, OSHA has an agreement with the Bureau of Labor Statistics to collect statistics on employee injuries and illness from employer annual reports.

States

Most States do collect accident data from the railroads operating in their jurisdictions. The level of detail and the type of statistics gathered varies among the States. In general terms, these data are not significantly different from FRA data since, in most instances, the railroads are required to submit accident reports to the authorized State agency. However, each State's reporting criteria may sometimes be different from those of the FRA.

In most cases, States find little use for current FRA data because of the time lag involved in receiving current accident data and also the fact that they already collect the most relevant (regarding State's priorities) accident/incident statistics.

Accident/incident data are generally used by the States for identifying areas where inspection activities should be increased or decreased. The data are also used in the development of capital improvement programs and in determining areas where more legislative action may be required.

Due to limited resources in most State budgets, these data are not used or other data collected for the purpose of research. However, some States do analyze accident reports to determine trends of any type.

Appendix C

RAILROAD ACCIDENT TRENDS (1966-74)

Figure C-1 .—Summary of Reported Train-Service Accidents, All Class I Railroads (No Threshold Inflation Adjustment)

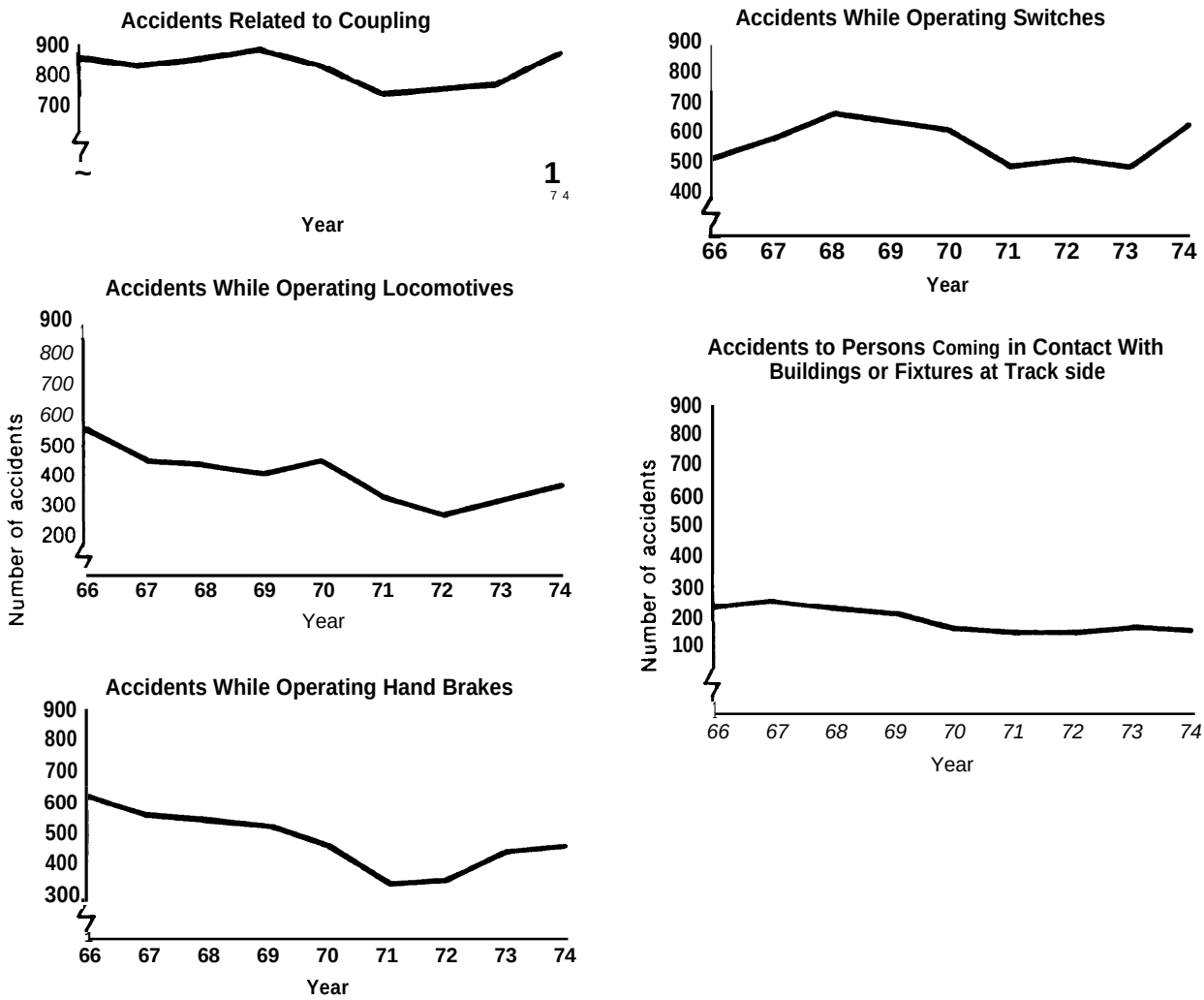


Figure C-l.—Summary of Reported Train-Service Accidents, All Class I Railroads—Continued (No Threshold Inflation Adjustment)

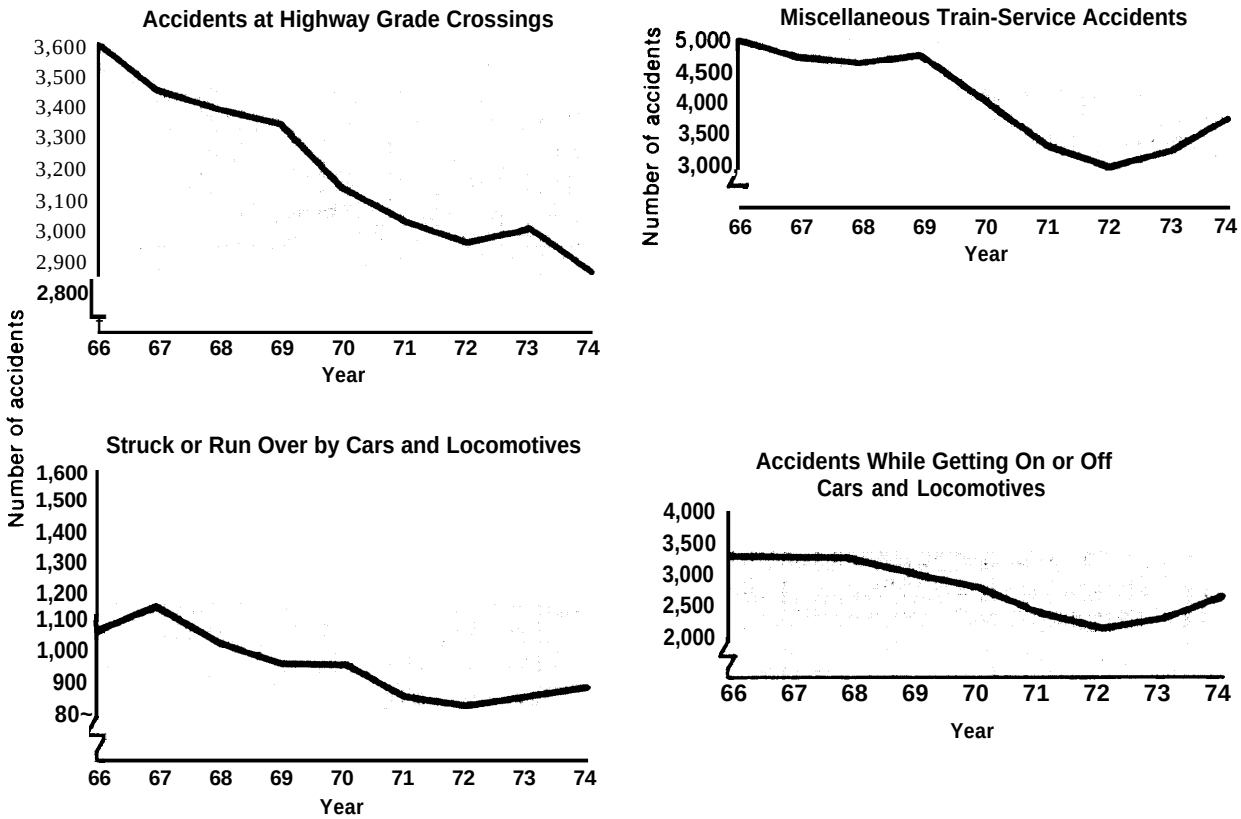


Figure C.2.—Summary of Reported Nontrain Accidents All Class I Railroads (No Threshold Inflation Adjustment)

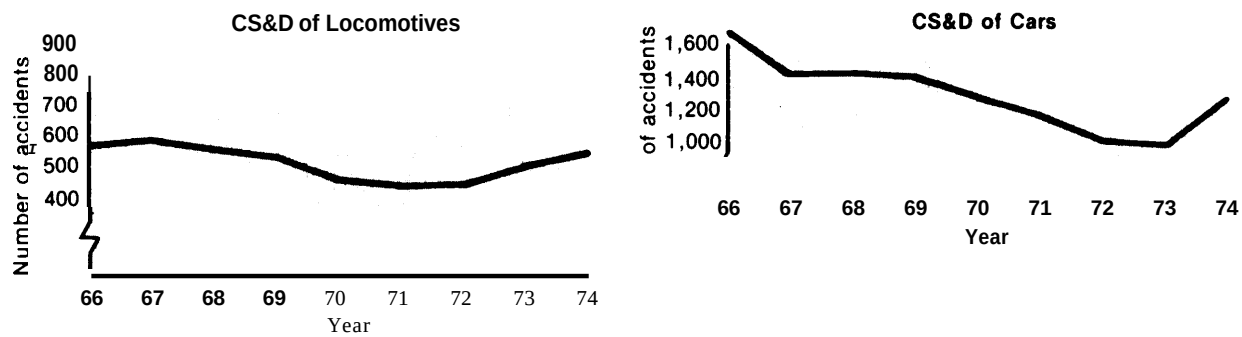


**Figure C-2.—Summary of Reported Nontrain Accidents
All Class I Railroads—Continued
(No Threshold Inflation Adjustment)**

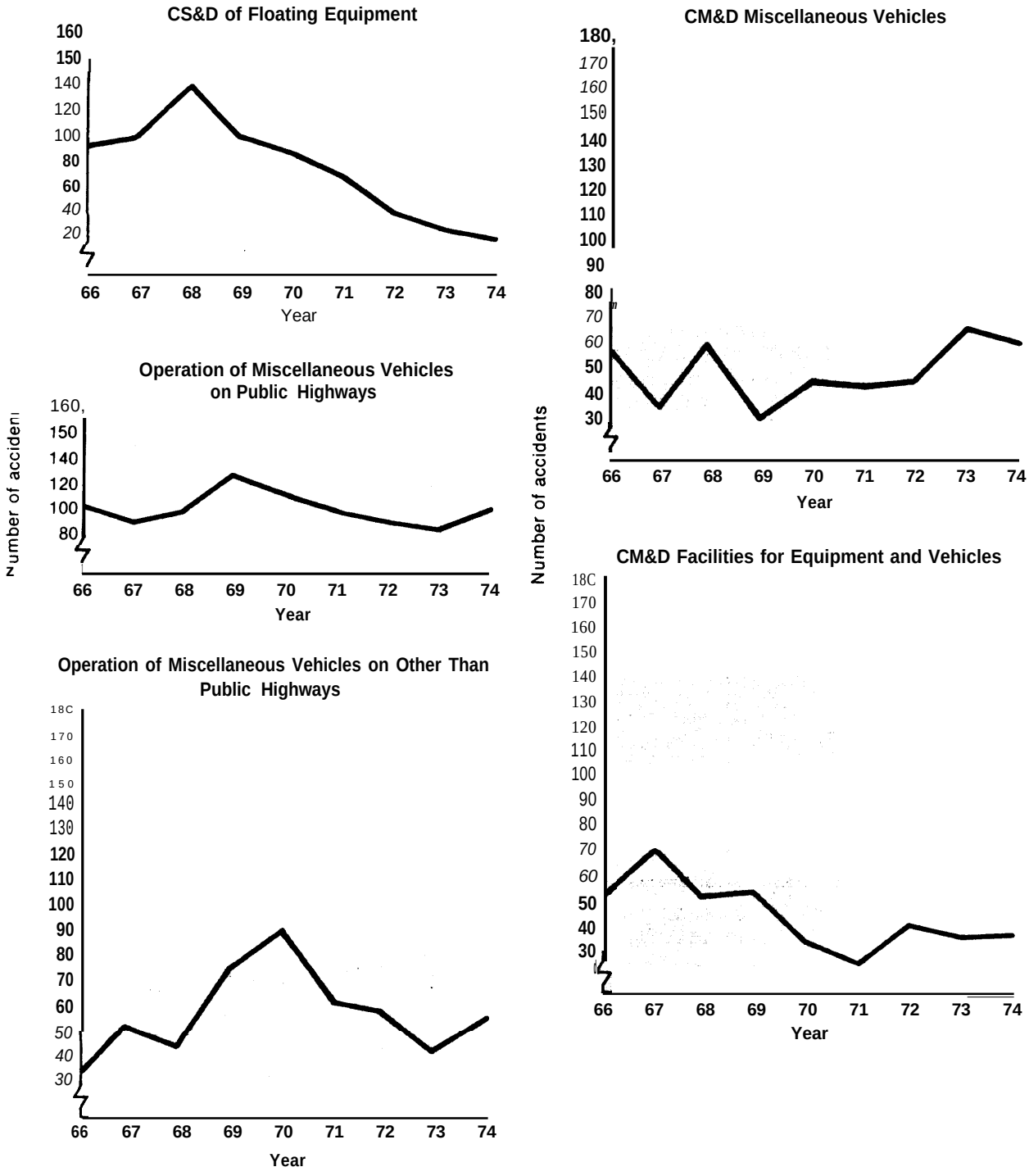
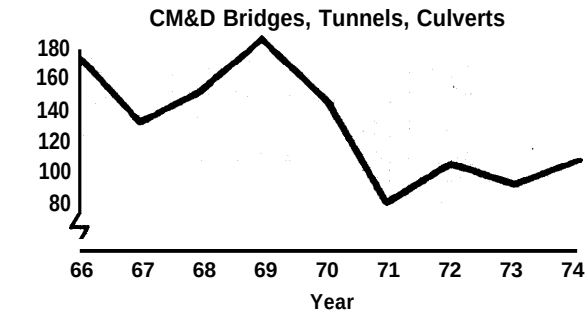
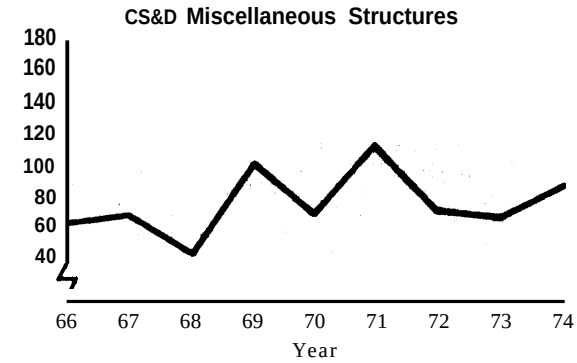
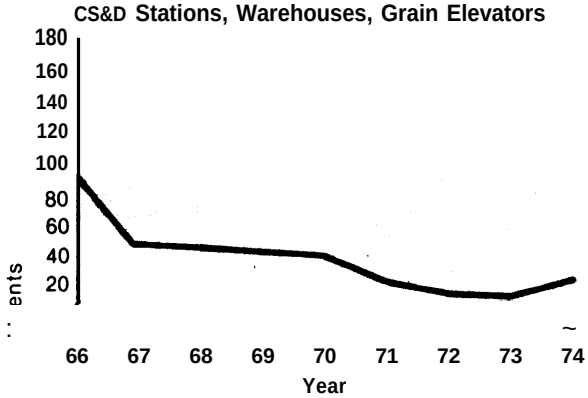
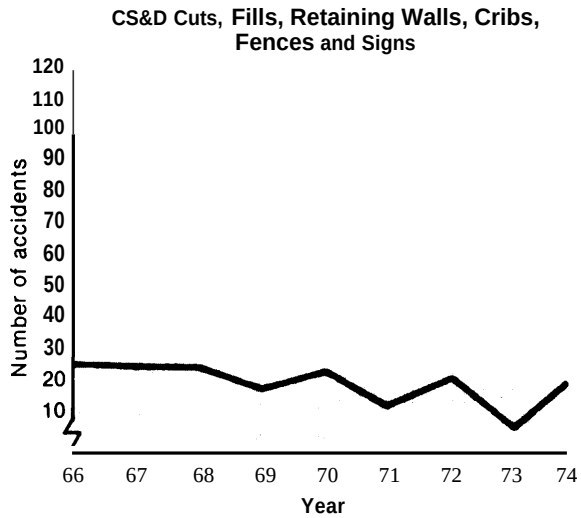


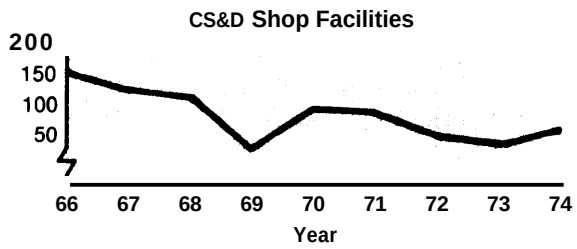
**Figure C-2.—Summary of Reported Nontrain Accidents
All Class I Railroads—Continued
(No Threshold Inflation Adjustment)**

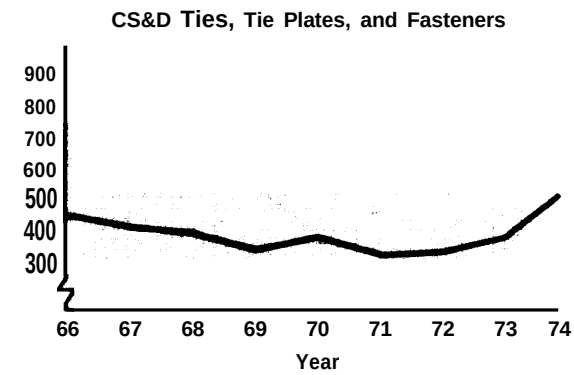












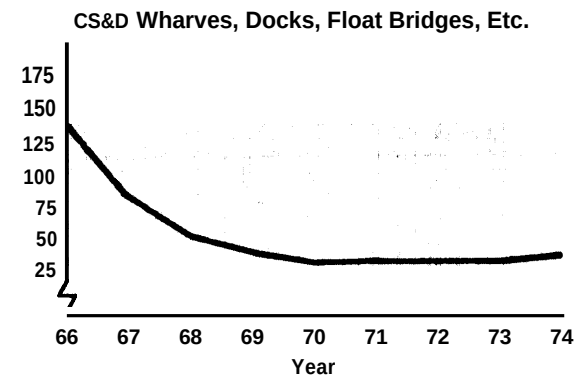


**Figure C-2.—Summary of Reported Nontrain Accidents
All Class I Railroads—Continued
(No Threshold Inflation Adjustment)**

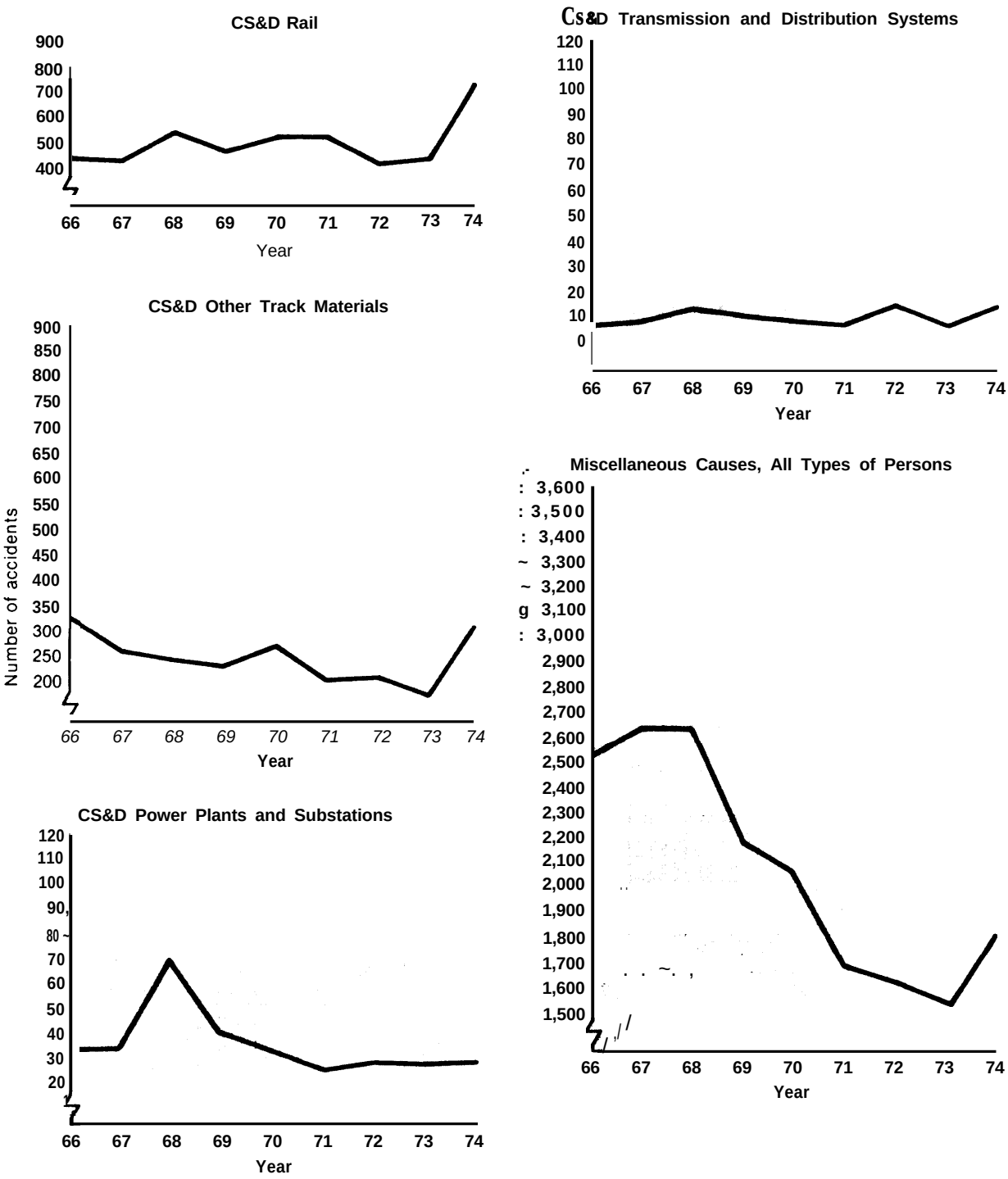


**Figure C-2.—Summary of Reported Nontrain Accidents
All Class 1 Railroads—Continued
(No Threshold Inflation Adjustment)**

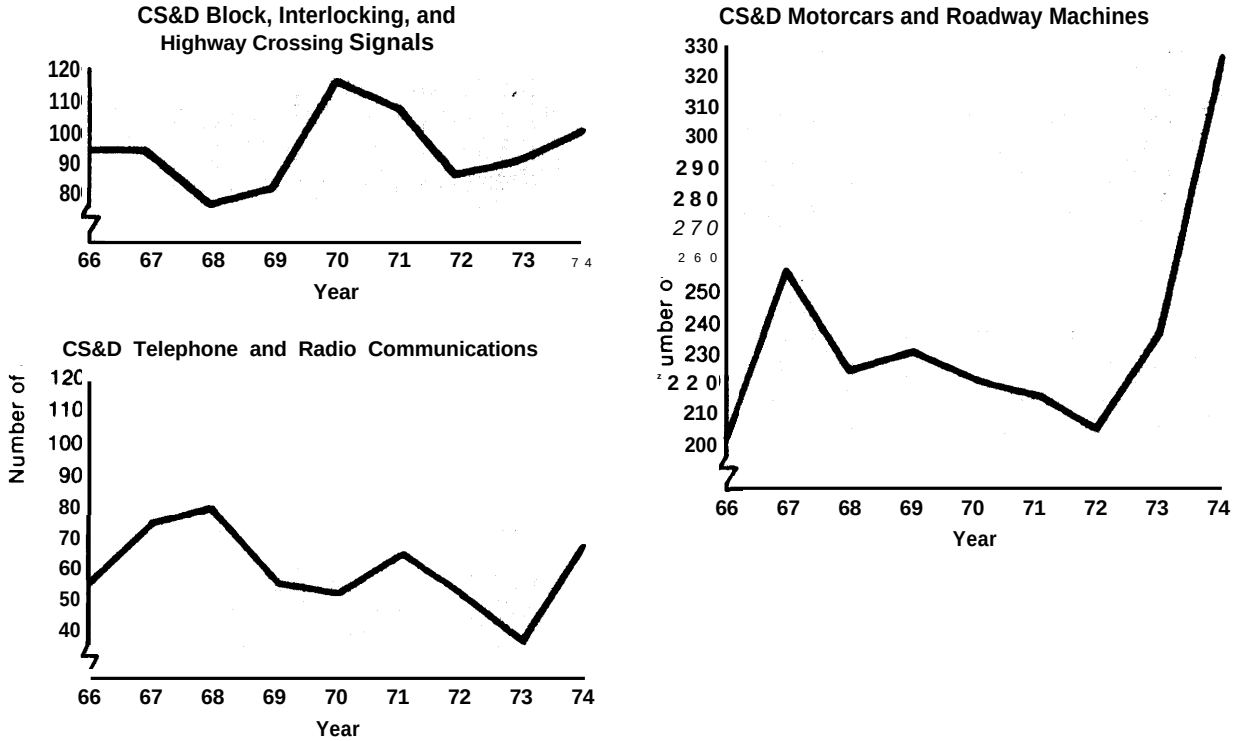


**Figure C-3.—Summary of Reported Derailments
All Class I Railroads
(No Threshold Inflation Adjustment)**

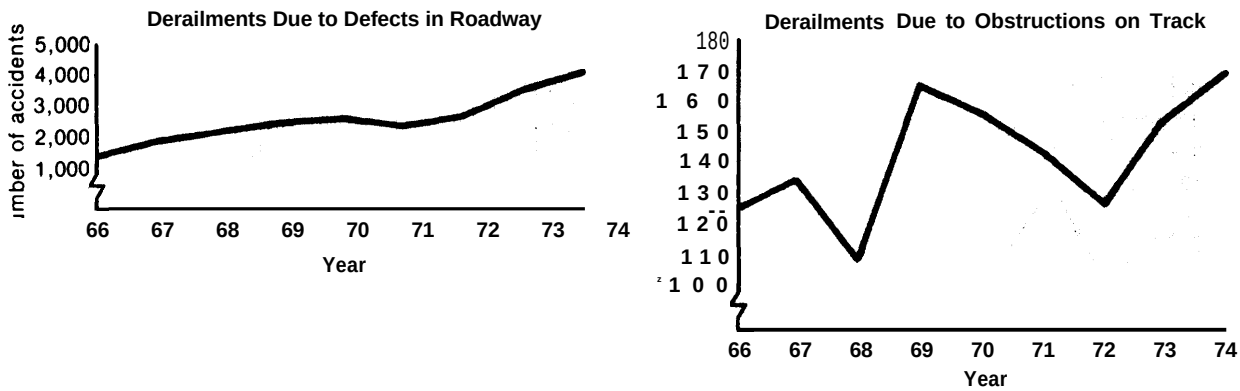


Figure C-3.-Summary of Reported Derailments
All Class I Railroads—Continued
(No Threshold Inflation Adjustment)

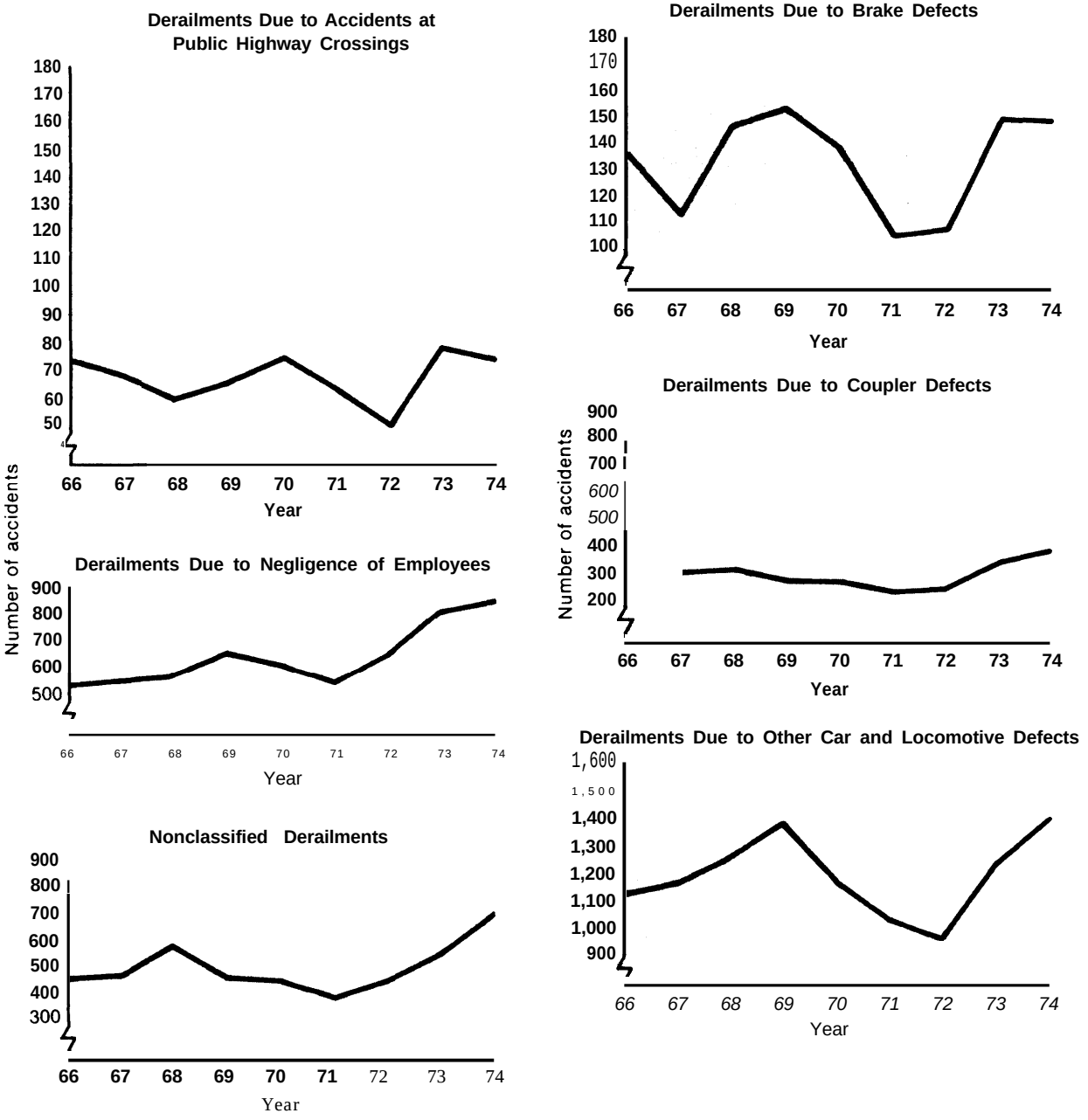


Figure C-3.—Summary of Reported Derailments
All Class I Railroads—Continued
(No Threshold Inflation Adjustment)

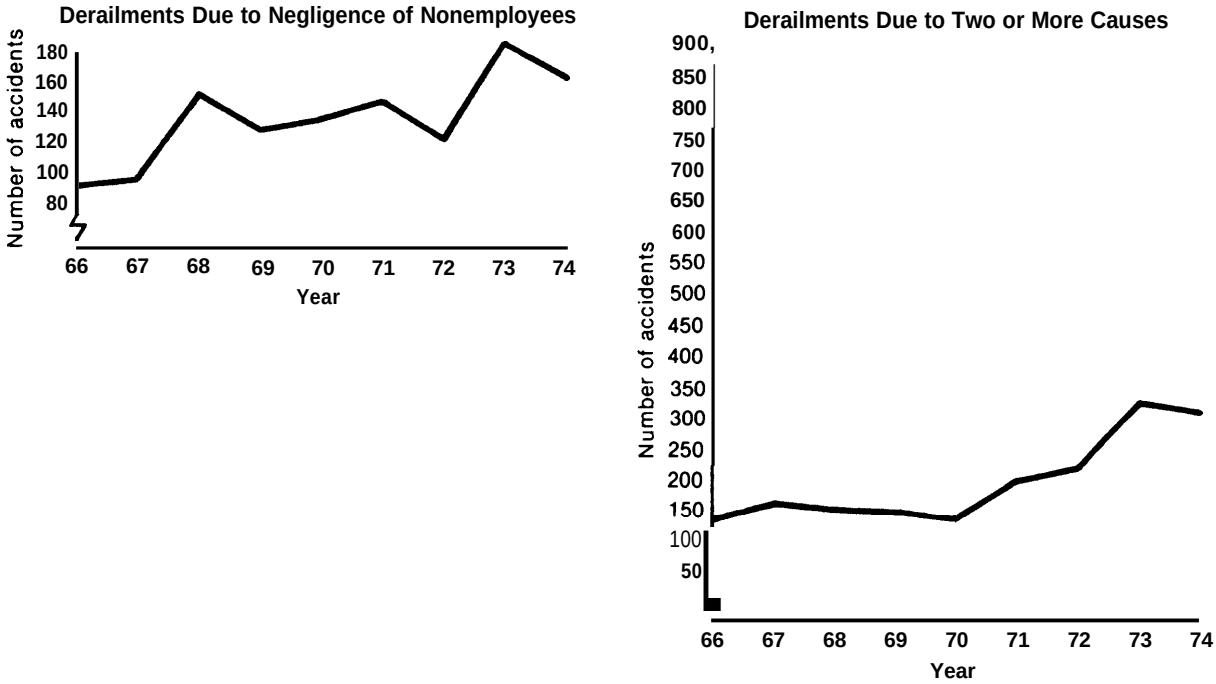
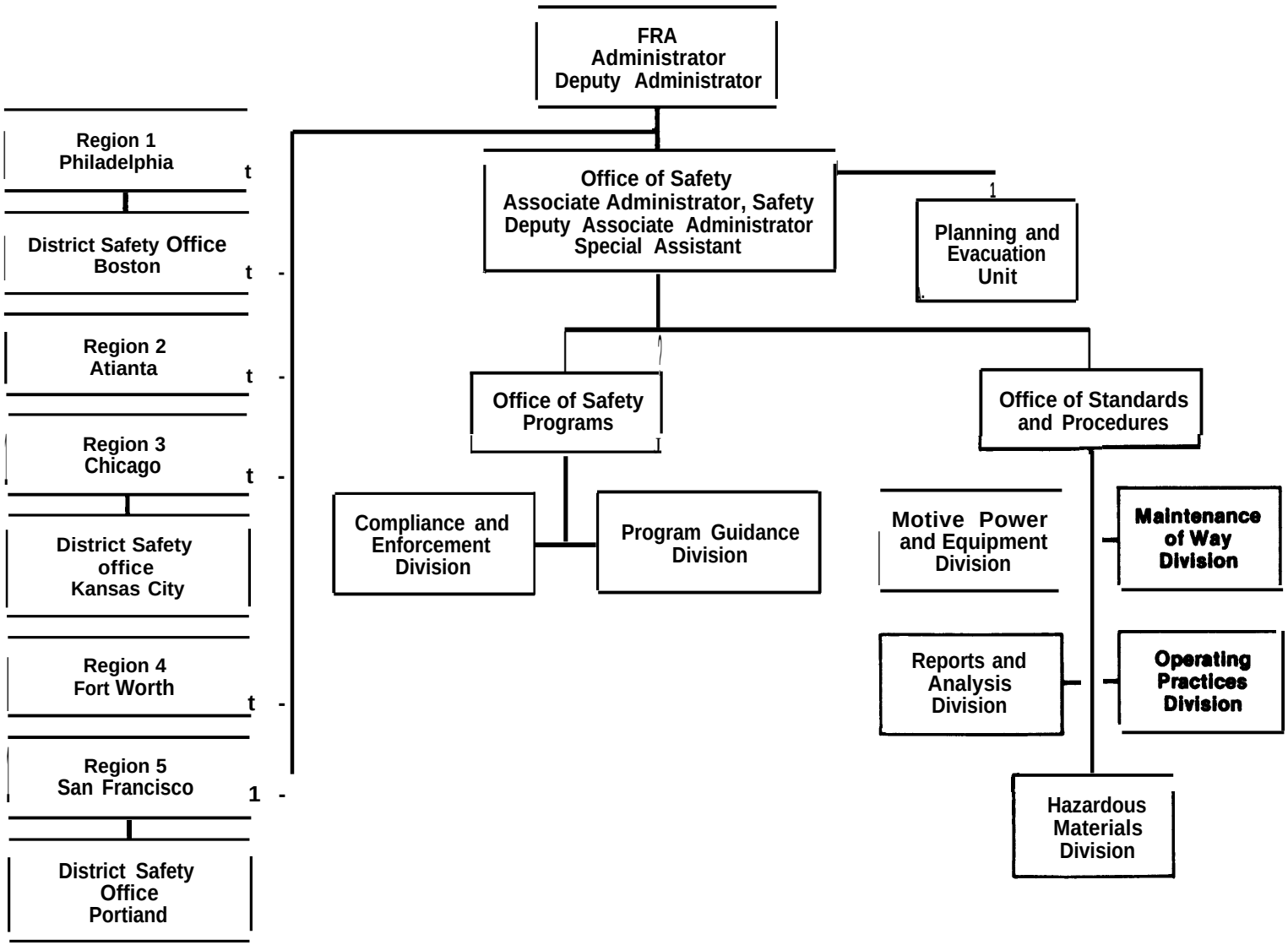
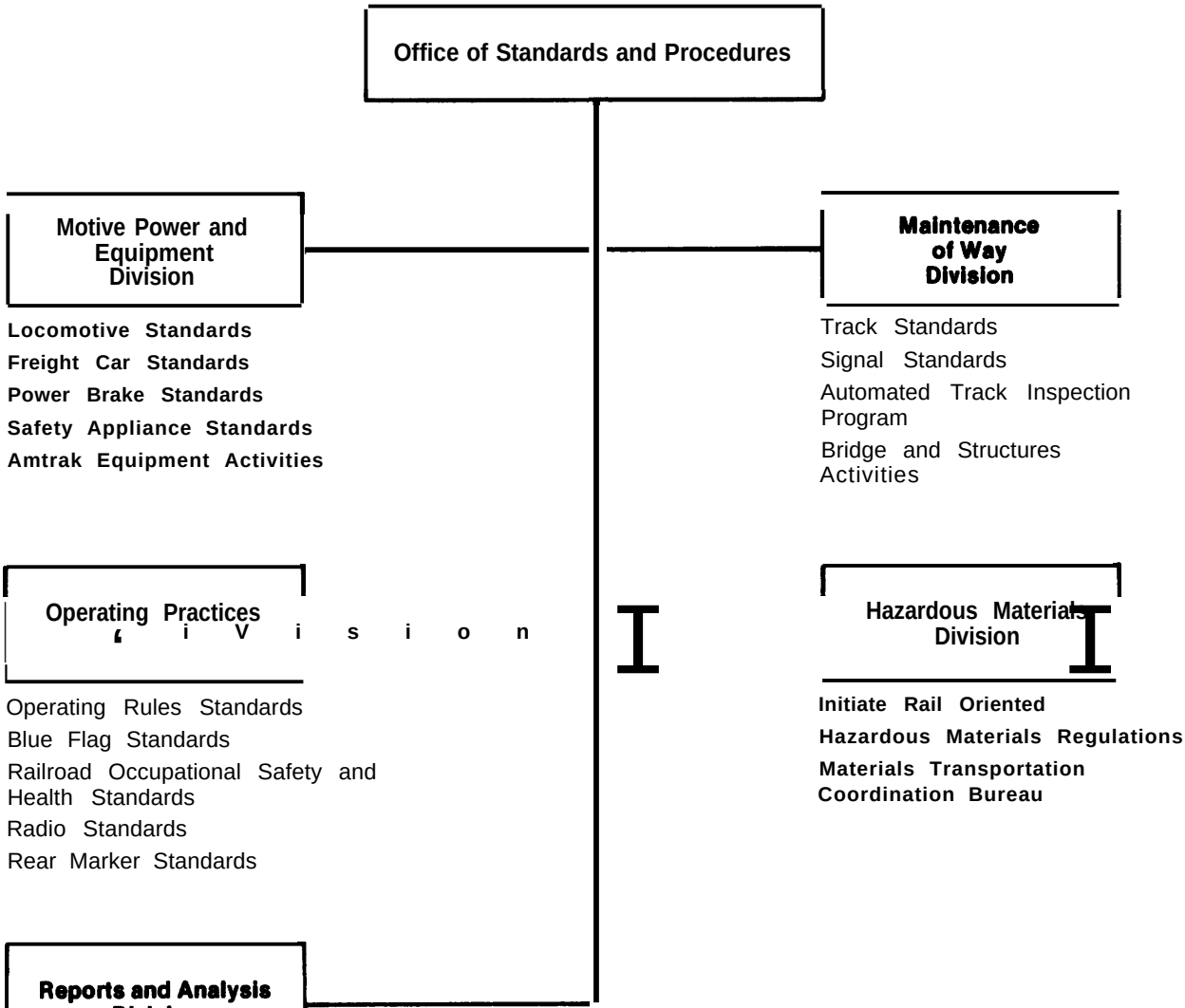


Figure D-l.— Federai Railroad Administration Office of Safety



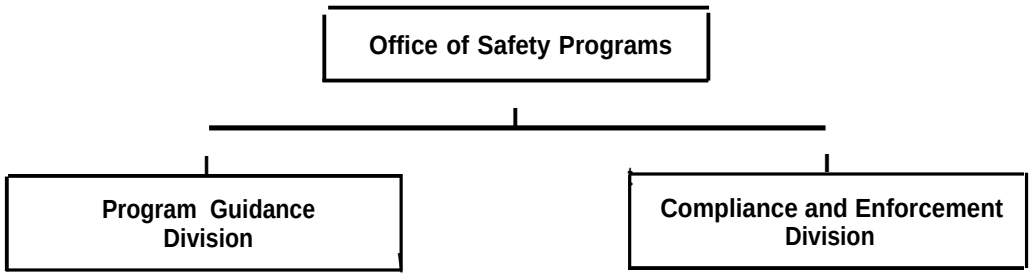
SOURCE: PMM, “Task Ill” working papers.

Figure D=2.— Federal Railroad Administration Office of Standards and Procedures Under the Office of Safety



SOURCE: PMM, "Task III" working papers.

Figure D-3.— Federal Railroad Administration Office of Safety Programs Under the office of Safety

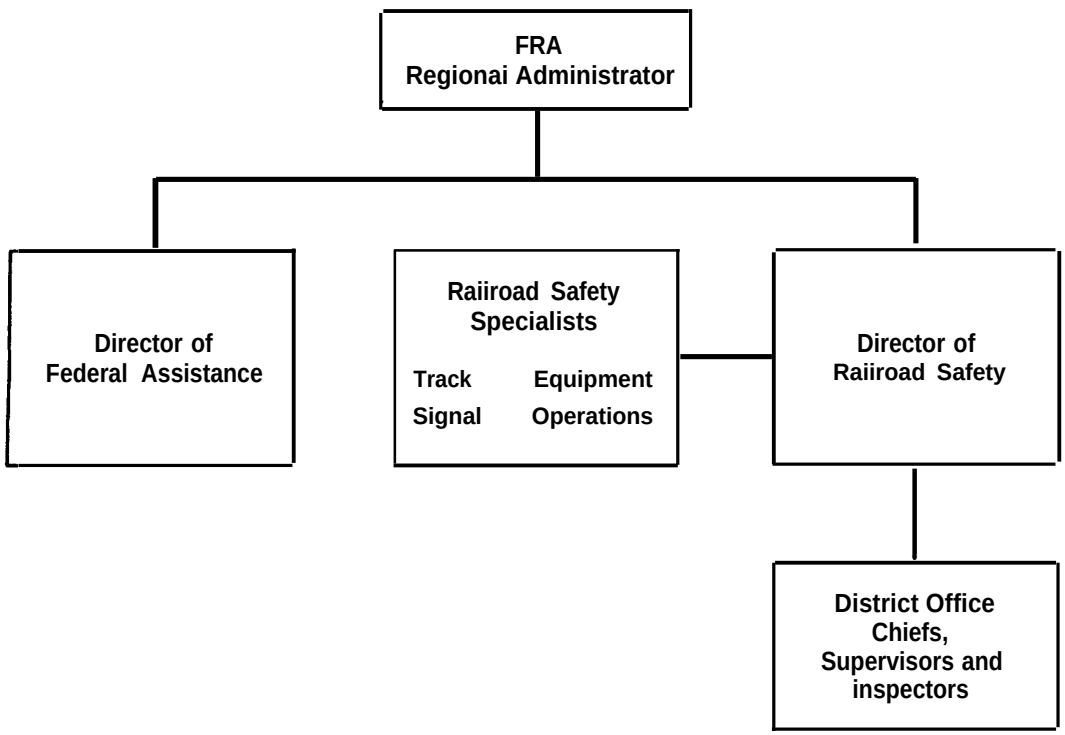


Field Program Guidance
Manpower Allocation
Training (field/state)
Coordinate State Program

Complaint Control Program
Violation Program

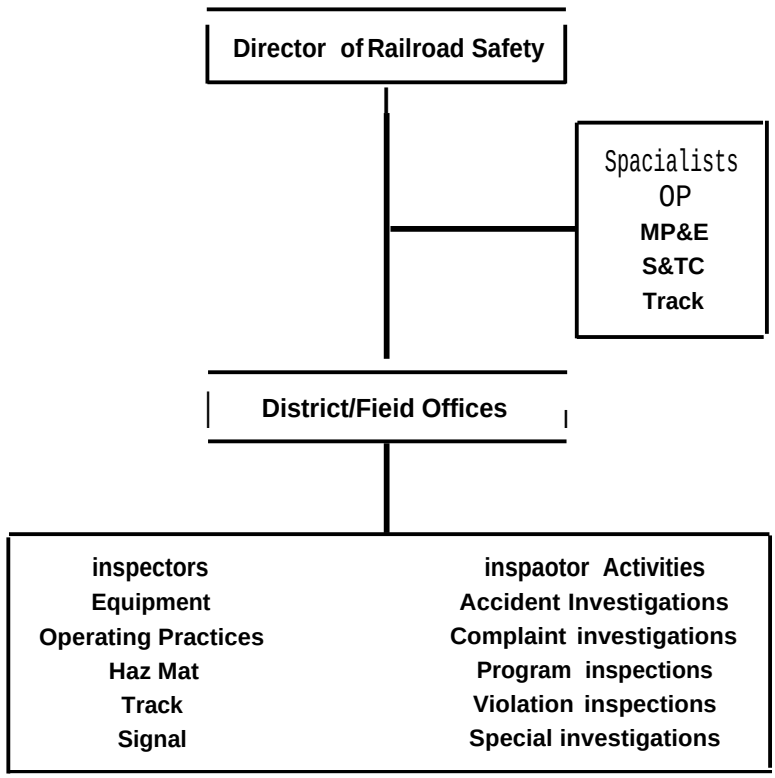
Source" PMM, "Task III" working papers

Figure D-4.— Federal Raiiroad Administration Regional Administrator



SOURCE: PMM, "Task III" working papers.

Figure D= S.—Federal Railroad Administration Director of Railroad Safety Under the Regional Administrator



- Supervisory Specialists in:
  San Francisco
  Philadelphia
  Chicago

SOURCE: PMM, "Task III" working papers.

Figure D-6.—Federal and State Participation in Railroad Safety Inspection Programs*

Program	Inspector Qualifications /	Number:	Authorized	On-board	Place of Assignment
1. Track Safety Program Has a state participation component	• 6 years railroad experience ineluding 3 recent, progressively responsible experience in track construction/maintenance or equivalent training including working knowledge of track inspection techniques, maintenance methods and equipment • Ability to examine and interpret records, including computer printouts • Ability to inspect for the prescribed maximum loadings and speed • Ability to prepare comprehensive reports • Skill in conducting investigation of a serious railroad accident	FEDERAL 46, including supervisors and 3 vacancies STATE*	46 (including 4 supervisors) 46*	41 and 4 supervisors 28* and 8* trainees	• Alabama I*/I • California 2 • Colorado 1 • Florida 1 • *Georgia* 3 • Illinois 4 / 3 • Indiana 1*/2 • Iowa 3 / I . Kansas IT*/1 • Kentucky 1 • Louisiana 2 • Massachusetts 2 • Minnesota 2'/2 • Missouri 1*/5 • Mississippi 1 • Montana 1 • Nebraska 1*/1 • New Jersey 1 • New York 2*/I • North Carolina 1 • North Dakota 1 • Ohio 2 + 2T*2 • Oklahoma 1 • Oregon 2'/2 • Pennsylvania 3"/3 • Tennessee 1 • Texas 4 • Utah 1 • Washington 2"/1 • West Virginia 2T*1 • Wisconsin •• does not include vacancies in Maryland, Texas, California, Massachusetts, and Illinois • Arizona I* • Connecticut IT' • Maryland IT* • Michigan 2" • New Hampshire IT* • Vermont 1*
2. Signals and Train Control Inspection Program Has no state participation component	• 6 years rail industry experience, ineluding at least 3 years in the signal and train control field • Progressively responsible experiencs must demonstrate knowledge of the design, instalation, inspection, maintenance or repair of railroad signalling or control systems or knowledge of applicable laws or ability to conduct accident inveatigations and to prepare accurate, comprehensive accident reports	28, including 8 specialists and 2 district chiefs	26	28	• California 2 • Colorado 1 • Florida 1 . Georgia 1 • Illinois 2 . Indiana 1 • Kentucky 1 • Louisiana 1 . Massachusetts 1 • Minnesota 1 • Missouri 2 • Maryland 1

Figure D-6.—Federal and State Participation in Railroad Safety Inspection Programs *— Continued

Progmm	Inspector Qualifications	Number:	Authorized	On-board	Place of Assignment
2. signals and Train Control lnap4ction Program (cent'd)					• Nebraska 1 • New Jersey 1 • New York 2 ŽOregon 1 • Pennsylvania 2 • Tennessee 1 Ž Texas 2 • Utah 1 • Virginia 1 • Washington 1
3. Motive Power and Equipment Safety Inapec-tion Program Has state participation component to freight car equipment only	• 6yeera railroad industry experience, including 3 years motive power and equipment experience Z/ • Progressively responsible experience which demonstrates knowledge of constru ction/deaign of locomotives or freight and pas-Sengar cam or knowledge of applicable laws/regulations of either locomotive insoectuib or safety appliance acts or ability to conduct accident investigations or to prepare accurate, comprehensive accident reports	FEDERAL 91, including 8 specialists and 7 supervisors STATE"	91 3 7	91 18*	• Alabama 1/2 • California 4 • Colorado 1 • Florida 2 • Georgia 3 • 6 • Indiana 2 • Kentucky 1 • Louisiana 3 • Maryland 1 / 2 • Massachusetts 2 • Michigan 2 • Minnesota 3 • Missouri 6 • Montana 1 • Nebraska 2 • New Jersey 6 • New York 416" • North Carolina 3 • North Dakota 1 • Ohio 7/1" • Oklahoma 1 • Oregon 3/1° • Pennsylvania 8 / 3 • Tennesse 2 • Texas 7 • Utah 1 • Virginia 2 • Washington 3 / 2' • West Virginia 2 / 2 • Arizona 1
4. Hazardous Materials Safety Inspection Pro-gram No state participation component	• 6 years railroad experience, in-cluding 3 years progressively responsible experience in the area of hazardous materials 2/ • Ability to perform hazardous materials inspections of carrier facilities or ability to inspect shippers' methods of packaging, marking, loading, etc. or the ability to conduct accident investigations and to write accurate, comprehen-sive accident reports	14 (FRA) 4 (MTB)	14 4	14 4	• Alabama 1 • California 2 • Georgia 1 • Illinois 1 • Louisiana 1 • Massachusetts 1 • Maryland 1 • Missouri .1 • New Jersey 1 Pennsylvania 2 • South Caroline 1 Ž Texas 1

Figure D-6.— Federal and State Participation in Railroad Safety Inspection Programs *— Continued

Program	Inspector Qualifications 1	Number:	Authorized	On-board	Place of Assignment
5. Operating Practices Safety Inspection Program No state participation component	• 6 years experience in railroad industry, preferably in operating capacity • 3 years must be progressively responsible experience which demonstrates knowledge of daily yard and road operations, or knowledge of the hours of service act or knowledge of FRA accident reporting requirements or knowledge of railroad safety practices or ability to conduct accident invastigations and to prepare accurate, comprehensive reports	42, including 7 specialists and 5 supervisors	42	42	• Alabama 1 • California 2 2 • Colorado 2 • Georgia 2 • Illinois 3 • Indiana 1 • Iowa 1 • Maryland 1 • Massachusetts 3 . Michigan 1 • Minnesota 2 • Kentucky 1 • Missouri 4 • Nebraska 1 • New York 1 • New Jersey 1 • Ohio 3 • Oklahoma 1 • Oregon 3 • Pennsylvania 3 • Tennessee 1 • Texas 2 • Virginia 1 • Washington 1

1/ Source: U.S. Civil Service Announcement PH – 6-02, 3/76.

2/ Two Yearn specialized experience for GS-9 level; three years for GS-11-12.

● Figuraa taken from PMM, "Task III."

Figure D-7.—[illegible] Direct Inspections

	Units	FY 1974 Costs	Cost/ Unit	Units	FY 1975 Costs	Cost/ Units	Units	FY 1976 Cost	Cost/ Unit
FRA WORKLOAD TITLE									
Motive Power and Equipment									
Railroad Freight Equipment	111,546	$ 48,554	$ .44	148,475	$ 139,654	$ .29	194,426	$ 183,411	$ .94
Railroad Passenger Equipment	832	730	.88	1,091	2,637	2.42	438	817	1.87
Trans Air-Brake Test Observation	2,924	28,409	9.49	4,632	37,617	8.12	3,281	39,559	12.06
Single Car & Devices Test Observation	1,613	8,356	5.18	1,540	9,083	5.90	1,071	7,991	7.46
Motive Power	73,472	340,730	4.64	43,083	236,898	5.50	30,678	186,499	6.08
Motive Power & Equipment Reloads	529,814	56,072	.11	226,399	46,321	.20	188,211	38,901	.21
Safety Appliance & Power Brake	404,752	157,974	.39	479,340	233,024	.49	428,289	208,930	.40
Total (Current Year Dollars)	1,124,953	640,825		904,560	705,234		846,394	666,108	
FY 1976 Constant Dollars		762,886			758,316			666,108	
Signal and Train Control									
Automatic Block Signal	1,133	32,040	28.28	1,591	34,680	21.77	829	33,778	40.75
Interlocking Control	2,297	51,134	22.26	1,799	53,199	29.57	1,602	63,635	39.72
Traffic Control	1,904	53,311	28.00	1,715	56,209	32.77	1,182	58,646	49.62
Automatic Train Control	211	7,084	33.57	632	4,257	6.74	140	5,168	36.91
Automatic Train Stop	259	3,206	12.38	130	1,627	12.52	110	3,042	27.65
Automatic Cab Signal	154	6,859	44.54	682	10,583	15.52	397	10,446	26.36
Signal Records	73,417	16,486	.22	75,973	19,907	.26	64,986	18,654	.29
Total (Current Year Dollars)	79,375	170,120		82,522	180,410		69,266	193,388	
1976 Constant Dollars		202,523			193,989			193,388	
Track & Structures									
Track — Mainline	69,463	72,132	1.04	110,344	211,258	1.91	98,915	202,758	2.05
Track — Yard	1,223	7,636	6.24	4,857	19,106	3.93	7,066	28,105	3.98
Track — RR/HW Grade Crossing	918	736	.80	4,866	2,542	.52	2,015	2,658	1.32
Track — RR Crossing & Turnouts	11,810	9,486	.80	29,017	24,603	.85	37,966	38,990	1.03
Track Records	74,486	19,221	.26	115,571	33,371	.29	139,202	45,007	.32
Total (Current Year Dollars)	157,909	109,211		264,655	290,880		285,164	317,518	
1976 Constant Dollars		130,013			312,774			317,518	
Hazardous Materials									
Hazardous Materials Equip./Oper.	23,132	32,608	1.41	18,049	47,234	2.62	21,122	44,023	2.08
Hazardous Material Mfg. Prod.	29	1,504	51.86	113	2,845	25.18	6	830	138.33
Hazardous Materials Shipper Prod.	1,365	14,368	10.53	527	19,495	36.99	842	18,725	22.24
Hazardous Materials Records	75,094	25,681	.34	17,769	43,648	2.46	4,963	44,243	8.91
Total (Current Year Dollars)	99,620	74,161		36,458	113,222		26,933	107,821	
1976 Constant Dollars		88,286			121,744			107,821	
Operating Practices									
Railroad Operating Practices	426	2,140	5.02	661	3,651	5.52	2,806	11,314	4.03
Hours of Services	206,535	17,514	.08	296,694	32,459	.11	342,692	40,415	.12
Railroad Operating Records	516	960	1.86	1,799	2,154	1.20	4,705	5,400	1.15
Total (Current Year Dollars)	207,477	20,614		299,154	38,264		350,203	57,129	
1976 Constant Dollars		24,540			41,144			57,129	
Total Costs (Current Year Dollars)	1,669,334	1,014,931		1,587,349	1,328,010		1,577,960	1,341,964	
1976 Constant Dollars		$1,208,251			$1,427,967			$1,341,964	

SOURCE: ERA Work Measurement System, Printout W24207, FY 1974 - FY 1976. Taken from PMM, "Task III."

Figure D-8.—Status Summary at Fiscal Year End for Track Safety Inspection[1]

State	Full Cert. - cert. - Agree	No. of Inspectors 75	76	77	No. of Trainees 75	76	77	Federal Funding 1975	Federal Funding 1976	Federal Funding 1977
AL	C		1	1					*$26,652*	$33,393
AZ	FC		1	1					N/A	NIA
CN	A			1			1			• 3,062
IL	A	1	1	3		1		$24,040	51,650	30,325
IN	TA		1	1					24,915	20,641
10	FC	1	2	3				29,916	54,453	51,766
MO	tA						1			• 7,712
MI	C			2						26,970
MN	A		1	2		1			52,500	42,221
NC	C	1	1	1			1	26,496	45,931	36,291
ND	C	1	1	1				32,413	26,125	17,709
NH	A						1			9,064
NY**	A			2						* 73,659
OH	A	1	1	2			2	1,466	29,712	15,314
OR		1	2	2				29,069	45,916	60,651
PA		4	4	3				22,645	63,539	75,656
VT	A	1	2	1				9,956	14,450	14,150
WA	FC	1	2	2				59,405	72,065	60,026
Total		12	20	27	2		6	$235,608	$526,126	$561,032

• Funding Agreements are still panding finalization,

•* The present maximum of inspector level of effort unauthorized by FRA's State Participation Regulations without a higher level being authorized by the Administrator New York State is in the process of requesting additional authorization.

Under Certification for FY 1976,

Under Full Certification until FY 1977.

'These figures represent FRA "commitment" baaed on individual state estimates so, in some cases, they may not coincide with actual expenditures. Taken from PMM, ' 'Task (11, " pp. III. 14-15.

Figure D-9.—Status Summary at Fiscal Year End for Freight Car Safety Inspection

State	Full cert.= agree.	No. of inspector 76	77	Federal funding 1976	Federal funding 1977
AL	C		1		$16,063
AZ	FC	1	1	N/A	N/A
MO	FC		1		* 6,550
OH	A	1	1		18,568
OR	FC	1	1	$37,321	51,738
PA	C	3	3	$15,450	70,134
WA	t FC	1	2	53,546	59,327
WY	FC		2		28,461
Total		7	12	$106,317	$250,831

● Funding Agreements are still pending finalization.
t Under Certification for FY 1977.

Appendix E
RESPONSES TO RAILROAD SAFETY QUESTIONS

In the preparation of this report, OTA outlined a list of 33 issues and questions for consideration and discussion by the Assessment Advisory Panel. The issues raised were drawn from a review of the literature, various interviews, and contractor research efforts. As indicated to the panel, the issues would finally be narrowed down, and panel comments utilized as inputs for writing the final report.

As a result of outlining the initial 33 questions, the Railroad Labor Executives Association and the Association of American Railroads (AAR), each with members on the Advisory Panel, prepared extensive responses to the questions raised by OTA. The responses of each group were considered before writing the Issues and Alternatives section to this report. Because of the merit of each group's responses to the questions as well as the time and effort taken in the preparation of their responses, this appendix includes the full list of questions raised by OTA and the responses prepared by the two interest groups. It should be noted that individual railroads and labor organizations may or may not agree in full with the positions taken by their executive or lobbying organizations.

In formulating the issues finally selected for the major section of the OTA report, the railroad safety assessment team reviewed and condensed the list of issues initially outlined. The following is the list of questions initially raised by the OTA staff.

RAILROAD SAFETY ASSESSMENT ISSUES

1. Should safety be explicitly defined in legislative and regulatory policy or should safety be defined in general terms?
2. Should railroad safety legislation be general in order to permit Government regulatory and programmatic flexibility or should it be specifically designed to address particular safety problems or concerns?
3. Should labor-management relations and collective-bargaining questions be considered when legislating safety or should safety questions only be dealt with in such processes?
4. How should other criteria such as economic, environmental and consumer considerations be taken into account when legislating or regulating safety?
5. How should safety legislation include measures to evaluate its effectiveness?
6. Should older safety statutes (including Safety Appliances Act, Ash Pan Act, Locomotive Inspection Act, Power Brake law, etc.) be repealed in whole or in part, be modified and revised for incorporation into omnibus safety legislation, or should the laws remain as they are?
7. Should the Occupational Safety and Health Administration (OSHA) continue to handle the occupational safety and health aspects of railroad maintenance shops or should all occupational safety and health for railroads be assumed by the Federal Railroad Administration (FRA)?
8. Should Congress follow safety legislative examples it has set for other transportation modes or should railroads continue to be treated uniquely in future safety legislation?
9. Should Congress consider safety policy as a part of future railroad regulatory reform legislation or should Congress consider safety policy separately?
10. Should Congress consider safety policy as a part of any future railroad economic

assistance policy or should safety be considered separately?

11. Should the Government role in railroad safety be clarified and/or expanded or should clarification and increased responsibility for safety be handled by railroad carriers, suppliers, and labor with Government policy directed strictly toward public concerns (e.g., hazardous materials and railroad grade-crossings)?

12. Should Federal Government policy continue to preempt State regulatory enforcement authority or should State authority be expanded?

13. Should the State Participation Inspection Program, authorized by the 1970 Act, be repealed, revised, or maintained in its current form?

14. Should the criteria and procedures for data collection be revised or should the current system be maintained?

15. Should procedures used in analyzing accident and incident data be revised and a standard set of analyses be conducted or should the current system remain unchanged?

16. How should the safety considerations versus collective bargaining considerations of the Hours of Service law be determined or is the current relationship of hours of service to safety accurately defined for purposes of compliance?

17. Should safety standards related to employee age, qualifications, and training be set or does the current regulatory system adequately address these human factors considerations in safety?

18. Should specific criteria and research data be a mandatory part of the rulemaking process or is the current system adequate?

19. Should the Federal inspection program be directed toward monitoring carrier performance records with quantitative and descriptive goals, should the current system directed toward inspecting design compliance be continued, or is some combination of the two appropriate?

20. Should Federal inspectors be required and trained to inspect a range of technologies and operating practices or should inspectors be required and trained for specific railroad equipment inspection?

21. Should (participating) State inspectors be qualified and paid according to Federal standards or should States establish their own inspector qualifications and pay scales?

22. Should attempted Federal improvement of railroad safety be directed to a system of enforcement and penalties, or through incentive measures for carrier and employees, or is some combination of the two appropriate?

23. Assuming deferred maintenance correlates with decreased safety, should the Federal Government monitor equipment- and track-maintenance programs, should it rely on existing safety standards, or should it revise standards to mandate safety maintenance?

24. Should Government responsibility in closing potentially unsafe plants or operations be based solely on safety considerations or should economic considerations also be taken into account?

25. Should Government safety policy for railroads in extreme financial trouble differ from Government safety policy toward other carriers or should all carriers' safety be considered uniformly?

26. Should the Federal Government require an expanded safety cost-reporting system or does the existing system provide adequate safety cost information and definition?

27. Under what circumstances should railroads be mandated to carry hazardous materials or should they have the right to establish the safety conditions by which such materials are carried?

28. Should safety certification standards be adopted for railroad equipment or is the current system of quality control adequate?
29. Should an established set of priorities for rulemaking be determined-based on analysis of existing accident and incident data and available research, or is the current method of selecting rules appropriate?
30. How should priorities be established for research and development?
31. Should research, development, dissemination, and implementation of new technology which would increase safety take into account existing collective bargaining and economic factors or should such technologies preclude those considerations?
32. As research identifies technological or other practices which may impact safety, how should these considerations be weighted against other policies such as economic, environmental, or collective-bargaining factors or should such findings be considered separate?
33. To what extent should near-term safety benefits be considered in lieu of long-term economic and/or other long-term safety policies?

ASSOCIATION OF AMERICAN RAILROAD RESPONSES

Railroad Safety Issues

The Office of Technology Assessment has prepared an outline/list in which it identifies 33 railroad safety issues. The fact that most of the issues have been expressed as disjunctive questions, together with the extremely broad implications presented in each part of the issues **as** stated, has made response very difficult—so difficult, in fact, that answers ranging from "yes or no" to doctoral dissertations have been suggested as equally adequate.

Despite these problems, the Association of American Railroads has attempted to provide a response to each of the matters in OTA's "Issues Outline. "

1. **Should safety be explicitly defined in legislative and regulatory policy or should safety be defined in general terms?**
2. **Should railroad safety legislation be general in order to permit Government regulatory and programmatic flexibility or should it be specifically designed to address particular safety problems or concerns?**

Safety legislation should be general. Safety regulations should be specific, but subject to constant review based on performance and the causal reasons for any poor performance.

In general the fewer regulations and the less enforcement the better, *consistent with safety performance*.

The essential feature of any safety regulatory program is that it be responsive to changes in technology, in operating practices, and in economic circumstances; and, above all, that it be responsive to changes in performance. Legislation which engraves in stone specific standards or requirements (as, for example, the Railroad Safety Act of 1976) cannot meet these requirements to be responsive.

(It is worth noting that the forthcoming DOT report to Congress under Sections 504 and 901 of the Railroad Revitalization and Regulatory Reform Act will identify the inability of railroads to respond to change as the root cause of the industry's problems. The inflexible Federal program of safety regulation has contributed to that state of affairs.)

3. **Should labor-management relations and collective-bargaining questions be considered when legislating safety or should safety questions only be dealt with in such processes?**

An answer cannot be provided that would be appropriate in all circumstances. However, the following observations are relevant:

First, it is undeniably true that in the railroad industry many issues are considered in the legislative forum—generally at the insistence of labor organizations—that in other industries would be dealt with at the collective bargaining table. The so-called "full crew laws" are typical examples. Those laws were ostensibly based on safety considerations, but they were repealed without union objection in the wake of a collective bargaining settlement of the fireman manning issue. In other industries, the size ,of the work force is, by and large, a matter committed elusively to collective bargaining.

Second, there is much to be said for settling as many of these issues through collective bargaining as possible. The parties are intimately aware of the relevant facts—much more aware than outsiders can ever be. And if the issues are settled in collective bargaining, the economic consequences of possible alternative courses of action are likely to be carefully weighed by both parties.

Third, the Government, accordingly, should refrain from intruding into an area appropriately reserved to collective bargaining unless the safety considerations are clear and compelling.

Fourth, where the Government is obliged to intervene, it should be prepared also to take whatever steps are necessary to resolve in a fair fashion other collective bargaining issues directly related to the safety issue. For example, legislation has been proposed setting a limit to the length of trains. The railroads do not believe any sound case can be made for such legislation on safety grounds. But were the Congress to conclude otherwise, then the Congress should at the same time consider the related collective bargaining issues. One of the main reasons for the operation of long trains is the labor costs associated with the size of crews. The railroads have attempted to reduce crew size since 1959. Every independent panel that has examined the issue has concluded that the railroads are correct. If the collective bargaining process proves unable to resolve this issue, then Congress could not fairly mandate the length of trains without establishing the procedures necessary to settle the directly related issue of crew size. The same sort of approach would be necessary with respect, for example, to proposed legislation further restricting hours of service of operating employees. In other industries, by and large, this is a matter for negotiations. If this issue were to be lifted once again from the bargaining process, then so too should be the issue of the method of pay for operating employees, most of whom are still paid, not by the hour, but by the mile, with 100 miles equalling 8 hours' pay—the consequence being that employees on long runs often make several days' pay in less than 8 hours.

4. **How should other criteria such as economic, environmental, and consumer considerations be taken into account when legislating or regulating safety?**

Safety legislation should explicitly recognize that economics will necessarily impose constraints on any program aimed at improving safety, as will environmental considerations.

The impacts of all these criteria should be determined by the regulatory agency charged with implementing a safety statute in order to allow an informed balancing of competing interests and of competing national policies. Legislation and regulations for the evaluation of economic and environmental considerations already exist and further specific provisions are not necessary.

As for "consumer" interests, they are best represented by ensuring that the consumer gets rail transportation (in this case) at the lowest possible cost consistent with other policy goals.

Safety regulation should be designed to produce the maximum improvement in safety for the minimum dollars of expense.

5. How should safety legislation include measures to evaluate its effectiveness?

At the **present** time there is no need for additional legislation on railroad safety. The broad, sweeping authority granted the Secretary of Transportation in the **1970** Federal Railroad Safety Act, to issue rules, regulations, and standards as necessary for *all areas of railroad safety,* is sufficient to permit him to take such action as is essential to improve the safety of railroad workers and the public.

In the past, Congress has too often been too specific in the statutes which have been enacted. This inhibits changes which are necessary due to the application of advancing technology or improved operating practices and, through inertia, many unnecessary statutes remain on the books.

The regulatory authority now possessed by the Secretary should be exercised only when accident experience clearly reveals that preventive measures are necessary, and that, in the absence of regulations, no improvement will be effected. Regulations should not be issued on the basis of one or two isolated incidents, but only when a continuing and increasing pattern is revealed by careful review of records and practices.

Results of the imposition of regulations should be reviewed on an annual basis; if the accident experience has not been reduced over time, consideration must be given to the repeal or amendment of the regulation and the substitution of alternate measures.

6. Should older safety statutes (including the Safety Appliances Act, Ash Pan Act, Locomotive Inspection Act, Power Brake law, etc.) be repealed in whole or in part, be modified and revised for incorporation into omnibus safety legislation, or should the laws remain as they are?

The older safety statutes (those which preceded the 1970 Safety Act) were enacted during an era in which no Federal agency had broad authority to issue safety regulations. Each such statute was designed to meet a specifically identified need. The needs have changed, but the statutes haven't and the DOT should be urged to convert the still-necessary old statutes (e.g., the Locomotive Inspection Act and the Power Brake law) into meaningful, new regulations and to request repeal of those laws and of the ones for which no current regulatory mandates (e. g., the Ash Pan Act) are needed.

7. Should OSHA continue to handle the occupational safety and health aspects of railroad maintenance shops or should all occupational safety and health for railroads be assumed by FRA?

In the Federal Railroad Safety Act of 1970, Congress granted to the Secretary of Transportation authority to issue rules, regulations, and standards as necessary for all areas of railroad safety. The Act also contained provision for preemption of State regulations covering the same subject matter. It is obvious that Congress believed that regulations should be standardized throughout the Nation, with exception of unique localized situations less than statewide in character, and that the FRA (through delegation from the Secretary) should be the governmental body directly responsible for the development, issuance, and enforcement of those regulations and standards which were deemed essential.

While the **1970** Railroad Safety Act was under consideration by Congress, the Occupational Safety and Health Act was being acted upon by other committees in both houses. Had the Commerce Committees, working on the Railroad Act, believed the Department of Labor should have authority to establish safety regulations applicable to all or part of the railroad industry, the blanket authority would not have been granted the Secretary of Transportation. The OSH Act covered all industries in general, but contained the provision that it was not applicable to any industry regulated by another Federal agency which was exercising its authority to establish and enforce safety standards. The question framed by OTA, thus, misconstrues the law. FRA **has** jurisdiction over railroad occupational safety and health, and litigation has ensued over whether that authority is being "exercised. " The railroads firmly believe that an industry should be responsible in safety matters to

only one Federal agency and, because DOT is the agency with the broadest powers, it should be the all-inclusive, safety regulator for the railroad industry.

8. Should Congress follow safety legislation examples it has set for other transportation modes or should railroads continue to be treated uniquely in future safety legislation?

By posing the question in this form, OTA may have, without realizing it, recognized the discriminatory "super-attention" paid to the railroad industry by Congress. A half century and longer ago, when railroads were the heavily predominant means of transporting people and goods and there was no Federal agency with overall responsibility for railroad safety. There may have been justification for Congress to enact specific rail safety legislation. That need, if it once existed, has since passed. In 1970, with the passage of the Federal Railroad Safety Act, Congress saw fit to provide the Secretary of Transportation with broad authority for actions to improve safety. Thereafter, Congress should have limited its consideration of railroad safety to oversight hearings to determine how the Secretary was exercising this jurisdiction. Congress should have refused to consider legislation proposing specific rail safety measures (or other proposals under the guise of safety) but the consideration continues unslackened.

The Federal Railroad Safety Authorization Act of 1976 contained amendments to the Hours of Service Act mandating requirements for crew quarters and it contained amendments to the 1970 Safety Act requiring "highly visible" rear markers and revised blue flag rules. None of these three specific pieces of statutory enactment—and they are but examples—was justified by hard evidence, dispassionately weighed, but that is beside the main point of this discussion. Where in the oversight of the activities of the Bureau of Motor Carrier Safety is there a parallel? In reviewing the statutory implementations of the National Highway Traffic Safety Administration, is there a pattern similar to that which exists between Congress and the FRA? (The ignition interlock fiasco is an example of the reverse kind of oversight.) Only one item of congressionally required equipment for another mode comes to mind—the emergency locator transmitter (ELT) required for aircraft—and the general consensus now on that device is that it should have had some more development time; that it has probably been about as much of a source of trouble as it has been a source of help.

Congress should drastically change its policy of attempting to pass specific legislation aimed at narrowly focused problems; history shows that broad-scale requirements, whether legislative or regulatory, based on "single incident" statistics have a poor record of achievement and the best results (e.g., the clean cab project) seem to flow from the cooperative participation—perhaps in a nonmandatory forum—of all interested parties in seeking to achieve an agreed upon common goal.

9. **Should Congress consider safety policy as a part of future railroad regulatory reform legislation or should Congress consider safety policy separately?**

While fewer economic regulations *may* result in a more healthy and thus safer industry, rail safety should not be an explicit goal of regulatory reform legislation. Safety problems are a very indirect function of economic regulation, thus economic regulatory reform legislation need not concern itself with safety as such.

10. **Should Congress consider safety policy as a part of any future railroad economic assistance policy or should safety be considered separately?**

Involving economic assistance with safety policy would only add another layer of confusion to an already confused subject. The present programs of Federal financial assistance to railroads are intended as only interim measures and safety policy should not be tied up with temporary programs. If railroads are in business at all, they can and should pay for their own safety programs; the more reasonable (from a

cost/benefit standpoint) the programs engendered by regulatory schemes, the better the rail carriers will be able to afford them. Of course, where public facilities and operations are involved, such as at highway grade-crossings, public money should also be involved but this is more a matter of the correct allocation of cost than it is of economic "assistance. "

11. **Should the Government role in railroad safety be clarified and/or expanded or should clarification and increased responsibility for safety be handled by railroad carriers, suppliers, and labor with Government poIicy direct strictly toward public concern (e.g., hazardous materials and railroad grade-crossings)?**

Railroad managers recognize and accept the responsibility for conducting company operations in a manner which will pose no threat to the safety of their employees and the public; though the responsibility of the railroads is obvious, Government and labor also have roles in the promotion of safety.

In the 1970 Act, Congress defined the areas in which the Secretary of Transportation should participate and railroad management believes that Federal activity should go far beyond the mere issuance of regulations. Regulations have a relatively limited impact in solving safety problems while much more could be accomplished by attacking the root causes of accidents through research, development, testing, and training.

The railroad labor unions could contribute toward improving safety by joining management in cooperative programs and by calling upon their members to give greater attention to safety than is presently done. Instead of constantly criticizing management and instead of trooping before Congress and the regulatory agencies with pleas for the enactment of more legislation and the issuance of more regulations, they should work with the carriers in efforts to reduce hazards and thus to provide a safer environment for their members.

12. **Should Federal Government policy continue to preempt State regulatory enforcement authority or should State authority be expanded?**

Federal governmental policy—at least as it operates through FRA-does not preempt State regulatory enforcement authority. FRA has a rather detailed regulatory scheme under which States may become certified to carry out and assist in enforcement of many railroad safety regulations.

In terms of the regulations themselves, AAR believes that they must be nationally uniform—except to account for particular local circumstances. Railroads are a national industry and railroad equipment must be able to operate freely in all parts of the country. The congressional and judicial policy for national uniformity is sound and should be continued.

13. **Should the State Participation Inspection Program, authorized by the 1970 Act, be repealed, revised, or maintained in its current form?**

The major problem with the State Participation Inspection Program is the constant need to ensure that State-employed inspectors meet Federal qualifications.

14. **Should the criteria and procedures for data collection be revised, or should the current system be maintained?**

15. **Should procedures used in analyzing accident and incident data be revised and a standard set of analyses be conducted or should the current system remain unchanged?**

Issues 14 and 15 will be addressed jointly, since data analysis procedures could affect the criteria and procedures for data collection.

The AAR and the railroad industry have been unable to detect any evidence of systematic, comprehensive accident/incident data analysis by the Federal Government. The industry would encourage and support such analysis. Thus, it is urged that procedures for analyzing these data

be established and analyses be conducted to provide guidance for the formulation of safety research and action programs and for monitoring the effectiveness of these programs once implemented.

An objective of FRA data collection and analysis should be to monitor trends and to assist the industry with the identification and priorities of existing and potential safety problems. This data collection and analysis at the industry level should not attempt to pinpoint the specific nature of each safety problem or to support in-depth analysis. Once the industry-level system identifies potential problems that appear significant, appropriate action could include notification of railroad representatives and recommendations for corrective action. In some cases, special studies may be appropriate, requiring the collection and analysis of detailed data at the individual carrier level to more accurately determine such factors as accident frequency, severity, and specific causes. These data could then be analyzed to determine whether the problem deserves a high priority and, if so, the kinds of research or action that may be required.

The current FRA criteria and procedures for data collection are adequate to monitor trends and provide indications of potential problem areas which may require more detailed investigation. To substantially enlarge the present FRA data-reporting requirements in an attempt problems would result in an expensive and cumbersome system which would place an unjustifiable burden on the railroad industry, especially in light of the lack of analysis of the data now being collected. Further, the determination of the data reporting requirements for such an expanded system would require anticipation of all potentially significant safety problems as well as the detailed data necessary for their in-depth analysis.

AAR's members believe that the current FRA safety data system is sufficient for its intended and justifiable purpose. FRA should be urged to develop a systematic approach to the anlaysis of the data available through this system to assist the industry in the identification of significant safety problems.

16. **How should the safety considerations versus collective bargaining considerations of the Hours of Service law be determined or is the current relationship of hours of service to safety accurately determined for purposes of compliance?**

Safety is a legitimate concern of Congress; collective bargaining—other than guaranteeing its free availability—is not. Governmental "consideration" of substantive collective bargaining issues must or could lead to the Government "taking sides" in the collective-bargaining process and that would be neither fair nor proper. It would, in fact, destroy the system.

17. **Should safety standards related to employee age, qualifications, and training be set or does the current regulatory system adequately address these human factors considerations in safety?**

It is fairly well settled that the age of an employee is not a proper subject for regulation. What is significant is the ability of the employee to perform safely the tasks required in his or her occupation.

Virtually without exception, the railroads have each established physical qualifications for their employees. The qualification standards, and the railroads' various requirements about periodic physical examinations, are not uniform throughout the industry; this is only natural, given the fact that they were not developed as a joint effort. Equal employment opportunity guidelines and Federal regulations requiring that Government contractors (including railroads) hire physically handicapped individuals are a fact of life and, because of them, rail carriers are experiencing great difficulty in defending their physical qualifications standards. Several, in fact, have been forced to accept into employment individuals whom the medical officers believe are not physically qualified. AAR's members want to avoid hiring persons who are poor safety risks and they believe that adoption by FRA of minimum standards for employees

will be of great assistance; each of the other modal regulatory units within DOT has established regulations of this type: the FAA for flight crews, the BMCS for over-the-road truckers and the Coast Guard for maritime personnel and the 1970 Act specifically authorizes the Secretary to act in this matter.

FRA also has the authority to conduct training and could be of assistance to the industry in the promotion of safety training programs and in studies which would demonstrate the manner in which employees could be motivated to perform more safely.

Regulations governing training are not necessary at this time.

18. **Should specific criteria and research data be a mandatory part of the rulemaking process or is the current system adequate?**

In terms of assessing the environmental and inflationary impacts of proposed regulations, the system is designed to be adequate but seldom functions that way. Impact assessments, when made, are often perfunctory and inaccurate and, when missing, their lack has been justified on an inadequate basis. The assessment of research data is not a requirement and is only very rarely done.

The result of this process is the formulation of regulations based on single-incident statistics (using the Decatur, 111., accident as a basis for establishing new crew quarters regulations; using the Chicago commuter train tragedy as a basis for writing legislation on rear end markers) or the writing of mandatory standards based on the theoretical calculations of governmental engineers (the requirement for a larger tank car head shield than had ever been tested in actual service) or the failure to draft regulations when supported by data developed in railroad industry research projects (the long-standing [and, as yet, incompletely resolved] refusal to require top and bottom shelf couplers on certain pressurized, uninsulated tank cars despite overwhelming research data in their favor). Another aspect of the failure to assess research and accident data is the transferal of industry standards and guidelines from their intended purpose into inappropriate areas (the adoption of the good maintenance practices of the AAR Interchange Rules by FRA **and their reincarnation as Federal mandatory safety limits; the change** in the rear marker from **a** railroad designation of the end of a train into a device to increase conspicuity and, allegedly, to reduce rear end collisions).

In all of these instances, and in others (such as the creation of Federal blue flag rules in potential conflict with earlier Federal rules relating *to* yard speeds and to rear end flagging a full the purpose of a regulation would surely have resulted in better safety standards for the railroad industry.

19. **Should the Federal inspection program be directed toward monitoring carrier performance records with quantitative and descriptive goals, should the current system directed toward inspecting design compliance be continued, or is some combination of the two appropriate?**

Since its inception, the FRA safety program has been directed toward enforcing compliance with track and equipment standards. These track and equipment standards are essentially those used by the railroad industry for many years; the FRA did not develop a new set of standards, but merely cast into regulations the design standards which the railroads had already developed. In promulgating these regulations, FRA has not addressed the following questions: 1) have circumstances developed for which these previously developed recommended standards are no longer appropriate? 2) are these recommended industry standards not generally being observed by the industry; if so, has that resulted in additional track and equipment-related accidents and has that created a safety problem? 3) were the industry standards ever intended as absolute rules, or as merely recommendations of good—or of financially justifiable—practices? and 4) was there real evidence of widespread "violations" of the industry standards in the first place, such as would make Federal adoption justified?

20. **Should Federal inspectors be required and trained to inspect a range of technologies and operating practices or should inspectors be required and trained for specific railroad equipment inspection?**

While it might be possible to train some individuals to inspect track, equipment, and signals it would not be cost-effective nor would it be possible in all cases. It certainly would be unrealistic to expect a Federal inspector to understand the intricacies of electrical circuits, on one hand, and, at the same time, be able to interpret a series of super-elevation and horizontal track-alignment data.

The railroad industry specializes its forces to a large extent and experience has shown that, for instance, maintenance-of-way and structures personnel require skilled knowledge that is different from that required of those who maintain locomotives, or rolling stock, or communications and signals equipment. Only rarely, and then usually at middle- to upper-management levels, do these employees develop proficiency in more than one of these fields. The railroads do not believe that Federal or State employees who may be experienced in one of the disciplines could attain the necessary qualifications in another through a training program of limited length. Judgment is required in each of these skilled positions and judgment can only be developed through experience.

There are some inspection activities which can be performed by persons who do not possess highly technical backgrounds or who have not worked in technical fields, but who do have knowledge of and experience in railroad operations. For instance, inspections for compliance with federally prescribed operating rules could be coupled with inspections for hours-of-service compliance, or accident-reporting, or perhaps with hazardous materials regulations. (This latter area is, however, becoming more complex with each passing month and no doubt either does or soon will require at least some degree of specialization.)

Very little could be as bad for a program of inspection as an incompetent, or under-trained, or unskilled force of inspectors.

21. **Should (participating) State inspectors be qualified and paid according to Federal standards or should States establish their own inspector qualifications and pay scales?**

If the States insist upon a role in inspecting for compliance with Federal railroad safety regulations, and in enforcing such regulations, the partnership arrangement as provided for in the 1970 Federal Railroad Safety Act should be maintained.

The railroads are deeply concerned about the qualifications of inspectors, Federal or State. They regard the standards established by the FRA for track and freight car inspectors as reasonable and realistic, requiring, as they do, experience in the railroad industry, with professional technical training substituting to some extent for part of the experience requirement. In the opinion of the railroads, State inspectors should possess equal qualifications because the authority given inspectors, if not prudently exercised, could seriously impair the efficiency of railroad operations.

Difficulties experienced by States in attempting to recruit qualified personnel for inspector positions are recognized. The problems of salary and benefit differences between the State and Federal scales must be resolved between the State and Federal agencies; the industry insists only that qualification standards established by FRA must be maintained, and not compromised for the State inspectors.

22. **Should attempted Federal improvement of railroad safety be directed to a system of enforcement and penalties, or through incentive measures for carrier and employees, or is some combination of the two appropriate?**

Safety cannot be achieved through the enactment of legislation or the issuance of regulations with penalties assessed for noncompliance. Improvements in safety performance can be accomplished only through the united efforts of

people at all levels of responsibility who are well-qualified, well-trained, and motivated to perform their duties in a manner that will limit the opportunity for accidents to occur.

Congress has given the Secretary of Transportation far-reaching authority to conduct activities to improve railroad safety. While this authority includes the power to issue regulations and mandatory standards, it also carries the duty to use care in exercising the authority. Too many regulations are issued without full or proper justification and, in all too many instances, they do not provide a solution.

Maintaining strict compliance with each minor provision of a comprehensive set of standards is a virtually impossible task. Many citations are issued for technical violations of a minor nature, and penalties are assessed. This is counter-productive because it siphons off resources and channels them into areas that may not represent the most pressing problems on a particular property. If a true safety problem exists and the railroad is aware of it and makes no effort to correct it, then perhaps penalties are justified. However, attempts by a Federal agency to bring a carrier to its knees through citations and fines for minor deviations from published standards will do nothing to improve safety and will begin to create disrespect for the law in general and for the regulations of that agency in particular.

The 1970 Act authorizes the Secretary to "conduct, if necessary, research, development, testing, evaluation, and training for all areas of railroad safety." Many of the funds devoted to the development and enforcement of regulations could better be expended in these areas. Through cooperative programs between DOT, carrier management, and the labor organizations, greater strides could be taken toward the improvement of the industry's safety performance.

23. **Assuming deferred maintenance correlates with decreased safety, should the Federal Government monitor equipment- and track-maintenance programs, should it rely on existing safety standards, or should it revise standards to mandate safety maintenance?**

The assumption is not justified. Deferred maintenance is a rather vague and most often loosely used term. Its most precise and best meaning refers to a maintenance state in which the average age of the components in a system exceeds half the expected life of those components. This is a statistical and economic concept and not *one* which can be used to pinpoint dangerous areas or even, except in a broad sense, to assign priorities for maintenance activities. For example, it is quite possible to have unsafe conditions in track which has virtually all new components while, at the same time, a section of track with statistically defined deferred maintenance can be far superior in terms of safety and rideability.

Decisions concerning the scheduling and programming of maintenance are largely decisions of engineering economics. They require an extensive background knowledge of traffic flows, labor rates, labor productivity, equipment and material prices and availability and a host of other factors of which Government representatives have no knowledge and to which they have no legitimate access. These decisions also carry with them a measure of responsibility. The employee in charge, bluntly, may lose his job if wrong decisions are made. Failure to make the right decisions can cost lives, jobs, and property damage—facts of which railroad management is acutely aware. Governmental representatives may be aware of the consequences of wrong decisions in this area but they are insulated from the responsibility for them in such a way that they should not attempt to substitute their necessarily more remote judgment, before the fact, for that of those who are, and should be, in charge.

24. **Should Government responsibility in closing potentially unsafe plants or operations be based solely on safety considerations or should economic considerations also be taken into account?**

25. **Should Government safety policy for railroads in extreme financial trouble differ from Government safety policy toward other carriers or should all carriers' safety be considered uniformly?**

The closing of operations (taking equipment or trackage out of service) or the imposition of maximum speed restrictions can only realistically be done on technical grounds. Introduction of economic considerations would clothe Federal inspectors with judgmental prerogatives which properly belong to railroad management and which are based on background information to which only they are privy. Economic considerations, on the other hand, do have a legitimate role to play in determining kinds of inspections, frequency of inspections, timing, locations, and the like.

If inspection criteria are set technically, as they should be, the financial health of the carrier should not and will not have any bearing on questions of serviceability. Management decisions about restoration of service or the methods used to meet minimum standards or the extent to which minimum standards are exceeded will vary, depending on financial strength, but these are questions separate and distinct from compliance with properly established minimum standards of safety.

26. Should the Federal Government require **an** expanded **safety cost-reporting system or does the existing system provide adequate safety cost information and definition?**

The only justification for requiring the reporting of any additional safety cost data would be to help estimate the priorities, costs, and effectiveness of current and proposed safety research and action programs. The industry is unaware of any priority or cost-effectiveness estimates which are currently available or in use by the Federal Government; nor is it aware of any efforts underway to develop techniques to provide such estimates. Railroads would support the development and use of a cost-effectiveness methodology with which to evaluate current and proposed safety programs and regulations; however, any expanded safety-cost reporting should not be required until such methodology is fully developed and the costs of its data requirements defined and justified.

27. **Under what circumstances should railroads be mandated to carry hazardous materials or should they have the right to establish the safety conditions by which such materials are carried?**

The facts are that railroads are required, as part and parcel of their common carrier duties, to carry hazardous materials and to carry them under conditions established by other entities. The recent Interstate Commerce Commission decisions requiring the transportation of spent nuclear materials, the failure of FRA, for years, to even allow the installation of shelf couplers on modern tank cars and the scant cooperation received from the Materials Transportation Bureau in the recent revision of the hazardous materials regulations are but examples of the atmosphere within which these materials are carried by the railroads. Despite this, their safety record is superb.

What is needed in this area is a little more attention paid to those who know how to accomplish the job and a little less paid to those who are alarmed by the fact that it is being done at all.

28. **Should safety certification standards be adopted for railroad equipment or is the current system of quality control adequate?**

Under no circumstances should safety certification standards be adopted for railroad equipment. The railroad industry, through its AAR Committees, provides adequate control of railroad equipment and the components authorized for use on cars in the interchange fleet.

The various technical committees are composed of industry experts from 1s to **20** major freight car owners, in the particular area of the committee's responsibility. The committee members consult with related experts from component manufacturers. There is no way the

Government bureaucracy could assemble such broad-based expertise to respond in a timely fashion to technical progress in the various areas offreight car components.

The industry system of initial review and comments from committee members, subsequent laboratory testing and, finally, limited testing in the field, utilizing actual railroad environment, has provided adequate quality control. At any stage in the current system of introducing improved components or monitoring components previously approved, there is evidence that the industry is capable of responding promptly and effectively.

29. Should an established set of priorities for rulemaking be determined-based on analysis of existing accident and incident data and available research, or is the current method of selecting rules appropriate?

30. How should priorities be established for research and development?

The problems and approaches which apply to the establishment of rulemaking priorities are closely allied with establishment of research and development priorities, so issues 29 and 30 are addressed jointly.

Analysis of available accident and research data constitute necessary, but not sufficient, ingredients for the establishment of priorities; at present, there is every indication that this process, especially its rulemaking side, derives primarily from the pressure from special interest groups, the subjective perceptions and appraisals of DOT (FRA) staff members, and the recommendations of the NTSB. All three of these sources suffer from the same basic deficiency: They are unable to take proper account of the total spectrum of railroad safety issues. NTSB recommendations, for example, are biased because they are based on investigations of high-severity accidents. Preliminary analysis by AAR shows that the criteria used by NTSB to determine which accidents to investigate renders these accidents unrepresentative of significant rail safety issues and, therefore, not useable in the setting of safety research and action priorities.

Given the limited dollar and manpower resources available for safety research and for the formulation, implementation, and enforcement of safety rules by FRA and the rail industry, it is essential that safety priorities be established with utmost care. Recent analysis of all FRA accident and employee casualty data by the AAR revealed that too much emphasis and too many resources have been focused on train accidents caused by track and equipment failures, whereas the more frequent and serious accidents were employee casualties which had no relation to failure of track or equipment.

The focusing of FRA's emphasis towards the elimination of human factors accidents will not be as politically dramatic as the establishment of standards for tracks or of safety rules for freight cars, but it will, if it is successful, save more lives. A reordering of priorities away from collecting large fines for small technical violations—who, for instance, has ever been killed by a late-filed railroad accident report?—will cause FRA to feel enormous pressure from interests who know full well how to make their pressure felt, but the courage to go against what seems to be the popular wisdom is a necessary ingredient for one who seeks a solution rather than an arena.

The problem is all the more difficult by the very nature of its subject. It is comparatively easy to realize, for instance, that certain indications on a wheel—e.g., shelled tread, cracked or broken flange, etc.—could lead to premature failure and thus to write rules outlawing car wheels with these characteristics. It is a quantum leap upward in difficulty to identify the early warning signs of impending human failure. What is there about an engineer which is analogous to a cracked, broken, or missing flange? How does a switchman show the kind of warning that a series of missing tie-plates do? The answers to these questions are as difficult *as* they are important and the sooner all interested parties get about answering them, the sooner there will be answers. Congress could help by encouraging the search instead of misdirecting

the effort off towards the quest for a perfect rear end marker; but that, too, will take both the courage and the convictions of statesmen.

31. **Should research, development, dissemination, and implementation of new technology which would increase safety take into account existing collective bargaining and economic factors or should such technologies preclude those considerations?**

From previous answers, it should be obvious that the railroad industry believes that Congress should not involve itself in the substance of the collective-bargaining process and that research and the development of new technologies should never be circumscribed by existing collective-bargaining agreements.

32. **As research identifies technological or other practices which may impact safety, how should these considerations be weighted against other policies such as economic, environmental, or collective bargaining factors or should such findings be considered separately?**

If research efforts identify an opportunity to improve safety, the restraints of practicality demand an assessment of its costs and benefits and of its impacts on other priorities and programs, including the agreements arrived at in collective bargaining. If there are advantages in all of these factors, then obviously the findings of research should be immediately applied. If there is a serious question as to the cost-effectiveness of the safety approach, measure, or practice derived from research, then great care must be taken so as not to mandate ever-increasing costs in the search of the ultimate will-o' -the-wisp: a total lack of accidents.

There is some hazard in every aspect of life. It is the object of safety research to attempt to reduce that hazard. But if the cost of implementation becomes prohibitive, then some alternate means of providing the service or carrying out the function will be found. At present, as a consequence of safety research on tank cars, very substantial expenses are being incurred for improvements, and this means that the rates for the movement of hazardous materials in tank cars will certainly increase. Railroad safety will increase. However, the movement of these products by other modes (encouraged, perhaps by the newly created rate disparities) may well lead to more accidents, because the other modes are not now required to pursue the safety measures that the railroads are required to follow. From a national point of view, therefore, action to increase safety in one mode may decrease overall national safety. This is an issue which has not yet received the attention it deserves.

33. **To what extent should near-term safety benefits be considered in lieu of long-term economic and/or other long-term safety policies?**

Near-term safety benefits which, because of their costs, affect long-term industry economic viability must be viewed with great caution. Total railroad safety can always be ensured by shutting the railroads down or by driving them out of business. That is clearly not in order as a matter of public policy.

As a matter of practicality, it need not happen if costs and benefits are intelligently considered and weighed and if implementation of alleged "benefits" is limited to those with positive cost/benefit ratios.

RAILROAD LABOR EXECUTIVE ASSOCIATION RESPONSES

2. Should railroad safety legislation be general in order to permit Government regulatory and programmatic flexibility or should it be specifically designed to address particular safety problems or concerns?

Federal railroad safety legislation should be specifically designed to address particular safety problems and concerns. The most far-reaching Federal legislation concerning railroad safety has been general rather than specific. The enactments by Congress of the Safety Appliances Act in the early **1900's were designed to correct specific problems** where the railroads had failed to self-regulate. Even as late as **1970,** only 5 percent of the causes of accidents were covered by Federal laws. Continued deterioration in the safety picture led Congress to conclude that the railroads would not, or could not, control the increases in injuries or accidents without Federal supervision. The Federal Railroad Safety Act of 1970 delegated authority to the FRA to regulate all areas of railroad safety. Although the FRA has the broad authority to regulate and to promote railroad safety, it has failed to do so.

The FRA's abdication of its responsibilities forced Congress to enact some specific safety standards under the Federal Railroad Safety Authorization Acts of **1974** and 1976. Referring to the need for legislating the specific safety requirements contained in the Federal Railroad Safety Authorization Act of 1976, the Senate Committee on Commerce stated:

> The inability of the Federal Railroad Administration and the Nation's railroads to make major safety gains continues to be a source of great frustration to the Committee. . . Many of the amendments contained in S. 3119 could be accomplished under the existing regulatory powers of the FRA. Petitions regarding many of the matters contained in the amendments have been filed with the FRA but it has not responded to the petitions in a timely manner.
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> These amendments appear to be more appropriate for administrative rather than legislative action. However, if the agency which is responsible for implementing the Federal Railroad Safety Act is going to be unresponsive to public petitions for rulemaking, the Congress may be forced to act. S. Rep. No. 94-855, 94th Cong., 2d Sess. 2-3 (1976).

The FRA's record has not improved since the enactment of the 1970 Act. Thus, Congress must fill the vacuum created by the FRA by enacting legislation to remedy specific railroad safety problems.

3. **Should labor-management relations and collective-bargaining questions be considered when legislating safety or should safety questions only be dealt with in such processes?**

17. **Should safety standards related to employee age, qualifications, and training be set or does the current regulatory system adequately address these human factors considerations in safety?**

There always exists the possibility that some collective-bargaining matters affecting working conditions of employees may be interrelated with safety problems. Nevertheless, railroad safety involves not only the employees, but the general poublic. It is no secret that the unsafe conditions have resulted in many devastating accidents, causing great damage, injuries, and deaths to nonrailroad employees. The fact that a collective-bargaining agreement may not cover an unsafe working condition which is the cause of such accidents should not preclude Congress or DOT from doing so. The railway labor organizations simply do not have sufficient power to force the railroads to collectively bargain adequate safety rules. That is, where an important safety issue has not been resolved by self-regulation by the railroads or by FRA regulations, Congress has enacted statutory standards. The fact that labor-management relations may be involved should not deter Congress from acting.

Also, Congress has addressed the issue of qualifications of employees in the **1970** safety law and subsequent amendments. Title 45 U.S.C. 431(a) permits the Secretary of Transportation to establish qualifications of employees so long as they are specifically related to safety. However, the Secretary may not issue regulations which might disqualify an employee solely because of his age. H. R.Rep. No. 91-1194 at p. 16.

In summary, we feel Congress has dealt with both issues the most practical and effective way.

7. Should OSHA continue to handle the occupational safety and health aspects of railroad maintenance shops or should all occupational safety and health for railroads be assumed by FRA?

RLEA believes that OSHA should not only continue to handle the occupational safety and health aspects of railroad maintenance shops, but should also have occupational safety and health jurisdiction over all other aspects of the railroad industry. At present, the relationship between OSHAS jurisdiction and that of FRA is defined by Section 4 (b) (1) of the Occupational Safety and Health Act of 1970 (29 U.S.C. ~653(b)(l)). Under that section, OSHA retains jurisdiction over all aspects of railroading for which FRA has not actually promulgated occupational safety and health regulations. Only when FRA has promulgated such regulations governing a particular working condition OSHA'S jurisdiction displaced. Southern *Pacific Transportation Co. v. Usery, 539* F. 2d **386 (5th** Cir. 1976), *cert. denied,* U.S. (October **3, 1977);** *Southern Railway Co. v. OSHRC, 539* F. 2d 335 (4th Cir. 1976), *cert. denied,* U.S. (December **12, 1976);** *Baltimore and Ohio Railway Co. v.* OSHRC, **548** F. 2d 1052 (D.C. Cir. 1976).

RLEA has supported legislation designed to alter this situation and confer on OSHA exclusive jurisdiction over occupational safety and health in all aspects of the railroad industry. We have reluctantly reached this conclusion because FRA has proven entirely inadequate to the task. First, FRA has consistently failed to promulgate adequate safety standards. For example, as recently as 1976, Congress had to enact a detailed requirement that trains have highly visible rear-end markers because FRA had failed to discharge its regulatory responsibility to do so. P.L. **94-348, Sec. 5,** July **8, 1976, 90 stat.** 819. By way of explaining the enactment of specific safety requirements, the Senate Committee on Commerce stated the following:

> The inability of the Federal Railroad Administration and the Nation's railroads to make major safety gains continues to be a source of great frustration to the Committee. . . Many of the amendments contained in S. 3119 [the Act] could be accomplished under the existing regulatory powers of the FRA. Petitions regarding many of the matters contained in the amendments have been filed with the FRA but it has not responded to the petitions in a timely manner.
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> These amendments appear to be more appropriate for administrative rather than legislative action. However, if the agency which is responsible for implementing the Federal Railroad Safety Act is going to be unresponsive to public petitions for rulemaking, the Congress may be forced to act. S. Rep. 94-855, 94th Cong., 2d Sess. 2-3, reprinted in (1976) U.S. Conde Cong. and Ad. News, 1535-6.

Since FRA's record in discharging is responsibility for promulgating safety rules governing railroad operations is this dismal, it is ludicrous to believe that FRA will adequately regulate occupational safety and health. To relieve Congress of the burden of having to do FRA's work in that field, occupational safety and health jurisdiciton in the railroad industry should be exclusively lodged with OSHA.

Second, FRA's record of enforcing railroad safety standards is no better than its record in promulgating them. The rail workers represented by RLEA's constituent unions continually report the complete inadequacy of FRA's inspection efforts. These reports are confirmed by views expressed by concerned committees of Congress. For example, the Senate Committee on Commerce has observed that:

> Notwithstanding the statistics and the evidence of increasing deterioration, the Department of Transportation has permitted the Federal Railroad Administration to concentrate on activities other than enforcement of rail safety regulations. Senate Committee *on Commerce*, *S.* Rep. 93-1192, 93d Cong., 2d Sess. 14 (1084).

Similarly, the House Interstate and Foreign Commerce Committee has complained that:

> The weight of evidence gathered in testimony before this subcommittee indicated the Federal Railroad Administration simply was not living up to neither [sic] the spirit of the Federal Railroad Safety Act of 1970, nor, in some cases the letter of the law.
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> The Committee found that the Federal Railroad Administration has consistently downgraded enforcement and inspection, and has devoted most of their resources to research and development. The evidence presented in testimony before this subcommittee, and in staff research, indicated a strange set of priorities in this regard, and a conscious effort by the Department to de-emphasize inspection of rail carriers. H. Rep. 93-1083, 93d Cong., 2d Sess. 6 (1974).

The result of this failure to inspect and enforce has been an alarming increase in the number of railroad employees killed and injured on the job. FRA has thus demonstrated its incapacity to achieve safety and health protection for railroad workers. Consequently, OSHA and not FRA should be charged with that responsibility.

8. **Should Congress follow safety legislative examples it has set for other transportation modes *or* should railroads continue to be treated uniquely in future safety legislation?**

The only way in which railraods have been treated uniquely in the area of safety legislation is that they are subject to grossly inadequate safety regulations. Responsibility for promulgating railroad safety regulations has largely been delegated to the FRA, which generally has ignored that responsibility. Because of the FRA's abdication of its responsibilities, Congress recently enacted several limited statutes which address particular safety problems. See, S. Rep. No. 94-855, 94th Cong., 2d Sess. 2-3 (1976); H.R. Rep. No. 93-1083, 93d Cong., 2d Sess., reprinted **in** 1974 **U.S.** Code Cong. and Ad. News 7669, 7671.

What may or may not be necessary to reduce injuries and accidents in other industries is irrelevant. The attitudes of railroad management toward safety dictate Federal and State supervision. Moreover, the inherent dangers in railroading cannot be compared with other kinds of industries.

Because numerous railroad safety problems have not been remedied, safety legislation can only be characterized as "unique" in light of the FRA's unique failure to carry out the duties delegated to it by Congress.

9. **Should Congress consider safety policy as a part of future railroad regulatory reform legislation or should Congress consider safety policy separately?**

10. **Should Congress consider safety policy as a Part of a future railroad economic assistance policy or should safety be considered separately?**

25. **Should Government safety policy for railroads in extreme financial trouble differ from Government safety policy toward other carriers or should all carriers' safety be considered uniformIy?**

In **RLEA's** view, questions 9. 10. and ***25*** are closely related. They all involve the relation between railroad safety and the other areas in which the Federal Government regulates or assists railroads. We will, therefore, deal with these three questions together. The final paragraph of this answer summarizes our views on each question separately.

In establishing a proper relationship between Federal railroad safety regulations and other Federal regulation of railroads, there are two essential points. First, the process of, and the criteria used in, setting railroad safety standards must be kept separate from other regulatory issues. Second, useful means to supplementing,

but not supplanting, the primary methods of enforcing Federal safety standards can be built into other regulatory schemes. The following sections discuss these two points in turn.

1. Both the process of setting Federal railroad **safety standards and the criteria used to set such standards should be separated from the issues which arise** in other facets of Federal railroad regulation. Setting and enforcing minimum safety standards for railroads is essential to the lives and safety of both railroad employees and the general public. Human lives are concerned and no amount of money can buy back an amputated leg or a fatally injured worker. Since the stakes are so high, the citizens of this country have the right to expect that their Government will provide them with the maximum achievable safety protection. In working toward this goal, considerations of safety and how safety can be achieved must be paramount. Other regulatory considerations and issues should enter the question, if at all, only in the most peripheral way.

From this basic proposition, several conclusions follow. First, the task of setting minimum safety standards for railroads, whether undertaken by the Congress or an administrative agency, must be segregated from other regulatory issues. Otherwise, the efforts to achieve the basic goal, maximum safety protection, will be diluted or lost amidst the controversies surrounding other regulatory problems. For example, if safety policy were comingled with efforts to reform railroad rate-setting practices, there would be an irresistible tendency to trade safety protection off against various rate-setting considerations. Such a trade-off would be inexcusable in light of the public's right to expect maximum safety protection from its Government and the railroads that Government regulates. Similarly, if safety were considered along with financial assistance to railroads, the ground would be laid for the railroads to contend that they should be required to comply with minimum safety standards only if they are given financial aid with which to do so. Obviously, this proposition is unacceptable. No crack should be opened through which the railroads can drag it into the debate.

Second, for the same reasons, the process of establishing and evaluating the primary mechanism for enforcing Federal safety standards must be kept separate from other regulatory concerns. Safety standards are only as good as the method used to enforce them. Therefore, an adequate primary enforcement system must be established using safety as the paramount criterion. Inclusion of issues concerning this primary enforcement **mechanism in proceedings or forums in which other regulatory provisions are also considered would detract from the necessary focus on safety.** Such a procedure would be unacceptable. Safety and the enforcement of basic safety standards are not relative concepts which can be traded off against other regulatory goals. No such bargaining is permissible where human lives are so vitally affected.

Third, suggestions that safety regulation and the protections it affords to human life should be relaxed in cases of financially troubled railroads must be rejected out of hand. Observance of minimum safety standards must be viewed as an integral part of railroading. Such observance is essential to the protection of human life and is not a luxury which railroads need indulge in only when they have surplus funds. As we discuss below, the Federal Government more properly discharges its responsibilities if it provides financial assistance to help economically **weak** railroads comply with safety standards than if it relaxes those standards for such railroads.

For the reasons given, RLEA believes that the task of setting safety standards and establishing the primary mechanism for enforcing them should be governed by considerations of safety and should not be comingled with other regulatory issues.

2. RLEA does not, however, wish to give the impression that there should be no relationship between railroad safety and other regulatory programs. There are a variety of creative ways in which other regulatory programs can be used to help achieve high safety standards by supplementing the primary method of enforcement. A railroad's eligibility for financial assistance

could be conditioned on achieving high safety standards. The burden should be on the railroad to demonstrate its safety record, which it could do by showing either compliance with Federal minimum standards or, perhaps, a verified record of very few accidents. This incentive for maintaining high safety standards should not, however, be permitted to replace the primary enforcement mechanism. That mechanism must remain intact and effective to ensure maintenance of minimum standards where this incentive program and other supplementary approaches fail.

A second way in which financial assistance programs can contribute to safety is the suggestion made above that financially weak railroads be given grants to aid their safety compliance efforts. The making of such grants is a far better way for the Federal Government to discharge its obligations to the public and to railroad workers than is the suggestion that financially pressed railroads be excused from meeting minimum safety standards. Being required to comply with such standards would actually benefit railroads in financial trouble because their accident rates would be reduced with a consequent reduction in the high costs which flow from serious accidents. Care must be taken, however, to avoid any suggestion that railroads need comply with safety standards only when paid to do so.

Other examples of using general regulatory schemes to supplement the basic safety program include conditioning eligibility for rate increases on the railroad's demonstration of a good safety record and requiring that a specified percentage of each grant of Federal assistance to a railroad be used for designated safety purposes. Through these and similar strategies, strong incentives for safety compliance can be built into many facets of railroad regulation. However, the basic task of setting and enforcing safety standards should, as we point out above, be segregated from general regulatory concerns.

The foregoing should make clear our position on the three questions we are addressing in this answer. As to questions 9 and 10, we believe that Congress should consider the tasks of setting safety standards and enforcing those standards separately and not as a part of future railroad regulatory reform legislation or future railroad economic assistance policy. However, as we point out, both regulatory policy and economic assistance can be used to supplement the basic safety program. As to question 25, we believe that the Government should, under no circumstances, relax safety standards for railroads in extreme financial trouble. We do believe, however, that it maybe appropriate for the Federal Government to assist such railroads in complying with safety standards so long as there is no implication that those railroads need comply only so long as they are assisted.

11. **Should the Government role in railroad safety be clarified and/or expanded or should clarification and increased responsibility for safety be handled by railroad carriers, suppliers, and labor with Government policy directed strictly toward public concern (e.g., hazardous materials and railroad grade-crossings) ?**

The Government's responsibility in railroad safety should be expanded and clarified. The Federal Railroad Administration has avoided promulgating and enforcing adequate safety regulations. History has shown that railroad carriers, suppliers, and labor cannot be expected to assume increased responsibility for railroad safety. The suppliers and labor do not have the leverage to force the railroad carriers to adopt adequate safety measures, and the railroad carriers have exhibited a continuing unwillingness to voluntarily adopt such measures.

The question implies that railroad safety, other than such safety matters as hazardous materials and railroad grade-crossings, is of no concern to the public. On the contrary, the public is vitalkly concerned with railroad safety. For example, the number one cause of rail accidents in America is track failure. To suggest that rail accidents caused by track failure or any other safety deficiency are not of public concern is absurd. Many track failures have resulted in explosions from a derailing train.

The Committee on Interstate and Foreign Commerce cited the growing evidence that track failure is a direct result of industry policy to defer maintenance. H.R. Rep. No. 93-1083, 93d Cong., 2d Sess., reprinted in (1974) U.S. Code Cong. and Ad. News 7669, 7673-75. So long as such deferred maintenance continues and the railroads do not require adherence to the safety laws, rail safety will not be improved.

12. **Should Federal Government policy continue to preempt State regulatory enforcement authority or should State authority be expanded?**

No. Under Section 206(a) of the Federal Railroad Safety Act of 1970 (45 U. S. C. A., Sec. 435(a)), the Federal Railroad Administration can assess penalties or obtain injunctive relief in Federal courts for violations of safety standards. Pursuant to Section 207 of the Act (45 U. S. C. A., Sec. 436), if the Secretary has taken no action on an alleged violation for a period of 90 days, a State may go into Federal court for relief unless the Secretary has determined in writing that no violation has occurred.

The States need some independent enforcement authority to support their investigative efforts. The present enforcement mechanism is cumbersome and is not supportive of State efforts to carry out an effective safety program. State inspectors are frequently treated with less respect than is due because the railroads know that, for all practical purposes, no violations will be enforced unless the Federal Government pursues the matter.

There appear to be few, if any, valid reasons for what amounts to a complete preemption of State enforcement authority. On the contrary, it would seem that the States are frequently in a better position to pursue swift and responsible enforcement of safety standards. Further, the States' concern for the safety of their citizens and the potentially disastrous local consequences of violations of Federal standards require that the States, at a minimum, be vested with authority to seek immediate injunctive relief.

A bill (H.R. 8361) has been introduced in the 92d Congress by Congressman Rooney of Pennsylvania, and referred to the House Committee on Interstate and Foreign Commerce, which would amend the **1970** Act to allow a State participant to apply for such immediate injunctive relief in the district courts of the United States. Enactment of such provisions into law would greatly enhance the national effort to improve the railroad safety record.

13. **Should the State Participation Inspection Program, authorized by the 1970 Act, be repealed, revised, or maintained in its current form?**

Section 206 of the Federal Safety Act of 1970 (45 U. S. C. A., Sec. 435) establishes authority for State participation in the enforcement of Federal railroad safety standards. Those States certified to carry out investigative and surveillance activities on behalf of the Secretary of Transportation, and those States which have entered into agreements with the Secretary, provide money and manpower to ensure that safety regulations promulgated in Washington, D. C., are, in fact, implemented throughout the country.

Section 206, as approved by Congress, was regarded as a key section of the bill. State regulators had high hopes that it marked the beginning of a cooperative Federal-State effort to drive down the depressingly high accident statistics.

Yet the FRA has interpreted Section **206(a)** in a manner which precludes the States from participating in the enforcement of rail safety laws passed either before (e.g., the Signal Inspection Act) or after (e.g., the Hazardous Materials Transportation Act) the 1970 Act. Such an interpretation, whether or not justified by the legislative history of the Act, reduces the role the States may play in improving rail safety and prevents the States from making maximum use of available manpower. If a State wishes to establish a comprehensive safety program, in which the duties and responsibilities of its employees are clearly defined, it must have authority to enforce all relevant Federal standards.

Again, it is difficult to see how the national goal of reducing all railroad-related accidents can be achieved when the potentially most effective and concerned party, the State agency, can approach the problem only in a piecemeal manner. The House bill (H. R. 8361), referred to in the answer to question 12, would allow participating States to carry out investigative and surveillance activities in connection with railroad safety laws and regulations in effect on the date of enactment of the 1970 Actor made effective subsequently.

These provisions of the bill would effectively modify the 1970 Act to ensure more meaningful participation by the States and other affected parties.

18. Should specific criteria and research data be a mandatory part of the rulemaking process or is the current system adequate?

RLEA is uncertain as to the precise meaning of this question. On the one hand, the question may ask whether Federal railroad safety standards and rules should, whenever possible, be written in terms of specific, measurable criteria with which railroads must comply, rather than in general terms. On the other hand, the question may ask whether the rulemaking process should be revised to require that safety standards be promulgated only when the need for and the content of such standards can be determined by reference to data produced through research projects. We will address both of these questions in turn.

First, Federal safety standards for the railroad industry should be written, whenever possible, in terms of specific requirements and criteria. Federal railroad safety standards are necessary because the industry has proven incapable of maintaining adequate safety standards without external compulsion. To remedy this situation, the Federal standards must be readily enforceable. Only standards written in specific terms will be enforceable because they are the only ones under which it is possible to determine when a railroad is or is not in compliance. Furthermore, such precise standards provide an additional benefit. They encourage voluntary compliance because both employees and the railroads know what is expected of them and that violations will not go undetected for long.

A flagrant example of failure to adhere to these sound principles can be found in the flagging rules recently promulgated by FRA. That regulation (49 CFR $218.37) appears, on first inspection, to require flag protection for the rear-end of stopped and slowly moving trains. However, closer examination reveals that 49 CFR ~218.37(a)(2)(iv) permits the railroad to dispense with this requirement simply by issuing a train order to that effect. The regulation contains absolutely no standards or guidance to indicate the situations in which it would be appropriate for the railroad to issue such a train order. FRA has thus promulgated an unenforceable regulation because railroads are given discretion to grant themselves waivers and there are no standards to guide their exercise of that discretion. Unenforceable standards such as this one should be replaced by standards which can be enforced.

We turn now to discuss whether the setting of minimum Federal safety standards should await the availability of research data establishing the need for and the content of such standards. RLEA's answer to this question is emphatically in the negative.

The best source of information concerning the need for safety standards and the type of standards which should be adopted is the years of practical experience possessed by the individuals involved in the railroad industry, both railroad workers and management personnel. By drawing on their experience, these individuals can identify necessary regulations long before researchers obtain the necessary funding even to begin studying the same problems. Similarly, those with actual experience in the field can provide workable, common-sense solutions to safety problems without waiting for studies and research projects to be completed. Regulatory implementation of the solutions provided in this manner can save lives and make railroading safer for all involved. There is no valid reason not to embody these years of prac-

tical experience in safety regulations as soon as possible.

Awaiting confirmation of these common-sense judgments through expensive, time-consuming research projects would be irresponsible. Everyone is familiar with the recurring phenomenon of heavily funded research projects which, when finally completed, tell us little more than we already know through observation and common sense. Making the results of such research a prerequisite to the issuance of Federal safety standards would merely delay essential protection for railroad workers and the public. Such a requirement would only serve to give those who wish to prevent or delay the promulgation of enforceable Federal safety standards the opportunity to do so by arguing that a particular regulation should not be promulgated because the requisite studies have not been completed or are inadequate. These opponents of safety standards should not be given this excuse to avoid obviously needed regulation.

For the foregoing reasons, RLEA opposes any attempt to mandate the use of specific research data in rulemaking. Such data, when available, should be considered as part of the overall rulemaking process. However, it should take its proper place as only one relevant factor, along with common sense and practical experience in the field. Research data should not be artificially elevated to a status more important than its intrinsic worth merits.

21. **Should (participating) State inspectors be qualified and paid according to Federal standards or should States establish their own inspector qualifications and pay scales?**

The States should be allowed to establish their own inspection qualifications and pay scales. There is nothing in the language or legislative history of the 1970 Act which requires or specifically allows the FRA to promulgate qualifications for participating State inspectors. The Act itself was modeled after the Natural Gas Pipeline Safety Act of 1968 (49 U.S.C. 31674), which did not require State inspector qualifications and under which none had been promulgated. Nevertheless, the FRA has procedded to establish minimum qualifications for State inspectors in the two areas where safety standards have been issued, which are as stringent or more stringent than those for Federal inspectors.

Federal inspectors are classified at a GS-11 or GS-12 level, with a minimum salary in 1976 of $16,255 and **a maximum of $25,200.** In addition, there are opportunities for promotion to supervisory positions at GS-13 and GS-14 levels. In contrast, the starting salary in 10 States is less than $10,000, **21** States have a ceiling of **$16,800** or less for senior inspectors, and only 1 State can pay more than $22,000. Given the State pay scales and State budgetary problems, it seems clear that FRA's insistence on State inspectors meeting the same specifications as are required for Federal inspectors serves as a serious deterrent to participation by many States.

The FRA appears to argue that its standards are the minimum necessary to ensure that a State inspector is qualified to perform his tasks. However, it should also be noted that the standards are patterned after Civil Service Commission job classifications designed to provide, to the maximum extent possible, uniformity and equity in Federal hiring practices. Thus, under present Federal practice, a job applicant must have 3 years general experience and 3 years of specialized experience to qualify for a GS-11 position, whether that position is in railroad safety inspection or aircraft maintenance.

There is simply no justification for attempting to conform the myriad of State hiring and salary regulations to the Federal system, yet this appears to be exactly what the FRA is attempting. Further, there is no reason to doubt that the States would diligently pursue the goal of seeking out and hiring qualified personnel to serve as State inspectors for, after all, it is their citizens who will suffer the most from an inadequate State safety program. Accordingly, the States should be given the greatest possible latitude in establishing their own inspector qualifications and pay scales.

23. **Assuming deferred maintenance correlates with deceased safety, should the Federal Government monitor equipment- and track-maintenance programs, should it rely on existing safety standards, or should it revise standards to mandate safety maintenance?**

RLEA believes that regularly conducted maintenance correlates with increased safety and that the Federal Government, either through legislation or through regulations, should mandate regular safety maintenance. Railway labor is in a particularly good position to judge the effectiveness of regular maintenance programs because the men we represent work on railroads where the maintenance programs vary from good to almost nonexistent. Comparing the safety experience of these railroads can lead to only one conclusion: where regular, thorough maintenance programs are conducted, safety hazards are detected and corrected, thereby significantly reducing the incidence of accidents and injuries. On the other hand, where regular maintenance is deferred, accidents increase. These views are confirmed by the House Committee on Interstate and Foreign Commerce:

> The number one cause of rail accidents in America is track failure. There is growing evidence that track failure is a direct result of industry policy to defer maintenance. H. Rep. No. 93-1083, 93d Cong., d Sess., reprinted in (1974) U.S. Code Cong. and Ad. News, 7669, 7673-75.

Only regularly conducted maintenance can be expected to keep railroad equipment and track in safe and efficient operating condition. No Federal inspection effort can eliminate unsafe conditions, if the basic maintenance program is inadequate. Therefore, Federal safety regulations should be revised to require not only compliance with minimum standards, but also regular maintenance. Failure to require this most effective way of keeping track and equipment in a safe condition is inexcusable.

24. **Should Government responsibility in closing potentially unsafe plants or operations be based solely on safety considerations or should economic considerations also be taken into account?**

RLEA believes that only safety considerations should be used in deciding when equipment or facilities are so unsafe that they must be closed or taken out of operation in order to prevent death or injurv to Persons affected. As stated previously, the citezenns of this country have the right to expect that the Government will provide them with the maximum achievable safety protection. Congress has already adopted this same view. In the Federal Railroad Safety Act of 1970, Congress gave the Secretary of Transportation authority to "immediately issue an order.. prohibiting the further use of" any facility or piece of equipment which the Secretary determines is "in unsafe condition and thereby creates an emergency situation involving a hazard of death or injury to persons affected" (45 **U.S.C.** 432). In 1974, Congress broadened the authority to permit the Secretary to issue orders directing a railroad to terminate any action in violation of the safety laws (45 U.S. C. 437(a)). As the language under both sections makes clear, the Secretary's authority to order a facility closed depends solely on the hazard to persons affected. See H.R. Rep. No. 91;1194, 91st Cong. 2d Sess., reprinted in (1970) U.S. Code Cong. and Ad. News, 4104, 4116. The Secretary is not authorized to take economic considerations into account in making such order.

In enacting this provision, Congress recognized that, when a facility must be closed in order to prevent death or physical injury, there is no economic consideration which can properly be advanced to keep the facility open. RLEA heartily endorses this position.

29. Should **an established set of priorities for rulemaking be determined-based on analysis of existing accident and incident data and available research, or is the current method of selecting rules appropriate?**

The setting of priorities for issuing Federal railroad safety rules should be based, insofar as possible, on the expressed needs of the persons

affected by those rules, including railroad employees who must spend their working lives exposed to railroad safety hazards. The persons exposed to the hazards of railroading are the ones whose health and lives are at stake and who have the necessary experience to recognize safety problems and areas needing regulation. The present system under which interested persons may file petitions requesting rulemaking upon which FRA must act within a statutorily prescribed time limit provides an appropriate mechanism through which the need for safety regulations as perceived by the persons affected by those regulations can be recognized. See 45 U.S.C. 431(d) and 49 C.F.R. ~211.9 et seq.

This procedure could be strengthened by enacting specific standards to govern FRA's decision as to whether to initiate rulemaking proceedings on a particular petition. At present, the only standard is that contained in 49 C.F.R. ~211.ll(b), which states that FRA will initiate rulemaking when the Administrator determines "that the petition contains adequate justification." More appropriate would be a statutory requirement that FRA initiate rulemaking on each petition unless the Administrator is able to make a factual finding that the conditions described in the petition do not pose a hazard to the safety of railroad employees or the public. Under this requirement, the Administrator would not be able to decline rulemaking in cases where hazards requiring regulation exist.

Establishing a system that requires setting regulatory priorities based on accident data and available research would be a step in the wrong direction. Such a system would not be responsive to the express needs of persons exposed to railroading hazards. Rather, it would place responsibility for setting regulatory priorities in the hands of the regulated railroads and the individuals who determine research priorities.

A priority system based on accident data would be controlled by the railroads. Except in those cases where the National Transportation Safety Board or FRA investigates a major accident, responsibility for reporting accidents is in the hands of the railroads. The railroads, without input from their employees, are thus free to place their own interpretation on the accident and assign to it whatever cause, such as employee error, suits their purpose. If regulatory priorities were set by analyzing the causes of accidents as indicated in the reports submitted by the railroads, the railroads could, by manipulating the accident reports, manipulate FRA's regulatory priorities. To alleviate somewhat the present deficiency in accident reporting, the employee representatives, on a voluntary basis, should be afforded an opportunity to present relevant factual information concerning safety violations of the carrier.

Reliance on available research to set priorities would suffer from a similar infirmity. The availability of research data on which to base regulations in a particular area depends largely on whether research projects in that area have been funded. Some topics will have been thoroughly researched and others will not. Consequently, priorities based on the availability of data produced by such research will be determined by the persons who choose the areas in which research will be conducted. Again, the result would be to take the setting of regulatory priorities away from the people in the field who are in need of the protection and who are in the best position to determine what type of protection is needed.

The proper role of both accident statistics and available research should be to aid in evaluating petitions for rulemaking. When used in this way, the limits of both research data and accident reports, as described above, should be kept clearly in mind. Conclusions drawn from such information should always be tempered with common sense and knowledge gained through practical experience.

30. How should priorities be established for research and development?

It is clear that there is not **a** single simple solution for establishin$_g$ research priorities, goals, and ensuring continuing effectiveness. In addition to supporting FRA safety mandates, the following considerations are deemed prime fac-

tors in any responsible R&D safety activity justification:

1. Statistical Trends (Accidents, Fatalities, Injuries, Cost). —History is always a good starting point for determining the relative importance of problem areas. Reasonably accurate data bases are necessary but not sufficient to set R&D priorities. It is extremely difficult to set up in advance and justify a comprehensive system of data collection which has enough detail to guide research efforts. In addition, history sometimes reacts too slowly to newly emerging problem areas—such as nuclear transport hazards.

2. Evaluation of Statistical Trends.—Statistical trend data must be mixed with "practical" assessments and inputs from knowledgeable representatives, who are actively engaged in the railroad processes on a daily basis. Different perspectives and interpretations need to be solicited and openly discussed. Frequently, where perceived priorities are made, more in-depth statistical information may need to be developed through limited surveys, communications, and investigations. Such data supplements the broader guidelines of the formal data system.

3. **Safety Problems Projections /Predictions.—There are some cases where major safety concerns** may *not* be revealed in statistics. Consequently, there is a need to make projections as to likely future railroad safety problems. Areas of greatest concern here would tend to be situations where a singIe accident might have catastrophic consequences.

4. Will **Research Help?—It may be in certain applications that no new technology is required to make substantial improvements in safety.** In such cases, even though the statistical problem is demonstrated, initiation of significant research endeavors may not be appropriate.

In other "grayer" areas, the balance between the extent of research allocation and probable benefits must be "traded off."

5. **Extensive Exposure of R&D Activity/Plans.—Priorities for on-going R&D activities** need to be continually re-examined from the viewpoints of current progress and perceptions of incolved parties. Where possible, resources among individual groups should be maximized by avoiding unnecessary duplication, even though agreed to parallel research paths by industry/Government groups may be entirely warranted in significant safety projects—because of recognized constituency differences.

6. "Opportunity" for Immediate Progress/Implementation. —Absolute priorities for R&D need to be adjusted periodically to reflect current conditions that may be attractively conducive for swift implementing actions. This criteria of "the time is ripe" provides the flexibility to realize the difficult *implementation* goal of applied research.

7. Potential "Break-Through" Potentials.—Periodically, on-going research findings may reveal potentials for unanticipated advanced in safety. Any system for establishing priorities for research and development should recognize the need to consider diversion of an appropriate amount of efforts to further evaluate the feasibility of uncovered potentially "high reward" technological "break-throughs."

8. **Public/Legislative Requirements. —Although priorities should be established to anticipate "public" presures, R&D resources must be allocated to be responsive to public, regulatory, and legislative directives and requests; whether from local, State, or Federal levels.**

The driving thrust in all of the above considerations should be aimed at achieving a reduction in the rate of personal fatalities and injuries associated with railroad activities.

31. Should research, development, dissemination, and implementation of new technology, which would increase safety, take *in*-**to account existing collective-bargaining and economic factors, or should such technologies preclude those considerations?**

In terms of uncovering potentials for making substantial improvements in the rate of fatalities

and injuries, R&D efforts should not be unnecessarily "bounded."

Prejudgments that "the industry can't afford to do anything about that" could conceivably block research activity which might uncover a larger systematic approach which could not only be economically justified but be attractive from industry/union/public viewpoints. Within the realm of established priorities, R&D should be as "free" as possible—consistent with the application of realistic yardsticks to prevent "cloud-nine" approaches.

On the other hand, the implementation process must take into account real world "political," economic, and collective bargaining factors.

Dissemination of R&D information should be virtually unrestricted, extensive, and responsive to requests from all sources.

32. **As research identifies technological or other practices which may impact safety, how should these considerations be weighted against policies such as economic, environmental, or collective-bargaining factors or should such findings be considered separate?**

Generally, the research role should be viewed as providing factual support in the technology regime of the total picture. Appropriate broader-view forums should be utilized to "mix" input from R&D and various other "expert" safety interest groups—to analyze and arive at decisions/compromises which more fully comprehend the specturm of meaningful considerations.

At times, R&D findings may serve only in a minor way to assist in effective resolution of the overall safety problem.

33. **To what extent should near-term safety benefits be considered in lieu of long-term economic and/or other long-term safety policies?**

Where safety benefits are defined as reduction in loss of lives, near-term progress should be the foremost consideration, i.e., every practical opportunity should be seized to assist in this respect. Where long-term intentions and accomplishments are in direct conflict with contemplated near-term actions, the immediate opportunity should be modified (i.e., if a better 5-year fatality picture can be convincingly supported). A positive attitude should be brought to bear on economic implications. Ways in which public money might be utilized to augment and improve the railroad industry cost/benefit ratio should be actively explored for each specific safety improvement proposal.

Research and development efforts should be conducted toward supporting near-term improvements (within the above philosophy) while generating guidelines for longer-term gains (i.e., deal with the existing equipment retrofit needs while providing the basis for *new* equipment safety specifications). This near-term focus ensures "practicality" and provides a foundation for the generation of knowledgeable guidelines for future safety improvement actions.