The Role of the Federal Employers' Liability Act in Railroad Safety

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I. INTRODUCTION

Safety emerged as a premier transportation issue in the late 1980s. The increasing number of near mid-air collisions led to proposals for re-regulating the airline industry as well as increased spending for air traffic control and airports. The Truck and Bus Safety Act was passed in 1988. The Railroad Safety Act was reauthorized and amended in 1987. As highway congestion increases and the number of large trucks proliferate, the safety issue is sure to be in the forefront of the debate concerning the 1991 re-authorization of the federal highway program.

In the past few years, the railroad industry has asked Congress to change the reparations system governing injuries to railroad workers. Their proposal involves replacing the Federal Employers' Liability Act (FELA) with a no-fault system such as state workers' compensation. The objectives of this paper are: (1) to analyze safety trends in the rail indus-

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try in recent years, and (2) to compare the impact of FELA and workers' compensation on railroad investment in safety.

II. RAILROAD SAFETY TRENDS

Before examining safety trends in detail, a brief look at the aggregate safety picture is instructive. By any standard, railroading is a dangerous job. In the 1976-1988 period, there were 80,143 train accidents, 130,884 train incidents, and 477,273 non-train incidents.[1] Thus, total mishaps were 688,300. If these numbers are calculated on an average daily basis, 17 accidents, 28 train incidents, and 101 non-train incidents occur every single day.

The toll on railroad workers is extraordinary. Between 1978 and 1988, 998 railroad on-duty employees were killed and 551,657 injured.[2] This results in an average of 91 on-duty employees killed and 50,151 injured per year.

Railroad accidents also present a significant safety problem for the public. Between 1980 and 1988 there were 4,384 train accidents involving hazardous materials. Of these, 629 cars released hazardous materials, which in turn caused 141,000 people to be evacuated.[3]

Table 1 contains the number of fatalities for all types of persons involved in railroad accidents/incidents during the 1982-1988 period. The number of fatalities remained roughly the same throughout the period. The highest number of fatalities was 1,247 in 1984 and the lowest number was 1,036 in 1985. The mean number of total fatalities for the entire time period was 1,133. Thus, there is no trend either up or down in railroad fatalities. In fact the total number of fatalities in 1988 (1,199) was nearly the same as in 1982 (1,119).

The total number of on-duty railroad worker fatalities declined from 78 in 1982 to 43 in 1988. Railroad employment, however, declined 38% during this period, placing fewer workers at risk.[4] A more accurate gauge is the fatality rate, computed as fatalities per million man hours x

1. U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, various years. Train accidents, train incidents, and non-train incidents are defined by the Federal Railroad Administration as follows:

Train Accident: A collision, derailment, or other event involving the operation of railroad on-track equipment resulting in damages that exceed the reporting threshold.

Train Incident: Any event involving the movement of railroad on-track equipment that results in a death, a reportable injury, or a reportable illness, but in which railroad property damage does not exceed the reporting threshold.

Non-train Incident: Any event arising from railroad operations but not from the movement of on-track equipment, which does not exceed the reporting threshold, and results in a death, a reportable injury, or a reportable occupational illness.

2. *Id.*

3. *Id.*

4. ASSOCIATION OF AMERICAN RAILROADS, Railroad Facts, 56 (1988).

100. Table 2 displays fatality rates of railroad on-duty employees for the 1982-1988 interval. The rate remains relatively constant throughout the period, reaching a high of 9.73 in 1982 and a low of 6.60 in 1985 with a mean of 8.21. There is also no consistent trend, either positive or negative in the fatality rates of railroad on-duty employees. The rate fell between 1982 and 1985, increased in 1986 and 1987, and then declined in 1988.

Table 3 contains injuries for all types of persons involved in railroad accidents/incidents. The trend in fatal injuries during the 1982-1988 time frame has been downward. The trend, however, is not consistent or predictable. For example, total injuries declined in 1983, increased in 1984, fell in 1985, 1986, and 1987; then rose in 1988.

Injury rates (defined as injuries per million man hours) of on-duty railroad employees displayed no predictable trend over the 1982-1988 interval (see Table 4). The rate fell about 7% in 1983, increased 8% in 1984, and again dropped about 5% in 1985. In 1986, the injury rate plunged nearly 19%; but this was followed by a 7% increase in the rate in 1987-1988.

Table 5 contains passenger casualty rates (defined as passengers injured and killed per billion passenger miles). There is no consistent nor predictable pattern in the passenger casualty rate that persists over the entire 1982-1988 interval. In the 1982-1984 period, the rate increased 130%. Between 1985 and 1988, it fell nearly 75%.

As noted above, there is no consistent trend in the fatality and injury rates of on-duty rail employees. There is, however, reason to believe that the Federal Railroad Administration (FRA) accident statistics have understated rail employee injuries. James Snyder of the United Transportation Union (UTU) has testified that:

> The Railway Labor Executives Association has little confidence in the validity of the statistical data base. The FRA is ignoring the increasingly widespread failures by the railroads to report accidents and incidents as required by law. We have knowledge of many cases where the railroads simply keep injured employees on the payroll and do not report the accident. Other situations involve blatant non-reporting even though the accident or incident is obvious.[5]

Mr. Snyder's lack of confidence in FRA accident statistics was confirmed by a General Accounting Office (GAO) study released on May 1, 1989.[6] The GAO study involved an audit of 1987 railroad accident and

5. *Oversight Hearing On January 4 Amtrak-Conrail Accident: Hearings Before the House Comm. on Government Operations*, 100 Conf., 1st Sess. at 59 (1987) (testimony of James R. Snyder).

6. UNITED STATES GENERAL ACCOUNTING OFFICE, RAILROAD SAFETY, FRA NEEDS TO CORRECT DEFICIENCIES IN REPORTING INJURIES AND ACCIDENTS (April, 1989).

injury records of four railroads that accounted for one third of the accidents reported in 1987. Some of the findings of the study are as follows:

- Lost work days associated with employee injuries, which is an FRA measure of injury severity, were underestimated by about 269%.
- FRA data reflected only 57% of the actual number of severe injuries, defined by FRA as 10 or more lost work days, at three of the railroads surveyed.
- Of the 521 unreported injuries, about 12% should have been reported to FRA.
- Of the 532 unreported accidents, about 10% should have been reported to FRA.

The GAO study also referred to FRA's periodic audits of railroads which confirm the GAO findings of railroad under reporting of accidents and injuries. For example, in 1987, FRA conducted an audit of Conrail safety records. They discovered that Conrail only reported 68% of the worker injuries that should have been reported to FRA.[7] A 1987 FRA audit of Burlington Northern also discovered significant under reporting of injuries and accidents.[8]

The GAO investigators concluded that the findings "raise questions about the overall effectiveness of FRA's safety program and the extent to which railroads have become safer."[9]

III. Comparison of Railroad Safety to Other Industries

The hazardous nature of the rail industry is indicated by Table 6. The table compares occupational injury incidence rates by industry for the 1975-1987 period. On average, the railroad injury rate was 44.6% higher than the rate for all private sector industries.

The National Safety Council compiles occupational injury and illness incidence rates by industry. Table 7 contains 1987 injury and illness incidence rates per 100 full-time employees for injury cases involving lost work days. The National Safety Council data is based on reports of National Safety Council members participating in the Occupational Safety/Health Award Program. Table 7 indicates that the railroad transportation injury rate is 161.7% greater than the rate for the total economy and 134.3% more than the Transportation and Public Utilities industry.

IV. Severe Injuries in the Railroad Industry

Table 8 contains the types of injuries suffered by railroad on-duty employees in 1988. While over 50% of the injuries are sprains and strains, there is also a high percentage of severe, potentially, career-ending inju-

7. *Id.* at p. 30.
8. *Id.* at p. 31.
9. *Id.* at p. 3.

ries. For example there were 64 amputations and 1,289 fractures (combining to equal 8.3% of total injuries). There were 44 concussions and 1,138 lacerations (7.2% of total injuries). Of the 1,138 lacerations, 324 were potential disfigurements involving cuts to the head or face. There were 228 burns and 618 potentially blinding injuries involving objects in the eye.

The severity of injuries in railroading can be compared to other industries by using the Supplementary Data System (SDS) compiled by the U.S. Department of Labor. Established under the Occupational Safety and Health Act (OSHA), SDS provides valuable information about the characteristics of injuries for various occupations and industries. The data are compiled from state workers' compensation records and are organized into three groups. Group 2 is used in this analysis. It includes data from 18 states and each case involves disability.

While Group 2 of the SDS contains injury data for only 18 states, the geographic and industrial diversity of these states makes the data representative of the national experience. The SDS data were adjusted to obtain national totals by industry for the most severe injuries—amputations and fractures.[10] The national total amputations (fractures) in a given industry was divided by national employment in that industry. This results in an amputation (fracture) rate, which is the number of amputations (fractures) per million employed workers. The 1983 rates by industry are in Table 9.

The amputation rate in railroading is 58% greater than the economy as a whole. Only mining and manufacturing have significantly higher rates than railroading. The fracture rate in the rail industry is 114% greater than the rate for all U.S. industries as a group. Although the amputation rate in manufacturing is higher than railroads, the reverse is true of the fracture rate. In 1983 the railroad fracture rate was 52% greater than manufacturing. Only mining had a significantly higher fracture rate than railroading.

The last column of Table 9 contains the sum of the amputation and fracture rates. The combined rate in the rail industry is 111% greater than the economy as a whole, 43% greater than manufacturing. Only mining has a significantly higher combined rate of severe injuries. This analysis clearly indicates that rail workers suffer a higher rate of severe injuries relative to other industries.

The comparisons used throughout this and the preceding section employ railroad accident and injury statistics reported by FRA in the *Accident/Incident Bulletin.* If the May, 1989 GAO report cited above is correct

10. The 18 states in Group 2 of SDS account for 41.6% of U.S. employment. Thus national totals can be obtained for each industry by dividing the number injured by .416.

that rail industry totals are materially understated, railroad accident rates could compare even less favorably with other industries.

V. AMTRAK'S SAFETY RECORD

In 1989 a bill was introduced in Congress to switch the reparations system for Amtrak injuries from FELA to state workers' compensation. In 1986 the GAO issued a report comparing Amtrak FELA costs to those that would occur under state workers' compensation.[11] Thus, it is relevant to examine the safety record of Amtrak in recent years. Table 10 contains several measures of Amtrak safety during the 1982-1988 interval. The first two columns contain fatalities and injuries to all types of persons in Amtrak accidents, train incidents, and non-train incidents. Fatalities averaged about 40 per year in the 1982-1984 interval, then declined to an average of 17 in 1985-1986. Fatalities, however, jumped to 101 in 1987 and 99 in 1988. Even after excluding the 16 deaths that occurred in the Chase, Maryland disaster, Amtrak fatalities in 1987 and 1988 were up sharply. Injuries increased 21% between 1982 and 1987, but fell 16% in 1988. The third column displays the casualty rate measured as the frequency of fatalities and injuries per million train miles (involving all types of persons). The rate increased 14% between 1982 and 1987, before dropping 21% in 1988. The next column contains the casualty rate for on-duty rail employees only. It is measured as the frequency of fatalities, injuries, and illness per 200,000 man hours. It increased about 12% between 1982 and 1986, but declined 25% in the 1986-1988 period. The last column displays lost day injury cases which declined by one third between 1982 and 1984, jumped nearly 62% in the 1984-1987 period, and then fell about 12% in 1988. It is interesting to compare the safety of passenger trains to that of other for-hire passenger transportation modes. Table 11 contains passenger death rates (defined as deaths per 100 million passenger miles) for buses, passenger trains and scheduled airlines. In the 1980-1987 period, the average death rates for buses and scheduled airlines were both .04, about two-thirds the rate for passenger trains.

VI. A MODEL OF SAFETY INCENTIVE

From the railroads' point of view, injury prevention involves both costs and benefits. The costs are the outlays for injury prevention. The benefits are reduced outlays for injury claims, equipment damage, labor downtime, and labor recruitment and training costs. A profit maximizing firm will continue to invest in safety as long as the extra benefits exceed the incremental costs.

11. U.S. GENERAL ACCOUNTING OFFICE, AMTRAK, COMPARISON OF EMPLOYEE INJURY CLAIMS UNDER FEDERAL AND STATE LAWS (August, 1986).

These considerations can be formalized in a model as follows:

—MCS (Marginal Cost of Safety)—the increase in the firm's costs stemming from an increase in injury prevention expenditure.

—MBS (Marginal Benefits of Safety)—the reduction in the firm's costs stemming from an increase in injury prevention expenditure.

In Figure 1 the left vertical axis represents expenditures on injury prevention. The right vertical axis, labeled S*, represents perfect safety (no injuries). The horizontal axis represents the degree of safety. At the left origin, all of the firm's workers are being injured; at S*, none are injured. The MCS curve slopes upward, suggesting that it becomes much more expensive to reduce injuries as safety improves.

The MBS curve slopes downward. When many workers are being injured, the marginal benefits of safety are high. When safety is nearly perfect, the marginal benefit of further investment in safety is low.

The profit maximizing level of safety for the railroad is S_o. To the left of S_o, the MBS exceed the MCS. Therefore, the railroad can increase its profits by investing in more injury prevention. To the right of S_o, the MCS are greater than the MBS. These levels of injury prevention would reduce railroad profits.

Suppose the MBS curve reflects the railroad industry under FELA. Now suppose Congress repeals FELA and replaces it with state workers' compensation. Workers' compensation is a no-fault system which partially compensates injured workers for lost wages. It does not compensate the worker or his family for pain and suffering. Furthermore, most states replace only two-thirds of the worker's lost wages, subject to some ceiling amount, which heavily penalizes highly paid workers such as rail employees. If two-thirds of the worker's weekly wage is more than the ceiling amount, the worker does not receive two-thirds wage replacement. A Michigan study concluded that only 20% of the workers' compensation cases received the 66% gross wage replacement specified by statute.[12] In California, average workers' compensation benefits replace only 49% of the earnings lost by permanently disabled workers.[13] Another study revealed that workers' compensation benefits were less than half the workers' pre-injury weekly wage.[14]

Workers' compensation benefits often are paid according to a rigid schedule (loss of an arm or a leg results in a fixed payment) regardless of

12. See A. H. Hunt, Workers' Compensation System in Michigan 48 (1982).

13. CALIFORNIA WORKERS' COMPENSATION INSTITUTE, ECONOMIC CONSEQUENCES OF JOB INQUIRY, A REPORT TO THE INDUSTRY 7 (1984).

14. RESEARCH REPORT OF THE INTERDEPARTMENTAL WORKERS' COMPENSATION TASK FORCE, *found in* U.S. DEPARTMENT OF LABOR, RESEARCH REPORT OF THE INTERDEPARTMENTAL WORKERS' COMPENSATION TASK FORCE, AN INTERVIEW SURVEY OF WORKERS' COMPENSATION CLAIMANTS (Vol. 7, 1977).

the worker's economic losses. Thus, an employee near retirement age and a new employee facing decades of future wage loss receive the same damage award for a scheduled injury. Maximum payments for scheduled injuries in most states are very low. In 1987, 82% of the states paid a maximum award for loss of an arm that would be less than two years' salary and benefits for a railroad operating craft employee.[15]

Benefits provided by workers' compensation would keep families of injured railroad workers close to the poverty level. As of January 1, 1987, the U.S. average maximum weekly compensation payment for total disability was $303.[16] Maximum payments for permanent partial disability are much less.[17] The 1986 poverty line income was an average of $215 per week (family of four).

Therefore, it is clear that injury awards would decline dramatically if FELA is replaced by worker's compensation. Costs avoided through investment in safety (MBS) would decline substantially. The MBS curve would, therefore, shift downward for all levels of safety investment. The result is a reduction in the profit maximizing level of safety from S_o to S_o'. Thus the safety incentives of FELA clearly exceed those of state workers' compensation.

An important question pertains to the magnitude of the difference in safety incentives between the two types of reparations systems. In terms of Figure 1, how much would the MBS curve decline and what would be the reduction in safety investment? Some evidence of this can be gained by a review of actual FELA cases and the differences in awards that would result from the two types of reparations systems.

VII. CASES

A. *HOECKER VS. SANTA FE RAILROAD*[18]

In this case the victim was injured when he was ordered to cross over a railroad car to get to his train. The train moved, knocked him off the car, and caused soft tissue injuries in the neck area.[19]

Under workers' compensation the injury would have been judged a temporary total disability with the total award in the area of $3,000, depending on the state. However, in the subsequent FELA case the victim was awarded $38,000 in an out-of-court settlement.

15. Calculations are based on 1987 total compensation per rail employee of $49,558 and assuming no raises in future years. Most state workers' compensation payments ignore supplemental benefits. Fringe benefits in the railroad industry were 22.8% of total rail wages in 1987.

16. U.S. CHAMBER OF COMMERCE, ANALYSIS OF WORKERS' COMPENSATION LAWS (1987).

17. *Id.*

18. ILLINOIS PUBLIC ACTION COUNCIL, RAILROADING THE PUBLIC SAFETY 26 (1988).

19. *Id.*

B. *Mendoza vs. Colorado Wyoming Railway*[20]

This case involved a worker who suffered a crushed foot while in the railyard. The injury required four surgeries and the victim continued to work for the railroad throughout the surgeries. The foot condition progressively worsened to the point where he was rendered permanently disabled from railroad work.[21]

In this FELA case the jury issued a judgment of $460,000. Under workers' compensation, the victim would have received a maximum of $18,000.

After the accident, the railroad equipped all employees with steel-toed work boots which would mitigate or eliminate the type of injury suffered by the victim.

C. *Barrett vs. Conrail*[22]

In this case the victim was killed when the sides of a ditch where he was required to work collapsed around him. Afterward, it was discovered that the ditch had not been shored up in a way that would have prevented the accident. A substantial settlement was reached that provided for the victim's widow and minor children, which among other things, included their education. The settlement was much higher than would have been possible under workers' compensation.[23]

The importance of FELA is emphasized by the insignificant $490 fine assessed by OSHA in the incident. Had this fine been the only financial incentive for safety, it would have had no significance.

D. *Barker vs. Conrail*[24]

In this case the victim was a train dispatcher for Conrail in the Philadelphia area. He had a heart attack on the job and subsequently retired. In the ensuing FELA suit it was demonstrated that the railroad company had created such a stressful work environment and had so overburdened the victim with assignments, that as a result he suffered the heart attack.[25]

As a consequence of the settlement made in this case, working conditions for train dispatchers improved significantly. Territories covered by train dispatchers were decreased and a number of complaints made by train dispatchers concerning stressful working conditions were finally addressed by the railroad company. Had the victim been covered under workers' compensation it is unlikely that he would have received any benefits. Furthermore, the railroad would have had little incentive to alter its work procedures.

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20. *Id.*
21. *Id.*
22. *Id.* at 27.
23. *Id.*
24. *Id.* at 28.
25. *Id.*

E. Perkins vs. Missouri Pacific[26]

In this case the victim was killed in a derailment. He was survived by a wife and three children, who received $1,250,000 in the wrongful death settlement. Under workers' compensation, the surviving family would have received a maximum of $16,762 per year for a limited number of years, depending on the respective state's workers' compensation regulation.[27]

F. Quiring vs. Atchison, Topeka and Santa Fe[28]

In this case the victim was killed in a derailment. He was survived by a wife and two children who received $1,200,000 in a wrongful death verdict. Under workers' compensation they would have received a maximum of $13,333 per year for a limited number of years (again depending on the state).[29]

Other statistical evidence is available which indicates a large disparity in the awards received by injured workers under the two reparations systems. In a sample of FELA cases terminated between 1982 and 1985, the average compensation for loss of a leg was $751,000.[30] In 1989, the average scheduled compensation for loss of a leg in the workers' compensation system was approximately $64,000.[31]

VIII. Conclusion

Both rail employees and railroad companies have incentives to avoid workplace injuries. Employees want to avoid the pain and suffering of an injury and railroad firms want to reduce the costs of accidents and injuries. Thus the relevant question is not whether workers and railroads want to avoid casualties, but which compensation system provides the greatest economic incentives to do so. FELA safety incentives for railroads exceed those of the workers' compensation system. Since FELA fully compensates rail workers for lost income and workers' compensation would not, the cost of an injury to the railroad is higher under FELA. Thus, under FELA railroads would have a greater economic incentive to insure safe working conditions rather than under a system based simply on workers' compensation.

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26. *Id.* at 29.
27. *Id.*
28. *Id.*
29. *Id.*
30. Computed from a representative example of 2,645 FELA cases that were closed by 25 law firms in 15 states in the 1982-1985 period.
31. U.S. Chamber of Commerce, 1989 Analysis of Workers' Compensation Laws 22 (1989).

FIGURE 1

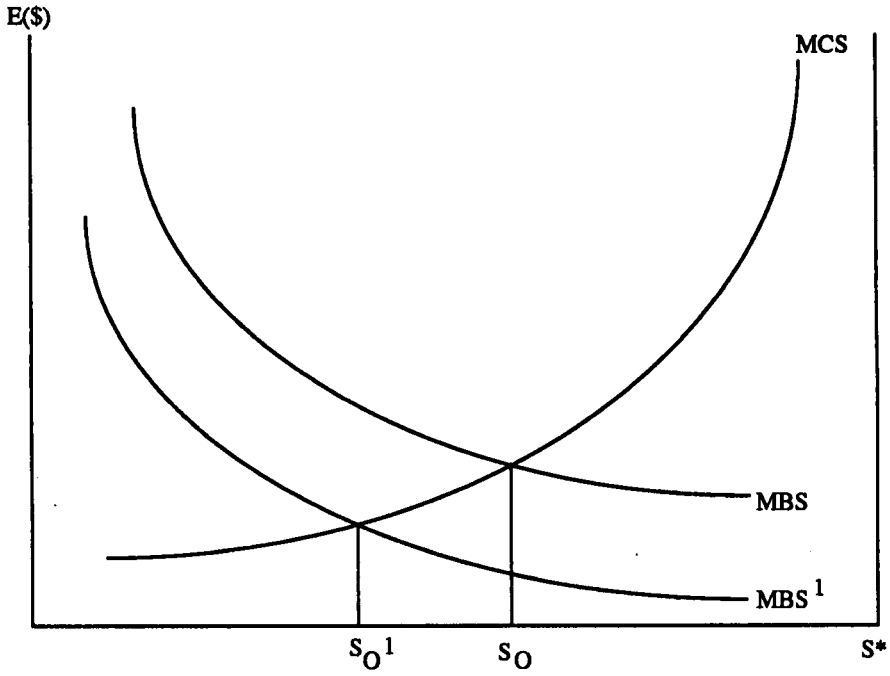

TABLE 1
FATALITIES IN RAILROAD ACCIDENTS/INCIDENTS
1982-1988

Year	Fatalities
1982	1,119
1983	1,073
1984	1,247
1985	1,036
1986	1,091
1987	1,165
1988	1,199

SOURCE: U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, various issues.

TABLE 2
FATALITY RATES OF RAILROAD ON DUTY EMPLOYEES*
1982-1988

Year	Fatality Rate
1982	9.73
1983	8.36
1984	7.94
1985	6.60
1986	8.85
1987	8.89
1988	7.07

*Fatalities per million man hours $\times$ 100.

SOURCE: Railroad On Duty Employee Fatalities and Man-Hours. U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, various issues.

TABLE 3
INJURIES IN RAILROAD ACCIDENTS/INCIDENTS
1982-1988

Year	Injuries
1982	40,275
1983	34,819
1984	38,570
1985	34,304
1986	26,923
1987	26,033
1988	27,054

SOURCE: U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, various issues.

TABLE 4
INJURY RATES OF RAILROAD ON DUTY EMPLOYEES*
1982-1988

Year	Injury Rate
1982	44.96
1983	41.67
1984	44.92
1985	42.79
1986	34.74
1987	35.51
1988	37.12

*Injuries per million man-hours.

SOURCE: Injuries of Railroad On Duty Employees and Man-Hours, U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, various issues.

TABLE 5
CASUALTY RATES OF RAILROAD PASSENGERS*
1982-1988

Year	Casualty Rate
1982	99.2
1983	119.7
1984	228.6
1985	137.9
1986	137.7
1987	91.6
1988	59.6

*Casualty rate is passenger injuries and deaths per billion revenue passenger miles.

SOURCE: Passenger Injuries and Deaths, U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, various issues.

Passenger Miles, ASSOCIATION OF AMERICAN RAILROADS, Railroad Facts, various issues.

TABLE 6
OCCUPATIONAL INJURY AND ILLNESS INCIDENCE RATES BY INDUSTRY*
1975-1987

Industry	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Private sector	54.6	57.8	60.0	62.1	66.2	63.7	60.4	57.5	57.2	61.8	64.9	65.8	69.9
Railroads	77.8	78.0	88.3	98.5	104.7	106.1	94.9	87.1	76.1	92.6	92.0	75.1	88.3
Agriculture	68.4	81.1	78.8	78.3	81.7	81.3	81.4	84.2	89.5	89.4	91.3	93.6	94.1
Mining	109.6	113.9	128.3	142.3	149.8	162.8	145.7	136.7	124.1	159.3	145.3	125.9	144.0
Construction	98.6	102.6	109.7	108.1	119.2	116.1	112.1	114.6	117.3	126.7	128.9	134.5	135.8
Manufacturing	72.9	76.7	79.3	82.3	87.3	84.0	79.4	72.4	70.4	74.2	80.2	85.2	95.5
Wholesale Trade	48.8	50.9	51.9	56.8	58.2	57.1	53.5	51.6	50.1	54.8	59.8	62.5	64.0
Retail Trade	34.6	38.9	40.0	39.1	44.1	44.1	40.8	42.1	46.3	47.9	47.0	50.5	52.9
Finance, Insurance, Real Estate	10.5	11.0	10.2	12.1	12.9	11.6	11.3	12.8	12.4	13.2	15.4	17.1	14.3
Services	31.2	31.9	34.2	35.4	37.1	34.5	34.7	35.1	36.2	40.3	45.4	43.0	45.8

*Total lost workdays per 100 fulltime workers. Total lost workdays includes number of days away from work and number of days of restricted work activity.
SOURCE: U.S. Department of Labor, Bureau of Vital Statistics, *Occuaptional Injury and Illness in the United States By Industry,* various issues.

TABLE 7
OCCUPATIONAL INJURY AND ILLNESS INCIDENCE RATES BY INDUSTRY*
1987

All Industries	60
Railroad Transportation	157
Agriculture, Forestry, and Fishing	121
Mining	49
Construction	71
Manufacturing	58
Durable Goods Manufacturing	67
Non-Durable Goods Manufacturing	50
Transportation and Public Utilities	67
Wholesale Trade-Durable Goods	80
Wholesale Trade-Non-Durable Goods	26
Retail Trade	39
Services	35

*Total lost work days per 100 full time employees. Lost work days include both days away from work and days of restricted work activity.

SOURCE: NATIONAL SAFETY COUNCIL *Accident Facts*, at 44-45 (1988).

TABLE 8
NATURE OF INJURIES TO ON DUTY RAILROAD EMPLOYEES — 1988*

Nature of Injury	Number	Percent
Amputations	64	0.4
Fractures	1,289	7.9
Concussions	44	0.3
Cuts, Lacerations	1,138**	6.9
Burns	228	1.4
Objects in the eye	618	3.8
Dislocations	108	0.7
Contusions, Bruises	2,862	17.5
Sprains, Strains	8,792	53.6
Non-fatal Illness	236	1.4
Others	1,009	6.2
Total	16,388	100.0

*Injuries involving lost work days or days of restricted work activity.

**Of this total, 324 are cuts, lacerations to the head or face.

SOURCE: U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, (1988).

TABLE 9
SEVERE INJURY RATES BY INDUSTRY — 1983

Industry	(1) Amputation Rate*	(2) Fracture Rate**	(3) (1)+(2)***
Total—All Industries	159	2,503	2,662
Railroads	252	5,356	5,608
Agriculture	166	2,522	2,688
Mining	479	6,215	6,694
Construction	258	5,591	5,849
Manufacturing	421	3,513	3,934
Transportation & Public Utilities	67	2,717	2,784
Wholesale Trade	234	3,587	3,821
Retail Trade	103	1,861	1,964
Finance, Insurance, & Real Estate	27	866	893
Services	31	1,032	1,063
Public Administration	11	621	632

*Amputations per million employed.

**Fractures per million employees.

***Amputations and fractures per million employed.

SOURCE: Amputations and Fractures, U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS, Supplementary Data System, Table 201, (1983) at 1-160.

SOURCE: Employment, U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS, Employment and Earnings, January (1984), Table 28, at 188-191.

SOURCE: Rail Amputations and Fractures, U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, (1983), 79.

SOURCE: Railroad Employment, ASSOCIATION OF AMERICAN RAILROADS, Railroad Facts—56 (1986).

TABLE 10
AMTRAK CASUALTIES
1982-1988

Year	Killed	Injured	Casualty Rate[2]	Casualty Rate[3]	Lost Day Injury Cases
1982	39	1,709	58.46	8.05	1,086
1983	36	1,749	61.98	8.23	832
1984	44	2,005	70.41	8.06	727
1985	19	1,963	68.27	8.79	1,048
1986	15	1,904	66.08	8.99	1,163
1987	101	2,072	66.66	7.60	1,176
1988	99	1,737	52.50	6.72	1,040

*Casualties are fatal and non-fatal casualties in Amtrak accidents, train incidents, and non-train incidents.

**Rate is frequency of fatalities and injuries per million train miles (involving on- and off-duty rail employees, passengers, trespassers, and non-trespassers).

***Rate is the frequency of fatalities, injuries, and illness per 200,000 man-hours (on-duty employees only).

SOURCE: U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL RAILROAD ADMINISTRATION, OFFICE OF SAFETY, Accident/Incident Bulletin, various issues.

TABLE 11
PASSENGER DEATH RATES BY MODE*
1980-1987

Year	Buses	Passenger Trains	Scheduled Airlines
1980	.05	.04	.01
1981	.05	.04	.01
1982	.04	.09	.10
1983	.05	.04	.01
1984	.03	.11	.02
1985	.04	.03	.07
1986	.03	.03	.001
1987	.03	.13	.07
Average 1980-87	.04	.064	.036

*Death rate is deaths per 100 million passenger miles.

SOURCE: NATIONAL SAFETY COUNCIL, Accident Facts, 87 (1988).