

RAILROAD SAFETY AND PUBLIC POLICY

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ABSTRACT

This paper discusses the safety challenges faced by railroads in the United States. It discusses and evaluates public policy dealing with trespassing, grade crossing collisions, occupational injuries and operational accidents. The primary conclusion is that the government oversight body, the Federal Railroad Administration (FRA), should take on the role of teacher and risk analyst rather than that of police officer. By doing so the FRA can more effectively target safety problems and do so at reduced cost.

INTRODUCTION

Twice in recent years, the public's attention has been drawn to safety on the railroads. The first was due to a run of crashes involving passenger trains in the winter of 1996. The second was a series of crashes in the summer of 1997 involving the Union Pacific Railroad subsequent to its merger with the Southern Pacific. There were consequent calls that the government "should do something." This paper discusses whether there is cause for public concern, and assesses the adequacy of the public policy response.

To a certain extent the events described in the previous paragraph, while grabbing the public's attention, are not an accurate reflection of the true safety challenges facing the railroads. About 1,000 people are killed each year on the railroads. In 1997, 530 were trespassers¹, 460 were users of highway-rail grade crossings, 50 were employees or contractors, and six were passengers on trains (FRA, 1998). Therefore, in terms of absolute numbers, trespasser and grade-crossing user fatalities are a far greater problem than the popular image of twisted metal and burning tank cars.

Further insights can be gained by looking at recent historical trends for the three predominant casualty types. Figure 1 presents data since 1960 on employee fatalities per employee hour, trespasser fatalities per head of population, and grade-crossing fatalities per highway vehicle registered.² All of the casualty rates are expressed as an index with 1960 set equal to 100.

The casualty rate for crossings has recorded the most impressive improvement falling rapidly and continuously since 1967. The risk is now less than a fifth of what it was in 1960. The trespasser casualty

rates also started to decline rapidly after 1967, but leveled out at about 40% below the rate in 1960. If anything, there may be a slight upward trend in recent years. Employee casualty rates increased by 30% in the 1960s. They only started to decline in 1973. The subsequent improvement has been substantial such that the fatality rate is now only half of what it was in the early 1970s.

But what has contributed to these trends, and what are the prospects for changes in public policy that can contribute to further improvements? The discussion will look at the following four safety risks: trespassing, grade-crossings, employee occupational injuries, and collisions and derailments.

TRESPASSING

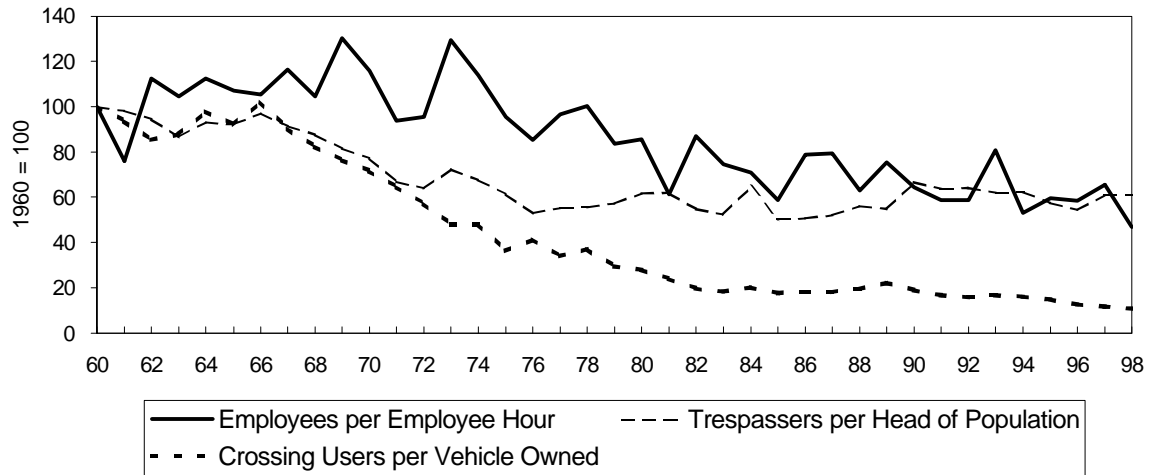
As is clear from figure 1, the casualty rate for trespassers has been constant, if not increasing, in recent years. At the same time the risk at grade crossings has fallen considerably. As a consequence the number of trespassing fatalities in 1997 exceeded the number of grade-crossing fatalities for the first time since 1941. This is quite a change, for as recently as 1970 the number of crossing fatalities exceeded the number of trespasser victims by a ratio of three to one. It would not be surprising if this turnaround leads to renewed public policy interest in coming years.

Most of the headlines highlight unfortunate cases where children playing or people taking a well-used shortcut are struck by trains. However, victims of these types are less than a fifth of the total. The typical trespassing victim is a single adult male who is under the influence of considerable amounts of alcohol (Pelletier, 1997). The *average* blood-alcohol ratio of all victims in Pelletier's study was two to three times the legal limit for driving an automobile, and almost a third of the victims had received prior treatment for alcoholism. Many are poorly educated, but few are homeless. It would seem that the railroad right-of-way is a popular place to socialize, drink and rest. A third of the victims were sitting or lying on the tracks, which suggests the possibility that a large proportion may be committing suicide, even though they do not leave evidence for a coroner to draw this conclusion.

When one understands who the victims are, the effectiveness of an oft-discussed possible requirement to fence the tracks in urban areas can be

RAILROAD FATALITY RATES SINCE 1960

1960 = 100



examined in a new light. While fences may deter those who become extremely inebriated off railroad property, they may have the perverse effect of making the railroad right of way even more attractive as a relatively private place to socialize. There is also the worrying fact that the annual North American rate of trespassing fatalities at two per million population is the same as in Britain where the railway is generally fenced. Trespassing is therefore a very difficult problem to tackle. The law has always placed the responsibility for taking care squarely on the trespasser, yet this does not seem to be a total deterrent. The effective response would be to change the attitudes of social trespassers by enhanced enforcement of trespassing laws, and a publicity campaign targeted at at-risk adults.

GRADE CROSSINGS

There are two basic problems. The first is that 60% of crossings with public roads are not provided with flashing lights or gates, known as active warning devices, to warn of the approach of the train. The second is that some road users do not exercise enough care when using crossings, even when gates and/or flashers are installed. The considerable reduction in the collision risk over the past twenty-five years is a testament to progress in tackling both problems.

Since 1978, over a quarter of all crossings have been closed either as a result of railroad abandonment or due to consolidation of several little-used crossings. In addition under the 1974 *Section 130* program, the federal government has spent more than \$6 billion, at current prices, to upgrade the warning devices at the remaining crossings: gates have been installed where there were only flashing lights, flashing lights have been installed where there were previously only marker signs, marker signs have been installed where previously there were no signs, and little-used crossings have been consolidated with neighboring ones. On a cost-benefit basis there are many little-used crossings for which one could never justify the installation of active warning devices. Even taking this in account, I estimate in my book (Savage, 1998, chapter 8) that based on average daily road traffic that there are still at least 8,500 and maybe as many as 20,000 crossings in need of having active warning devices substituted for passive marker signs. Unfortunately, at the current rate of progress, this will be accomplished somewhere between the years 2013 and 2036. My calculations show that the *Section 130* program demonstrates a large ratio of benefits to costs, and there are large welfare gains

from continuing, and even accelerating this program (Savage, 1998, Chapter 8).

There has also been progress in advising drivers on appropriate conduct at grade crossings. The government and industry-supported *Operation Lifesaver* has attempted to make the public aware of the dangers of ignoring flashing lights or driving around closed gates. Despite these efforts, 150 highway users a year die due to ignoring properly-functioning active warning devices. The program also advises drivers on how to deal with crossings with only marker signs. Specific conduct at these crossings is rather ill-defined and was debated all the way to the Supreme Court in the 1920s and 1930s. There is no longer any legal requirement to “stop, look and listen,” and the advice of *Operation Lifesaver* to “always expect a train” is clearly not a reflection of reality in many rural areas where the rational expectation is for no train to be present. There are moves to try to resuscitate the “stop, look and listen” laws by replacing the traditional “crossbucks” crossing markers with standard highway stop signs. This would clearly be advantageous to railroad lawyers attempting to deflect law suits, but it is not without its problems including the fact that slow-moving vehicles are more likely to be hit by a train than a vehicle moving quickly across a crossing. There is also an increased chance of rear-end collisions between highway vehicles at the stop sign, and the possibility that stopping for nonexistent trains may diminish the regard that drivers have for stop signs elsewhere on the highway.

OCCUPATIONAL INJURIES

Economic theory, dating back to Adam Smith, indicates that if workers are knowledgeable about job risks, market mechanisms will compensate workers for working in industries that are particularly risky. Workers with a greater tolerance of physical risk will tend to gravitate toward riskier occupations. A market failure will only exist if wages are insufficient to compensate for the risks. Railroad workers are among the highest paid workers in the nation whereas injury and fatality rates are low in comparison to peer industries that involve heavy, moving machinery and work outdoors. Construction, maritime, trucking and warehousing jobs have far higher casualty rates (Bureau of Labor Statistics, 1997a table A-2, 1997b, table 1).

Therefore the controversy surrounding occupational injuries does not concern their rate, but rather deals with the unusual method by which injured employees are compensated. The railroads are governed by the *Federal Employers' Liability*

Act(FELA) which is a judicial system under which injured employees can bring suit to recover both monetary and non-monetary losses. However, awards can be reduced or eliminated if the worker was found to be partially or fully negligent. This is in contrast to the workers' compensation scheme applicable to other industries, where benefits are lower but cannot be reduced based on relative fault.

The issue of whether the railroads should change over to workers' compensation has been debated repeatedly and at length (see, most recently Transportation Research Board, 1994; General Accounting Office (GAO), 1996). However there is little prospect of any reforms in that both management and unions are firmly entrenched. Management looks to cost savings, although I regard these as quite speculative. FELA benefits are highly valued by the railroad unions, and it is unlikely that they could be removed without making some other concessions to labor.

Nonetheless my research has convinced me that the adversarial judicial nature of FELA does not foster a constructive attitude for investigating and mitigating workplace injuries. Injured employees correctly respond to FELA by not wanting to reveal details of the nature of their cases to railroad managers prior to legal proceedings. This clearly works against informal sharing of information between employees and management on ways to learn from experience in mitigating injuries. Under workers' compensation the employee is guaranteed compensation, and will therefore be able to honestly admit to the circumstances of the injury and ways in which it might be avoided in the future. FELA also works against rehabilitation and a swift return to work, because injured employees would thereby undermine the magnitude of their claims for compensation.

OPERATIONAL SAFETY

There are about 2,000 reportable operational accidents, primarily collisions and derailments, each year which result in about 20 deaths, 450 injuries and about \$250 million in property damage (Savage, 1998, chapter 16).³ Two-thirds of these occur in yards and sidings during switching operations. Derailments are primarily caused by the state of the track, while most collisions are caused by incorrect or inappropriate operating practices (FRA, 1998).

Operational safety became an issue in the 1960s when many decades of safety improvements were reversed. At that time the railroads were in considerable financial difficulties and it is widely believed that standards of maintenance were reduced.

The worsening rate of collisions and derailments and employee injuries lead to the *Federal Railroad Safety Act* of 1970, the first substantial change in railroad safety regulation in sixty years. Until its passage the railroads had very little formal regulation. The 1970 Act introduced design standards for track for the first time and codified existing industry standards on the design and maintenance of freight cars. The government also appointed an inspectorate force to ensure compliance with the laws.

Despite the new regulations, collisions and derailments did not decline until the end of the 1970s. Since 1980, the rate of collisions and derailments per train mile has fallen substantially and is now only a quarter of what it was in the late 1970s (FRA, 1998). However, the cause of this reduction is subject to some controversy. The Federal Railroad Administration claims that it is a direct result of its safety regulatory efforts. The industry points to the economic deregulation of the industry in 1980. Subsequent to the *Staggers Act* of 1980, the financial health of the industry improved and railroads were able to substantially increase their expenditures on track and equipment.

In addition, there has been a change in the way that railroads handle traffic. Traffic is increasingly handled in unit trains and there is much less switching of cars. The proportion of train miles that are represented by yard and switching operations has fallen by half, from 30% to close to 13%, in the past twenty years. As most collisions and derailments occur in yards and sidings it is not surprising that the risk has fallen.

Unfortunately for the analyst, the increase in deregulation-induced expenditures parallels increases in federal safety inspections and decreases in the amount of risky switching. It is impossible to separate these effects econometrically. The inability to definitively ascribe causation for the safety improvements has led to an impasse between the industry and the government as to whether the 1970 federal safety regulations have helped or hindered the industry.

Industry Criticism of Current Safety Regulations

The industry argues that there are two major shortcomings of the present regulations: the method for setting and updating the safety standards; and strategy adopted for monitoring and ensuring compliance. The industry terms this a "command and control" strategy. To use less emotive terms, the FRA uses a quite traditional approach to regulation. Detailed minimum engineering specifications are written on how to design and maintain track and

equipment, and the minimum experience and maximum hours of work for employees. An inspectorate force then conducts semi-random inspections to determine compliance, and citations are issued for violations found. In recent years the FRA has added to its arsenal a *Safety Assurance and Compliance Program* whereby teams of inspectors target individual railroads or divisions of particular railroads.

The regulations of the 1970s have drawn criticism not only from railroads but also from independent government agencies such as the General Accounting Office and the late Office of Technology Assessment in a succession of reports over the years. The regulations concerning track standards and brakes in particular have been criticized because of a lack of cost-benefit analysis in setting of the standards. It is possible that organized labor has been able to coerce Congress so as to write rules that preserve existing working practices. There is an additional concern that even when appropriate standards are written into law, the rulemaking process necessary to update these standards in the face of technical change or modern requirements is so lengthy and stifling that regulation can impede progress. The main cause of this problem is the penchant of Congress and the FRA to express standards in terms of the design of equipment rather than the performance of it. One would imagine that the FRA is really only interested in how quickly a train can stop or whether there is excessive lateral deviation in track, and not in the specific design of the braking equipment or the number of spikes per section of track.

The enforcement of the regulations has been subject to much criticism. There is considerable feeling, not only in the railroad industry, that semi-random inspections resulting in violation notices and fines are ineffective in improving safety. There is evidence that this is true in the trucking industry (Moses and Savage, 1997), and even the Occupational Safety and Health Administration (OSHA) has recognized that there must be a better way of obtaining a safe workplace. Reports by the GAO (see especially those in 1982 and 1997) suggest that the FRA does not have adequate models to determine which railroads pose the greatest safety threat and therefore cannot reasonably set priorities for targeted or special assessments of individual railroads. Resolution of violations and the payment of fines by large railroads does not normally involve senior officers of the railroads, and there is little evidence that the fines influence corporate policy.

The Necessity for Safety Regulation

To fairly evaluate the criticisms made by the industry, it is worthwhile to take a step back and evaluate why intervention in the market may be needed. Theoretical economists point to four market failures in the optimal determination of safety between firms and their customers. The first is customers cannot accurately perceive the level of safety on offer, the second is that even-fully informed customers do not react rationally to the choices they are given, the third is that uncompensated externalities are imposed on third parties, and lastly that firms are myopic in trading off the current costs of preventing accidents against accident costs in the future (Savage, 1999).

As railroads are primarily in the freight business, the problems of imperfectly informed and irrational customers are less severe than they are, say, in the airline industry. Most freight shippers are making consignments on a daily basis and are continually settling claims for minor loss or damage. In addition, because there is no threat to their own life and limb, shipping managers can quite rationally compare the prices and safety records of rival railroads or modes of transportation.

Longstanding legal requirements have also made railroads responsible for compensating bystanders for externalities caused in accidents, even in extreme cases where hazardous materials are released into the environment. The sole concern in this area is that railroads have yet to fully reflect the expected liability and clean up costs of carriage of different hazardous materials in their pricing. Too often a standard surcharge is collected on all freight movements to cover these costs. As a result too-much extremely hazardous materials are shipped and too little low or non-hazardous materials are shipped. (See Dennis, 1996, for an indication of how the magnitude of expected externalities varies markedly by commodity.)

The leaves myopia as the most threatening and most likely market failure. Two types of railroads are susceptible to such myopia. The first are the many small railroads established since the *Staggers Act*. These railroads may make myopic decisions due to inexperience rather than unscrupulous intent. The second type are those who intend to "cheat" on their customers. These railroads hope to save money in the short term by reducing expenditures on accident prevention, yet hope that their customers do not notice and react by taking their business elsewhere or demanding lower prices. There is ample evidence that this occurred in the 1960s.

Economists argue that the response to these market failure should take many complementary forms (Kolstad, Ulen and Johnson, 1990). The insurance industry can have an active role in assessing the precautions taken by a new railroad and charging an appropriate premium to reflect the probability that accident claims will result in the future. A concern about myopia by unscrupulous railroads could be mitigated if customers could readily detect the cheating. There may be a role for government in ensuring that customers are better informed not only about accidents but also about leading indicators of future safety in the form of data on inputs to safety such as maintenance activities, training and the age and condition of capital equipment.

There is also a role for direct regulation by the government to reduce the chance of myopia. The two possible causes of myopia call for two different regulatory approaches. An educational system is needed to prevent myopia by inexperienced railroads, while a delinquency system is needed to detect and punish unscrupulous myopic railroads who are trying to cheat their customers. An important question is whether the traditional forms of regulation practiced by the FRA are appropriate to these tasks, and whether new and improved regulatory strategies could be more effective and cost-efficient.

Designing an Educational System

The FRA already holds seminars, jointly with industry groups, for managers of newly-formed railroads. Press reports suggest that people attending such sessions have found them to be very useful. An open question is whether in addition new railroads should be accredited before they are allowed to operate. There is a possible model that the FRA might look to. *Railway Safety Cases* had to be completed by private operators who wished to take over the services formerly provided by the state-owned railways in Great Britain in the mid-1990s (Health and Safety Executive, 1994). In addition to requiring details of the safety management systems put in place, operators had to complete a risk-assessment exercise in which they had to identify the major safety risks they faced, appraise the probability and severity of these risks, rate the risks and provide plans for ameliorating those risks that were too high. While data on risk probability and severity may be limited and rating of risks is judgmental, the important role of the risk assessment is to require railroad managers to think deeply about the risk faced and the ways in which the railroad can reduce the risks. It is unlikely that a new railroad that has to

undertake a risk-assessment exercise will be myopic due to inexperience.

Designing a Delinquency System

A delinquency system is not much different in intent from the current purpose of the FRA. The objective is to identify those railroads providing sub-standard service or those whose safety record is precipitously declining. The industry claims, and in general I am sympathetic to their claims, that the FRA's current method of semi-random inspections to find violations with design specifications leaves a lot to be desired.

There is an alternative which is frequently but somewhat misleadingly called "performance standards." To my mind the alternative entails a four-stage process. The first stage requires the FRA to adopt the role of risk analyst. The FRA would analyze data on safety performance for individual railroads to determine which railroads might be delinquent. The second stage involves inspections and evaluations of railroads that the first stage has flagged as potentially delinquent so as to confirm or disprove the FRA's suspicions. The third stage requires a delinquent railroad to prepare a remediation plan to correct its delinquent behavior. The fourth and final stage requires the FRA to monitor whether the railroad is making a good-faith effort to implement its remediation plan. Failure at this stage would trigger traditional methods of inspections, citations and fines.

Such a system is in use in the trucking industry. The Federal Highway Administration uses information on the accident rates of carriers, and other information it has, to set priorities for the work of its inspectorate. OSHA conducted an experiment in the state of Maine in 1993 whereby the largest firms were exempted from the traditional OSHA inspections if they made self-assessments of workplace risks, prepared a plan to ameliorate the risks, and made good-faith efforts to implement their plans. They intend to expand their *Cooperative Compliance Program* nationwide.

The hardest part of the proposed system is to design an information system to provide an early warning of railroads who may be cheating. An obvious component is the data that are already collected on train accidents and workplace injuries. While accidents are random events which lead to some natural variation in the number of accidents a railroad will have from year-to-year, there are well-understood statistical rules that explain the nature of this variation. Examples given in my book (Savage, 1998, chapter 20) indicate that the FRA should be

able to statistically identify those railroads whose accident performance is deteriorating or is worse than peer railroads using measures which occur at least 10 times a year.

However, this is essentially an *ex-post* identification of myopic railroads. It is clearly preferable if the FRA could identify railroads who are acting myopically before their reductions in preventive efforts are reflected in increased accidents. The FRA might develop a system of warning flags for railroads whose circumstances might suggest myopic behavior, such as financial distress, declines in revenue, financial restructuring, stock offerings or being a takeover target. The FRA might also wish to develop information on safety inputs to alert them to railroads that do not appear to be spending sufficient amounts on track maintenance or who are allowing the average age of their fleets to increase, or who have inordinately high staff turnover. Such warning flags could trigger inspections or a special assessment of the railroad.

Such a statistical risk-analysis approach to analyzing data on safety inputs and outputs is only really applicable to the largest forty or so railroads. The smallest Class II and all of the Class III railroads have accidents so infrequently that any statistical inference would be impossible. It would also be impractical to collect extensive financial or safety input data on these railroads. It is likely that traditional inspections strategies will have to be retained for the smaller railroads. It may be worth investigating whether random inspections should be replaced by an annual audit of each small railroad. This would be quite manageable given that there are probably only about 300 different corporate entities involved in the railroad industry.

IN CONCLUSION

The terms of annual fatalities, the most significant safety risks are deaths of trespassers and collisions at rail-highway grade crossings. The latter risk has declined significantly over the years, and there are well-understood ways that the risk can be reduced further. Trespassing, however, is a more complex and growing problem. The victims tend to be marginalized members of society, and solutions to this problem need to be more sophisticated than just demanded that fences be erected.

Operational accidents occur much less frequently than the headlines would suggest, and the risk of these accidents has fallen significantly since the dark days of the 1960s and 1970s. There was ample evidence from the 1960s that some railroads will act myopically with regard to safety. The current

challenge is investigate ways in which public policy can most effectively prevent myopic behavior. There is discussion in other branches of the Department of Transportation as well as in other parts of the federal government that new monitoring and enforcement approaches have the promise of targeting safety problems at a lower cost. From my research there is a strong suggestion that the FRA should change their outlook from that of a police officer to that of a teacher and a risk-analyst.

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ENDNOTES

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This paper is a summary of the author's recently completed book *The Economics of Railroad Safety*,

¹ For the purposes of this paper, trespassers are defined as those people trespassing at places other than at rail-highway grade crossings. People with known suicidal intent are excluded from the data.

² Sources of data are FRA (1998), Department of Commerce (annual), and Federal Highway Administration (annual).

³ A train accident is defined as "a safety-related event involving on-track equipment (both standing and moving), causing monetary damage to the rail equipment and track above a prescribed amount." That amount changes with inflation and was \$6,500 in 1997 (FRA, 1998).