

PB80137888



REPORT NO. FRA-RRS-80-01

LEGAL EFFECTS OF USE OF INNOVATIVE EQUIPMENT
AT RAILROAD-HIGHWAY GRADE CROSSINGS
ON RAILROAD'S ACCIDENT LIABILITY

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REPRINT

DECEMBER 1979

FINAL REPORT

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Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION
Office of Safety
Washington DC 20590

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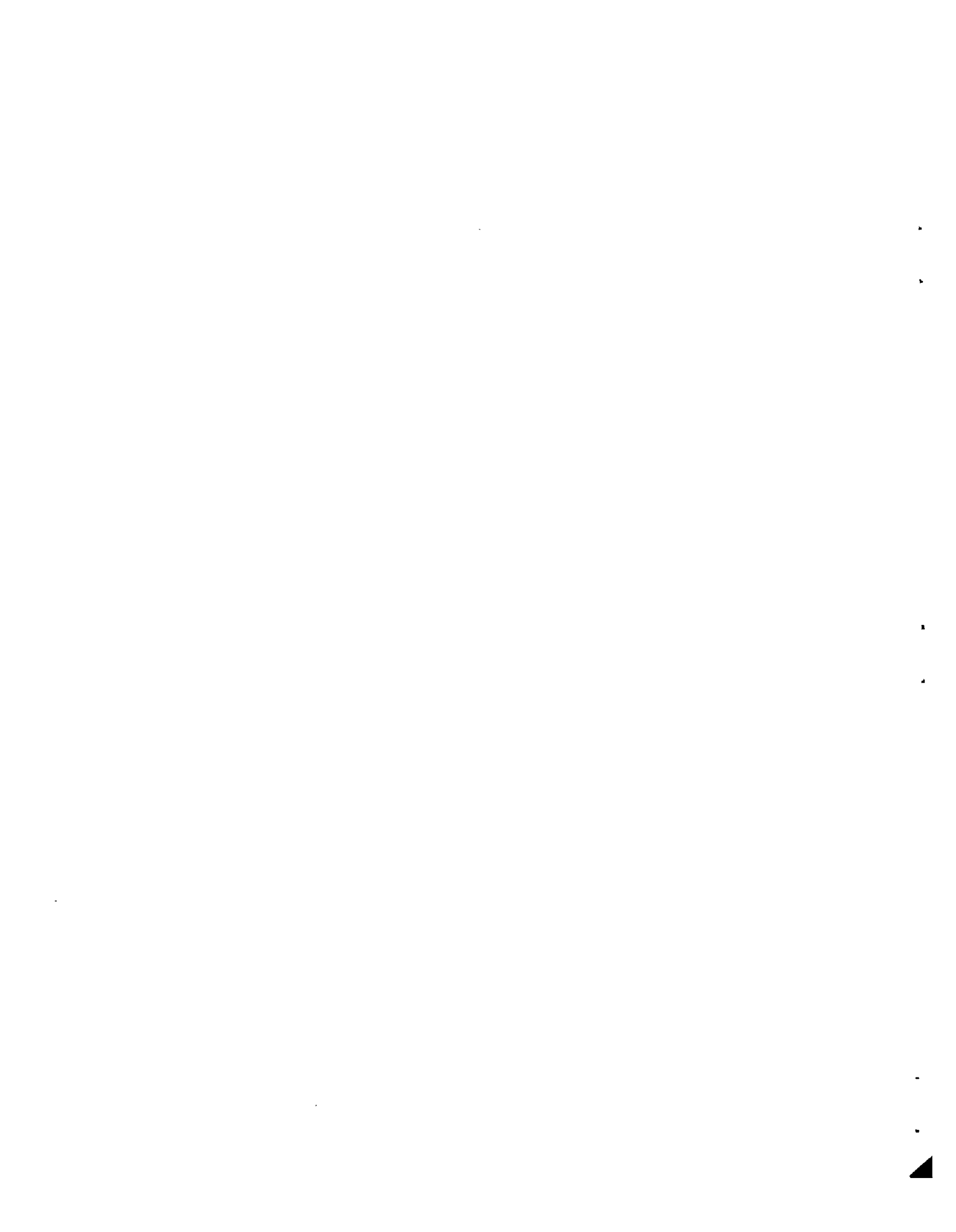
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1. Report No. FRA-RRS-80-01		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle LEGAL EFFECTS OF USE OF INNOVATIVE EQUIPMENT AT RAILROAD-HIGHWAY GRADE CROSSINGS ON RAILROAD'S ACCIDENT LIABILITY				5. Report Date Reprint December 1979	
				6. Performing Organization Code	
7. Author(s) David S. Glater and Terry K. Mond				8. Performing Organization Report No. DOT-TSC-FRA-79-19	
9. Performing Organization Name and Address U.S. Department of Transportation Research and Special Programs Administration Transportation Systems Center Cambridge MA 02142				10. Work Unit No. (TRAIS) RR033/R030J	
				11. Contract or Grant No.	
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Railroad Administration Office of Safety Washington DC 20590				13. Type of Report and Period Covered Final Report April 1978-April 1979	
				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract: <p>This report discusses the effect on a railroad's legal liability for railroad-highway grade crossing accident costs when that railroad uses innovative grade crossing safety equipment. Its purpose is to evaluate the assertion that a railroad's use of innovative warning device technology increases the likelihood that the railroad will be held liable for accidents at that (or other) crossings.</p> <p>The methodology employed in carrying out this research involved the identification and analysis of relevant federal and state court decisions. Three significant conclusions resulted from this study. First, railroads do not necessarily increase their legal liability for grade crossing accident costs by deploying innovative grade crossing warning equipment. Second, railroads should carefully monitor government and industry activities demonstrating the feasibility of new warning equipment because such activities may affect their liability exposure. Finally, railroads may deploy new technology at a particular rail-highway crossing in response to accidents at that site without significant adverse effect on their position in relevant litigation.</p>					
17. Key Words Rail-Highway Grade Crossings, Legal Liability, Innovative Warning Device Technology, Grade Crossing Accident Costs			18. Distribution Statement DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22161		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 52	22. Price PC A04 MFA01



PREFACE

This report describes one of several recent Transportation Systems Center studies of institutional factors related to rail-highway grade crossing safety improvements. The current study addressed the legal effects of using innovative crossing warning equipment on railroad's accident liability. The Office of Safety, Federal Railroad Administration, sponsored this work.

The authors wish to express their appreciation to various individuals who reviewed this report and offered excellent suggestions for improving it. Among them were Bruce George and Larry Wagner of the FRA, Janet Coleman and Sid Louick of the FHWA, and Fred Martin of TSC.



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1. INTRODUCTION

Although railroad-highway crossing accidents cause a significant number of injuries and fatalities each year,¹ there has been a general reluctance to deploy grade crossing warning devices embodying innovative new technology.² Federal transportation legislation³ and safety studies⁴ confirm the need to make the country's 219,000 public grade crossings safer, yet much of the equipment currently in use is based on designs developed in the 1920's and 1930's.⁵ The fact that the costs of installing new equipment are borne substantially by the federal government suggests that factors other than initial cost may be influencing the railroads, states, and suppliers in making deployment decisions which opt for existing technology.

One explanation for this reluctance to innovate is that those responsible for making crossing equipment deployment decisions believe that, should an accident occur, a railroad will be more likely to be held liable for the accident if it has employed new technology (at the crossing in question or elsewhere) rather than making no change at all. Railroad decision-makers may also fear their firms will be subject to liability for failure to employ a new technological design once such technology becomes commercially available. (A new technology or design may be incorporated into grade crossing warning equipment either as a noticeable change in the appearance

or operation of the equipment, or as a change in equipment construction or internal operation which is not particularly noticeable to the public.) Consequently, a railroad may perceive itself in a "damned if we do, damned if we don't" position in relation to innovation. There is a fear of increased liability whether or not the railroad innovates. Confronted with this seeming "no-win" situation, a railroad's inclination appears to be, make no changes: it is better to continue to do what has been done in the past, thereby continuing to be liable only for the historically predictable costs of crossing accidents which court verdicts have required them to bear.

No case⁶ has been found in which a railroad was held liable for the costs of an accident just because it employed grade crossing warning equipment embodying new technology.⁷ This paper will evaluate the soundness of this proffered explanation of railroad behavior. It will identify the factors which judges and juries usually consider in assessing the reasonableness of a railroad's use (or nonuse) of grade crossing warning devices embodying new technology. These factors include industry custom (represented by actual practice and industry safety codes), governmental regulation, and the availability of new technology alternatives to presently used equipment. This paper will also briefly consider the admissibility at trial of evidence of changes a railroad makes in warning devices installed at grade crossings.

Before proceeding further, a note as to methodology: The railroad grade crossing cases cited in this paper generally deal with the adequacy of equipment already deployed. No reported cases have been found broaching the question of whether equipment embodying new technology should or should not have been deployed. (This may be because little new technology has been deployed.) The cases available are nevertheless relevant to explain how courts will likely deal with cases involving deployment of equipment embodying new technology. Products liability cases in other transportation areas (commercial aircraft, automobiles, etc.) which discuss the use of or nonuse of innovative technology have also been relied upon to provide a basis for analysis of the effect on legal liability of technological innovation in the grade crossing context.⁸

2. RULE OF LIABILITY AT GRADE CROSSINGS:
REASONABLE CARE TO PREVENT INJURY

Liability for accidents occurring at railroad grade crossings is governed by the law of negligence.⁹ The law imposes upon railroads the duty to exercise reasonable care to avoid injury to persons using the highway. Railroads are under no duty to provide absolute safety.¹⁰ A railroad must meet its duty of reasonable care by giving the public reasonable warning that its trains are approaching a crossing.¹¹

Ultimately, what constitutes ordinary, reasonable or due care in warning the public of the danger posed by an approaching train must be determined within the specific facts of each case; but generally, the care required to prevent injury is proportionate to the danger and chance of injury at the crossing in question.¹² Accordingly, what may constitute reasonable care in one locality, or with reference to a particular crossing, may be unreasonable with respect to other crossings.¹³

The courts look to two major factors in determining whether a railroad has taken reasonable care in giving the public adequate warning at a particular crossing: (1) In light of the history of accidents and/or level of traffic at the particular crossing, was an accident reasonably foreseeable? If so, (2) was the railroad reasonable in its choice of warning devices to alert the public of the foreseeable risk?

CHANGING TIMES AND THE FORESEEABILITY OF ACCIDENTS

When there is no history of accidents at a particular crossing, a railroad may reasonably hesitate to make changes in the warning equipment it has installed there. The case law treats extended effective use of warning devices as strong evidence that such devices provide reasonably adequate warning.¹⁴ There would seem to be little to gain by making changes in the equipment, either in terms of reducing the risk of accidents or of subsequent liability.

A grade crossing warning device which has operated safely and effectively for a number of years, however, may at some point become an unreasonable choice because of changed conditions at the crossing at which it is installed. Evidence of an increase in the frequency of accidents,¹⁵ an increase in the level of vehicle and/or train traffic, or other evidence that crossing conditions have changed, may create a duty on a railroad to take appropriate action in response. An ostensibly cautious railroad may therefore be taking a risky position in relying upon old and proven technology if crossing conditions have changed. Regular reassessment of the risks of each crossing should be performed to assess whether the risk of accidents may be lessened through the deployment of other equipment.

3. STANDARDS FOR ASSESSING THE REASONABLENESS OF RAILROAD'S GRADE CROSSING WARNING EQUIPMENT DEPLOYMENT DECISIONS

In deciding whether a defendant railroad exercised due care in its choice of warning devices, judges and juries often apply the standards implicit or explicit in past industry practice or custom, industry safety codes, and/or legislative or regulatory requirements. This section explores the effect on these factors of the development, availability, and use of grade crossing warning device technology.

3.1 INDUSTRY CUSTOM

Custom, in the legal sense, is a usage or practice, which, by common adoption and long unvarying habit, has acquired the force of a tacit and common consent.¹⁶ The weight given custom, however, may vary according to the circumstances of the particular case. A custom may so obviously represent all that can reasonably be required in the way of precautions that its observance should not be characterized as negligence. This might occur when the custom in the industry is to use the safest, most advanced technology available. On the other hand, a custom may be so clearly dangerous that its observance means very little. The weight given custom falls somewhere between these two extremes.¹⁷

3.1.1 No Safer Technology Commercially Available

Generally, if there is no safer technology in existence and commercially available which will better protect the public against the risk of injury than the technology currently employed, a user of the current technology may not on that account be found negligent, should an accident occur. In Northwestern Airlines, Inc., v. Glenn L. Martin Co., the court ruled that the question whether Northwestern Airlines was contributorily negligent in failing to install airborne radar equipment on an aircraft purchased from defendant manufacturer should not be submitted to the jury because there was no evidence that such radar equipment was commercially available at the time of the crash in question.¹⁰ The court cited testimony in the record to the effect that commercially available airborne radar equipment was unreliable and unsatisfactory, and that further development of radar equipment was necessary. Applying this reasoning to grade crossings, it appears that even if a technological alternative exists which might improve some aspect of grade crossing warning equipment, if that alternative is not commercially available for use, a railroad rests upon reasonably safe ground in continuing to employ current technology warning devices.

One court, however, expressing what appears to be a minority view, has held that there is a "continuing duty" on the part of a manufacturer to use a reasonable amount of resources in adapting

recently developed technology for commercial use, where the resulting device would reduce the risk of harm inherent in the original product. That case, Noel v. United Aircraft Corp.,¹⁹ involved a crash of an aircraft caused by an overspeeding propeller which could not be "feathered." (To "feather" means to turn the propeller blades to a position parallel to the airstream so that the blades will stop rotating due to the pressure of air across the blades.) Because the overspeeding propeller could not be feathered, it became detached from its shaft and then whirled off the engine. At the time of manufacture and initial sale of the aircraft no safer design existed which might have lessened the danger. Because of previous occurrences of propeller overspeeding, the manufacturer developed a safety device to deal with the problem on its new aircraft models. But the manufacturer did not make the device available for retrofit of older aircraft. Noting the high degree of risk involved ("It requires no expert testimony to imagine the terrible consequences of a fire ... on an airliner 20,000 feet in the air"²⁰), the federal district court held that the defendant United Aircraft was under a duty to develop a more dependable retrofit propeller system for its older model aircraft.

In holding the aircraft manufacturer in Noel to this duty, the district court placed great importance on what was missing from the company's defense to the charge of negligence: It presented no evidence (1) that an accelerated program to produce

acceptable alternative safety devices was decided upon; (2) that such a program was pushed ahead vigorously; (3) that "despite the use of all reasonable efforts, nothing more could humanly have been accomplished"; and (4) that development programs being conducted for new planes had not detracted from a vigorous program for existing propeller systems.²¹

The Noel decision appears to rest on three preconditions: (1) defendant manufacturer's knowledge of a high degree of risk; (2) defendant's ability (both financially and technically) to produce a device which would reduce the risk without unreasonably burdening its resources; and (3) society's relative dependence on the defendant to protect it from dangers inherent in a product or service against which the public cannot otherwise adequately protect itself.²² The import of Noel is that it declares a duty to devote a reasonable amount of resources to bring new technology into commercial use in order to reduce an obvious risk to human life and safety. The manufacturer was not left free to rest on its laurels, content in the belief that, as long as no new technology was commercially available, it had no duty to respond to the risk created by use of its product. (If the new technology had not been developed, it is unlikely that a plaintiff could prove the feasibility of new technology.) Once enough research has been conducted to demonstrate the availability of a safer technology, Noel establishes the

possibility that a defendant could be held liable for failing to adapt technology that would make its products safer.²³

The application of the reasoning in Noel may have significant implications for the railroad industry. Because of the dangers posed by grade crossings, if research results demonstrate the possibility of technologically improved grade crossing warning devices, a railroad may be under a duty to use a reasonable amount of its resources to adapt the technology for use in its grade crossing warning devices in order to meet its duty of care. Failure to adapt the new technology would, under Noel, constitute a default of the railroad's "continuing duty" to protect the public from risk of injury inherent in earlier equipment.

The doctrine created in Noel has been criticized because it penalizes a manufacturer or supplier for making efforts to improve its original design.²⁴ Any research conducted becomes evidence which may be used to discredit the original design, and to impose a new basis of liability, i.e., that the research results were not incorporated into the commercial products in a timely manner. While application of the Noel doctrine may increase a manufacturer's responsibility to make improvements once technological feasibility has been demonstrated, that doctrine may also discourage product improvement by creating a fear of being penalized for failing promptly to introduce research results.

3.1.2 New Technology Commercially Available but Not Used

In the absence of a custom in the railroad industry to use a new warning device technology, each railroad rests upon reasonably safe ground in employing devices embodying older technology. If most others in the industry use the older design, a defendant railroad will usually be found to have met its duty to keep reasonably abreast of techniques and devices in the industry when it also employs such designs.²⁵ In Frankford and Bristol Turnpike Co. v. Phila. T. R.R. Co.,²⁶ the court said:

"It is not everything that looks well in the theory that works well in practice. In mechanical contrivances especially it is true that that which is approved by experience as the best, is commonly found to be so. When something certainly better is invented, and approved by the only true test of mechanical contrivances, practical experiment continued long enough to test its real utility, then railroad companies will be bound to adopt it."

In Northwestern Airlines v. Glenn L. Martin Co.,²⁷ however, the court ruled that the fact that the defendant airline chose to follow the practice of other airlines in not equipping its planes with radar did not automatically render that decision reasonable. Customary practice was not ordinary care; it was but evidence of

ordinary care. The most frequently cited case standing for the proposition that there may be a duty beyond the general practice or custom in the industry is The T.J. Hooper.²⁸ It was there held that a shipping company had a duty to equip its ocean-going tugs with radio receiving sets in order to receive storm warnings even though there was no such custom in the industry. Judge Learned Hand there stated:

"[I]n most cases reasonable prudence is in fact common prudence; but strictly it is never its measure; a whole calling may have unduly lagged in the adoption of new and available devices. It never may set its own tests, however persuasive be its usages. Courts must in the end say what is required; there are precautions so imperative that even their universal disregard will not excuse their omission."²⁹ [citations omitted]

Courts which have imposed technological requirements beyond an industry's practice or custom have generally done so when one (or more) of the following factors was present: an obvious error in product design;³⁰ the public cannot act in the marketplace to protect itself from a less-than-completely-safe design³¹ (that is, individuals are not given a chance to buy a safer product if they so desired³²); and, the-less-than-completely-safe design is not accompanied by adequate warning of its risks.³³ The latter

two are of particular relevance to railroad grade crossings since individuals cannot "buy" safer crossings from railroads. And, it can always be alleged that a railroad has not provided adequate warning of a less-than-completely-safe crossing. The adequacy of the warning provided is, in fact, often the essential issue posed in grade crossing litigation.

Will a railroad more likely be found negligent if it chooses to employ new grade crossing warning technology instead of adhering to industry custom using older technology? In Cunningham v. Ft. Pitt Bridge Works,³⁴ the court discussed the significance of such deviation from customary practice:

"The party charged with negligence disproves it by showing that the tools he employed were those in general use in the business, but the converse does not follow. The party charging negligence does not show it by showing that the machinery was not in common use. If it should be so held, the use of the newest and best machine, if not yet generally adopted, could be adduced as evidence of negligence."

The availability of safety studies or research results which describe the higher levels of safety resulting with use of a new technology device may, of course, be used to support a decision to deploy the new technology.

3.1.3 More Widespread Deployment of New Technology

Once several railroads have deployed new technology warning devices, the resulting absence of consensus in the industry leaves each individual railroad free to deploy whatever technology (old or new) it reasonably deems best suited to its particular needs. The court, in Norfolk & W. Ry. Co. v. Bell³⁵, defined the relevance of evidence of alternative technology in this way:

"In selecting between different instrumentalities for its purposes the master [a railroad] should keep reasonably abreast with improved methods, so as to lessen the danger to those in his service; but he is not bound, in the performance of his duty, to furnish the best known instrumentalities, but such only as are reasonably safe. The test is not whether it has omitted to do something it could have done, nor whether a better appliance could have been obtained or a better method adopted, but whether the selection made was reasonably prudent and careful, and the instrumentality selected reasonably adequate and proper for the use to which it was to be applied."

In a context in which no technological custom dominates, industry safety studies or government research indicating that

safety can be increased with a particular type of warning device may be particularly persuasive to a jury evaluating a railroad's conduct. In Southern Pacific Transportation Co. v. Lueck,³⁶ for example, the Supreme Court of Arizona ruled that a jury could find the railroad negligent for failing to inform its employees and agents of a safety study³⁷ which concluded that automatic crossing gates should be installed at the crossing in question. The railroad chose flashing lights, warning bells, and stop signs for protection at the crossing in question, notwithstanding the study's finding that automatic crossing gates could reduce fatal accidents over any other type of protective device by 90 percent.

3.1.4 General Adoption of Safer Technology

Once there occurs general adoption of a particular new technology in the industry, it is clear that a railroad best protects itself from liability by deploying that technology. It has been widely held that common use of a safer design within an industry is relevant "to establish that the defendant's [older] design involves both unreasonable danger and a failure to exercise the skill of an expert."³⁸ One commentator has postulated that there may be a duty to withdraw from the market or redesign products lacking safety features which have become standard in the industry, on the ground that the original design now creates an unreasonable risk.³⁹

3.2 SAFETY CODES

Industry safety codes are additional factors which a jury may consider in determining whether a railroad was reasonable in its choice of warning devices at a particular crossing. Generally, such codes represent a consensus carrying the approval of a significant segment of an industry.⁴⁰ Thus, they may be used in a jury's balancing process in a way quite similar to custom. Two nationally recognized safety codes govern safety practices at railroad grade crossings: the Association of American Railroads Bulletin (AAR Bulletin), and the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). The AAR Bulletin is a code of recommended practices developed from sources in the railroad industry, Federal and state governments, and manufacturers of grade crossing warning devices.⁴¹ The MUTCD is published by the Federal Highway Administration for application to all classes of roads and streets, including the approaches to and crossings of railroad tracks.⁴²

Because safety codes usually establish only minimum standards, a railroad may deploy technology other than that recommended in a safety code if the technology deployed meets the minimum requirement and provides a reasonable degree of protection.⁴³ Safety studies and government research demonstrating the advantages of alternative technologies may, of course, be used to support such a decision. A railroad cannot be sure of avoiding liability for grade crossing accidents simply

because it has complied with an applicable safety code. There may be a duty to deviate from code standards where strict adherence to those standards would constitute an unreasonable risk. In Rouse v. New York, C. and St. L. R. Co.⁴⁴ for example, a "dwarf" or "pot" signal located to the side of a track knocked a railroad employee off a ladder on an engine and caused him injury. The signal met approved clearance standards and came within other specifications contained in the AAR Bulletin. The court, while noting that compliance with AAR specifications was relevant evidence on the question of negligence, said that such evidence was not controlling. The test, rather, was "whether there was necessity in the practical operation and movement of defendant's trains to locate the 'dwarf' or 'pot' signal at the point in question."⁴⁵ Expert testimony at the trial demonstrated the feasibility of locating the signal elsewhere, leading the appellate court to rule that it was in the jury's province to decide, in light of this testimony, whether the railroad, in the exercise of reasonable care, could have foreseen the possibility that the location of the signal would become unsafe under certain circumstances. If it could have done so, it was liable for negligence despite its compliance with AAR specifications.⁴⁶

3.3 LEGISLATION AND ADMINISTRATIVE REGULATION

Legislation and administrative regulation are additional factors which may be introduced to aid a jury in deciding what constitutes reasonable conduct in a particular situation. When it promulgates statutes or regulations, the government in effect sets itself up as an expert in the field, and its requirements represent at least minimum standards which must be met.⁴⁷ Some courts have ruled that compliance with governmental requirements per se constitutes due care,⁴⁸ there being no duty above and beyond the statutory duty. More often, however, compliance with statutes will operate only as evidence of due care, with courts showing a tendency to allow juries to pass judgement on the reasonableness of the defendant's conduct.⁴⁹ In LaGoroa v. Kroger Co.,⁵⁰ for example, the defendant clothing manufacturer was held liable for injuries resulting when a jacket it manufactured caught fire, burning with unusual intensity. Although the jacket's composition conformed to, or at least was not in violation of, the Federal Flammable Fabrics Act,⁵¹ the court said:

"If the manufacturer could provide a safeguard which would make the jacket substantially safer for children to wear without prohibitive cost, marketing the jacket without such safeguard would seem unjustified."⁵²
(citation omitted)

Similarly, statutes or regulations setting standards for grade crossing warning devices are generally considered to establish minimum standards which a railroad may be required to exceed in specific instances. The fact that a railroad has complied with a statute in deploying certain technology at grade crossings would not relieve the railroad of its duty to make an individual determination at each crossing as to what technology will provide the best protection.⁵³

3.4 NOTICE OF HAZARDOUS CONDITION GENERALLY REQUIRED ON PUBLIC HIGHWAYS

The case law dealing generally with the duty to warn users of public highways of hazardous conditions may also be used to flesh out a railroad's obligation at railroad-highway grade crossings. The standard of care owed to the public by states and municipalities in their operation and maintenance of public highways is the same due care standard (reasonable care under the circumstances) used to assess railroads' conduct at grade crossings. See, e.g., Gordon v. Howard County, 13 Md. App. 42, 280 A.2d 906 (Md. Ct. Special Appeals, 1971); Boeing Co. v. State, 89 Wash. 2d 443, 572 P. 2d 8 (1978); Taylor v. So. Carolina Highway Dept., 242 So. C. 171, 130 S.E. 2d 418 (1963). Thus, a contractor repairing a public highway who creates a hazard on a section of highway within his control "is under a

duty to exercise ordinary care under the circumstances to protect and warn the traveling public of any such hazards by appropriate signs or warnings." Metropolitan Paving Co. v. Puckett, 389 F. 2d 1 (10th Cir. 1968) (approving jury instruction quoted here based on Oklahoma substantive law). In the Boeing case cited above, the Supreme Court of Washington appears to have employed reasoning similar to that applied in Noel v. United Aircraft, supra, in permitting the jury to decide the negligence question presented there. In Boeing a shipment of jet engines was damaged when a truck on which the engines were carried struck a 12 foot high underpass. Boeing argued that the municipality in which the bridge was located was negligent in failing to install a warning system to alert highway users to the unusually low clearance at the underpass. Evidence was introduced as to the technical feasibility of such a system and of the local police chief's prior support for its deployment. There was also evidence that signs were present warning of the dangerous condition. The municipality responded that "because such a system was not in common use and was not commercially available before this accident, to require a city to exercise ingenuity in conceiving such a system is to impose a duty of extraordinary care upon it. It [the municipality]cites ... [citations omitted] cases holding that negligence is not established by showing that any injury might have been prevented by the use of some device that has not yet been generally adopted." 572 P. 2d at 11. While the court

acknowledged the city's position represented the "general rule," it observed that "there are extraordinary situations which may call for extraordinary measures in the exercise of reasonable care." Id.

"Here, the respondent's evidence showed a past history of frequent accidents in spite of the warning signs posted. It further showed the appellant's awareness of the need for a more effective warning system and that in other similar circumstances governmental bodies had devised warning systems to meet the problem. This evidence was sufficient to take to the jury the question whether the appellant exercised reasonable care under the circumstances. The jury could reasonably conclude that the situation called for the exercise of some ingenuity in the solution of the problem presented by this substandard underpass - either the invention and construction of an adequate warning system, the rerouting of truck traffic, or the restructuring of the highway to correct the defect."

572 P.2d at 12.

The court went on to affirm the jury's verdict for Boeing against the municipality.

This case, like the Noel decision, may represent a minority judicial view as to a municipality's duty to adopt and utilize innovative warning technology once its technical feasibility has been demonstrated. The case is significant, however, in that the appeals court approved the judge's decision to leave to the jury the question whether the city should have adopted new technology to warn of the particular hazardous condition.

4. ADMISSIBILITY OF EVIDENCE OF CHANGES
IN WARNING EQUIPMENT DEPLOYED

Thus far we have been concerned with the substantive issues relating to the use of new technology which may be considered by judges and juries charged with assessing the reasonableness of a railroad's choice of crossing warning equipment. A railroad may be reluctant to employ new grade crossing warning technology for fear that evidence of this change will be used as a basis for criticizing the railroad's continued use of the former technology at other crossings. Or, a railroad may fear that a change in warning equipment made after an accident has occurred will be viewed as an admission of the inadequacy of the warning devices formerly deployed at that crossing. This section will consider briefly the legal rules of evidence which determine whether evidence of innovation may be introduced and used for these purposes.

4.1 EVIDENCE OF INNOVATIONS INSTALLED AT OTHER CROSSINGS

What effect will a railroad's deployment of new technology at one grade crossing have, should an accident occur at a crossing which has not been similarly equipped?

The general rule is that evidence as to the safety devices used at one crossing is not relevant (and therefore inadmissible) to the question of what safeguard is needed at another

crossing.⁵⁴ This rule is based upon the notion that although crossings may have some features in common, the details of each situation are too numerous for fair comparison.⁵⁵ Evidence of a railroad's use of new technology at some grade crossings can be admitted into evidence for another purpose: to show that the railroad's knowledge of the existence of the alternative technology. In Alden Speares Sons Co. v. Boston and Maine Railroad,⁵⁶ it was held that the railroad's use of automatic bells at other grade crossings was admissible to show that the railroad knew of such devices. Such knowledge can be easily demonstrated in other ways, however, regardless of whether the railroad has in fact developed the new technology. For example, railroad employees may know of such improvements from safety studies, research reports,⁵⁷ or trade publications. Because a railroad's knowledge of the existence of alternative technology can be shown through such alternative evidence, fear that evidence of deployment will be used for this purpose should not determine a railroad's equipment deployment decision.

4.2 CHANGE IN WARNING DEVICES DEPLOYED AT SAME CROSSING UNDER LITIGATION

A railroad may deploy new technology warning devices at a particular grade crossing in response to accidents which have previously occurred there. If evidence of a change made subsequent to an accident were admissible into evidence, a

railroad would reasonably be reluctant to make repairs or changes so as not to adversely affect its position in subsequent litigation. In response to this possibility, almost all state jurisdictions subscribe to the "exclusionary repairs" doctrine, which holds that evidence of repairs or precautions after an accident is not admissible as evidence of negligence.⁵⁸ Thus, in Atlantic Coastline R. Co. v. McLean Trucking Co.,⁵⁹ the court approved exclusion of evidence showing that after the accident, gates were installed at the crossing where the accident occurred. Such evidence, if admitted, might serve as an admission by the defendant that the prior condition was deficient in some one or more ways alleged by the plaintiff.

Evidence of repairs may be admissible into evidence for other purposes, however. Evidence of subsequent changes, repairs, or precautions have been held admissible to clarify what conditions were at the crossing at the time of an accident,⁶⁰ for the purpose of impeachment of witnesses,⁶¹ to show the railroad's control of the crossing,⁶² and for various other purposes.⁶³ The most that can be concluded from the cases is that a judge will balance the prejudicial effect of admission of evidence on post-accident changes against the effects of exclusion of such evidence.⁶⁴ Although a jury usually will be cautioned as to the purpose for which evidence is received, the danger remains that such evidence will consciously or subconsciously influence the jury's decision on the question of negligence itself.

5. CONCLUSIONS

The preceding discussion does not support the proposition set forth at the outset of this paper, that a railroad generally increases the likelihood of being held liable for grade crossing accidents if it deviates from present custom by employing grade crossing warning devices embodying new technology. If it is apparent that customary technology has not kept up with commercially available technology, or if increasingly widespread deployment of new technology points to establishment of a new custom in the industry, judges and juries may not view a railroad's adherence to the past custom as providing reasonably adequate crossing warning. Government and industry-sponsored research and demonstrations may play an expanding role in increasing the availability of grade crossing warning equipment embodying new technology. Thus, a railroad which ignores these developments and continues to adhere to customary technology may unintentionally be increasing its liability exposure.

REFERENCES AND NOTES

1. Between 1960 and 1970, the total number of casualties (deaths and injuries) in accidents involving trains and motor vehicles at public railroad-highway grade crossings ranged from a low of 4226 in 1962 to a high of 5584 in 1966. Although there was a general downward trend in train miles until 1958 (and thus a corresponding decline in casualties), this has since been offset by an increased upward trend in motor vehicles miles traveled. Source: Federal Railroad Administration and Federal Highway Administration, U.S. Department of Transportation, "Report to Congress on Railroad Highway Safety," Part I, November 1971, pp. 6-17.
2. For a brief history of the development and deployment of equipment at railroad grade crossings, see "Rail-Highway Grade Crossing Warning Systems: Equipment and Application," Railway Progress Institute, 1977, pp. 1-3 / 1-4.
3. See, Highway Safety Act of 1970, P.L. 91-605, Section 205(a), 23 U.S.C. Section 322, as amended; Railroad Safety Act of 1970, P.L. 91-458, Section 204(a), 45 U.S.C. Section 431; Federal-Aid Highway Act of 1973, P.L. 93-87 Section 203, 23 U.S.C. Section 130, as amended.

4. See, for example, Federal Highway Administration Evaluation of the Railroad-Highway Grade Crossing Safety Program, Remarks by Howard L. Anderson, National Conference on Railroad Highway Crossing Safety, University of Utah, August 23-25, 1977. One table contained therein evaluated accident rates for various warning device types as a function of highway and train volume.
5. Supra note 2.
6. The case law reviewed for this study was found in 1) legal encyclopedias, 2) the American Law Reports Annotated, 3) law treatises, 4) law review articles, 5) West's Regional Reporter System, 6) West's National Reporter System, and 7) West's Supreme Court Reporter. This brief survey should not be considered a comprehensive review of all the case law potentially applicable to the topics presented. See generally, The Research Group, Inc. (under contract to the U.S. Dept. of Commerce, Interagency Task Force on Product Liability), "Product Liability: Legal Study," Vols. II & III ("The State of Product Liability Law"). The law relating to products liability is rapidly developing, and legal advice should be obtained as to the legal consequences of particular fact situations.

7. The question of the amount of testing required before new technology is deployed is beyond the scope of this report. Generally speaking, however, if there is a high degree of danger to be anticipated from failure of a particular device, there may be a duty to adhere to a high standard of care in regard to the amount of testing required. See Northwest Airlines, Inc. v. Glenn L. Martin Co., 224 F. 2d 120 (6th Cir. 1955), cert. denied, 350 U.S. 937 (1956) (applying Ohio Law), where the jury was presented the question of whether an aluminum alloy used in a wing joint had been sufficiently tested for metal fatigue.
8. The research for this paper was performed during the summer of 1978 by Mr. Mond.
9. See, generally, 65 Am Jur 2d, Railroads, Sections 386, 390, 477-522. (1977).
10. Gallagher v. Montpelier & W. R.R. Co., 100 Vt. 299, 137 A. 207 (1927) (defendant railroad held not liable for motorist's injuries despite railroad's failure to give warning of presence of train on crossing, where motorist failed to take prudent precautions while approaching the crossing).

11. Grand Trunk R. Co. v. Ives, 144 U.S. 408, 36 L. Ed. 485, 12 S. Ct. 679 (1892). The court noted that what constitutes "reasonable care" cannot be arbitrarily defined, but is fixed according to the jury's judgement and experience of what reasonable men would do under the circumstances. 144 U.S. at 417. Thus it noted that whether reasonable care required a railroad company to keep a flagman stationed at a crossing that was especially dangerous was a question of fact for the jury.

12. Delaware, L. and W.R. Co., v. Converse, 139 U.S. 469 at 473, 35 L. Ed. 213, 11 S. Ct. 569 (1871) (severing of train cars at night, so that rear section of cars entered the crossing without any warning whatsoever, held to be negligence as a matter of law).

13. Grand Trunk R. Co., v. Ives, 144 U.S. 408, 36 L. Ed. 485, 12 S. Ct. 679 (1892). The court said: "In a crossing within a city, or where the travel is great, reasonable care would require a flagman constantly at the crossing, or gates or bars, so as to prevent injury; but such care would not be required at a crossing in the country, where but few persons passed each day." 144 U.S. at 420.

14. See generally, 2 F. Harper and F. James, Law of Torts, Section 28.13 (1956).

15. C. F. Dillingham v. Chevrolet Motor Co., 17 F. Supp. 615, 617 (W.D. Okla. 1936). In general, evidence of prior accidents may be admitted for the purpose of showing the dangerous nature of a crossing and the defendant's knowledge of this fact. Atlantic Coastline R. Co. v. Hadlock, 180 F. 2d 105 (5th cir., 1950); accord, Moore v. Bloomington, D. and C. R. Co., 295 Ill. 63, 128 N.E. 721 (1920). Admission of such evidence, however, is contingent upon a showing that the conditions operating to produce the accident have been substantially similar on the two or more occasions in question. Porter v. Chicago, M. St. P. and P.R. Co., 41 Wash. 2d 836, 252 P. 2d 306 (1953); Missouri-Kansas-Texas R. Co. v. McFerrin, 279 S.W. 2d 410, rev'd on other grounds 156 Tex. 69, 291 S.W. 2d 931 (1956). In Evans v. Pennsylvania Railroad Co., 255 F. 2d 205 (3rd Cir. 1959), the court admitted evidence of prior accidents for the purpose of showing the defendant railroad's notice of the dangerous character of the crossing. Although the court qualified admission of the evidence as not being for the purpose of showing negligence itself, it did not require earlier accidents to be under circumstances exactly similar to those in the case being litigated. 255 F. 2d at 210. In such a

situation, a jury left to its own devices, may view such evidence as significant on the question of negligence, despite instructions from the judge to the contrary.

16. (f.) Black's Law Dictionary, 4th Ed. Rev., West Publishing Co., P. 461 (1968).
17. 2 Harper and James, supra note 14 at Section 17.3 (1956). Evidence of custom may have bearing on the reasonable feasibility of a particular safeguard. Holding a defendant who has conformed to custom negligent will force change upon an entire industry. Id. In Williams v. New York Rapid Transit Corp., 272 N.Y. 366, 6 N.E. 2d 58 (1936), for example, a holding that the defendant railroad was negligent would have forced expensive reconstruction of railway platforms throughout the country. Holding negligent a defendant who has departed from custom, however, will not disturb the fabric of a trade, and the custom itself is therefore considered generally feasible. In either event, the question is one for the jury to decide.
18. 224 F. 2d 120 at 129-130, (6th Cir. 1955), cert. denied, 350 U.S. 937, 76 S. Ct. 308 (1956).

19. 219 F. Supp. 556 (D. Del. 1963), affirmed in pertinent part, 342 F. 2d 232 (3d Cir. 1965).

20. 219 F. Supp. at 569.

21. Id. at 572. The court also noted that "many vexing and complicated problems with which big business is faced" in developing new technology, but responded by pointing to the "virtual monopoly" which United enjoyed. The lack of competitive pressure, the court stated, gave United the freedom to schedule its development program "in a manner most favorable to its overall operations without the threat of losing business." Id.

For an in-depth discussion of the allocation of financial responsibilities for improvement and upgrading of grade crossings, see "A Legal-Historical Review of the Division of Responsibility for the Elimination and Protection of Railroad-Highway Crossings," reprinted in "Report to Congress on Railroad Highway Safety," supra note 1, at Part I, Appendix A.

22. "Recent Development-A Manufacturer's Continuing Duty to Improve Products," 27 Ohio State Law Journal 746 (1966). For a discussion of the various theories of liability which may or may not justify the decision reached in Noel, v.

United Aircraft Corp., supra note 19, see 40 Tulane Law Review 436 (1966). The author justifies the post-sale duty of care theory on the inadequacy of a simple warning to the carrier, it being foreseeable that the carrier might consider prolonged grounding of the aircraft too burdensome economically in light of the degree of risk involved (no lives had been lost previously). The carrier, furthermore, lacked contractual basis for demanding a cure, and the manufacturer was the only party with technical competence to perfect a corrective device. An alternative to a post-sale duty of care theory as justification for the decision is based upon design or construction negligence at the time of sale. This theory, however, would produce an absolute obligation to prevent injuries after sale, regardless of whether there was knowledge of the danger or a known means of remedying it. The post-sale duty theory would therefore seem the preferable one. Only one opinion handed down since Noel has even acknowledged the rule that a manufacturer is under a continuing duty to improve its product when "human safety" is involved. The court, in Braniff Airways, Inc. v. Curtiss-Wright Corp., 411 F. 2d 451 (1969) found it not necessary to adopt the rule in Noel. The court stated only that it was clear that after a product has been sold and dangerous defects have come to the manufacturer's attention, the manufacturer has a duty either to remedy these or, if

complete remedy is not feasible, at least to give users adequate warnings and instructions concerning methods of minimizing the danger. The case was submitted to the jury on the issue of negligence where the manufacturer had changed the design of the aircraft engine and the manufacturer knew such changes in design caused "scuffing" difficulties but took no effective action to remedy the problems.

23. In the grade crossing field, research demonstrating technical feasibility of new warning device technology may also be done by the Federal Government. Once such research is made available to the railroads and suppliers, the Noel doctrine arguably would impose a duty to adopt that research for use at grade crossings.
24. Air Safety Symposium, 34 Journal of Air Law and Commerce at 492, 494 (1968).
25. Noel, "Manufacturer's Negligence," Yale L. J. 816 at 847 (1962).
26. 54 Pa. 345 at 352 (1897) (use of sparkcatchers by other railroads relevant evidence on question of ordinary care).

27. 224 F. 2d 120 at 129 (6th Cir. 1955).
28. 60 F. 2d 737 (2d Cir. 1932).
29. Id. at 740.
30. Where the design choice at issue was obviously unreasonable and there existed little used but widely recognized design alternatives, the recognition of which required no expert knowledge or managerial background, courts have found a duty beyond general industry or custom. In the T. J. Hooper, supra note 28, for example, expertise was unimportant to the choice of whether radio receiving sets should have been adopted for use on ocean-going tugs. The court therefore felt free to require more of the defendant than was the general custom in the industry. Such analysis may lend itself to the grade crossing problem.
31. For example, if an automobile is placed on the market with defective brakes, a warning of that fact to the purchaser will not protect everyone coming into contact with the dangerous vehicle. Other automobile owners and pedestrians are subjected to the danger without warning of its existence. See, e.g., Comstock v. General Motors Corporation, 358 Mich. 163, 99 N.W. 2d 627 (1959).

32. In Caruth v. Mariani, 11 Ariz. App. 188 at 190, 463 P. 2d 83, 85 (1970), the court, in justifying an extension of manufacturer's liability to a non-purchaser bystander, who was struck by a car experiencing brake failure, concluded: "[Bystanders] should be entitled to greater protection than the consumer or user where the injury to the bystander from the defect is reasonably foreseeable because consumers and users, at least, have an opportunity to inspect for defects and to limit their purchases to articles manufactured by reputable manufacturers and sold by reputable retailers, whereas the bystander ordinarily has no such opportunity. Or, to put it another way, at least the consumer or user when buying an automobile has a chance to "kick the tires." The duty to prevent injury to persons not in privity (having a legal relationship with the manufacturer) was originally recognized in MacPherson v. Buick Motor Co., 217 N.Y. 382, 111 N.E. 1050 (1916), and has long been well settled in the law of products liability. See Restatement of Torts, 2d, Section 388 (1965): ("One who supplies directly or through a third person a chattel for another to use is subject to liability to those whom the supplier should expect to use the chattel with the consent of the other or to be endangered by its probable use, for physical harm caused by the use of the chattel in the manner for which and by a person for whose use it is supplied, if the supplier: (a)

knows or has reason to know that the chattel is or is likely to be dangerous for the use for which it is supplied; and (b) has no reason to believe that those for whose use the chattel is supplied will realize its dangerous condition, and (c) fails to exercise reasonable care to inform them of its dangerous condition or of the facts which make it likely to be dangerous."

33. Although courts usually focus upon the adequacy of warning given in products liability cases as grounds for determining liability, they are forced to consider technical issues of improper design where warning is impossible or ineffective. Henderson, James A., "Judicial Review of Manufacturers' Conscious Design Choices: The Limits of Adjudication," 73 Columbia Law Review 1531 (1973). Because the issue of warning in railroad grade crossing cases cannot be considered apart from the issue of improper design (what warning devices used), courts may similarly be forced to consider warning device design choices.
34. 197 Pa. 625, 47 A. 846 (1901) (moving heavy girders by hand not the usual way in business).

35. 52 S.E. 700, 701, 104 Va. 836 (1906) (water gauge, different than that used by other railroads, exploded, injuring employee).
36. 535 P. 2d 599 at 609, 111 Ariz. 560 (1975).
37. California Public Utilities Commission, "The Effectiveness of Automatic Protection in Reducing Accident Frequency and Severity at Public Grade Crossings in California," August 1975.
38. Noel, "Manufacturer's Negligence," 71 Yale L. J. 816, 850, (1962).
39. Id. at 851. Muller v. A. B. Kirschbaum, 298 Pa. 560, 148 A. 851, 853 (1930) (coffee urn lacked reducing valve customarily provided in similar construction).
40. Annotation, "Admissibility in Evidence, on Issue of Negligence, of Codes or Standards of Safety Issued or Sponsored by Governmental Body or by Voluntary Association," 58 ALR 3d 154, Section 2 [a] (1974).
41. Recommended Practices for Railroad-Highway Grade Crossing Warning Systems, Bulletin No. 7, Bulletin of Communication

and Signal Section, Association of American Railroads, Washington DC, 1974, p. 1. The weight given to the AAR Bulletin by judges and juries in determining what constitutes "reasonable conduct" may be influenced by attitudes concerning self-regulation such as that expressed by The Report of the National Commission on Product Safety:

"In no standards procedure can it be said that consumers have a substantial voice. Rarely have they an effective veto. Safety itself has been a secondary consideration in the usual process of developing voluntary standards. The need for a consensus commonly waters down a proposed standard until it is little more than an affirmation of the status quo...

Dependence on industry financing and technical experts who are paid by industry as regular employees, consultants, or contractors tends to subordinate rational interest to private ends...

National Commission on Product Safety, Final Report, June 1970, at p. 62.

42. U.S. Department of Transportation, Federal Highway Administration, MUTCD, Part VIII-Traffic Control Systems for Railroad Highway Grade Crossings, 1977. Part VIII of the MUTCD is the national standard for traffic control devices

at railroad-highway grade crossings (43 FR 35491, August 10, 1978).

43. In Texas & Pacific Ry, Co. v. Behymer, 189 U.S. 468, 23 S. Ct. 622, 623 (1902), the court said: "What usually is done may be evidence of what ought to be done, but what ought to be done is fixed by a standard of reasonable prudence, whether it usually is complied with or not."
44. 110 N.E. 2d 266, 349 Ill. App. 139 (Ill. App. Ct. 1953).
45. 110 N.E. 2d at 269.

The AAR Bulletin itself contains the following cautionary language:

"These recommendations are intended to serve as guidelines only and are not to be taken or interpreted as absolute standards to be followed in all circumstances. Engineering judgement should be used considering local conditions and laws and regulations of both public authorities and railroad companies.... The practices set forth herein do not in any way imply or suggest inadequacy of any installation which may not conform to the provisions of this bulletin. . . (or suggest) that existing installations need to be modified

solely for the purpose of conforming with the practices set forth herein." Bulletin No. 7, Supra note 41.

46. But see, St. Louis - San Francisco R. Co. v. Bunlinson, 262 So. 2d 280 (Fla. Dist. Ct. App., 1972), where the court held that the railroad's failure to observe AAR signalization procedures would support a finding of negligence. (Even in this case, however, the jury was bound to find negligence as a result of the failure to follow the generally recognized safety rule. Liability turns upon the reasonableness of the railroad's actions, of which safety rules are but one factor.)
47. Henderson, "Manufacturers' Design Choices," 73 Columbia Law Review 1531 at 1555 (1973).
48. See Morris; "Role of Criminal Statutes in Negligence Actions," 49 Columbia L. Rev. 21 (1949).
49. See 2 Harper and James., supra note 14, at Section 17.6, n.66.
50. 275 F. Supp. 373 (W.D. Pa., 1967).
51. 15 U.S.C. Sections 1191 et seq.