

National Cooperative Highway Research Program

NCHRP Synthesis 265

**Managing Product Liability to
Achieve Highway Innovations**

A Synthesis of Highway Practice

Transportation Research Board
National Research Council

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National Cooperative Highway Research Program

Synthesis of Highway Practice 265

Managing Product Liability to Achieve Highway Innovations

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Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communication and cooperation with federal, state, and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

NOTE: The Transportation Research Board, the National Research Council, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the individual states participating in the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

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NOTICE

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration of the U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to highway administrators and engineers. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire community, the American Association of State Highway and Transportation Officials has, through the mechanism of the National Cooperative Highway Research Program, authorized the Transportation Research Board to undertake a continuing project to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

*By Staff
Transportation
Research Board*

This synthesis will be of interest to state DOT engineers, legal counsel, researchers, and administrators; transportation product development engineers, equipment manufacturers, and engineering and product manufacturer associations; state, regional, and federal product testing and evaluation centers; and attorneys of law interested in tort liability as it applies to highway innovations. The synthesis describes the current state of the practice for managing product liability to achieve highway innovations. Information for the synthesis was collected by surveying and interviewing state transportation agencies and private transportation related organizations and by conducting a literature search.

Administrators, engineers, and researchers are continually faced with highway problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to available practices for solving or alleviating the problem. In an effort to correct this situation, a continuing NCHRP project, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common highway problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCHRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific highway problems or sets of closely related problems.

This report of the Transportation Research Board identifies and discusses specific tort and product liability problems and principles, the specific tort liability experience of public agencies in state DOTs, and the tort liability experience of private organizations involved in introducing new products to the highway market. In addition, details on the litigation risks of highway innovation, the perceptions and perspectives of public agency

and private sector personnel, and the state-of-the-art methods to confront litigation risks are presented. Finally, methodological comparisons and a general tort and product liability overview are included in the appendices.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of state highway and transportation departments. A topic panel of experts in the subject area was established to guide the research in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

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Crawford F. Jencks, Manager, National Cooperative Highway Research Program, assisted the NCHRP 20-5 staff and the Topic Panel.

Information on current practice was provided by many highway and transportation agencies. Their cooperation and assistance are appreciated.

MANAGING PRODUCT LIABILITY TO ACHIEVE HIGHWAY INNOVATIONS

SUMMARY

There is concern among policymakers that the highway community, including private sector suppliers of highway products and services, has substantially lagged other sectors of the economy in the application of technological advancements. They point to innovations in communications and information systems, materials, electronics, computers, vehicle systems, and manufacturing processes and question why these advancements, which permeate many industries, are not similarly prevalent in the highway industry. Their fear is that without faster paced innovation in highway products and services, sustained improvement in highway conditions is unlikely.

Explanations for the highway industry's slower rate of innovation cite the fear of liability among both the private sector and public highway agencies as a principal inhibitor of innovation and experimentation in the highway community. Since the 1960s, governments in the United States have steadily lost the protection from litigation provided by sovereign immunity. The number of claims and lawsuits associated with highway conditions has risen continuously, placing highway agencies under an increasing financial burden from tort liability. In this environment, it is argued, agencies are reluctant to move forward with new technologies because of the risk of increasing their liability exposure.

Private sector highway suppliers' heightened concern with liability is attributed, in part, to accelerated product liability litigation throughout society in general during the 1980s coupled with a perception that highway product applications create a high level of liability exposure. The contention is that private sector anxiety over potential product liability is sufficiently significant to stifle innovation and technological advancement of products destined for the highway sector. If accurate, this is a particularly troublesome scenario for the highway community, which is looking to the private sector's innovative capability as the principal source of technological advancements needed to meet forever growing demands on highway systems.

The principal objective of this synthesis is to closely examine product liability as a potential inhibitor to innovation in the public highway sector. The synthesis focuses solely on highway applications and does not include in-vehicle technologies. A literature review was undertaken for information on the magnitude, pervasiveness, and costs of product liability litigation in general. Experience more specific to highway product litigation was sought through two surveys, one to the states, District of Columbia, and Canadian provinces and a second to a selection of private sector highway suppliers. A review and application of relevant legal theories is used to explain some of the findings on current product liability experience.

The surveys also explored for the impact of product liability on innovation through questions directed to product and research and development decisionmaking, costs and availability of insurance, and state requirements for procurement, testing, and acceptance of highway products. These questions were designed on the basis of an analytical framework developed by RAND Corporation to examine, in part, the linkage between product liability and private sector management decisionmaking. The surveys also sought opinions on the impact of various tort and product liability reform measures and the literature review provided additional insights on this subject as well.

One of the unfortunate difficulties in the product liability reform debate is that there is no comprehensive database available to answer, unequivocally, fundamental questions on the magnitude, pervasiveness, costs, and nature of products and organizations involved in product liability litigation. Best estimates must be drawn from periodic studies made using partial databases collected on either federal court or a portion of state court filings. Even with the limitations of these efforts, however, the following conclusions can reasonably be made:

- Governments are rarely involved in product liability litigation, either federal or state courts.
- Product liability litigation is a relatively small portion (less than 4 percent as of 1986) of total federal and state civil litigation. However, its relative share of federal court filings appears to be growing and the impact of individual product suits is often more significant than other types of civil suits because of the magnitude of costs and numbers of plaintiffs that tend to be involved.
- Highway products have not been involved in an explosion of product liability litigation. The explosion theory sometimes used to describe the current product liability environment is associated with a small number of products (asbestos, Dalkon Shield, Bendectin) and defendants named in thousands of suits. On the other hand, thousands of firms have experienced some product litigation, such as one or two suits, but the litigation trends for this group are no different than for other categories of federal civil litigation.

The literature review and public and private sector surveys found that highway product suppliers and state highway agencies had little experience with being sued for defective highway products under product liability theories. A review of liability principles produced numerous insights on why product liability theories are not genially applied in suits against governments for hazardous highway conditions and why suppliers of highway products are reasonably shielded from product litigation. Public highway agencies are held liable for dangerous conditions of the highway on the basis of public premises legal theories rather than product liability theories, even though dangerous conditions may be caused by defective products installed into the highway infrastructure. The following may explain the reasons for plaintiffs' choice of premises over product theories:

- Premises theories are generally sufficient for liability,
- The high degree of civil engineering care used in the testing and selection of new materials,
- Product sellers are generally too remote from injured parties to be held liable, and
- Little evidence of states using third-party practice (impleading).

The practical effect of this choice has been to deflect liability for defective products away from product sellers. Current and past practice however, should not be construed to say that product theories would be pursued against highway suppliers in future highway condition cases. Nonetheless, at least four factors seem to favor the current focus on governmental responsibility for highway conditions and thus the use of premises theories in highway cases:

- Government visibility relating to control and responsibility for highway infrastructure conditions,
- The deep pockets of governmental agencies,
- Government's pervasive infrastructure responsibilities extending from conception to maintenance of existing facilities, and
- Difficulty of proving a highway product failure as the cause of a highway accident.

In general, highway suppliers view product liability litigation as an important factor in product related management decisions, regardless of whether the product is destined for

public highway or other markets served by the suppliers. Potential product liability is not the principal factor inhibiting highway product or service innovation, however. Other factors generally related to public purchasing requirements, plus a multitude of state testing and certification standards, are believed to be more significant barriers than potential product liability to the provision of innovative highway products or services.

Some survey respondents do not believe that product liability litigation is inhibiting innovation. Approximately one-third of the private sector respondents indicated that concern over product liability litigation inhibits innovation in at least one of their firm's products. The impact on innovation is revealed principally through an unwillingness to invest in sufficient product research and development to create innovative products or through decisions not to offer new highway products or services. On the other hand, one-half of the private sector surveys indicated that product liability litigation does not impede innovation in their firms. A large majority of public sector respondents also believed that product liability litigation is not a barrier to highway innovation.

Most members of the highway community are unaware of the considerable successes in tort and product liability reform. Many state courts and legislatures are drawing a balance in the tort system away from favoring plaintiffs. However, reform is not generally consistent between the states and efforts have been politicized at the federal level, where there has been only limited success. Respondents do not expect reform to have much positive impact on the deployment of new technologies.

Responsible highway design decisions must consider methods to avoid injuries from highway product failures. This concern is inevitable in the highway community and is strongly related to the anxiety over product liability. Sound public policymaking on tort and product liability reform depends on good data about cases and settlements. Better tort databases are needed, preferably collected and analyzed by interdisciplinary teams reflecting expertise in the critical disciplines of tort litigation, risk management, and civil engineering.

Much of the existing misconception that product liability erects barriers to highway innovation could be alleviated with broad dissemination of the results of this synthesis showing the lack of product liability litigation experience. Such progress would be reinforced with greater publicity about the rather extensive product liability and tort reforms adopted in most states. Indeed, advocating tort reforms seems a wise course. However, some states have turned back some forms of tort reform on state constitutional grounds. This suggests seeking more balanced reforms rather than industry-specific tort exemptions. Federal attempts at tort and product liability reform risk raising "state's rights" issues. This "federalism" issue deserves further research so that the balance between a uniform federal scheme and state-by-state experimentation with reform can be evaluated.

INTRODUCTION

BACKGROUND

The tort system developed in western culture to compensate victims of civil wrongs. It serves to further justice and fairness and provides an economic incentive to continually raise standards of professional care. As society has advanced technologically, dangerous conditions and the cause of product failures have become increasingly complex. Concurrently, courts have generally become more sympathetic to victims' rights and society more litigious. As governments have steadily lost the protection from litigation provided by sovereign immunity, a tort crisis is now perceived. In this context, highway agencies and state governments have been exposed to an increasing financial burden of liability.

As highway agencies at all governmental levels in the United States struggled to maintain and rebuild an aging highway network during the early 1980s, concern was expressed within the highway research community that without innovation in highway products and processes, sustained improvements in highway conditions were unlikely (1). While technological advances were readily recognized as accelerating performance in computers, communications, electronics, and material sciences, innovation in the highway industry was lagging in comparison (2).

The 1980s also witnessed a growing concern with burdens that product liability litigation may be imposing on U.S. businesses (3,4). One of these burdens was believed to be a product liability environment that created a disincentive for innovation. A survey sponsored by the Conference Board, a business information service whose purpose is to assist senior executives and other leaders through an international program of research and meetings, found a high percentage of its manufacturer respondents had either discontinued existing products, not introduced new products, or reduced product research due to liability concerns (5).

Liability issues were also being identified as one of the barriers to innovation in the construction industry in general and in the highway industry specifically. Harvey M. Bernstein of the Civil Engineering Research Foundation (CERF), a non-profit research organization of the American Society of Civil Engineers, wrote that "Tort liability has created a crisis in the U.S. and has become a strong disincentive to the introduction of new innovation into practice"(6).

The genesis of this synthesis study has its roots in the Final Report of the Task Force on Highway Research in Industry (7). The Task Force was created by the Transportation Research Board (TRB) in 1990 to explore means of expanding private industry involvement in highway technological advances. In discussing barriers to innovation, the Task Force stated:

Tort liability has been a major deterrent to innovation and experimentation in the highway community both by the private

sector and the highway agencies. . . . The societal and legal issues are complex and contentious, but the impact on innovation is significant and the highway community needs to assess the real costs of this unrestrained litigation on its budgets and programs and seek ways to reduce this damage.

In recognition of the need for factual information, the Task Force identified a study of the impact of tort liability on highway innovation as the fourth item on a prioritized list of 17 prospective activities and proposed that the study be conducted through the National Cooperative Highway Research Program Synthesis Studies Project (i.e., NCHRP Special Project 20-5, Synthesis of Highway Practice).

SYNTHESIS OBJECTIVES

The purposes of this synthesis are threefold: first, to identify and discuss specific tort and product liability problems and principles; second, to identify the tort liability experience of public agencies in all U.S. states, the District of Columbia, Puerto Rico, and the Canadian Provinces; and third, to identify the tort liability experience of selected private organizations involved in introducing new products to the highway market. A literature review on tort problems and product liability relating to highway innovations provides fundamental background. Pilot interviews among state agencies in several Northeastern states and the Federal Highway Administration refined the development of a survey questionnaire instrument administered to public highway agencies. A companion survey was developed for administration to private sector suppliers covering the impact of product liability laws and product liability reform on the deployment of new products and technologies. The synthesis focuses solely on highway applications and does not include in-vehicle technologies.

A major objective of this study was to examine whether and how product liability and tort laws may impose disincentives to public agencies and to private organizations in deploying new technologies. Components of these barrier problems are listed below.

Disincentives to Deployment of Highway Innovations

- Perception versus reality of product liability as a barrier to innovation,
- Relative priority of product liability risk concerns as an inhibitor to deployment compared to other legal constraints, e.g., privacy, procurement, intellectual property,
- Product liability litigation risk exposure of public agencies, private suppliers, and contractors to experimentation and deployment of new products, processes, and equipment,

- Resistance to change in an established market in traditional technologies,
- Unfamiliarity with opportunities and apprehension of litigation risks by some private sector firms in introducing new products into the highway sector, and
- Evolving criteria for testing and acceptance.

The synthesis also reports information on various tort and product liability reform methods that respond to the perceived product liability litigation risk in introducing highway innovations.

Tort and Product Liability Reforms

- Sovereign immunity,
- Specialized forums for damage claims,
- Statutory mandates to deploy technologies,
- Prequalification by testing and certification,
- Liability limitations and damage caps,
- Demonstration projects,
- Completeness and accuracy of disclosing product performance and specifications,
 - Insurance and indemnity,
 - Warranty coverage and beneficiaries,
 - Evaluation of standards and testing,
 - Privatization,
 - Statutes of limitation/repose, and
 - Liability limitation statutes for architects and builders.

NATURE AND EXTENT OF HIGHWAY TORT LIABILITY

At state and local levels, tort liability issues and the financial costs associated with tort actions against governmental units are of great concern. No governmental responsibility creates more risk or exposure to liability than the design, construction, maintenance, and operation of street and road systems. In Pennsylvania, for example, approximately 75 percent of tort actions against the Commonwealth are related to motor vehicle accidents associated with alleged conditions of the highway.

Prior to the mid-1960s, the doctrine of sovereign immunity provided most state and local governments with a nearly impregnable defense to tort liability. However, changing public attitudes on highway safety, social justice, and tort litigation in general, coupled with state court opinions eroding the once-unassailable doctrine, prompted a majority of state legislatures to modify their sovereign immunity statutes in the late 1960s and 1970s. These modifications enabled plaintiffs to hold governments liable for negligent performance of their duties and afforded individuals a judicial mechanism for collecting monetary compensation for losses due to government negligence. Victim compensation prior to that time was generally effected through special private legislation.

On the heels of the erosion of governmental immunity came a multitude of tort claims and lawsuits. Recent nationwide

estimates made for the American Association of State Highway and Transportation Officials (AASHTO) indicate that highway related tort claims or cases have grown almost 15 percent annually since 1972 (8). Although the complete picture is unknown, estimates of state payments made in settlements or judgments based on partial responses to previous AASHTO surveys range from \$135 million to \$345 million for 1991 alone. The number of pending claims and lawsuits against state transportation agencies is estimated to exceed 30,000 (8).

During the 1980s, responsible state and local governments implemented risk management programs and processes in response to rising costs of tort liability (9-11). The purpose of highway risk management is to identify and mitigate the dangerous conditions that raise the risk of tort actions. Successful risk management thereby provides the information needed to improve the safety and quality of the public roadway system. There are different organizational structures responsible for risk management and tort defense in the various states. Although many states manage risk by purchasing liability insurance, other states are self-insured. As of 1992, at least 28 states were self-insured, one consequence of which is that the state assumes a much larger responsibility for claims administration. The rise of state tort liability has clearly had several significant financial and organizational impacts on the states.

MAGNITUDE AND TRENDS IN PRODUCT LIABILITY LITIGATION

There is no single comprehensive compilation or database of all litigation from which accurate statistical analysis can be derived to answer questions fundamental to public policy decisionmaking. The empirical deficiencies in court records include:

- The number of product liability suits filed each year against private businesses and public agencies,
- The annual growth rate in product liability filings,
- The total amount paid out in settlements and judgments for product liability litigation by private businesses, public agencies and insurance companies each year,
- The number of private businesses or public agencies involved in product liability litigation each year,
- The industries that tend to be involved in product liability litigation, and
- The nature of the products involved in product liability litigation.

Nor can separate federal and state judicial system compilations be combined to obtain a complete picture on these questions. Likewise, no inclusive study has been attempted on these or similar product liability trends. Recognizing that a complete picture is not available at this time, the purpose of this section is to review findings of several recent studies that, while limited in scope, nonetheless provide at least a partial

and best currently available analysis of the extent and nature of product liability litigation.

Answers to the above questions were sought as the policy debate on tort reform roared through the mid-1980s. Those arguing for reform were claiming that federal product liability litigation was escalating at an alarming rate and that this growth was not confined or explained by a surge in cases involving just a few products but, rather, was pervasive throughout the U.S. economy (12). Others countered that the apparent explosion in product liability suits was caused principally by a few products that involved a relatively small number of companies and industries (13-15). Asbestos, the Dalkon Shield, and Bendectin were the products most frequently cited.

In an effort to provide a better empirical foundation for the debate, Terence Dungworth of The RAND Corporation's Institute for Civil Justice created and analyzed a comprehensive federal court filings database for the period July 1, 1973 through June 30, 1986. A filing is a documented complaint that initiates a civil lawsuit. Dungworth's objectives were to (1) estimate the number of product liability lawsuits, (2) identify the types of products, industries, and number of businesses involved in product liability litigation, and (3) analyze the rate of filing growth (16).

As shown in Table 1, Dungworth found that product liability litigation at the federal level is relatively small, just 3.8 percent of total federal civil liability filings. A recent study issued by the Bureau of Justice Statistics (BJS), U.S. Department of Justice, on a sample of tort cases in state courts of general jurisdiction estimates a similar relative magnitude of product liability litigation, as shown in Table 2 (17). The BJS data are for torts only however, while Dungworth's federal data are for all civil litigation. (Additional detail and differences between the BJS and Dungworth approaches and estimates are discussed in Appendix A.) Using a National Center for State Courts estimate that torts constitute approximately 10 percent of all civil litigation filings in general jurisdiction courts decreases the estimated percentage of product liability litigation at the state level to less than one percent of all state civil litigation court filings (18).

TABLE 1
DISTRIBUTION OF FEDERAL CIVIL LIABILITY FILINGS,
SY74-86 (16)

Nature of the Suit	Cumulative Number	Percent
Product liability suits	85,694	3.8
Nonproduct torts	314,383	14.0
Other private civil cases	1,057,221	47.0
U.S. case	<u>790,241</u>	<u>35.2</u>
Total	2,247,539	100.0

While the number and relative magnitude of product liability cases is small, Dungworth suggests that their impact is often much more significant due to the magnitude of costs involved and the tendency for a higher than average number of plaintiffs to be involved in product liability suits. These other measures, though, cannot be determined from the federal or state databases (16).

TABLE 2
DISTRIBUTION OF TORT BY CASE TYPE FROM STATE
COURTS IN LARGEST COUNTIES (17)

Case Type	Number	Percent
Auto	227,515	60.1
Premises liability	65,492	17.3
Product liability	12,857	3.4
Product liability-toxic substance	6,045	1.6
Intentional injury	10,879	2.9
Malpractice	25,312	6.7
Slander/libel	3,159	0.8
Unknown tort	4,708	1.2
Other negligence	<u>22,347</u>	<u>5.9</u>
Total all torts	378,314	100.0

As for the types of products, industries, and number of businesses involved in product liability litigation, Dungworth found that product liability litigation in federal courts shows a diversity of patterns depending upon the industry and the specific firms within an industry. From his analysis, he characterizes two types of litigation, concentrated and dispersed. Concentrated litigation generally represents an explosion of suits associated with a single product, such as asbestos, the Dalkon Shield, or Bendectin, that tends to have a high level of exposure due to mass marketing and sales to a large customer base. Fewer than 80 companies accounted for half of the federal products liability cases filed between 1974 and 1986. Firms in this group tend to be associated with some aspect of asbestos or in one of three industries: tools, machinery, and industrial equipment; pharmaceuticals and healthcare products; or motor vehicles. The number of products involved is probably between 20 and 50 (16).

In contrast, dispersed litigation involves a large number of companies and variety of products, but a small number of suits per company. Dungworth found that almost 17,000 of the nearly 19,500 companies identified in product litigation were lead defendant only once over the 1974 to 1986 study period. The number of products involved numbers at least in the thousands (16).

Governments appear to be rarely involved as lead defendants in product liability litigation. Dungworth estimates that 26 government institutions were lead defendants in 1,562 federal product cases between 1974 and 1986. This represents approximately 1.8 percent of the estimated total number of product suits. Of an estimated 378,000 tort cases of all types in state courts of general jurisdiction, BJS estimates that 142 or 0.04 percent involved a governmental unit as the primary defendant in product liability litigation. Governmental units were plaintiffs in a similar number of product liability cases. Even if only the 20,250 tort cases involving governments as the primary defendant are considered, the 142 product liability cases still only represent 0.7 percent of state tort cases (17).

As for the rate of filing growth, for the period July 1, 1975 to June 30, 1986, annual federal product liability filings grew by 370 percent, from approximately 3,400 cases to over 12,600 suits (16). This growth rate far outpaced the growth of other types of civil suits, resulting in product liability cases constituting 5.3 percent of all federal civil filings by the end of

the period, up from 2.7 percent at the start of the period. This type of growth gives some support for the explosion theory of product litigation. In addition, however, the growth in the number of different companies named as lead defendants has also been pronounced, thus giving some credence to the pervasiveness theory.

Dungworth's closer examination of the data shows that an economywide generality may be misleading for several reasons.

Difficulties in Generalizing from Tort Data

- For asbestos, there was a filings explosion that occurred in the mid-1980s;
- For pharmaceuticals and health products, individual firms have experienced an explosion in suits that are tied to individual products. When these products are removed from the market, the litigation subsides; and
- No other corporate defendants were found to have litigation growth rates comparable to those found for asbestos or the single product pharmaceutical company experiences.

Outside of asbestos and single product pharmaceuticals, product liability litigation growth appears to be about seven percent per year over the 1975 to 1986 period. This rate was at 11 percent during the 1970s, slowing to four percent during the 1980s. Non-product torts were at about three percent annually during the 1980s while all other private suits grew at seven percent annually (16).

The implication is that filing patterns for the underlying product liability litigation—consisting of cases not involving products that individually lead to hundreds or thousands of suits—is more comparable to the remainder of the federal civil caseload than it is to the litigation represented by such products as asbestos, the Dalkon Shield, or Bendectin.

Based on these findings, Dungworth opines that both the explosion theory and the widespread phenomenon theory are only partially accurate descriptors of product liability litigation characteristics in the United States. He concludes that:

- The explosion theory is associated with a small number of defendants named in thousands of suits.
- The widespread phenomenon theory is associated with thousands of firms that have experienced a small amount of litigation, such as one or two product liability suits. Without the explosion group, litigation trends for this group are no different than they are for other categories of federal suits.
- This diversity of product liability experience is consistent with Hensler's findings on the characteristics of tort litigation in general (19).

The policy significance of these conclusions is that tort reform prescriptions should recognize the complexities of the product litigation environment and that any given reform measure may be appropriate for some situations but not for others (16).

No update has been attempted of Dungworth's study and the BJS estimates do not provide trends for state court cases. Nonetheless, several matters particularly relevant to this synthesis study appear clear to the extent that Dungworth's results remain valid. First, governments are seldom involved in product liability litigation, either in federal or state courts. Second, product liability litigation is a relatively small portion of total state and federal civil litigation, although as a portion of the latter, it may be growing at a significant rate. Third, highway products have not been involved in an explosion of product liability litigation.

HISTORICAL BACKGROUND OF PRODUCT LIABILITY LAW

Historically, product liability suits were brought infrequently and were usually unsuccessful. Two basic legal principles limited liability for unsafe products. A first legal principle limited product liability suits: *caveat emptor*, or "let the buyer beware." *Caveat emptor* protected sellers from buyers' suits, essentially requiring buyers to inspect each product for defects prior to purchase. Before the 20th century, products were simple and buyers had a basic understanding of most materials and mechanisms. *Caveat emptor* was also the result of the prevailing rugged individualism that demanded self-reliance during the development of the American frontier. It also protected the growth of the new American industrial base in the late 19th century by shielding manufacturers from product liability suits.

The industrial revolution changed the basic assumptions underlying *caveat emptor*. First, products became more complex, utilizing electronics, and a flood of new materials were developed with unknown characteristics: plastics, composites, metal alloys, dangerous chemicals, and synthetics. These new materials often have new and unknown mechanisms, with capabilities outside most buyers' general experience. Second, after the West was settled, the work skills of most people became increasingly specialized. The capabilities and rugged individualism of the jack-of-all-trades became unsuitable for the increasingly specialized factory work. Third, complex new products were mass-produced in distant factories, breaking the traditionally close contact buyers had with the local craftsmen who made the goods. As a result of these structural changes, buyers had greater difficulties comparing the safety and quality of new products to the experience they had with similar products.

The second legal principle limiting liability for defective products was the doctrine of *privity of contract*. *Privity* presumes legal responsibility only between two parties who deal directly together, such as by contract. When applied to product liability, *privity* denies the injured party the right to sue an entity or person in the distribution chain of an unsafe product unless the injured party had a purchase contract directly with that seller. Typically, suits against manufacturers were barred because the injured party purchased from a retailer. The assembler/manufacturer, wholesaler, or component part manufacturer lacked *privity* with the injured party and was thus shielded from liability. *Privity* was also absent if the injured

party was a bystander, such as a pedestrian in an auto accident or a member of the purchaser's family.

The recent trend—one of the most significant legal trends of this century—to relax privity somewhat in product liability cases, particularly suits based on tort theories. However, there is a resurgence of privity in service liability cases such as auditor malpractice. Other vestiges of privity also remain in products liability, particularly under the breach of warranty theory. The relaxation of privity has contributed to a change from *caveat emptor* to *caveat venditor* under which the seller must increasingly beware of defective products that harm consumers or bystanders even if there is no direct privity.

PRODUCT LIABILITY THEORIES

There are several theories of product liability; each is a separate legal basis for liability. As of this writing, the most significant product liability theories are found only in state laws. An awareness of the range of legal theories available to plaintiffs can better equip decisionmakers to reduce litigation risk. Product liability law is a hybrid from three major sources of law: the common law derived from judge-made precedents, statutes passed by the legislatures, and regulations promulgated by administrative agencies. Product liability is not a

fully distinct or unitary area of the law; that is, it comprises both tort law and contract law theories. Many of the complex results of this combination of sources and theories are discussed in this synthesis. At the outset, it is important to understand that this combination produces some redundancy between theories, some conflict among the theories, and some alternative types of proofs. This complexity often frustrates newcomers to the area. Initially, it should be recognized that the contract theories of express and implied warranty can be invoked by anyone entitled to enforce a contract for the sale of the goods.

Although it seems intuitive that products liability should be based on a contract, in actuality it has been the tort theories which have proliferated in the 20th century. The growth in product liability theories can be attributed to the inclusion of more tort theories, most notably negligence, strict liability, and misrepresentation. Tort theories generally expose all vendors to broader liability risk than under contract theories. Each theory, as applied in different states, may have different substantive and procedural requirements complicating general understanding of product liability and the expanding risk of liability. An understanding of the nuances of product liability law is essential for members of the highway community to effectively participate in the debate over reform. Appendix B provides a readily accessible overview of product liability law.

LITIGATION RISKS OF HIGHWAY INNOVATIONS

APPLICATION OF LIABILITY PRINCIPLES TO HIGHWAY INNOVATION

The traditional liability risk exposure for innovations in highways is based on two major areas of legal duties: (1) the public duty to provide services and (2) several particular duties owed by the owners of premises. This range of duties become legal responsibilities that subject state and local governments to liability derived from ownership and operation of public facilities for two reasons: (1) the operation of public infrastructure is considered an essential public works function of government and (2) such activities are located on real estate that traditionally carries safety responsibilities for those rightfully present. These dual sources produce near exclusive responsibilities for public agencies to provide safe highway facilities and it therefore exposes them to litigation risks.

The predominant legal theory of public premises liability is the tort of negligence. Premises negligence is similar to the product liability theory of negligence in that all conduct is judged by a hypothetical reasonable person standard. In each area, persons must act reasonably under the circumstances by foreseeing risks of harm and guarding against the harms caused by these risks. A breach of this duty results in negligence. However, there is no legal liability unless there is harm as a direct and proximate result of the negligent act. These are the elements of negligence that plaintiffs must allege and prove to make out a successful case for personal injury or property injury. First, the plaintiff must prove that a duty of due care for the defendant exists. Second, the plaintiff must prove the defendant breached the duty of care. Third, the plaintiff must prove the defendant's breach of duty (negligent act) caused the plaintiff's damages. Finally, the plaintiff must prove damages or injury were suffered.

Distinguishing Premises Liability from Product Liability

While the jurisprudence used to implement the negligence theory is similar in both premises and product liability suits, most liability suits alleging dangerous highway conditions are not products liability cases per se. This is apparently a fundamental source of rather widespread confusion. Government and public agencies may be held liable for dangerous conditions in the highway infrastructure, even if directly caused by the failure of a defective product, because highways are public premises (20). This is so even though the highway infrastructure is composed of products installed onto the real estate. Therefore, public agency liability is properly characterized as negligence with respect to some aspect of the public premises. This

litigation risk exposure has not traditionally been characterized as the state's liability for faulty products (20).

The distinction between product and premises liability may appear contrived at first, perhaps even an artificial legal technicality. However, in practice the distinction has several major impacts on the burden of proof for injured plaintiffs and on the liability exposure for suppliers of highway products and services. The most fundamental of these differences is that, in practice, the strict liability theory of products liability has not been generally applied to products after they become permanently installed in the real estate or as part of the highway infrastructure. Except for strict liability for ultrahazardous activities (e.g., use of explosives, crop dusting), state highway agencies have not been held to the greater risks associated with the less stringent proof standards of strict products liability for dangerous highway conditions. The primary basis for strict products liability suits, §402A of the Restatement of Torts, applies primarily to *sellers* of products and not generally to *owners* of premises (20). Instead, injuries sustained by hazardous highway conditions are largely judged under the tougher burden that requires proof of the negligence prima facie case.

The propensity to hold state agencies responsible for dangerous premises conditions, even those resulting from defective products, has had the practical effect of significantly deflecting liability for defective products away from sellers of highway products. The all-encompassing control and responsibility exercised over the highways by state highway agencies essentially has prevented most suppliers of highway products from much exposure for product liability litigation. This is not to say that a product liability case could not be made out against highway product sellers. However, four factors often work to substitute government for product sellers as the party ultimately held responsible.

Factors Minimizing Product Liability Claims Against Highway Suppliers

- Government visibility relating to highway infrastructure
- Apparent deep pockets of government entities
- Government's pervasive infrastructure responsibilities
- Difficulty of forensics in dangerous highway conditions

First, as the owner and operator responsible for the highway premises, the state highway agency has the highest *visibility*. This visibility suggests responsibility, and the apparent responsibility attracts damage suits. Second, states, local governments, and other quasi-governmental authorities operating highway projects are generally perceived as having *deep pockets*. Further, from an injured plaintiff's economic point of

view, the tax base and public financing of governmental entities makes them attractive as defendants. Third, the most principled justification for holding states liable for injuries resulting from dangerous highway conditions is that *government assumes ultimate responsibility* for the overall highway project from start to finish. Government acts as “orchestrator” by initiating the many policy determinations at the planning stage, administering at the programming stage, supervising at the implementation stage, and managing at the operations stage. Government entities have continuing legal duties consistent with their overarching involvement. However, if the design/build method by outside contractors becomes a trend, this third factor may become less convincing. Also, governments held liable for injuries from defective products can look for indemnity under third-party practice (impleader) from suppliers. Finally, the scientific *forensics* to determine the cause of failure can be difficult for complex products and complex construction projects. It can be difficult to identify particular sources of failure in compound products. Failure may destroy or so damage the defective component that reliable determination of precise causes is too difficult.

Ultimate liability may rest with government because of its oversight responsibilities. Of course, failures of particular products in some instances may be more evident than in others. For example, in many instances it may be easier and more obvious to discover the definitive cause of a sudden catastrophic failure. This might contrast with the difficulties of determining a single predominant cause for the failure of a highway element from slow deterioration. The deterioration could have multiple potential causes and it will likely be argued that there was ample opportunity for remediation before the injury in question.

Comparison of Premises Liability Theories with Product Liability Theories

Despite the differences between premises and products liability there are some interesting parallels. Both types of litigation can be based on the negligence theory. This suggests proof of negligence will follow a similar path in either context by following a similar inquiry into the processes underlying design, construction, and testing. For example, both types of negligence suits must examine the status of practice in either the particular product design and manufacturing or in the particular design and construction process for the allegedly defective highway element. The standard of foreseeability is used to determine whether there was sufficient speculation and then the examination of possible dangers undertaken to design around obvious dangers and thereby prevent injuries.

First, and most fundamentally, under both regimens there is a duty to use due care in developing the initial *design*. Product liability theory requires the manufacturer to design products in such a way as to eliminate defects that could lead to injury. Negligently designed products result from a lack of due care by the designer or manufacturer focusing the proof required on the design process, which must be examined closely for considerations of how carefully the designer(s) considered the foreseeability of particular danger(s). Generally, a reasonably

acting designer may escape negligence liability if the design appeared reasonable when first developed. Similarly, premises liability for improper design follows a like pattern of proof and sets a similar behavioral standard for highway design. The demise of general sovereign immunity also included the elimination of design immunity in many states, thereby exposing the development of highway designs to liability risk.

A second parallel duty accompanies the next subsequent phase: *manufacturing and construction*. Product liability law imposes a duty to use due care in manufacturing products. The parallel analog in premises liability is the duty to use due care in construction of the highway element(s). Proof of this duty often involves an examination of manufacturing, construction, and inspection records as well as forensics of the physical materials to discover whether a causal defect was preexisting. In the premises liability sector, this duty may also expose governments to litigation if they are responsible for negligent selection of inadequate contractors.

Third, product liability jurisprudence has developed two different concepts of *misinformational* liability: the duty to warn and the misrepresentation theory. Under the failure to warn theory, the seller of products can be held liable for either (1) a failure to detect knowable dangers or (2) to warn of known dangers. The misrepresentation theory holds sellers liable for misrepresenting the nature, composition, performance, or dangers of their products. A similar duty under premises liability exists for governments when they fail to adequately warn or sign the highway concerning dangerous road conditions that contribute to injuries. A variant of this duty extends to improper signing that misrepresents road conditions.

Fourth, product liability law imposes a *duty to test* designs, works in progress and finished products to discover defects. The corollary in premises liability is the duty to test and certify particular materials and equipment before permanent deployment. In addition, there is a duty during highway construction to inspect delivered materials before they are incorporated into the finished highway element and then again at the conclusion of each construction phase.

Finally, some states still recognize the *economic defense*, although its validity may be declining (21). The economic defense may permit states to prioritize their plans for projects to upgrade conditions to current standards while deferring expenditures to remediate the less hazardous sites when restricted by budget constraints. Risk/benefit analysis is sometimes used in product liability suits to evaluate how the investment in product design relates to the product’s inherent dangers and to the utility of the product in question. It has also been used by administrative agencies such as the Consumer Product Safety Commission (CPSC) in regulatory decisions to ban certain products or to require elaborate safety precautions.

Despite the similarities between the component duties under premises and product liability, there are also some differences that create other, relatively unique duties under each regimen. First, there is no duty to provide under product liability law like the duty requiring governments to provide certain public infrastructure. Second, absent a future oriented warranty regarding durability or wear, the product liability law imposes little or no continuing duty to maintain products. By

contrast, premises liability law recognizes there is steady deterioration of the highway infrastructure and such conditions require continuing and adequate maintenance. Third, there is seldom any product liability analog to the premises owner's duty to carefully operate the infrastructure (e.g., drawbridge, contra-flow express lanes, toll). Finally, there are also duties under product liability law with no counterpart duty under premises liability law, most notably: strict liability for unreasonably dangerous and defective products and the product seller's more general duty to adequately package and carefully handle the goods.

ANALYSIS OF STATUTORY PROVISIONS GOVERNING PRODUCT LIABILITY

Most tort laws in the United States and Canada have their origin in the English common law. By contrast, the civil law nations of the European continent depend almost exclusively on legislation to create new legal duties. The common law nations have taken their law-making heritage from the common law system of precedents. The strict common law approach permits only a limited role for legislation but instead introduces most new legal duties only after an actual dispute. The common law gives judges and juries the power to determine the reasonability of the parties' activities and then use this to establish new precedents or refine existing legal duties. Strong precedents emerge when many trial and appellate courts settle similar disputes by applying similar precedents. In a federated democratic republic like the United States or Canada, precedents are made even stronger when a majority of the states voluntarily adopt similar precedents in large numbers of cases. Some theorists, particularly those in the law and economics discipline of the University of Chicago school of thought, insist that broadly accepted precedents that stand the test of time are the most economically efficient set of legal rules (22). They further argue that the efficiency engendered by the common law should not be too easily overturned with temporal compromise of legislation because it also often represents an ill-conceived political settlement.

Legal scholars at the respected American Law Institute (ALI) have labored for nearly a century on the Restatement of the Law to address the problems of inconsistent and unclear laws inherent in a federal system. The Restatement is a fairly comprehensive compilation of precedents on various legal subjects from all the U.S. states. While the ALI usually clarifies the law by collecting and interpreting precedents, sometimes the ALI also seeks to influence the direction of common law development. Such normative efforts are occasionally profound. The ALI has produced two of the most significant product liability theories: strict liability under §402A and misrepresentation under §402B (23). These Restatement "views" have become the law in most states when product liability test cases were resolved through the judges' voluntary adoption of these views. Therefore, while the Second Restatement of Torts is not strictly a statute, it nevertheless performs a similar function. That is, the Restatement provides a fairly uniform national articulation of product liability law in the guise of quasi-legislation.

Genuine product liability statutes have advanced through two phases. First, a few early statutes were intended to expand product liability laws. Second, more recently there has been a proliferation of reform statutes, as part of the larger tort reform movement, that limit the growth in new victims rights and reform tort procedures. Many tort reforms have addressed the special interest risk exposures of particular groups, industries, or types of cases. For example, limitations have proliferated to constrain liability risk exposure of medical malpractice, ski resorts, product sellers, and others. Other reforms apply more generally to confine the operation of common law tort principles to broad categories, some even to all classes of tort cases. The initial and phenomenal success of tort reform efforts by the states is discussed in considerable detail in chapter 4. In addition, chapter 4 also reviews some troublesome setbacks in which some elements of these tort and product liability reforms have been invalidated.

ANALYSIS OF LIABILITY CASE LAW APPLICABLE TO HIGHWAY INNOVATIONS

A review of the literature and the survey conducted for this synthesis as discussed in the next chapter both confirm that few if any cases have ever held sellers or state highway agencies liable under product liability theories for defective highway products. Indeed, even though many respondents are deeply concerned about product liability risks and many have considerable experience with premises tort liability, no respondent can cite specific litigation over product failures that was based on any product liability theory. This near complete absence of case law or experience is pervasive over private sector suppliers, state highway departments, and state attorneys general. It relates to traditional products with decades of use experience as well as to new and innovative products. This lack of experience also extends comprehensively over the range of products used in highway applications, including: subsurface materials, surface materials, structures and structural components, drainage components, guideway and safety controls, and traffic control devices. This lack of litigation experience also relates to products across the full range of litigation risks, from products whose failure could produce sudden and catastrophic hazards of personal injury (e.g., structural failures) to lower-risk products susceptible primarily to slow or obvious deterioration (e.g., concrete integrity).

There appear to be four somewhat related reasons for this lack of product liability experience. First, premises liability is currently an adequate theory and thus has become the predominant theory of liability for hazardous highway conditions. Second, careful civil engineering practices provide an effective preventive to highway related injuries. Third, product sellers are generally rather remote parties from those injured by hazardous highway conditions, so product sellers will naturally sustain only limited exposure to liability. Fourth, there is little evidence that states use third-party practice (impleader) to substitute highway product suppliers as the responsible parties. These reasons are now discussed more fully.

Reasons Why Product Liability Theories Generally Have Not Applied to Hazardous Highway Conditions

- Premises liability is generally a sufficient theory
- Civil engineering conservatism is an effective hazard preventative
 - Product sellers are usually too remote to be held liable
 - Little evidence states use third-party practice (impleading).

Sufficiency of Premises Liability Theories

The first reason, that premises liability is generally a sufficient theory, suggests that there is apparently no pervasive dissatisfaction among injured plaintiffs or their legal counsel with their expected success using the negligence theory of premises liability. This probably means that the proof requirements for traditional premises negligence suits is both predictable and generally achievable for plaintiffs. Premises negligence suits apparently provide sufficient compensation to injured motorists and bystanders. Further, it seems plausible that it may still be difficult for plaintiffs to establish sufficient forensic evidence to isolate particular product failures as the root cause or as a contributing cause of injuries. The overarching responsibility of state highway agencies for design, construction, and maintenance of highways apparently obviates plaintiffs' desire for alternative liability theories. The states' reliably deep pockets are sufficient to preclude plaintiffs from regularly seeking the alternate deep pockets of highway product suppliers. A related reason is that the jurisprudence of liability under premises negligence, when compared to the jurisprudence of product liability theories, is simply too similar for there to be any encroachment by product liability theories into the realm of premises liability. This is apparently so even though the burden of proof under strict products liability is arguably lower than under premises negligence. Indeed, the states' loss of design immunity or sovereign immunity are probably the most important factors in mitigating pressures for new legal rights to compensate those injured by hazardous highway conditions.

The predominance of premises negligence is no guarantee that products liability theories might not eventually emerge in litigation over hazardous highway conditions. In the future, it is possible that products liability could be alleged more often and/or the courts might become more receptive to such suits if premises negligence suits become difficult or if the states diminish as the primary source of deep pocket compensation (20). Any combination of several factors could trigger more experimentation by plaintiffs' counsel in basing suits for injuries from hazardous highway conditions on product liability theories. For example, such factors could include: state budgetary problems, resurgence in state immunities (e.g., design immunity, sovereign immunity, specialized immunity to encourage new product deployment), advances in product failure forensics, increased burden of proof for premises negligence, further simplifications in the burden of proving strict product

liability, or any pervasive reduction in the rigor of testing and certification for innovative highway products. It is also uncertain whether the trend to privatize formerly public facilities will produce changes in the relative duties for premises safety. Arguably, privatization could shift the risk of litigation from government premises liability to products liability as public facilities are privatized (24).

Civil Engineering Practice

The second reason that product liability is seldom applicable to hazardous highway conditions can be ascribed to civil engineering practice. Designers of public works persistently and steadfastly use designs with considerable inherent margins of safety and they generally employ well-tested and predictable materials in constructing these designs. Testing and certification programs effectively screen for reliable products with predictable performance and deterioration characteristics. Demonstration and experimental projects permit careful adoption of new products without extensive risk exposure. Construction contractor selection and bond requirements may have the effect of generally excluding incompetent contractors. In many states, project management procedures generally include considerable opportunities for effective inspections at nearly every critical phase of construction.

It is also believed that product manufacturers who expend correspondingly high levels of resources to avert defective designs and avoid manufacturing defects have lower litigation risk. This is precisely the argument originally used to require extensive screening for some other products that have recurring and considerable safety impact. For example, the Food and Drug Administration (FDA) is required to administer the significant testing and certification regime for the effectiveness and safety of new drugs or medical devices before these are certified for general public use. Similar safety programs exist for aircraft design certification under the Federal Aviation Administration's (FAA) mandate. At the local government level there are similar testing requirements for new materials or new designs before they are permitted under local building codes. This affects both residential and commercial building programs and costs. However, the risk aversion of such conservatism is not without its critics. New industries with innovative or alternative products often claim they have a near insurmountable difficulty in running the gauntlet of new product/design certification. Such attitudes are aptly demonstrated among the private sector respondents to this survey. Many cite such problems with various aspects of government procurement, including the delays and expense of testing and certification.

Product Sellers are Too Remote: Impedes "Peeling the Onion"

The third reason that product liability theories do not predominate in litigation over hazardous highway conditions is a combination of ultimate responsibility and the product seller's

remoteness from the injured parties. The state has pervasive control and responsibility for the safety of its real estate. This control makes theories of premises liability more compelling because they are the most principled justification for state responsibility. Similarly, the principled justification for holding product sellers ultimately liable for injuries from product defects is that product sellers are in the best position to assure safety. In both these instances, the entity with responsibility has the most pervasive control over: the selection of materials, configuration of the design, quality of construction or manufacturing, and access to the necessary expertise to implement safety.

This third reason ultimately reveals one of the remaining vestiges of contractual privity. Privity becomes the predominant liability rule, at least in practice, when applied to owners or operators of premises. Essentially, suppliers of highway products are so remote from those injured by defective highway conditions that they often avoid liability. This is because there are others to bear the risk who are closer in the chain of distribution to the injured party. These closer parties have responsibility later in the construction/operation process and this gives them the ultimate duty of care. This conclusion about proximity and responsibility can be illustrated with the following metaphor: plaintiffs have some difficulty peeling back the many successive layers of the liability “onion” to hold a product seller liable. While this is no impenetrable barrier to suppliers’ liability, it nevertheless has the practical impact that product liability is only a perceived potential problem and public sector respondents in this synthesis survey cannot report product liability experience.

Premises and product liability are somewhat similar in focusing the primary responsibility for injuries from defects on the party with the most pervasive control over design, manufacturing, and testing. Although parties throughout the product distribution chain can be held liable for defects, it is ultimately the manufacturer, as ultimate overseer, who bears the greatest responsibility. The same analysis applies to the role of states in premises liability cases. The state is the entity with ultimate responsibility for design, inspection and construction management. Additionally, as the owner of the premises, the state retains ultimate responsibility. Pervasive control over design, construction and operation of the premises triggers ultimate responsibility under the premises negligence theory. Additionally, there is no sale of any “product” by the state to an injured highway user. The sale of a product is generally necessary to invoke a product liability theory. Although highway product suppliers could conceivably be held liable for product failures, in practice they are usually too remote from the injured motorist or bystander to bear much product liability risk.

Peeling Back the Liability “Onion”

That highway product sellers are often too remote from an injured party to be held liable can be illustrated by examining the chain of distribution for highway products. Going “upstream,” back through the state, the construction contractor(s), and

ultimately to the highway product seller, it is possible to analogize this organization structure as the layers of an onion. The state comprises the outside layer and several inner layer(s). The highway product supplier comprises the innermost core of the onion. An injured plaintiff has no need to proceed against every entity in each layer to win a satisfactory judgment because the state has ultimate responsibility. The state occupies the highly visible and highly vulnerable outside layer. There is seldom *privity of contract* between the injured party and the supplier of highway products.

More realistic complexity can be added to this “onion model” as a chain of highway product distribution by considering a typical highway construction scenario. Assume the supplier of a component product or raw material is at the liability onion’s core. The supplier is contractually bound to provide products with certain qualities to its immediate buyer who occupies the next most inner onion layer. That buyer assembles or manufactures a finished highway product from various components supplied by component producers. This particular final product or a class of similar such products from several manufacturers must be accepted for use in highway projects. The state’s materials testing program is the next layer because it is responsible for certifying the permanent and regular use of tested products in particular design configurations. Nonconforming products are not generally deployed, except for experimentation or demonstration, raising separate but related liability concerns.

The state often assumes responsibility for designing the highway project by optimizing safety and utility within financial constraints. Injuries resulting from an unsafe highway design or from the selection of inadequate materials or unsatisfactory highway products ultimately falls on the state because it has the responsibility to perform the design function with due care. The state usually selects the construction contractor from the lowest reasonable bid, implying liability for the selection of an incompetent contractor. The construction prime contractor and all the various subcontractors are generally not considered suppliers of products under the law. Instead, contractors provide services and their due care is judged by the duty of reasonable care in providing their construction services. Of course, the construction layer(s) are complex and vary according to individual projects. Nevertheless, the construction phase(s) can clearly introduce defects and is an important stage when defective highway products can be discovered by direct observation during installation or with field testing.

Although contractors are generally required by contract to correct defectively built structures, their liability occurs much less often than it might otherwise because field inspections discover errors and out-of-spec construction. This pervasive system of quality assurance occurs at well-defined milestones throughout each project. Progress payments to the contractors are often conditioned on passing inspection of installation correctness and this can delay the next stage continuation. Continuation could conceal or compound defects, making inspections all the more important to controlling defects. This quality control function further reinforces the state’s pervasive control and responsibility in the highway construction process. Inspection by independent certification companies could ultimately shift

some liability risk, but probably only among the state, contractor, and inspector.

The pervasiveness of the states' responsibilities for highways is further reinforced as the operation phase of premises layers is examined. The state is responsible to make periodic inspections of the highway system's integrity. When triggered by incident reports at particular locations, the responsibilities of state highway agencies are even more evident. The state is primarily responsible for maintenance and the attendant discovery of defects occasioned during maintenance. Even if maintenance were outsourced to private contractors, the state could avoid liability only if it produced a reasonable maintenance program and monitored the private maintenance contractor sufficiently. Absent contractual risk shifting and indemnification, the state remains primarily liable because it occupies several outer layers of the liability onion.

Third-Party Practice

This survey found scant evidence of states using third-party practice, also known as *impleader*, to avoid liability for defective products or construction. Modern civil procedure permits a defendant to bring an outside third party into the litigation if the third party was responsible for the injury. In the highway tort context, this third-party practice could effectively permit the state, or any other defendant, to implead a highway product supplier or contractor and make this third party liable for some or all of the plaintiff's injury. In a successful impleading,

the state would prove the supplier or contractor was responsible and then the court would order the third party to pay their share, even though the plaintiff had not sued that particular third party. Increased success in the use of impleading would have the effect of peeling onion layers to make suppliers ultimately responsible by adding a product liability theory of recovery to the premises liability theories already in wide use.

In sum, product liability is primarily a litigation risk exposure only for the *sellers* of products. There is generally no product liability for conditions of the real estate or premises. There is much less product liability litigation risk for the users or installers of products. Highway products lose their character as products after they are permanently installed as fixtures into the highway infrastructure. Sellers of highway products have also enjoyed some protection from liability because so many intermediaries are involved. The survey conducted in this synthesis found no evidence that states use third-party practice (impleading) to recoup payments from suppliers of defective highway products, although this is a legal possibility mentioned by several persons. By contrast, highway liability is primarily seen as a condition of the premises. Liability for defective highway conditions is not based on some hypothetical, imaginary, fictional, and limited "sale" of the component product to each guest who temporarily uses the premises. While an injured plaintiff might be successful isolating a particular highway product as the ultimate cause of some injury, it is, nevertheless, the states' pervasive premises design and operation responsibilities that are usually substituted for any product seller's liability.

CHAPTER THREE

PERCEPTIONS AND PERSPECTIVES OF PUBLIC AGENCY AND PRIVATE SECTOR PERSONNEL

INTRODUCTION

This synthesis of practice focuses on a traditional corporate liability that is associated with defective products and the possible effects of that liability on innovation. Not addressed are other traditional corporate liabilities, such as contracts, or expanding newer forms of corporate liability, such as environmental and employee discharge.

Empirical findings in this synthesis are based in large part on public and private sector executive descriptions of their respective organizations' response to product liability litigation concerns. Testing the validity of these descriptions is beyond the scope of the synthesis.

BACKGROUND

Numerous anecdotes have been written of individual corporate experiences with the deleterious effects of the product liability environment in the United States. Among these harmful influences are accounts of withholding or withdrawing beneficial products from market, narrowing product lines, or reducing research and development expenditures in new materials, designs, or applications, all because of management concerns over product liability exposure. In some cases, these management decisions are made in response to actual product litigation experience, while in other instances they are made out of fear of potential litigation. MacLachlan, for example, describes Dupont's decision not to pursue the use of one of its elastomer products as earthquake shock absorbers for buildings because of the high likelihood that litigation would follow an earthquake (25). He notes that in response to an increase of 25 percent over the previous year in legal costs related to corporate product liability, Dupont reduced its long-range research and development budget by an additional \$12 million in 1993 (25).

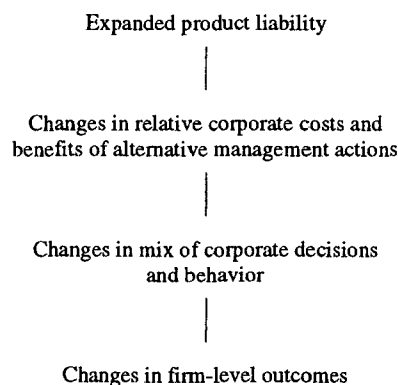
These assertions of the harmful effects of the product liability system also emphatically state that the system is impeding innovation and will ultimately hurt the U.S. economy's productivity and the ability of U.S. firms to compete in international markets. Castaing, writing on the effects of product liability on automotive engineering, states (26): "The threat of product liability suits inhibits the incentive to innovate," and "... the threat of product liability is that it can actually prevent manufacturers from implementing new or improved designs in their vehicles quickly, the backward logic being that implementing a design change quickly is often misconstrued in a courtroom as an admission of faulty design." MacLachlan adds (25): "... in the past three decades, the phenomenon of

injury litigation has become a major risk that is having a chilling effect on innovation in many American industries."

Liability Impact on New Product Decisionmaking

One unfortunate aspect of anecdotes is that, alone, they do not provide a solid basis for public policymaking because the experiences and circumstances of individual firms may be unique and thus not generalizable. The anecdotes nonetheless do provide useful insights that are helpful in building a research framework for more generalizable studies of the relationship between the product liability system and innovation. One such framework has been developed by Reuter at The RAND Corporation's Institute for Civil Justice (27). Reuter's framework, together with several studies sponsored by The Conference Board, and the individual corporate anecdotes provided much of the foundation for the design of the two surveys conducted for this Synthesis study.

The purpose of Reuter's research was to develop an analytical framework for examining the effects of expanded product liability on the aggregate economy. He argues that an understanding of such effects can be enhanced by defining and analyzing several intermediate causal linkages that necessarily lie between changes in the legal environment and impacts on the economy. "To understand the aggregate economic effects of expanded liability, we must first determine firms' responses to it and then the effects of those responses on what we shall call 'firm-level outcomes'—e.g., labor productivity and innovation." (27). Thus, Reuter's framework consists of the following stages and linkages:



Examples of an expanded product liability environment might include a shift from a negligence standard to strict liability or evidence of higher plaintiffs' awards in product liability

litigation. Corporate costs most directly affected are higher legal fees for firms involved in litigation and insurance premium and indemnity payments. Alternatively, these latter costs may remain relatively constant if the firm expends more for product testing to pinpoint potential hazards. In either case, higher costs in a particular product line may raise the dollar threshold that management requires from expected sales before deciding to develop a new product or to continue marketing an existing product. Higher expected profitability may be required from a product even if the firm has not experienced any direct liability cost increases simply because of management's aversion to the increased risk it perceives in an expanded liability environment. Thus, Reuter suggests that expanded product liability may produce several corporate reactions, decisions, or courses of action.

Corporate Reactions to Expanded Product Liability

- More product safety testing,
- Changes in product designs or materials used,
- More stringent decision rules on mix of products developed and marketed,
- More stringent decision rules on acquisition of new firms,
- Enhanced product warning labels or use instructions,
- Restrictions from high-hazard applications of product, and
- Restrictions on the nature of users to whom the product is sold.

A difficulty for management in choosing among these alternatives is that the choices do not come with certainty about the future safety and liability experience of the product. Additional product testing may improve management's confidence in the future performance of a product, but, it cannot eliminate the uncertainty over the future safety performance and liability exposure that may be experienced by the firm.

Impact of Perceived Liability on Financial Decisions

One outcome from these changes in corporate decisions may be fewer unsafe products introduced into the marketplace. Increased expenditures on product testing may uncover hazards that would have produced injuries had they not been detected. This discovery may result in withholding the unsafe product from the market or it may spur changes in product design or materials used to create a safer product. These outcomes should be considered benefits of expanded liability. Whether they are net benefits to society or not depends on how one values the costs of injuries and the magnitude of this valuation relative to the costs of increased testing, alternative designs, or substitute materials. It should also be noted that corporate actions taken to improve product safety are undertaken not only because of liability concerns, but also because

the corporate reputation and ultimate profitability is influenced by the public's perception of the safety of the firm's products.

Another probable outcome from an expanded liability environment is that a greater number of products that would have performed safely will be withheld from the marketplace because the perceived risk is too high or the cost of additional safety testing reduces expected product profitability below management's required threshold. This circumstance is an example of an indirect cost of an expanded product liability environment. It is also at the core of the claim that the product liability environment is inhibiting innovation. Because new products represent unknown hazards, they must be more thoroughly tested, meaning increased investment in product development. Unless expected revenues increase commensurately, perhaps from public perception of an improved product, this increase in development costs will make some new products not worthy of the investment risk. Thus product lines narrow and the rate of innovation declines (27).

Unfortunately, this type of indirect cost is very difficult to measure or even detect because of the many decision points within the product development process. Reuter provides the example of a chemist who decides not to pursue her interest in a line of research in a high hazard product because she is aware that senior management is reluctant to fund subsequent and more costly stages of development because of the higher risks associated with potential liability. Reuter notes that surveys of senior management are not likely to uncover such behavior (27).

Another scenario that may affect innovation is a management decision to restrict applications of its products from high-hazard uses due to concerns over liability. Such actions may impede innovation in industries or uses perceived to be high hazard. The decision by Dupont not to sell elastomer products for shock absorber applications in buildings is one example. Another is a chemical manufacturer with a product it believed would improve the safety of aircraft landing gear but who nonetheless refused to allow one of its products to be used in what it perceived to be a high-hazard application (27). On the surface, it is not hard to imagine, given the exposure of a public highway system, that some potential suppliers of highway products may be reluctant to allow product applications because they perceive highway applications to be high-hazard uses of their products.

Ultimately, management decisions on whether to develop or market new products or to allow new applications are financial ones made with uncertainty. As the perceived risks of liability rise, the probability of sufficient profitability must also rise to warrant management's willingness to undertake the riskier investment. Because individuals tend to be risk averse, successive unit increases in perceived liability risks will have to be met with successively higher likelihood of sufficient profitability. The degree to which the potential new product is a major innovation likely to catapult to a large market share and profitability, the higher the probability that a decision to move ahead will be made, regardless of an expanded liability environment. There are some product and application combinations, however, where a high enough likelihood of sufficient profitability levels are extraordinarily difficult to

TABLE 3
JOB TITLES OR RESPONSIBILITIES OF PRIVATE SECTOR SURVEY RESPONDENTS

Job Title/Responsibility	Number of Respondents	Percent
CEO/President	31	48.4
Sales or Marketing	14	21.9
Product Design/Development/Research	8	12.5
Technical Director	3	4.7
Business Development	2	3.1
V.P. Finance	2	3.1
Other	4	6.2
Total	64	100.0

reach. One example is materials for permanent medical implants such as artificial hearts, pacemakers, hip replacements, vascular grafts, etc. These devices are small and lightweight. Individual material suppliers may provide only a few cents worth of product in each device. If the device requires only five cents worth of material, then 1,000 devices only generate \$50 of revenue for the material supplier. If one of the devices ends up in litigation, it does not take long for legal defense fees, even when the supplier is found not liable, to consume revenues from thousands of sales of the material.

INFORMATION SOURCES FOR THE SYNTHESIS

Sources of information for this synthesis included public and private sector surveys, selected telephone and personal interviews, and a limited literature review. Questionnaires for the surveys were generated in a multiple-stage iterative process. This process included the literature review, interviews with state and federal highway officials, private sector firms, and several members of the project topic panel, and feedback from the project topic panel on questionnaire drafts. The questionnaires included open-ended, itemized checklists, and attitude measurement questions. Each of the latter included a definitive statement on an item of interest and a 7-point scale ranging from strong disagreement to strong agreement. This format was chosen partially to enrich the survey responses and partially in recognition that a yes or no response would be difficult or misleading on many of the issues, particularly those dealing with aspects of managerial decisionmaking. Copies of each questionnaire are contained in Appendices C and D.

The public sector surveys were distributed to all U.S. states, the District of Columbia, Puerto Rico, and the Canadian provinces. The private sector questionnaires were distributed to targeted segments of the highway supplier industry. Several organizations generously provided their mailing lists.

Highway Supplier Organizations Mailing Lists

- American Traffic Sign and Safety Association,
- Highway Innovative Technology Evaluation Center,
- Industrial Fabrics Association International, and
- ITS America.

The survey questionnaires were organized into the several major sections to explore the following broad issues:

- Relationship between potential product liability and highway supplier creativity,
- Impact of product liability litigation on innovation by the highway supplier industry,
- The impact of product liability on state agency procurement, testing, and acceptance practices, and
- The need for tort and product liability reform.

CHARACTERISTICS OF SURVEY RESPONDENTS

Private Sector Survey Respondents

Sixty-four private sector firms provided useable survey responses. Table 3 provides a distribution of the individuals responding to the survey by job title or responsibility. Almost half of the respondents held the title of chief executive officer or president. In many cases, these individuals had direct responsibility for multiple roles, including marketing and new product development.

Generally, the responding firms individually do not supply large product lines to the highway industry (see Table 4). On average, the respondents supply 15 products but only four respondents supply more than 25 products. Slightly more than half the respondents have five or fewer highway products. Nearly all respondents however, also supply products or services to other nonhighway markets.

While the respondents do not have large product lines, they nonetheless tend to do business on a national if not international scale. Nearly 43 percent of the respondents supply

TABLE 4
NUMBER OF PRODUCTS OR SERVICES SUPPLIED BY THE RESPONDING FIRM TO THE HIGHWAY INDUSTRY

Number of Products	Number of Respondents (%)
1	11 (18.6)
2-5	21 (35.6)
6-10	10 (16.9)
11-25	13 (22.0)
> 25	4 (6.8)

TABLE 5
NUMBER OF STATES TO WHICH THE RESPONDENT
SUPPLIES HIGHWAY PRODUCTS OR SERVICES

Number of States	Number of Respondents (%)
0-5	11 (18.0)
6-10	4 (6.6)
11-25	9 (14.8)
26-49	11 (18.0)
all 50	26 (42.6)

highway products or services in all 50 U.S. states (see Table 5). About 18 percent of the respondents sell to highway markets in five or fewer states. There is virtually no correlation among the respondents between the number of highway products a firm supplies and the number of states a firm supplies products to.

Thirty-seven of the 59 companies responding to this survey question characterized themselves as start-up companies when they first entered the highway market and an overwhelming majority of the respondents characterized their product liability experience as minimal. Only 15 of the 64 respondents indicated moderate or higher product liability experience. These types of responses should be expected given that product liability cases appear to be a small percentage of all civil litigation or even of all torts.

Public Sector Survey Respondents

Thirty-two states, the District of Columbia, and three Canadian provinces, Alberta, New Brunswick, and Saskatchewan, returned responses to the public sector questionnaire.

The responding states, except Alaska and Hawaii, are shown in Figure 1. The responsibilities of the respondents, given in Table 6, varied from Department of Transportation (DOT) policy-level administrators to attorneys in the state Office of Attorney General. The largest group of states returned surveys completed by a combination of two or more individuals in different disciplines. Usually, these composite responses were provided by a blend of individuals in state DOT safety and materials/product testing offices and by legal staff either within the DOT or in the state Office of Attorney General. Responsibilities of individuals in the "other" category included new product coordinator, product evaluation coordinator, and value management.

TABLE 6
RESPONSIBILITIES OF RESPONDENTS TO PUBLIC SECTOR
QUESTIONNAIRE

Responsibilities	Number of Respondents
Policy-level administrator in DOT	4
DOT safety & materials/product testing	8
Legal counsel for state DOT	4
Legal counsel in Office of State Attorney General	3
Multiple respondents	14
Other	3
Total	36

In characterizing their agency's product liability experience, the overwhelming response was minimal experience. Only the Canadian province of New Brunswick indicated as much as a moderate level of product liability experience. These responses are consistent with recently published state

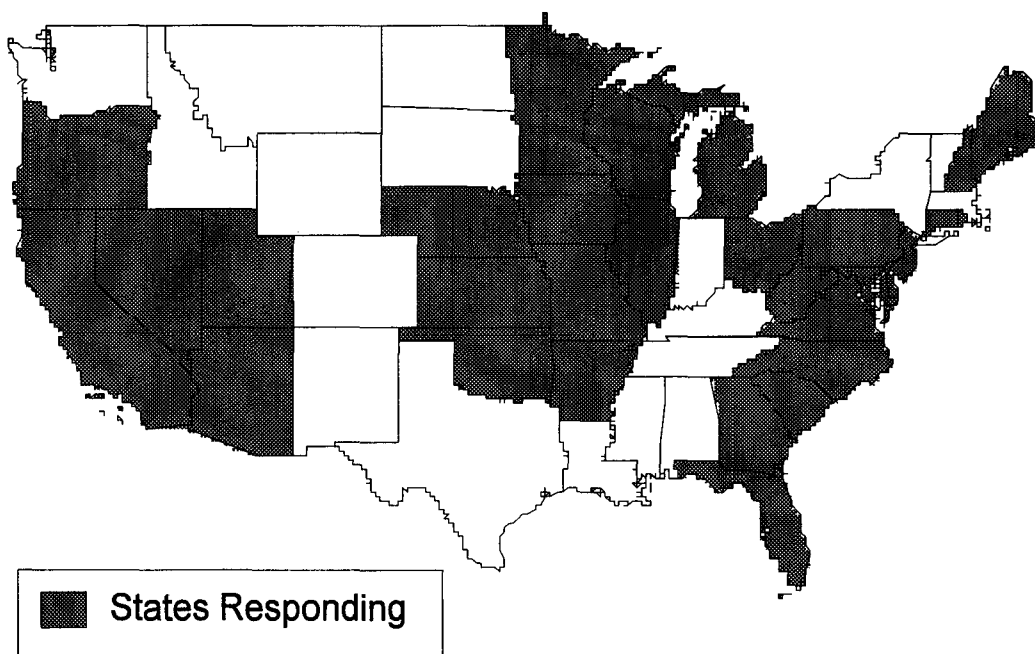


FIGURE 1 State survey respondents.

general jurisdiction court data from the Bureau of Justice Statistics (BJS), presented in chapter 1, which show that governments rarely are plaintiffs or defendants in product liability litigation.

RELATIVE IMPORTANCE OF PRODUCT LIABILITY AS A BARRIER TO INNOVATION

Literature Review

Identification of barriers to innovation in the public highway sector has been among the objectives of several recently completed surveys. In 1993, the Civil Engineering Research Foundation (CERF), asked users of new and innovative highway products or practices to rank the top three barriers to using innovative products or technologies in the design or construction of highway systems (28). CERF was conducting the survey as part of its efforts to plan and establish the Highway Innovative Technology Evaluation Center (HITEC), a CERF service center and clearinghouse for implementing innovative new product technologies. Users responding to the survey were primarily government agencies at the federal, state, regional, and local levels, but could also include private sector organizations that assist in the adoption of innovative products or processes.

The survey questionnaire contained a list of eight potential obstacles to innovation, including "potential liability too great." The survey responses, shown in Table 7, indicate that, by far, the largest barrier is the constraint caused by existing standards and specifications. Restricted use of proprietary products, and the time length and cost of the process for implementing an innovation were ranked second and third, respectively. Potential liability was selected by approximately 8.5 percent of the respondents, placing it sixth out of eight ranked obstacles.

TABLE 7
USER ORGANIZATIONS' BARRIERS TO USING NEW PRODUCTS (28)

Barriers	Respondents* (%)
Constrained-standards/specifications	23.0
Proprietary products	18.0
Process too long/cost too high	17.5
Known evaluation inadequate	12.0
No budget for adoption	9.5
Liability too great	8.5
Source of evaluation unknown	8.0
Contract system too slow	2.5

*Estimated percent from source document Figure 15, p. 19 of (28).

Another survey on barriers to implementation was made as part of *NCHRP Synthesis 216: Implementation of Technology from Abroad*. This synthesis addressed current practice related to the employment of foreign transportation technologies and methods in the United States (29). The survey questionnaire

was distributed to state DOTs and local transit agencies and to a variety of individuals involved with foreign transportation technologies and methods. The survey sought to identify obstacles encountered and overcome in implementation of foreign transportation technologies and methods as well as obstacles that prevented successful implementation. A primarily open-ended questionnaire format was used.

The most frequently reported obstacles overcome in successful implementation cases were inertia, procurement related difficulties, language barriers, and lack of technical data. No mention was made of liability related obstacles. A similar list was reported for obstacles that prevented implementation, except that this list contained liability concerns as a type of administrative obstacle. For unsuccessful implementation cases, *Synthesis 216* notes that 63 percent of the survey returns reported no instances of administrative obstacles, contracting procedures were the most frequently named obstacle, and liability concerns were noted several times (29). When asked to identify issues most needing attention to facilitate successful applications of foreign technologies, survey participants most frequently mentioned procurement practices. Liability and risk concerns ranked sixth. The report concludes that obstacles to implementation do not appear insurmountable; procurement problems and "the realities of (or misconceptions about) tort liability that impede innovation are being addressed" (29).

In the mid-1980s, The Conference Board sponsored two studies to identify the impact of product liability on U.S. manufacturers (5,30). Unlike the *NCHRP Synthesis 216* and HITEC studies, the focus of these studies was not on product or technical innovation and no attempt was made to rank barriers to innovation. Nonetheless, the study authored by McGuire found considerable adverse impact on innovation due to either actual product liability experience or anticipated product liability problems.

McGuire surveyed chief executive officers in 2,000 large manufacturers and 2,000 small (less than 500 employees) manufacturers across a broad spectrum of industries. He received responses from more than 500 executives for an approximate 14 percent response rate. Unfortunately, the low response rate does raise questions about the representativeness of the responses. From inquiries on the consequences of product liability for management decisions and firm operations, McGuire found that "... a number of chief executives say that fear of liability has had a chilling effect on their companies' entire research effort" (5). Radically new products are hit especially hard by fear over the uncertainty of liability impacts. It is very difficult for firms to anticipate all the ways customers may try to use their product and thus it is hard to develop adequate protections against all possible misuses.

McGuire acknowledges that evidence on the link between fear of liability and willingness of firms to invent or innovate is largely anecdotal, although numerous testimonies have been made to support the existence of an inverse relationship. For example, some corporate attorneys claim that their firms are reluctant to introduce certain safety related measures out of fear that this action will eliminate state-of-the-art defenses in claims against older products. While acknowledging that reasonable regulatory safeguards are appropriate to protect against

TABLE 8
ADVERSE IMPACTS OF PRODUCT LIABILITY ON STRATEGIC MANAGEMENT DECISIONS (5)

Type of Impact	Percent of Firms Reporting	
	Actual Experience (n = 180)	Anticipated Problems (n = 84)
Discontinued product lines	36	11
Decided not to introduce a new product	30	9
Lost market share to foreign firms	22	—
Discontinued product research	21	4
Decided against acquiring/merging	17	5
Laid off workers	15	1
Closed product plants	8	1
Moved production offshore	4	1

the manufacturing of unsafe products, interviewed executives “believe that there are many more instances in which innovation is inhibited because researchers and companies simply fear the unknown consequences of product innovation” (5).

McGuire’s survey listed eight strategic management decisions and asked respondents to indicate which decisions had been adversely affected by the product liability system. Several of these decisions, such as discontinuing product research, deciding against introducing new products, and discontinuing product lines, are indicators of a possible impact on innovation. Responses were segmented by firms with actual liability experience and those with perceptions about possible liability problems. Table 8 signifies that the decisions with the most direct probable impact on innovation were the impacts most frequently cited. Anecdotes were cited for firms making the following products:

- Electronic ignition systems for light aircraft (withholding product from market).
- Secondary pollution abatement devices (took product off market—could not get insurance).
- Pharmaceuticals and therapeutic drugs (discontinued sales—excessive liability costs).
- Pharmaceuticals (discontinued product—loss of insurance due to uncertainty of liability exposure).
- Intrauterine contraceptive, G.D. Searle & Co. (discontinued product due to cost of defense in suits won (\$1.5M) relative to

sales of product (\$11M in 1985)—could not get liability insurance for product).

- Major healthcare company (took products off market, turned down innovative and medically beneficial new product ideas, decided against otherwise attractive acquisitions because of product liability system).
- Chemical and plastics (withdrew one of most successful products from market due to liability costs).
- Hand and foot driving controls for handicapped drivers (firm forced to close due to high insurance costs even though it was never sued).

Survey Response Rankings

Data collection for this synthesis study on product liability as an inhibitor of highway innovation sought both a ranked list of barriers to innovation and respondent opinions on the impact of product liability on several management decisions related to innovation. Both the private and public sector surveys asked respondents which of 11 factors cited in other research studies or industry anecdotes were barriers to the provision of innovative highway products. (See questions 26 and 14 of the private and public sector surveys, respectively, in Appendices C and D.) The rank ordered lists produced by the respondents are shown in Tables 9 and 10.

TABLE 9
PRIVATE SECTOR OPINIONS ON FACTORS INHIBITING INNOVATION AMONG ESTABLISHED SUPPLIERS FOR TRADITIONAL HIGHWAY TECHNOLOGIES

Factor	Number of Respondents	Percent*
Low-bid purchase requirement	36	61.1
Multitude of testing and certification standards between the states	35	59.3
Restrictions on proprietary products	34	57.6
Restrictions on sole sourcing	32	54.2
Thin profitability deterring R&D	27	45.8
Risk of litigation/liability	26	44.1
No single government agency in charge within each state	22	37.3
Procurement procedure complexities	19	32.2
Cost	18	30.5
Insurance cost/availability	9	15.3
Domestic/local content requirement	4	6.8

*59 respondents indicated at least one factor. Thus, 59 rather than 64 is used as the denominator in calculating the percentages for this table.

TABLE 10
PUBLIC AGENCY OPINIONS ON FACTORS INHIBITING INNOVATION AMONG ESTABLISHED SUPPLIERS
FOR TRADITIONAL HIGHWAY TECHNOLOGIES

Factor	Number of Respondents	Percent*
Low-bid purchase requirement	24	75.0
Restrictions on sole sourcing	23	71.9
Restrictions on proprietary products	21	65.6
Cost	19	59.4
Multitude of testing and certification standards between the states	16	50.0
Procurement procedure complexities	11	34.4
Risk of litigation/liability	7	21.9
Thin profitability deterring R&D	6	18.8
Insurance cost/availability	4	12.5
No single government agency in charge within each state	4	12.5
Domestic/local content requirements	1	3.1

*32 respondents indicated at least one factor. Thus, 32 rather than 36 is used as the denominator in calculating the percentages for this table.

The rankings are similar in the sense that, with the exception of cost, the top (those listed by 50 percent or more of the respondents) and bottom (those listed by less than 50 percent) groups of factors are the same on both lists. Similar to other surveys, both groups rank procurement related factors in the top group, with low-bid purchase requirements ranked first and restrictions on proprietary products listed third. The risk of litigation/liability is ranked very similarly, sixth by the private sector and seventh by the public sector. However, this factor is listed by twice the relative number of private sector respondents (44 percent versus 22 percent). Another liability influenced factor, insurance cost/availability, is viewed as a barrier by a relatively small minority of both sectors.

IMPORTANCE OF PRODUCT LIABILITY AS A FACTOR IN MANAGEMENT DECISIONS

The first set of statements in the private sector survey sought a general understanding about the importance of product liability litigation as a factor in management decisions concerning the types of products or services supplied (see questions 1–3 of the private sector survey in Appendix C). For the purposes of discussing the results, the numeric ranges shown in Table 11 were used for classifying the responses to these statements as mild, medium, or strong. These same ranges were used to discuss all scale-based responses to statements in both the private and public sector surveys.

Table 12 shows that the average of all private sector responses was mild agreement with the assertion that product

liability litigation is an important factor in decisions on the types of products or services supplied. This assertion was tested for products supplied to all markets in general and for products with specific application to the public highway market. There was not a large difference in responses, however. In both cases, nearly half of the respondents expressed medium or strong agreement with the statement while only a small number indicated medium or strong disagreement. With respect to the highway market, there tended to be a stronger degree of agreement with the assertion, although more responses disagreed with the assertion, in comparison to the responses on all markets in general. As would be expected, those firms with actual product liability experience tended to hold product liability at a higher level of importance in both public highway markets and all markets in general.

A comparison of individual responses on both assertions shows that about 20 percent of the private sector respondents believe that products destined for the roadway create relatively more risk. There may be several reasons for these opinions. First, respondents may perceive highways to be hazardous because of accident history and traveling speeds. Also, they may perceive vehicle accident litigation to be extensive. Second, suppliers often sell large volumes of materials and their products are spread over large geographical areas; together, this may be perceived to raise suppliers' litigation risk exposure. Third, there are many highway travelers, further raising the apparent risk exposure. However, these respondents admit to little experience with product liability litigation for highway products. Their anxiety over greater exposure seems inconsistent with their lack of actual experience. One explanation might be that the fear of risk exposure is sustained by constant exposure to tort crisis reports. The impressions made by these reports may overpower suppliers' lack of direct experience, thereby producing their current attitudes. One respondent indicated that the expense of testing, certification, and meeting specifications was actually spent to avoid product liability and this focuses suppliers' attention on avoiding liability exposure.

Another set of statements explored the pervasiveness of management's concern with potential product liability in terms of the breadth of the company's product line (see questions 4–

TABLE 11
DESCRIPTORS USED FOR TABULATED RESPONSE DATA

Intensity Descriptor of Agreement or Disagreement	Numeric Response Range
Strong	1–5 or 6.5–7
Medium	1.6–2.5 or 5.5–6.4
Mild, Slight, or Weak	2.6–3.5 or 4.5–5.4
Neutral	3.6–4.4 (Group avg.) or 4 (individual)

TABLE 12
PRIVATE SECTOR RESPONSES TO ASSERTIONS ON PRODUCT LIABILITY LITIGATION AS A FACTOR IN
MANAGEMENT DECISIONS

Responses to the Assertion	<i>Assertion: Product liability litigation is an important factor in management decisions concerning the types of products supplied by my firm to . . .</i>	
	All Markets in General No. (%)	The Public Highway Market No. (%)
Agreement	44 (69.8)	40 (64.5)
Strong	15 (23.8)	15 (24.2)
Medium	14 (22.2)	18 (29.0)
Mild	15 (23.8)	7 (11.3)
Neutral	9 (14.3)	9 (14.5)
Disagreement	10 (15.9)	13 (21.0)
Strong	3 (4.7)	3 (4.8)
Medium	2 (3.2)	5 (8.1)
Mild	5 (7.9)	5 (8.1)
Total	63 (100%)	62 (100%)
Avg. Response (1–7 point scale)	5.10	4.95
No Response	1	2

6 of the private sector survey in Appendix C). Two-thirds of the respondents affirmed that they have concern with potential product liability for at least one of their highway products or services. However, on the assertions that this concern is either limited to a set of relatively “high liability risk” highway products or services, or extends across a broad spectrum of highway products or services, the responses were highly inconsistent. Respondents tended to answer with a similar level of agreement or disagreement on both assertions.

EVALUATION OF LINKAGE BETWEEN POTENTIAL PRODUCT LIABILITY LITIGATION AND INNOVATION

The next set of statements in the private sector survey began the exploration of whether innovation within the respondent’s firm is inhibited by the firm’s concern over potential product liability. This evaluation started with two assertions examining the pervasiveness of the respondent’s product liability concerns; the first assertion was made for at least one of the respondent’s highway products while the second addressed the broad spectrum of the firm’s highway products (see questions 7 and 9 of the private sector survey in Appendix C). The next two assertions searched for impact of product liability on innovation through changes in insurance availability and cost (see questions 20–21, Appendix C). A subsequent set of assertions explored for evidence of impact on innovation through management decisions to reduce research and development, discontinue existing products, withhold products from application to public highways, or not introduce new highway products or services due to concern over potential product liability (see questions 10–16). The last assertion in this set sought opinions on the characterization of potential product liability litigation as the most important factor explaining any reluctance within the respondent’s firm to provide innovative highway products or services (see question 22, Appendix C).

A similar line of inquiry was followed in the public sector questionnaire using assertions about highway suppliers in the respondent’s state or province (see questions 11–13 and 18–24 of the public sector survey in Appendix D). Finally, a subset of these assertions directed to the highway supplier industry in general was contained in the private sector survey (see questions 24, 25 and 27 of the private sector survey in Appendix C).

Pervasiveness of Product Liability Concerns

As a group, the private sector respondents are neutral on the assertion that innovation in at least one of the respondent’s products or services is inhibited by the firm’s concern over potential product liability. However, Table 13 shows there is considerable variation on this response with nearly half of the respondents disagreeing with the assertion and about a third expressing some agreement with it. Whether or not the respondent has actual experience with product liability litigation does not make much of a difference in the average response. Removing those respondents that do not have concern with potential product liability for at least one of their products only moves the average response even closer to the center of the neutral range and does not reduce the large variation.

Given the response on the prior assertion, fewer respondents agree with the assertion that innovation across a broad spectrum of the respondent firm’s products is inhibited by concern over potential product liability (see Table 13). The strength of their agreement is also lower and there is more neutrality on the assertion. The average response is mild disagreement with the assertion. This average does not significantly change by looking only at those with actual liability experience or by removing respondents that do not have concern for product liability litigation.

TABLE 13
PRIVATE SECTOR RESPONSES TO ASSERTIONS ON POTENTIAL PRODUCT LIABILITY AS AN INHIBITOR TO INNOVATION

Responses to the Assertion	<i>Assertion: Concern over potential product liability inhibits innovation . . .</i>	
	In at Least one of My Firm's Highway Products or Services No. (%)	Across a Broad Spectrum of My Firm's Highway Products No. (%)
Agreement	22 (34.4)	18 (28.1)
Strong	9 (14.1)	2 (3.1)
Medium	10 (15.6)	5 (7.8)
Mild	3 (4.7)	11 (17.2)
Neutral	11 (17.2)	16 (25.0)
Disagreement	31 (48.4)	30 (46.9)
Strong	13 (20.3)	13 (20.3)
Medium	15 (23.4)	13 (20.3)
Mild	3 (4.7)	4 (6.3)
Total	64 (100%)	64 (100%)
Avg. Response (1-7 point scale)	3.70	3.35
No Response	0	0

TABLE 14
PUBLIC SECTOR RESPONSES TO ASSERTIONS ON POTENTIAL PRODUCT LIABILITY AS AN INHIBITOR TO INNOVATION

Responses to the Assertion	<i>Assertion: Product liability litigation is a barrier to achieving highway innovation</i>	<i>Assertion: State has inhibited innovative product deployment due to potential product liability concerns</i>	<i>Assertion: Suppliers are reluctant to provide innovative products due to product liability concerns</i>
	No. (%)	No. (%)	No. (%)
Agreement	5 (13.9)	8 (22.2)	6 (17.6)
Strong	1 (2.8)	1 (2.8)	1 (2.9)
Medium	1 (2.8)	4 (11.1)	2 (5.9)
Mild	3 (8.3)	3 (8.3)	3 (8.8)
Neutral	9 (25.0)	9 (25.0)	9 (26.5)
Disagreement	22 (61.1)	19 (52.7)	19 (55.9)
Strong	2 (5.6)	4 (11.1)	2 (5.9)
Medium	7 (19.4)	8 (22.2)	8 (23.5)
Mild	13 (36.1)	7 (19.4)	9 (26.5)
Total	36 (100%)	36 (100%)	34 (100%)
Avg. Response (1-7 point scale)	3.38	3.42	3.25
No Response	0	0	0

More so than the private sector, public sector respondents expressed mild disagreement with the assertion that product liability litigation is a barrier to achieving highway innovation (see Table 14). Only five of the 36 public respondents expressed any degree of agreement with this assertion. A similar set of responses was given by the public sector in their opinions regarding the possibility that suppliers are reluctant to provide innovative highway products due to concern over potential product liability litigation. Also, the public sector mildly disagreed with the assertion that their respective states have delayed or canceled deployment of innovative highway technologies due to product liability concerns. That relatively fewer public sector than private respondents view product liability as a barrier to innovation seems consistent with their respective responses for liability/litigation risk in the rankings of obstacles to innovation discussed previously.

Impact of Product Liability on Insurance Availability and Cost

The impact on highway innovations of laws, regulations, or policies permitting product liability litigation has been more marked by rises in insurance premiums than by diminished availability of insurance or by reductions in aggregate dollar policy limits. Table 15 shows that only 25 percent of the private sector respondents and 13 percent of the public sector respondents indicated diminished availability of insurance or reductions in aggregate dollar policy limits due to product liability. The average private and public sector responses were slightly to the disagreement end of neutral on the issue. In contrast, 50 percent of the private respondents and one-third of the public respondents agreed that insurance premiums have risen while only 21 and 10 percent, respectively, disagreed.

TABLE 15

PUBLIC AND PRIVATE SECTOR RESPONSES TO ASSERTIONS ON THE IMPACT OF PRODUCT LIABILITY LAWS, REGULATIONS, OR POLICIES ON HIGHWAY INNOVATION THROUGH THE AVAILABILITY AND COST OF PRODUCT LIABILITY INSURANCE

Responses to the Assertion	<i>Assertion: The impact of product liability laws, regulations, or policies on highway innovations has led to:</i>			
	Diminished Availability of Insurance or Reductions in Aggregate Dollar Policy Limits		Heightened Costs of Insurance or Rises in Premium Rates	
	Private No. (%)	Public No. (%)	Private No. (%)	Public No. (%)
Agreement	16 (25.4)	4 (12.9)	32 (50.8)	10 (32.3)
Strong	4 (6.3)	0 (0.0)	14 (22.2)	0 (0.0)
Medium	9 (14.3)	0 (0.0)	8 (12.7)	3 (9.7)
Mild	3 (4.8)	4 (12.9)	10 (15.9)	7 (22.6)
Neutral	25 (39.7)	17 (54.8)	18 (28.6)	18 (58.1)
Disagreement	22 (34.9)	10 (32.3)	13 (20.6)	3 (9.7)
Strong	8 (12.7)	1 (3.2)	2 (3.2)	1 (3.2)
Medium	11 (17.5)	4 (12.9)	6 (9.5)	1 (3.2)
Mild	3 (4.8)	5 (16.1)	5 (7.9)	1 (3.2)
Total	63 (100%)	31 (100%)	63 (100%)	31 (100%)
Avg. Response (1-7 point scale)	3.74	3.69	4.72	4.19
No Response	1	5	1	5

TABLE 16

PRIVATE SECTOR RESPONSES TO ASSERTIONS ON THE IMPACT OF PRODUCT LIABILITY ON WILLINGNESS TO INVEST IN RESEARCH AND DEVELOPMENT (R&D)

Responses to the Assertion	<i>Assertion: Firm (industry) not willing to invest resources in R&D necessary to create innovative highway products or services due to concern over potential product liability</i>	
	Responses With Respect To Respondent's Firm	Responses With Respect To Highway Supplier Industry
	No. (%)	No. (%)
Agreement	12 (19.4)	26 (40.6)
Strong	5 (8.1)	2 (3.1)
Medium	4 (6.5)	10 (15.6)
Mild	3 (4.8)	14 (21.9)
Neutral	7 (11.3)	9 (14.1)
Disagreement	43 (69.4)	29 (45.3)
Strong	22 (35.5)	7 (10.9)
Medium	12 (19.4)	14 (21.9)
Mild	9 (14.5)	8 (12.5)
Total	62 (100%)	62 (100%)
Avg. Response (1-7 point scale)	2.78	3.70
No Response	2	2

The average response was in the mild agreement range for the private sector and was neutral for the public sector.

Evidence of Impact of Product Liability on Management Decisions Related to Innovation

Willingness to Invest in Research and Development

The assertion made in the survey was that the respondent's firm is not willing to invest resources into research and

development necessary to create innovative highway products or services due to concern over potential product liability litigation. There is mild disagreement with this assertion by the private sector respondents as only 12 (19 percent) found any agreement with the statement (see Table 16). In contrast, 22 (36 percent) expressed strong disagreement and another 12 (19 percent) expressed medium disagreement.

A similar assertion was made in the private sector survey with respect to highway suppliers in general. In this case, the average of the responses fell in the neutral range. However, the distribution of the responses was quite wide, with nearly equal numbers either agreeing or disagreeing with the assertion. The

TABLE 17
PRIVATE AND PUBLIC SECTOR RESPONSES ON THE IMPACT OF PRODUCT LIABILITY
ON INNOVATION-RELATED MANAGEMENT DECISIONS REGARDING EXISTING OR
NEW PRODUCTS*

<i>Assertion: Concerns over product liability is not a factor in my firm's (suppliers') decision to discontinue an existing highway product line(s)</i>		
Responses to the Assertion	Private No. (%)	Public No. (%)
Agreement	21 (34.4)	4 (12.5)
Neutral	22 (36.1)	12 (37.5)
Disagreement	18 (29.5)	16 (50.0)
Average Response	4.19	3.67
<i>Assertion: My firm (suppliers) has (have) not offered existing products for application to public highways due to concerns over potential product liability</i>		
Responses to the Assertion	Private No. (%)	Public No. (%)
Agreement	6 (9.4)	5 (15.6)
Neutral	7 (10.9)	12 (37.5)
Disagreement	51 (79.7)	15 (46.9)
Average Response	2.33	3.45
<i>Assertion: Concerns over potential product liability is not a factor in my firm's (suppliers') decision against introducing new highway product lines</i>		
Responses to the Assertion	Private No. (%)	Public No. (%)
Agreement	26 (41.3)	9 (29.0)
Neutral	12 (19.0)	10 (32.3)
Disagreement	25 (39.7)	12 (38.7)
Average Response	4.09	4.01

*Assertions in the private sector questionnaire were made with respect to the respondent's firm while assertions posed to the public sector were made with respect to the highway supplier industry.

strength of the latter responses though, was much greater than the strength of those supporting the assertion.

Discontinuation of Existing Highway Product Lines or Services

The assertion is that concern over potential product liability litigation is not a factor in the respondent firm's decisions to discontinue an existing highway product line or service. Nearly equal numbers of private sector respondents disagreed (18 respondents), agreed (21 respondents), or were neutral (22 respondents) on the assertion (see Table 17). In addition, the strength of the agreement and disagreement were also about equal. When the respondents were segmented to include only those that expressed concern with product liability and who believed innovation on at least one product is inhibited by product liability, then the average response moved to mild disagreement with the assertion.

Respondents were requested to give examples if product liability has been a factor in decisions to discontinue existing products. Only two of the 10 respondents with the strongest beliefs that product liability has been a factor gave specific

examples and these were speculation on products that might be discontinued if product liability problems arose. For example, one firm stated, "The commercialization of route guidance and other navigation products involves an inherent risk of products liability and associated adverse publicity. Some risks are associated with collision avoidance technology and many other ITS products" while another wrote, "We are trying to introduce and perfect a clay-soil stabilizer for road bases. We're trying it on the worst roads in some towns and counties where nothing else has worked. If failure occurs we agreed beforehand to fix the road, so no problems yet." An additional seven respondents provided statements, three of which were of the following general nature, "Liability is always a concern but not enough to prevent innovation where needed or possible. If necessary, actions are always taken to correct liability-prone products—but we have never discontinued a product for this reason."

Public sector respondents had a slightly different viewpoint from the private sector on the significance of potential product liability litigation as a factor in suppliers' decisions to discontinue an existing product line (see Table 17). While the average response was neutral on the assertion that product liability is not a factor in such decisions, 50 percent of the respondents

indicated some level of disagreement with the assertion, while only 13 percent expressed agreement.

Withholding Products from Application to Public Highways

The private sector respondents were asked to respond to the claim that their firm has restricted use of existing highway products or services from application to public highways due to concerns over potential product liability litigation. This set of respondents does not appear to be withholding highway products for this reason. Only four firms gave medium or strong agreement to the assertion while 40 indicated medium or strong disagreement (see Table 17). Subsetting the responses by degree of product liability concern or other measures does not significantly alter the response picture on this matter.

A few respondents provided examples of products they have had concerns about in highway application. A manufacturer of high-density polyethylene manhole covers has limited applications of manhole covers in certain roadway settings due to product liability concerns. A provider of real-time, site-specific traffic information from roadside to vehicle expressed strong agreement with the assertion, expressing particular concern for his firm's route guidance and navigation products. A manufacturer of woven and nonwoven geotextiles and erosion control products indicated that liability concerns often limit the applications for which they will recommend their products, although they know the products would work well in wider applications if installed well. Another manufacturer of geotechnical products for earth stabilization expressed concern relative to earth retention systems and their location relative to critical structures and high-volume traffic flows. Another product mentioned was the use of nonmetallic composites for bridge strengthening. Finally, a manufacturer of highway safety protection products objected to "flat" rules of thumb being made by states without consideration of past performance and liability experience. It appears that this company's products have metal components but that a state or states have specified nonmetal components, presumably, in the respondent's opinion, out of concern for product liability.

The public sector also believes that suppliers are not withholding existing products from application to public highways due to concern over potential product liability litigation (see Table 17). However, the strength of this belief is not as strong as that shown by private sector respondents regarding their own products.

Introduction of New Highway Products

The assertion posed to the private sector was that concern over potential product liability litigation is a factor in the respondent firm's decision against introducing new highway product line(s) or service(s). Forty percent of the respondents disagreed with this assertion, while a nearly equal percent agreed (see Table 17). The remainder were neutral on the

issue. Those agreeing tended to view the issue more strongly than those in disagreement with the assertion.

Subsetting the respondents into those with actual liability experience versus those basing their opinions on supposition produced a significant difference in the average response to the assertion. Respondents with actual experience showed mild agreement with the assertion while the supposition-based group indicated mild disagreement. Within both groups however, there was considerable variation in responses. The subgroup composed of firms with concern for product liability and who believe that product liability is inhibiting innovation also indicate mild agreement with the assertion although, even within this group there is great variation.

Several respondents provided comments and examples of new products that they decided not to introduce due to product liability concerns. The manufacturer of polyethylene manhole covers gave the following example, "We considered manufacturing polyethylene water-filled 'Jersey type' barriers and dropped it due to potential liability issues. This decision limits competition to only one or two suppliers of such designs in the U.S." A traffic control firm indicated they have refused certain jobs because of the perceived riskiness of the setup. Several respondents indicated that they strictly follow accepted procedures, processes, standards, criteria, tests, etc., which lessens the significance of product liability as a possible concern.

No new information on the assertion was obtained from the public sector respondents. Nearly an equal number of respondents indicated disagreement, agreement, and neutrality on the issue. Table 18 provides a list of examples given in response to the request for innovative highway products, processes, or services that have been discontinued, restricted from highway use, or restricted from initial introduction because of concerns over potential product liability litigation.

Product Liability as the Most Important Barrier to Highway Innovation

The last assertion in this line of inquiry on the product liability-innovation link stated that potential product liability litigation is the most important factor explaining supplier reluctance to provide highway innovations. Overall, there was mild disagreement from the private sector with this statement (Table 19). Thirty-four respondents or 54 percent believe that potential product liability is not the most important factor while 15 (24 percent) believe that it is. Fourteen respondents were neutral on the issue. The strength of the former group's response was significantly higher than that of the latter. For example, 25 respondents expressed strong or medium disagreement on the assertion that liability is the most important factor, while nine expressed medium or strong agreement.

The public sector disagreed with the assertion a bit more strongly than the private sector (see Table 19). Only four respondents expressed agreement with the assertion, but, it was only mild agreement. Nineteen respondents disagreed with

TABLE 18

EXAMPLES PROVIDED BY PUBLIC SECTOR RESPONDENTS OF INNOVATIVE HIGHWAY PRODUCTS, PROCESSES, OR SERVICES THAT THE RESPONDENTS RESTRICT FROM HIGHWAY USE DUE TO PRODUCT LIABILITY CONCERNS

Fog seal of HMA	Selected bridge expansion joints (3)*
TAR in HMA	Safety barriers and crash attenuators
Chromium-pigmented coatings	Pavement insulation systems
Rubberized asphalt	Barricades Type I and II
Asbestos based materials	Innovative delineators (designs and materials)
Products containing fluorocarbons	Early detection and warning systems for damaged structures
Fiber-reinforced plastic for use in bridge construction	Ice detection
Solid waste and recycled products (shredded tire, fly ash, recycled plastic, recycled shingles, glass, etc.) (2)	Guardrail end treatments
Blackout marking tape for pavement markings	Guardrail improvement and redesign
Hot-poured traffic lines	Concrete surface sealers that improve frictional characteristics of pavements
Products incorporating known environmentally sensitive materials (cutbacks, solvents)	Road Powered Electric Vehicle technology

TABLE 19

PRIVATE AND PUBLIC SECTOR RESPONSES TO THE ASSERTION THAT PRODUCT LIABILITY IS THE MOST IMPORTANT FACTOR EXPLAINING RELUCTANCE TO PROVIDE INNOVATIVE HIGHWAY PRODUCTS OR SERVICES

Responses to the Assertion	<i>Assertion: Potential product liability is the most important factor explaining any reluctance my firm (supplier) has to provide innovative highway products or services*</i>	
	Private No. (%)	Public No. (%)
Agreement	15 (23.8)	4 (12.5)
Strong	3 (4.8)	0 (0.0)
Medium	6 (9.5)	0 (0.0)
Mild	6 (9.5)	4 (12.5)
Neutral	14 (22.2)	9 (28.1)
Disagreement	34 (54.0)	19 (59.4)
Strong	11 (17.5)	3 (9.4)
Medium	14 (22.2)	8 (25.0)
Mild	9 (14.3)	8 (25.0)
Total	63 (100%)	62 (100%)
Avg. Response (1-7 point scale).	3.29	2.81
No Response	1	4

*Assertions in the private sector questionnaire were made with respect to the respondent's firm while assertions posed to the public sector were made with respect to the highway supplier industry.

the assertion and 11 of those were either medium or strong disagreement.

SOME BENEFICIAL IMPACTS OF LAWS, REGULATIONS, OR POLICIES PERMITTING PRODUCT LIABILITY LITIGATION

Most discussion on product liability litigation reform focuses on the claimed negative impacts or costs of the product liability system. Reuter's analytical framework however, provides for consideration of positive or beneficial influences of the system, one of which is providing some additional disincentive to producing or distributing an unsafe product. Several survey statements were designed to explore opinions on

possible beneficial impacts of laws, regulations, or policies permitting product liability litigation (see questions 17-19 and 28-30 in the private sector survey and questions 15-17 in the public sector survey, Appendices C and D). On average, the private respondents mildly believe that such laws, regulations, or policies have not improved the quality, safety, or durability of their highway products (see Table 20). Large numbers of respondents, from 19 to 39 percent, depending on the beneficial impact, gave neutral responses. However, nearly equally large or larger concentrations of respondents offered either medium or strong agreement that their products have not benefited in quality, safety, or durability as a result of such laws, regulations, or policies.

The same assertions, but with respect to the products of highway suppliers in general, were also posed to the private

TABLE 20
PRIVATE AND PUBLIC SECTOR RESPONSES ON POTENTIAL BENEFICIAL IMPACTS OF LAWS,
REGULATIONS OR POLICIES PERMITTING PRODUCT LIABILITY LITIGATION*

<i>Assertion: Laws, regulations or policies permitting product liability have improved the safety of my firm's (suppliers') highway products or services</i>			
Responses to Assertion	Private: Own Firm No. (%)	Private: Highway Suppliers in General No. (%)	Public: Highway Suppliers in General No. (%)
Agreement	13 (20.3)	29 (45.3)	17 (48.6)
Neutral	25 (39.1)	16 (25.0)	12 (34.3)
Disagreement	36 (56.3)	19 (29.7)	6 (17.1)
Average Response	3.44	4.06	4.43
<i>Assertion: Laws, regulations or policies permitting product liability have not improved the quality of my firm's (suppliers') highway products or services</i>			
Responses to Assertion	Private: Own Firm No. (%)	Private: Highway Suppliers in General No. (%)	Public: Highway Suppliers in General No. (%)
Agreement	27 (42.2)	15 (23.4)	5 (14.7)
Neutral	19 (29.7)	20 (31.3)	8 (23.5)
Disagreement	16 (25.0)	29 (45.3)	21 (61.8)
Average Response	4.45	3.83	3.12
<i>Assertion: Laws, regulations or policies permitting product liability have improved the durability of my firm's (suppliers') highway products</i>			
Responses to Assertion	Private: Own Firm No. (%)	Private: Highway Suppliers in General No. (%)	Public: Highway Suppliers in General No. (%)
Agreement	11 (41.3)	17 (26.6)	14 (41.2)
Neutral	18 (19.0)	25 (39.1)	11 (32.4)
Disagreement	41 (39.7)	22 (34.4)	9 (26.5)
Average Response	3.07	3.67	3.89

*Assertions in the private sector questionnaire were made with respect to the respondent's firm while assertions posed to the public sector were made with respect to the highway supplier industry.

sector. The average response fell into the neutral range but, as before, there were sizable numbers on both ends of the response range (see Table 20).

When the same assertions were asked of the public sector with regard to suppliers in their state or province, the respondents mildly agreed that quality had been improved but that durability had not been improved by the product liability system (see Table 20). Almost half the respondents also felt that safety had been improved, although the average response for the group fell just inside the neutral range.

IMPACT OF PRODUCT LIABILITY ON STATE AGENCY EXPERIMENTATION, DEMONSTRATION, AND PERMANENT DEPLOYMENT OF INNOVATIVE HIGHWAY TECHNOLOGIES

Public and private sector respondents were asked their opinions on several statements regarding the procurement, testing, and acceptance of highway products and services by state highway agencies (see questions 31–35 and 1–5 in the private sector and public sector surveys, respectively, Appendices C and D). These statements included the assertion that state policies restrict, in general, innovative highway technologies due to

concerns over product liability litigation. Several additional statements refined the initial assertion to experimentation, demonstration, or permanent deployment settings. A question was also asked as to whether the responses to these assertions were based on actual product liability litigation experience or on supposition.

The composite private sector response on all four statements is mild agreement with the assertions. In addition, there are not significant differences in these composite responses between the four statements. For each statement, approximately 25 percent of the respondents disagree with the assertions. The one difference between the assertion on state policies in general and the three more specific assertions is that there are significantly fewer neutral responses (17 percent vs. 27 percent) in the latter cases.

There are only small differences in responses to the assertions between those respondents with actual experience and those whose opinions are based on supposition (see Table 21). The degree of agreement with the assertions for the actual experience group is slightly higher than for the supposition group.

The four assertions were modified slightly for the public sector survey to inquire specifically about the respondent's state. Thus the first statement reads, "Your agency restricts

TABLE 21

PRIVATE SECTOR RESPONSES ON IMPACT OF PRODUCT LIABILITY ON STATE AGENCY EXPERIMENTATION, DEMONSTRATION, AND DEPLOYMENT OF INNOVATE HIGHWAY TECHNOLOGIES, BY ACTUAL LIABILITY EXPERIENCE VERSUS SUPPOSITION*

<i>Assertion: State highway agency concern over product liability restrains experimentation with highway innovations in an in-service environment</i>		
Responses to the Assertion	Actual Product Liability Litigation Experience	Supposition Regarding Product Liability
	No. (%)	No. (%)
Agreement	24 (75.0)	12 (42.9)
Neutral	1 (3.1)	7 (25.0)
Disagreement	7 (21.9)	9 (32.1)
Average Response	5.05	4.39

<i>Assertion: State highway agency concern over product liability restrains demonstration with highway innovations in an in-service environment</i>		
Responses to the Assertion	Actual Product Liability Litigation Experience	Supposition Regarding Product Liability
	No. (%)	No. (%)
Agreement	25 (75.8)	13 (48.1)
Neutral	1 (3.0)	6 (22.2)
Disagreement	7 (21.2)	8 (29.6)
Average Response	4.65	4.33

<i>Assertion: State highway agency concern over product liability restrains deployment with highway innovations in an in-service environment</i>		
Responses to the Assertion	Actual Product Liability Litigation Experience	Supposition Regarding Product Liability
	No. (%)	No. (%)
Agreement	22 (75.9)	16 (50.0)
Neutral	1 (3.4)	7 (21.9)
Disagreement	6 (20.7)	9 (28.1)
Average Response	5.59	4.39

*Respondents have been grouped on the basis of whether their opinions are based on actual experience with product liability litigation or supposition about such litigation.

experimental, demonstration or permanent deployment of innovative highway technologies due to concern over product liability litigation.” The other three statements are each worded specifically for either the experimental, demonstration, or permanent deployment settings. For each of the four statements, there is mild disagreement with the assertions. While there is considerable variation in the responses, 50 percent of the respondents express some level of disagreement on the first assertion and two-thirds of the respondents express varying levels of disagreement with the three more specific assertions. Because only a small number of states or provinces have actual experience with product liability litigation, this variable was not used to segment the public sector respondents.

STATES/PROVINCES CONSIDERED LEADERS IN REFINING TESTING AND PROCUREMENT TO ENCOURAGE INNOVATION

Both the private and public sectors were asked what states or provinces are leaders in refining their testing and procurement

to encourage deployment of innovative highway technologies (see questions 38 and 9 in the private sector and public sector surveys, respectively). Nearly all the states were named at least once by the private sector and 14 states were named two to five times. The states named more than five times in rank order were California, Pennsylvania, Florida, Minnesota, and New York. Minnesota was mentioned by four of the public sector respondents and California, Iowa, Texas, Virginia, Washington, and HITEC were each mentioned twice. Five other states and the province of Ontario were named once. “Active members” of the National Transportation Product Evaluation Program (NTPEP), created by the American Association of State Highway and Transportation Officials (AASHTO) to provide cost-effective testing of materials of common interest to AASHTO members, was also mentioned by one respondent.

One private sector respondent indicates that the product area influences the response to this question. He gives an example of one state that is a leader in pipe research and design while a neighboring state leads in edge drain research. He also expresses frustration with several states that

are research leaders but that ignore the results of their research. For example, one state “has participated in some of the best pipe research done in the world, but ignores the results of their work and instead uses obsolete design equations with additional safety factors. . . .” Another state is praised for its innovation in dealing with severe environment conditions.

TORT AND PRODUCT LIABILITY REFORM

Analysis of responses to questions on product liability and tort reform as contained in questions 26–33 in the public sector questionnaire and numbers 41–52 in the private sector survey is presented in chapter 4.

STATE OF THE ART METHODS TO CONFRONT LITIGATION RISKS

METHODS TO RESPOND TO TORT AND PRODUCT LIABILITY

States and suppliers have proposed, advocated, and employed a variety of responses to alleviate the perceived tort and product liability problem. Many of these responses can be effected only through legislation or court adoption to provide reliable shelter from liability risk. However, some responses may be possible using existing contracting powers or authority already possessed by government procurement offices, highway product suppliers, and highway contractors. The first section discusses some of these methods, the next section specifically discusses methods that are directly related to tort and product liability reform, and the last section assesses the perceived effectiveness of these methods.

Product Warranties

The use of warranties for highway products is not as well developed nor applied in practice as often as the use of warranties in the consumer goods and industrial products markets. Public and private sector respondents differ only slightly in their assessment that warranties are not uniformly used in procurement contracts for highway products. Public sector respondents answered that warranties are only sometimes required by procurement regulations; there was uniform variability among their responses. Private sector respondents answered with slight agreement that warranties are required by mandatory procurement regulations. Few private sector respondents showed much disagreement with the statement that warranties are generally required.

Part of the reason that warranties are not in such widespread use is that, at one time, the federal government prohibited the use of some types of warranties on highway projects using federal financing. This prohibition was intended to prevent the inflation of initial construction costs with future maintenance costs disguised as warranties. However, with the recent elimination of this prohibition, it can be expected that warranties will be given greater emphasis as procurement guidelines and mandatory procurement rules are revised.

It is important to distinguish between the three predominate types of warranties: (1) express warranties, (2) implied warranties of merchantability and (3) implied warranties of fitness for a particular purpose. The Uniform Commercial Code, detailed in Appendix B, is applicable to the sale of goods and manufactured products. Although highway products are most often supplied as part of on-site construction services, UCC warranties are a logical place to start this analysis. The implied warranty of merchantability could easily apply to highway products, requiring that products at least

conform to the characteristics of merchantability as stated in UCC §2-314(2) (31). The implied warranty of fitness for a particular purpose would appear on first blush to be very well suited to highway products. However, the fitness warranty is generally inapplicable because states specify highway product characteristics and procurement contracting does not generally rely on the suppliers' selection decision. So long as product certification, testing, and specifications are largely specified by the state, no fitness warranty seems applicable, except perhaps for limited demonstration projects. This could change as the design/build method of procurement becomes more widely utilized.

The most likely area for expanded warranty use is in express warranties. Any (1) affirmation of fact or any promise relating to the goods, (2) description, (3) sample, (4) technical specifications, or (5) model the seller uses to influence the buyer's decision forms an enforceable express warranty under the UCC. The negotiation process for procurement contracts must be carefully scrutinized because a supplier's warranty may arise unexpectedly or unintentionally from the parties' negotiating conduct. Of course, if the final written contract is on a form supplied by the seller, it may include exclusions that limit the warranty. This suggests careful contract drafting by both parties. State highway departments are very unlikely to be given any of the special protections the UCC generally affords to consumers. States will likely be viewed as sophisticated buyers, much like commercial buyers.

Express warranties can be expected to have variable terms of particular importance to highway applications. Terms may include the warranty's application to the present or the future, particular aspects of physical composition, compliance with advertised specifications, the existence of defects when delivered, the discovery of latent defects over a prescribed future time period, and the duration of the warranty's protections. While many suppliers may be expected to eagerly compete for highway business by offering fuller warranties, some highway product suppliers may not welcome the repeal of the federal prohibition on highway product warranties.

Indemnification and Insurance

Indemnification is a general term referring to a number of relationships imposed by the law or by contract. Indemnity is one of several related legal concepts that can work to balance or even shift liability risks. Other companion doctrines include subrogation, hold harmless agreements, insurance waivers, and the right of contribution. Indeed, insurance itself is a form of indemnity. In the market for highway products, indemnification encompasses one or more legal or contractual duties to pay the litigation judgments and possibly other litigation

expenses of another party. Usually, indemnity would be triggered by the proven or presumed fault by the indemnifier. Contractual risk-shifting agreements, including indemnification, are common in prime and subcontracts for construction services and they often appear in contracts of supply to product manufacturers and construction contractors.

The synthesis survey sought information concerning the presence of indemnity provisions in contracts for highway products: (1) when required by the state for suppliers to indemnify the state for liability claims and (2) when required by suppliers to indemnify suppliers for liability claims. Both private and public sector respondents answered that procurement contracts sometimes require that suppliers indemnify the state, but the responses showed considerable variability. By contrast, both groups answered that procurement contracts rarely require the state to indemnify the supplier. Both groups answered that insurance is sometimes required for demonstration projects, but there was considerable variability in their answers. Much like warranties and insurance, indemnity provisions may be customized to provide particular protections as to the type of suit or hazard indemnified, the level of indemnity and the duration of the indemnification duty (32).

Product Testing and Certification

The classic solution to tort and product liability problems that consumer groups continually propose to product sellers is that suppliers simply become more careful in design, manufacturing, and testing. The information gathered for this study is consistent with the principal that careful product testing and certification is a fundamental part of traditional civil engineering practice. This carefulness, previously referred to as "conservatism," probably accounts for a high level of infrastructure safety and low product liability experience on highways. The survey's responses to questions about testing and certification are consistent with previous studies and with other attitudes found in this study.

A few respondents indicated some dissatisfaction with the performance of private, centralized, or regionalized testing consortia. The future of seller or independent product testing and certification may become clearer when considered with changes in the federal warranty prohibition and more aggressive use of other risk-shifting devices (e.g., indemnity). Currently, a suppliers' own testing primarily functions to get acceptance of the supplier's product, to identify refinements to potential highway products, or to assist in expediting state acceptance or approval.

There may be potential for some forms of supplier testing to replace some state testing and/or independent third-party certification. The acceptance of supplier testing also has potential to lower procurement costs and delays. For example, the traditional testing and certification process could be replaced, to some extent, by suppliers own testing if this is combined with stronger warranties and broader indemnification clauses obligating suppliers to defend the state against tort suits arising from failure of the supplier's product. Supplier testing works in the crash testing of automobiles for

NHTSA and in the FDA certification of new drugs. In addition, centralized and coordinated testing and certification organizations, such as HITEC and NTPEP, provide advantages by reducing duplicate state testing and acceptance procedures.

However, widespread use of the private sector as replacement for state administration of testing and certification programs seems unlikely as long as states remain the owners of highway system premises. Indeed, compare the principled justification for states having responsibility for highway injuries because it owns the premises *with* the state's responsibilities arising from its comprehensive control over highway design, testing, and certification of highway products, highway construction management, inspection, and maintenance. The latter justification seems much more compelling. Furthermore, many suppliers may be unwilling to accept such a shift of litigation risk and states should have a concern with the continued solvency of suppliers to defend such suits.

Offshoring Production

Some observers have argued that product liability and other tort laws will eventually force the production of highway and other dangerous products offshore. Such advocates further argue that these products will then become available only from foreign suppliers, which are beyond the jurisdiction of domestic product liability laws. For example, it might be argued that tough domestic product liability laws will force domestic production of highway components to another country, perhaps high-value electronic signaling equipment.

This argument apparently presumes that foreign suppliers are subject only to foreign laws and that these laws are much more forgiving than laws in the United States. This argument is probably strongest for the laws regulating the actual production process, including environmental regulations applicable during manufacturing or processing, occupational safety regulations applicable to workplace safety, and other labor and employment laws that allegedly inflate the labor costs of production.

Offshoring production is probably not a good strategy to avoid tort and product liability from highway hazards once these products have been supplied to states in the United States for at least three reasons. First, highway premises are located within the United States so premises liability will continue to be a domestic problem unless the states start building highways overseas. Moreover, several provisions of the U.S. Constitution (e.g., full faith and credit, interstate commerce) and international law (e.g., comity) make it difficult for out-of-state suppliers to evade their responsibilities.

The second reason offshoring is not viable is that the domestic subsidiaries of foreign manufacturers are generally liable for any valid judgments obtained against that domestic distributor. Even though the foreign manufacturing facilities of a foreign supplier may not be subject to U.S. environmental or employment regulations, their domestic subsidiaries are subject to U.S. product liability law. For example, automobiles manufactured abroad are imported by U.S. subsidiaries of foreign manufacturers. These U.S. subsidiaries are subject to U.S. product safety regulations and product liability judgments.

There is no known reason to presume that the same principles would apply to the domestic subsidiaries of foreign highway product suppliers. It might be counter-argued that the domestic U.S. subsidiaries of such foreign manufacturers could seek to limit their litigation exposure by underinsuring their U.S. exposure, by undercapitalizing their U.S. distributors, or by selling through independent U.S. distributors. However, in the long run, the offshore manufacturers of defective products will not succeed in the domestic market. Foreign suppliers without sufficient financial commitment to the U.S. market or without a successful track record will eventually be weeded out because these will become important considerations for state procurement officers. Additionally, states determine the necessary level of insurance on state projects and state contracting officers will probably continue to require sufficient insurance.

The third reason offshoring is probably not viable are the rules on highway product domestic content and domestic source preferences. Many states require elaborate approvals before foreign suppliers can be used rather than U.S. suppliers. If product liability experience is nonexistent in the highway supplier sector, then it seems unlikely that U.S. suppliers are ready to abandon domestic production for domestic markets or move production offshore. Finally, product transportation costs also obviate much product importing for low-value, bulky products that make up significant portions of highway products purchased (e.g., aggregate, concrete, asphalt).

Influence Change in Tort and Product Liability Law

A considerable amount of literature has developed since the 1980s advocating closer examination of litigation excesses and urging some modifications. These critics presume that litigation imposes exorbitant social cost, causes delay in compensating the injured, and produces random and unpredictable results (33). Modern efforts to rein in the growth of tort law were first triggered in the 1970s by increased medical malpractice litigation and again more recently in the mid-1980s, triggered by a crisis of insurance availability and affordability. Tort reform's three most widely accepted successes have been: (1) the shift to forms of proportionate liability to replace contributory negligence and the joint and several liability rule, (2) limitations on jury discretion to award damages, and (3) various limitations specifically applicable to medical malpractice claims. Adoption of most other reforms described in the second section below are much less pervasive. Most of these tort reforms are also applicable to product liability claims. Some observers argue that the alleged tort crisis would be reduced to levels more consistent with other countries' tort experience if the United States had universal health care.

It is unclear from this survey whether state highway agencies or highway product suppliers have made much individual effort to support, encourage, or draft reforms to tort and product liability laws. However, discussions with some individuals clearly indicate that such reforms have become the primary lobbying focus for many trade groups through their support of tort and product liability reform at both the federal and state

levels. In the late 1980s and early 1990s, reform met with rather remarkable success, particularly at the state level. Tort reform has encountered some disappointment at the federal level, given Congress' failure to impose uniform and mandatory reforms on the states.

It is interesting to note the respondents' opinion that tort and product liability reform is needed. However, these opinions are somewhat puzzling given two other synthesis findings. First, the felt need for reform seems inconsistent with the success of reform in most states. Second, the argument for reform may be unnecessary given that neither of the groups surveyed for this synthesis believe reform would encourage deployment of highway innovations. Respondents showed mild disagreement with the statement that reform would impact deployment. The most likely explanation for these apparent discrepancies is that the extent of tort reform implementation is neither widely known nor understood. Existing reforms are perceived as still inadequate. Another explanation might be that uniform federal reform imposed on the states is considered preferable to the current piecemeal, state-by-state reforms. Tort and product liability reform is discussed more fully in the next section.

TORT AND PRODUCT LIABILITY REFORM

The 1980s concluded a period of dramatic growth in litigation. Tort law was expanded and more extensive tort duties were recognized by the courts. It is widely argued that juries became more sympathetic to individual victims of accidents, product failures, and unsafe conditions by applying the deep-pocket theory to punish defendants with extensive resources. Insurers eventually claimed they were unable to accurately predict the outcome of tort litigation, so insurance premiums skyrocketed and some types of insurance became unavailable. These events led to concerted efforts by insurers and potential defendants to seek tort reform through the various legislatures and in the courts (33).

The tort reform movement made considerable progress advocating changes in the law during the late 1980s. The future for further tort reform is somewhat uncertain, as discussed in the next subsection. Reform forces claim tort reform will create a more fair, predictable, and equitable fault system while reducing the costs of litigation. The various efforts of tort reform include one or more of the following: limits on certain types of damages; changes in the allocation of liability among several defendants, restriction of multiple-damage payments collection by plaintiffs, reduction of plaintiff attorneys contingency fee incentives, sanctions against frivolous suits, and requirements for structured periodic payments of damages over a number of years.

Joint and Several Liability

Joint and several liability requires the complete satisfaction of a plaintiff's damage award from any or all defendants, irrespective of the degree of fault of any single defendant. Any

defendant may be required to pay more than its share of the damage award if the other defendants are judgment-proof (e.g., bankrupt, uninsured). This provides plaintiffs an incentive to sue a deep-pocket defendant even if the defendant's negligence was trivial compared to other defendants' negligence. This is so because the joint and several liability rule requires any defendant to pay the whole compensatory and punitive award if other defendants have insufficient financial resources. For example, persons injured in traffic accidents often sue both the drivers and the state government responsible for road conditions. If the culpable driver is underinsured, the state's deep pocket may be required to pay the whole award amount. Many critics argue this aspect of the *deep-pocket theory* produces unjust results and compounds the tort crisis.

There are numerous reformulations of the joint and several rule that would limit or abolish full liability. The adoption of *several liability* (proportionate liability) is a popular reform. Many such reforms only limit traditional joint and several liability for certain torts or for certain classes of defendants. Pure several liability requires the judge or jury to assign a percentage of negligence among all parties at fault. Thereby, no defendant would pay for more than their proportional share of liability. Some states adopting several liability still retain joint and several liability for more serious torts. At the federal level, the Private Securities Litigation Reform Act of 1995 replaced joint and several liability for securities fraud defendants with a form of proportionate liability (34,35). This provision has confined the litigation exposure of the accounting profession to their own audit negligence, relieving them of unjust liability for their clients' fraud. This is precisely the type of limitation sought by many states for hazardous highway conditions where the state's negligence contributes only a portion of the fault in a highway accident.

The first wave of proportionate liability reforms came from the states, producing replacement of contributory negligence in many states with comparative negligence. The original contributory standard was often referred to as the "all or nothing rule." The defendant was liable for nothing if the plaintiff's negligence was proved to have contributed ever so slightly to the incident. Contributory negligence refers to various formulations that reduce the plaintiff's award by the proportion of the plaintiff's own negligence. This change would seem to favor plaintiffs, because it assures them at least some compensation even if they are somewhat negligent. If juries under contributory negligence were sympathetic to plaintiffs they could ignore the plaintiffs' contributory negligence in order to award them at least some compensation. The shift from contributory to comparative negligence arguably reduces these inaccurate jury findings because juries need not be "outcome oriented." Comparative negligence substitutes jury estimation of proportionate fault and this arguably provides a disincentive for juries to manipulate findings of fault. Decades of experience with comparative negligence arguably provides juries with experience in making proportionate allocations of fault. Doubt was once widespread about juries' abilities to allocate fault. This hesitancy was a primary impediment to the more just reform: systems of proportionate fault to allocate fault

between plaintiff and defendant under comparative negligence and among all defendants under pure several liability. However, the shift to comparative negligence has ceased. Some observers argue automobile insurance premiums are systematically higher in states with comparative negligence (36).

Reform of Damage Amounts and the Award Process

Damage payments made pursuant to a liability judgment are classified to represent different interests of the injured plaintiff. *Compensatory damages* represent economic losses actually suffered by the plaintiff. State inheritance law and wrongful death statutes generally entitle the injured party's survivors to such compensation if the injured is deceased. Compensatory damages include lost future earnings, property replacement/repair and medical expenses. Tort reform efforts seldom attempt to limit these economic damages directly, because injured plaintiffs have the most compelling claim to these more direct, traditional, and quantifiable measures of damages.

The one aspect of economic damages that has been addressed by tort reform is that many states either encourage (9 states) or mandate (18 states) a structuring of the payment timing for compensatory damages (37, 38). It is less costly for an insurer or defendant to disperse compensatory damage payments periodically because such annuity-like arrangements permit the insurer to wisely invest the funds until distribution. Mandatory periodic payments are sometimes required under the so-called *scheduled payment rule*. In some states they are optional, in other states a party may request periodic payments. When the payments are negotiated as part of a settlement, they are referred to as *structured settlements*. This arrangement is actually more accurate because *structured periodic payments* can be computed to become equivalent to the victim's actual receipt of periodic income. In many cases the plaintiff receives a huge lump sum damage award representing the discounted present value of all their future lost earnings.

Periodic payments may not be preferred by plaintiffs' attorneys. Attorney's contingent compensation may appear to be maximized only with a large lump sum. However, there is some evidence that plaintiffs, particularly in the throes of a personal injury, may mismanage the lump sum, thereby preventing them from replicating the intended cash flow into the future. Periodic payments hold promise to reduce the societal costs of damage awards but without compromising the financial status of many injured parties (39).

Tort reform efforts related to damage award have been most successful in imposing significant limits or even the elimination of some classes of *noneconomic damage*. These include: (1) pain and suffering, (2) loss of consortium with a spouse, (3) emotional distress, (4) embarrassment, (5) hedonic damages, and (6) punitive damages. For example, states have experimented with specific-dollar amount ceilings or *damage caps* for different classes of damages (e.g., noneconomic, punitives, compensatories) in all negligence cases or just in

particular classes of cases (e.g., medical malpractice, product liability). Some states require greater proof for noneconomic damages, such as “clear and convincing evidence” before noneconomic damages may exceed the statutory cap. As of June 30, 1996, more than 34 states had some form of statutory or common law restriction on punitive damages, such as *punitive damage caps* (40).

Some states have established more precise standards of proof before triggering *punitive damages*. For example, it is becoming more common to require a plaintiff to prove that the defendant’s conduct was wanton, willful, or malicious misconduct before awarding punitive damages. Some courts have developed a 4-to-1 rule of thumb to limit punitive damages, punitive awards exceeding four times compensatory damages are “close to the line” of unconstitutionality (41). The U.S. Supreme Court’s 1996 BMW punitive damages decision (new car retouched paint job) declared a \$2 million punitive damages award was unconstitutionally excessive (42). This precedent now requires all U.S. courts to impose limiting factors before awarding punitives: e.g., the reprehensibility of the defendant’s conduct, comparisons of the punitives awarded to similar criminal and civil penalties. Some states withhold some of the punitive damages from the injured claimant and place it into a public trust fund or even pay it directly into the state’s general fund, as done with many criminal fines. The BMW precedent is quickly spreading throughout other U.S. Circuit Courts of Appeal in other cases limiting punitive damages (43–46).

Although “excessive” and high-profile punitive damages have become a *cause célèbre* for reformers, considerable evidence is mounting that punitive damages are awarded infrequently (47), particularly in product liability suits (48). Indeed, punitive damages are much larger in “financial injury verdicts,” those involving insurance, securities, employment contracts, or unfair business practices, than in other classes of cases like product liability suits (49). Most punitive damage awards are reduced or eliminated on *remittitur* or are otherwise never paid. Some states permit only one punitive damage award per product defect, effectively encouraging plaintiffs to rush their cases to the courthouse or be locked out of punitive damages.

There are other methods to limit the social cost of litigation. One type of tort reform limits the plaintiff from informing the jury of the defendant’s wealth and insurance coverage. It is often argued that juries increase or decrease the damage amount awarded according to the defendant’s perceived wealth or insurance coverage. Arguably, such considerations have no place in what should be an objective determination of all damages. However, some theorists claim that the defendant’s wealth is a legitimate consideration in assessing punitive damages to assure that punitives include the sting of true punishment.

There are other procedural reforms to the conduct of civil trials that arguably make damages determinations more equitable. For example, trials may be bifurcated, a practice followed in some capital criminal trials. *Bifurcated trials* in tort cases divide the trial into two separate sessions: the first session determines liability and compensatory damages, and the

second session determines the punitive damages. This separation is believed to reduce the jury’s emotional tendency to overcompensate the injured plaintiff. A recent U.S. Supreme Court decision holds that punitive damages are now taxable as ordinary income. Taxability should greatly reduce the windfall of punitive damages but does not change the cost on defendants. Compensatory damages are not taxable.

Tort defendants were traditionally prohibited from informing the jury that the plaintiff was compensated from another source for some of the injury, such as when the victim’s medical insurance paid hospital and doctor bills before trial. However, under modifications to the so-called *collateral source rule*, 14 states now permit the court discretion in permitting introduction of this evidence, so that juries may become less likely to award “double compensation.” Eighteen states require a mandatory offset for such collateral sources (38). This may reduce the social cost of litigation in some situations. Under *subrogation*, the medical insurance carrier should be entitled to reimbursement of the medical costs from the defendant.

Many courts order defendants to pay amounts in addition to the various classes of damages. In some complex trials, a final resolution can take several years. Interest may also be due on the award, starting from the time of the wrong, and accruing until final judgment, known as *prejudgment interest*, or running from the final judgment until actual payment or settlement, known as *post-judgment interest*. However, these interest payment duties have been limited somewhat by recent reforms. For sizable awards, this prejudgment interest can amount to considerable addition to the damage amount. Prejudgment interest is generally computed at the *legal interest rate*, which typically ranges from 6 to 12 percent. Many states’ legal rates are close to 10 percent. The reform limitations variously prohibit prejudgment interest on some types of damages, such as punitives, set a maximum period for the interest, establish a lower rate of interest than the traditional legal rate, and delay the commencement of the interest period until a complaint is filed or the defendant refuses a settlement offer (50). Most states permit post-judgment interest at the legal rate. A few states require interest to accrue from the filing of the complaint until the date of final settlement. Many states permit the parties to set the interest rate by contract, although this is more likely in breach of contract suits than in tort suits.

Time Limitations on Tort Suits

Another type of proposal is to limit which suits are brought by changing the statute of limitations. *Statutes of limitations* in tort actions generally range from 1 to 4 years. However, they often fail to adequately protect defendants from overexposure to liability for defective products used beyond their useful lives. There have been two approaches to rectify this. First, defendants are favored when the limitations period begins to run at the time of the injury. Some courts have either refused to start the statute of limitations until the injured plaintiff discovers the injury or courts *toll* the statute of limitations during some period of time for a variety of reasons. States reforming the *statute of limitations accrual* require that the limitations

period commence when the injury occurs and not later when the injured party discovers the injury. However, this approach is controversial, particularly in some product liability cases where the injured party does not discover its injury until after the limitations period has expired. In most cases, the wrong is considered committed when the product is first sold so the limitations period accrues on the date of sale. However, in *delayed manifestation* cases like asbestos and some drug cases, the courts have either started the limitations period upon discovery or devised other creative solutions like *market share liability*.

A second type of limitations period has been devised in recognition that sellers should not have potential liability for products used beyond their useful lives. *Statutes of repose* attempt to set a maximum limit on the time during which consumers can expect legal protection from defective products. A statute of repose is often set at a period between 6 and 15 years from the date of first sale. By contrast, highways are commonly designed for a 20-year lifespan and bridges for 50 years. Where both limitations periods are applicable, the plaintiff must initiate a product liability suit within the statute of limitations period following the injury and further allege that the defect caused injury sometime within the statute of repose period. This effectively limits a product manufacturer's liability for defects to the period of these two statutes added together. There were 14 states by 1994 with statutes of repose, but several such repose limitations have been held unconstitutional, as discussed in the next subsection (32).

Reforms Aimed at Plaintiff's Counsel

Twenty-nine states now impose sanctions on attorneys and/or their clients for bringing frivolous or baseless suits. Often based on the well-known federal *Rule 11*, the states' rules are aimed at punishing suits brought to force a settlement for the *nuisance value* of successfully defending the suit. Courts may variously award attorney's fees, litigation expenses, or court costs to the defendant in a frivolous suit or penalize plaintiffs and their attorneys for bringing frivolous suits.

Reform forces have also had some success limiting plaintiff's attorneys contingency fee arrangements. These are often cited as a major source of excessive incentive to litigate because plaintiffs' attorneys allegedly become reluctant to settle. Attorneys may bill their clients in several ways: a retainer fee irrespective of work actually performed, an hourly billing, a predetermined fee for accomplishment of a particular purpose, some combination of these, or a contingency fee. Many injured plaintiffs are financially unable to commit to such fees up front, particularly if their damage award is uncertain.

In a *contingency fee* arrangement, the plaintiff's attorney risks complete nonpayment if the plaintiff loses. However, if the plaintiff wins, the attorney is contractually entitled to a specified percentage of the award, often a huge windfall if considerable punitive damages are awarded. With contingency fees, plaintiffs' attorneys can afford to lose several marginal cases so long as they have a few big successes. However, critics

charge the contingency fee arrangement provides plaintiffs' attorneys an incentive to press more frivolous claims or refuse reasonable settlement offers if they are driven by personal greed. Such hard-nosed settlement bargaining can result in an ultimate loss for the plaintiff and probably raises the costs of litigation generally. Attorneys fees are regulated in more than half the states. Some states have a single ceiling amount of 33 to 50 percent. Attorneys are free to compete for lower percentages. At least 10 other states impose a sliding scale of graduated limits on contingency fees so that the percentage of the attorney's fee is reduced as the plaintiff's award grows larger. Thresholds are commonly set at several hundred thousand up to millions of dollars (51, 52).

Contingency-fee limitations may be a less successful tort reform device for two reasons. First, it may limit some financially disadvantaged plaintiffs from access to competent legal services. Second, none of the contingency fee limitations would limit defense attorney's fees, raising the question of unfair discrimination. Some other countries prohibit altogether the use of a plaintiff's lawyer's contingency fee arrangement. This arguably denies persons of limited means any access to the courts.

Many countries avoid U.S. style attorney-client relations by forcing the loser to pay the winner's litigation costs under the so-called *English Rule*. Such a rule would clearly deter many suits. However, even in the UK, the English Rule is inapplicable in nearly half the cases. England has an extensive welfare bureaucracy to manage public funds for financing litigation by the poor and lower-middle income plaintiffs. The "loser pays" rule largely applies only to well-to-do individuals and to business litigants. If the English Rule were instituted in the United States, it seems likely a similar publicly financed legal-aid system would arise to soften the perceived harshness of any abrupt shift to a "loser pays" system.

Reforms Specific to Product Liability

The purported product liability crisis is closely related to the general tort reform movement because product liability suits for personal injuries are most often based on tort theories. Many manufacturers pass the additional insurance and redesign costs of product liability on to consumers through higher prices. Other countries impose significant barriers to product liability suits, such as limiting pretrial discovery, a major source for proof of liability. Many of the same forces are at work in product liability reform as in tort reform. Both reform movements have been triggered by the expansion of theories of liability and the growth in damage awards (33).

U.S. manufacturers and insurers have argued that the whole tort and product liability system is out of control and now requires uniformity (not just relating to transportation). Consumer groups and trial lawyers counter that the liability system is needed as an incentive to design and manufacture safe products. Many critics of reform also assert the so-called "tort crisis" was fictitious. It is alleged that the insurance availability crisis of the 1980s was caused primarily by vigorous but destructive competition in cutting premiums, poor

underwriting decisions, and even collusion among insurers. The collusion allegation was made by the National Association of State Attorneys General (NAAG) in an antitrust complaint against several property/casualty insurers that was eventually settled.

There is a natural limit to the insurance industry's reform efforts, insurers will not likely push for complete elimination of tort liability. The main business of property and casualty insurers' is to accept the shift of risk from insured persons who have personal responsibility for their wrongdoing. Without this western tradition of personal responsibility requiring due care in all activities, there would be little need for the property and casualty insurance industry. Some opponents even speculate that reform may backfire, eventually triggering a huge, costly, and stifling product-safety regulatory bureaucracy. This latter reason was cited as the critical feature lacking when one state's statute of repose was invalidated as unconstitutionally vague.

Specific product liability reforms have emerged in more than half of the states, involving various procedural and substantive law changes. Many successful reforms are largely derived from tort reforms that apply equally to product liability cases. In addition to general tort reforms, there are other reforms specific to product liability suits. Some states restrict product liability theories to defective design, failure to warn, or the manufacturer's deviation from the prescribed design. This is intended to halt the development of *any* new theories for fear they may carry easier burdens of proof for plaintiffs. For example, when the strict tort theory was first developed as a precedent, it opened vast new liability risks, spreading nationwide between the 1920s and the present. Likewise, recent decisions holding the tobacco and computer keyboard industries liable for misrepresentations appears to position this theory to further expand product liability risks. Other new product liability theories, such as *market share liability* (enterprise liability) may soon abruptly expand product liability risk exposure. For example, since *Sindell v. Abbott Labs* first developed market share liability, product sellers have had less protection from the causation requirement (53). Recall that plaintiffs must prove causation—that the defendant's product directly caused the injuries. Product sellers are understandably anxious that if any new tort theories of product liability develop, this could usher in similar quantum leaps in liability risk. Therefore, the centerpiece of *comprehensive product liability reform* comprises efforts to freeze the development of any new product liability theories, preventing their adoption through common-law precedents by the courts.

The recurring problem of proving facts takes on special significance in product liability suits. The forensic needed for precise determination of cause is still not fully developed. Courts grapple with setting standards for the introduction of scientific evidence to prove defects or how particular events or conditions cause injuries. Two developments often work in favor of product sellers. First, some product liability reforms require the certification of expert witnesses before they are permitted to testify before a jury. Allegations of *junk science* abound, essentially arguing that the "world renowned" expert witness for the plaintiff cannot logically testify in near

complete contradiction to the defendant's distinguished scientific witness in so many cases. Critics of junk science argue there must be better scientific bases for scientific testimony by all expert witnesses. The Supreme Court now requires better foundations for the admissibility of scientific evidence in federal cases (54). The implication for highway related tort cases is that civil engineering, structural engineering, human factors engineering, and accident reconstruction experts may be successfully challenged by opposing counsel in tort cases alleging injuries from hazardous highway conditions, designs, or component products.

Product liability reforms may also focus defenses or special exemptions on particular industries. For example, some states exempt prescription drugs, medical devices, and human blood and tissue products from the strict liability theory. A few states recognize the unavoidably unsafe conditions of products with inherently risky characteristics (e.g., knives) by recognizing their dangers are not design defects. This is known as the *unavoidably unsafe* defense. Many product liability reforms expand or confirm the affirmative defenses: contributory negligence, comparative negligence, and assumption of risk. Some states have added the *misuse* defense or expanded assumption of risk to include situations in which the plaintiff failed to use reasonable caution in using the product or should have appreciated an open and obvious risk or danger. Forty-two states have adopted the *state-of-the-art* defense by statute or by precedent (55). A few states have modified the privity concept by exempting retailers and other sellers from liability unless the manufacturer was beyond the state's jurisdictional powers or the reseller modified the product. Some states prohibit drug or medical device liability suits if Food and Drug Administration regulations are met. A few states prohibit plaintiffs from introducing evidence that the product design was later changed to eliminate the particular defect. Without this *exclusion of subsequent remedial measures*, product sellers would be strongly discouraged to make product safety improvements for fear of "self-incrimination."

Six states now have passed *comprehensive product liability reform statutes*: New Jersey, Louisiana, Illinois, Ohio, Utah, and Mississippi. While their provisions vary, most of these comprehensive statutes aim a wide range of the aforementioned types of reform directly at product liability suits. Most prohibit new precedents to develop new product liability theories and some eliminate existing theories, market share liability, for example. Some prohibit product liability exposure for wholesalers and retailers unless they controlled the manufacture, design, or warnings concerning the product. The highway sector might become convinced of the advantage in supporting comprehensive product liability reforms. However, several reasons may militate against major efforts or expenditures. First, this synthesis indicates that product liability is not currently a problem for the highway sector. Second, as discussed below, the Illinois statute is currently under siege; it is argued to be unconstitutional under the Illinois state constitution, which grants a right of access to the courts. Also, the section below on Setbacks to Reform indicates that comprehensive reforms are difficult to achieve. Nevertheless, to minimize the adverse impact of product liability, governments

and businesses serving the highway sector should remain aware of these developments and advancements and adhere to industry's standards.

PERCEIVED EFFECTIVENESS OF RESPONSES AND REFORMS

Despite the considerable tort and product liability reforms discussed in the previous sections, tort reform advocates apparently believe there is still much to be done. Reformers' top priority has shifted to achievement of a national uniformity imposed on the states by federal statute(s)(56). This would achieve two apparent reform-movement goals. First, federal statutes leave little room for state differences. Risk management is much more certain in a uniform legal system because loss estimates are less affected by differences in legal principles. This permits the focus of actuarial attention on nonlegal factors, e.g., competition in premium rates and special coverage endorsements, trends in the underlying risks. Second, reform by statute, rather than by common-law precedent, makes it much more difficult for state judges to later change or reinterpret the statute. Any introduction of new tort or product liability theories would probably need to pass Congress and receive the President's approval. A uniform federal statute effectively freezes the development of product liability law because of the difficult burden in advancing additional future reforms. Current reformers' recent difficulties in passing federal reform is evidence of the difficulties in achieving national legislation.

The United States' long experience with balancing *federalism* with *states' rights* is instructive on this point. If unconstrained by federal uniformity, it seems likely that state legislatures will continue to experiment with various limitations on tort and product liability suits. Some federalism theorists argue that the uniform, federal product liability reform that failed in the last Congress offends states' rights. If federal reform is ever successful, it will largely prohibit the states from experimenting with innovative liability theories or with reforms.

At the heart of federalism is the acknowledgment that local laws are developed in response to local needs. There have been a few obvious exceptions to the compelling states' rights argument. Even contemporary states' rights advocates usually accept the uniformity of the Bill of Rights, the exclusively federal powers (e.g., defense, uniform bankruptcy, single currency, post roads), the post-civil war individual rights legislation, and some of the New Deal legislation. National policymakers have effectively imposed national uniformity through legislation only when the sentiments favoring uniformity override arguments against states' rights.

The proliferation of uniform laws and model laws further confirm that states usually take the initiative to move toward some uniform equilibrium if it serves the best interests of all the states' constituencies. For example, the most comprehensive and widespread uniformity among states' laws has occurred in commercial law. The states, acting independently, have retained their sovereignty by passing the Uniform Commercial

Code, permitting them to reduce the kind of barriers imposed by differing legal systems. Uniformity clearly reduces costly barriers to interstate commerce. Perhaps the failure to win nationally imposed product liability uniformity is directly related to the weakness of reformers' argument that the states just cannot be trusted to achieve meaningful reform. It probably reveals that, given setbacks to reform in the states, reform is achievable only through uniform federal legislation that preempts piecemeal state law differences.

Respondents to this survey also indicated some trepidation with reformers' premise that reform is the key precondition to deployment of technological advances and therefore to the United States' global competitiveness. Respondents showed very little agreement with the statement that reforms would encourage deployment of highway innovations. Public sector respondents indicated medium disagreement while private sector respondents showed slightly less disagreement with the statement that reforms will encourage deployment. One obvious interpretation here is that perceptions about product and tort liability contribute greatly to supplier angst. However, the promise of reform does not greatly reduce uncertainty or eliminate the myriad other barriers to innovation. Respondents' direct experience with other obstacles to deployment of innovative highway products is apparently quite influential, among both public and private sector respondents. Experiences with procurement problems still predominate; this is a well-known problem.

In sum, only government attorneys appear to be well informed about the progress of reform in their own states. Large portions of the highway community appear to be unaware of at least the tort reforms and the more limited product liability reforms already enacted in many states where they work or do business. While many respondents express hope for the future of reform, few recognize it has already happened. Fewer still believe reform will have much positive impact on the deployment of new technologies. Therefore, reforms and other responses to the tort crisis are not perceived as effective to achieve the diffusion of technology.

Setbacks To Reform

Another approach to evaluating the effectiveness of reforms and other risk reduction measures is to examine how tort and product liability reforms have fared since their passage or adoption. Since 1983, when the contemporary tort reform movement began, over half the states in more than 70 court decisions have invalidated at least one particular aspect of tort or product liability reform. There appears no particular geographic or regional bias among states invalidating reforms other than that a few big states have not yet experienced invalidation, e.g., California, New York, and Pennsylvania.

Many of these reforms were found unconstitutional under provisions of each state's own constitution. The most common constitutional provision used to invalidate reform is the *right to remedy*; also known as *open court* provisions. These clauses generally go beyond the U.S. Constitution's Seventh Amendment right to civil jury trials by variously purporting to

guarantee the right of access to the courts. In addition to state constitutional provisions, the U.S. Constitutional *due process* and *equal protection* guarantees found in the Fifth and Fourteenth Amendments have also been used to invalidate particular reforms (56).

More than 150 decisions have upheld particular reforms in 44 states, which are fairly evenly distributed throughout all regions of the United States. Nevertheless, the move to invalidate reforms is worrisome to reformers. According to Victor Schwartz, a prominent reform advocate, "The trendline is toward courts coming in and upsetting the apple cart . . . [most existing reforms] will be dead by the year 2000" (57). Professor Schwartz' prediction may be overly alarmist. There have been twice as many cases validating as invalidating reforms. Both validation and invalidation cases are roughly equally weighted between the 1980s and the 1990s.

State courts have overturned statutes of repose and some damage caps quite frequently. Twelve states have invalidated statutes of repose on equal protection grounds for two primary reasons. First, statutes of repose require a uniform service life for all products even though products vary considerably in their useful lives. Second, statutes of repose fail to allow for suits when there is delayed manifestation of injury. Statutes of repose have been upheld in at least three states. Damage caps for pain and suffering have been invalidated in at least nine states, and caps for punitives overturned in four states. Collateral source rule reforms in three states have been invalidated. Another five states have invalidated liability limitations protecting specific industries. If such setbacks continue on industry-specific reforms, the prospects may dim for highway innovation-specific limitations at the state level (58).

The invalidation phenomenon suggests that some guidelines should be drawn from the accumulated reform experience to better design valid reform. At least one writer has

observed that some state legislatures have pushed reform with political power. Rather than seek consensus from a large group of differing stakeholders, lawmakers in at least two midwestern states have allegedly rammed through a politically friendly statehouse product liability reform that includes preferential treatment for their favored constituents. This nearly assures close constitutional scrutiny and possible invalidation of many favorable provisions (58). The lesson here may be that it is better to seek a balanced set of reforms rather than quick fixes and sweetheart deals. Multi-stakeholder solutions are often successful in contentious areas where consensus is needed, e.g., environmental matters, and ITS.

Reform pressures are likely to persist. However, success may be episodic, such as how the 1980s reforms were initially driven by popular anxiety over an alleged tort crisis. Much of the debate on both sides of reform is energized by hyperbole and exaggeration (59). However, once the crisis subsides and the conducive but transitory political environment evaporates, reform prospects may deteriorate. Indeed, reformers may be motivated to rush through reforms because they realize their window of opportunity is limited. It is realistic to recognize the opposing forces of human nature at work in the reform debate. There is a near universal apprehension of personal financial responsibility in tort. This emotion can be successfully cultivated for political support of reform, as was arguably done in the 1980s. However, reform-mindedness will eventually be balanced with societal recognition of the need for just compensation to victims. Reform was riding a transitory wave of supportive public and political sentiment that is apparently beginning to decline. Primary reliance on reform to encourage highway product deployment should be supported with careful legal research to provide a sound constitutional basis. Multi-stakeholder mediation efforts are also advisable to work toward consensus on as many reform issues as possible.

CONCLUSIONS

Tort and product liability suits are a small percentage of all those cases that reach final disposition, at both state and federal levels. Most of the evidence that product liability is a disincentive to innovation is anecdotal. Reform advocates commonly list a few testimonials and perhaps some additional examples to support their assertions about product liability risks. These anecdotes standing alone have convinced a segment of the manufacturing community that product liability is much more pervasive than the data suggest. This fear of liability probably produces caution that may impede innovation.

Comprehensive and rich databases covering litigation and claims is apparently nonexistent. The insurance industry is believed to have significant but often proprietary data on many aspects of highway hazards. The few existing studies are based on relatively small samples and their implications are limited by classification problems, inadequate data on size of settlements, and some double counting, overstating some types of cases. Court records often do not facilitate easy data collection on the wide variety of variables often cited as desirable for responsive public policymaking.

This synthesis of previous studies and the survey responses supports a conclusion that concerns over tort and product liability rank lower on ordered lists of barriers to innovation than most other barriers cited. Various procurement, testing, and certification issues are the barriers most often cited and ranked above concerns over liability.

One study specifically addressing the perceived liability risks as a deterrent to highway innovation lists the following types of adverse impacts, in order of frequency cited by respondents: (1) discontinue product, (2) did not introduce product, (3) lost market share to foreign sellers, (4) discontinued product research, (5) declined merger or acquisition, (6) employee layoffs, (7) closed facilities, and (8) moved production offshore.

Although the strict liability theory had its beginnings as a form of premises liability for ultrahazardous conditions, today its use is largely confined to product liability in most states. The impact of the distinction between product and premises liability is not widely understood by the highway community.

This synthesis is based on existing theoretical and analytical frameworks for the impact of tort and product liability on new product decisionmaking. Likely responses to these risks are modeled. This also includes economic models for how the uncertainties of tort or product liability impact capital budgeting decisionmaking for various corporate investments: research and development, new product development, adapting existing products to other markets, etc.

The “onion theory” of highway supplier liability is an observation explaining current practice. It contends that highway suppliers are usually so remote from injured plaintiffs that the more visible entities responsible for highway

project administration (e.g., state, contractor) are more likely to be targeted as defendants. When considered along with those states with particular sovereign immunity for product liability, these two factors may explain the absence of guiding caselaw on product liability claims for highway products. In addition, the state of the art in forensics for highway product failure may be insufficient to effectively pinpoint defective products as the primary cause of particular highway hazards.

Perceptions drive the attitudes about tort and product liability and reform efforts. Product liability is largely unwelcome by private sector business entities and, to a lesser extent, is believed unnecessary by the public sector highway community. The perceived excesses of the tort liability system are also widely unpopular. The product liability and premises liability distinction is not widely understood and, sadly, is often confused by large segments of the highway community. There is little or no product liability experience for highway products by either states or suppliers, thus confirming that product manufacturers are at the onion’s center, which makes them unlikely to be sued for product liability.

This synthesis study found mild agreement that product liability litigation is an important factor in management decisions concerning products or services. Two-thirds of private sector respondents are concerned with the potential for making damage award payouts for potential product liability on at least one of their highway products or services. However, these respondents show mild disagreement that product liability concerns inhibit innovation in at least one of their products. There is even less agreement on inhibitions across a broad spectrum of products and less agreement on both questions by public sector respondents. Neither group perceives that product liability litigation risk has had much impact on the availability of liability insurance. However, nearly half believe the risk has raised the cost of insurance.

Only about 20 percent of private sector respondents agree that product liability concerns have made suppliers unwilling to invest in research and development for highway innovations, while over half disagreed with the assertion. On the assertion that product liability risk has not led to highway product discontinuation decisions, private sector respondents were nearly equally divided, some showing agreement, some disagreement, and some neutrality. Some specific examples were cited. Public sector respondents showed a slightly higher level of agreement. Neither private nor public sector respondents believe suppliers are withholding products from the highway market because of concerns about product liability, although a few provided examples of products with which they have concerns. On new product introductions, as many private sector respondents agreed that product liability concern was *not* a factor as those who agreed that it was a factor in withholding new product introductions. Respondents with

product liability experience had somewhat stronger disagreement. A few examples were provided of products withheld from the highway sector. Public sector respondents provided similar answers.

Product liability and tort reform has been generally unsuccessful at the federal level. There have been a few exceptions for particular classes of liability. For example, accountant malpractice reform was successful in 1995 at the federal level. The joint and several liability rule has been eliminated in securities fraud suits, and difficulties with the federal racketeering law (RICO) have been nearly eliminated. However, the accounting profession's tort relief came with a price: auditors must now adhere to stronger fraud detection duties. The lesson for other tort reforms may be that persistence pays but at the price of compromise.

Product liability and tort reform efforts have been more successful at the state level. The apparently widespread perception that reforms have stalled is inconsistent with actual legislation and recent common law precedents. The American Tort Reform Association (ATRA) data clearly show widely invoked reforms. However, these reforms are not generally consistent between states. Only government attorneys appear to be well informed about the progress of reform in their own states. Large portions of the highway community appear to be unaware of recent tort reforms or that such tort reforms generally apply to most product liability cases, even in the states where they work or do business. While many respondents express hope for the future of reform, few recognize that it has already happened. Fewer still believe reform will have much positive impact on the deployment of new technologies. Therefore, reforms and other responses to the tort crisis are not perceived as effective to achieve the diffusion of technology.

There are lessons from the setbacks that tort reform has suffered in recent years. It may be better to seek a balanced set of reforms rather than quick fixes and sweetheart, industry-specific deals with legislatures. Multi-stakeholder solutions are often successful over contentious issues where consensus is needed, e.g., environmental matters and intelligent transportation systems. Primary reliance on reform to encourage highway product deployment should be supported with careful legal research to provide a sound constitutional basis. Multi-stakeholder mediation efforts are also advisable to work toward consensus on those reform issues on which the beliefs of the majority are already closely related.

Canadian provinces have much less experience than U.S. states with tort or product liability or with reform.

Given the importance of law in decisionmaking and business activities and the perceived persuasiveness of the tort crisis, better information is needed by policymakers before traditional rights are significantly reformed. Studies are needed to collect comprehensive litigation and settlement data affecting the highway sector. It is probably necessary to establish more precise, more timely, and clearer data collection systems for highway tort claims and litigation. Such studies could provide benefits outside the highway sector as a model for data collection in other areas of the law.

These efforts could take the initiative to set standards for case and claim classification to avoid double counting, vague

and overlapping definitions (e.g., sovereign immunity v. liability limitation for highway conditions, repose v. engineer liability limitations). National highway organizations could also approach the insurance industry, perhaps through its trade groups, and work with other organizations to make any existing data more widely available. This liaison with the insurance industry (e.g., NAAG, Administrative Office of U.S. Courts) could also provide assistance in formatting and archiving the data. Existing data likely to be found in insurance industry sources were heretofore largely unavailable. The insurance industry may generally consider the data to be proprietary, giving its owner a competitive advantage in setting rates and making underwriting decisions. Further, the industry may claim that data about the insured and claimants are confidential, and the industry may fear that release of the data will reveal each insurance company's proprietary methods to do efficient actuarial and underwriting activities. However, as to unlitigated claims records, the insurance industry may be the only comprehensive and accurate source of claims data. Data collected could include aggregate data on settlements made under confidentiality or secrecy order or agreement to prevent identification of individuals involved. The insurance industry directly benefits from reform legislation and apparently participates actively to influence public opinion that there is a "tort problem." Continuation or expansion of the insurance industry's antitrust exemption for intercompany exchange of claims data could be conditioned on the industry making such data more broadly available for public policy research purposes.

Future studies of litigation should employ interdisciplinary teams. Collaboration among experienced researchers with widely varying skills is necessary to capture the discipline-specific nuances of several fields. Such teams would logically include law scholars, litigation experts, political economists and public policy analysts, data management professionals, content analysis experts, risk managers, and experts from the particular field under study (e.g., civil engineers for highway liability studies).

Theoretical research is needed to compare premises and product liability theories and practice. This research would be useful if it would focus on the justifications and practical impact of differences between premises and product liability. A survey of premises liability plaintiffs and their attorneys might better target the reason why product liability claims are so seldom made in highway hazard litigation. It is doubtful such a survey would actually encourage product liability claims because plaintiffs' attorneys regularly take significant risks in making novel claims and the penalties for failure are still so low.

Additional related research is needed on the theoretical nature of how privity, piercing the corporate veil, mandatory contribution, and indemnity intertwine to produce the "onion" layers of liability protection apparently enjoyed by suppliers of highway products. Research is also needed to improve the forensics of determining cause in highway product failures.

Policymakers must stay apprised of developments in tort and product liability law from statutory, caselaw, and regulatory sources. A nationwide clearing house, perhaps a trade

organization, could be helpful in establishing or maintaining such data. Useful insights could arise from a better understanding of how lobbying efforts for reform in statehouses and Congress transform into actual legislation. Of particular interest are highly favorable industry-specific reforms that shift litigation risks to some new party (e.g., states, injured motorists, bystanders). It might also be useful to follow the foreign tort and product liability evolution as it moves closer to the more litigious American model.

Greater care is needed in advocating and drafting tort reforms. Reform proposals will be greatly informed by the progress, successes, and setbacks of tort and product liability reform, on a state-by-state basis and at the federal level. The federalism problem of mandatory federal uniformity in tort should be researched. A critique of national uniformity based on clear constitutional precedents may be needed to justify federal intervention into this traditionally states' rights arena of the police power. This could then be balanced with the advantages of continuing multistate experimentation with various types of reform.

Reform should embrace proportionate liability in all its various forms. Experimentation is highly indicated, perhaps on the model established by the introduction of comparative negligence. This permitted states to experiment with varying forms of proportionate liability, resulting in the elimination of less effective forms and the eventual selection of optimal forms of comparative negligence from the many states' accumulated experience. Broader proportionate liability should diminish or eliminate the "deep pockets" impact of the traditional joint and several liability rules and could help reduce the lottery mentality of some juries.

It is advisable to revisit procurement contract reform with a view to the evolution of this process to lower costs and encourage innovation. States should consider expanding the use of supplier warranties defining the types of defects or conditions for which warranties are most needed (e.g., durability,

delayed manifestation defects, recalls, warranty's duration). State highway agencies might consider adding indemnity and contribution clauses to all procurement contracts if this is feasible given the competitive environment.

Studies are needed to better understand how contractual assignments of risk sharing might work, such as risk splitting in direct proportion to risk contribution by various parties in highway construction, maintenance, and operations contracts (e.g., state, prime, subcontractors, suppliers, third-party inspectors, third-party testing and certification labs). Studies will eventually be needed to better understand the risk management impact of the privatization phenomenon. This will likely include whether public or private law should be applicable when government privatizes formerly public services by selling or subcontracting operations to private contractors.

Research is needed to review the advisability and economic impact of government mandated compensation systems as a correlate to reforms of the tort system. Any mandatory risk pooling technique suggested could be compared with existing compensation systems, such as some states' workers compensation or unemployment compensation systems. These systems have many similarities that could provide an interesting model for comparison with any reform that would develop a centrally administered compensation system. It is advisable to monitor the developments in healthcare reform, as this appears to be a key ingredient in jury sympathies and would have an impact on the type and amount of compensation paid to injured parties by any tort or product liability reform effort.

Finally, alternative methods of dispute resolution are frequently suggested to blunt the negative impact of the tort problem. For example, mediation and arbitration are often proposed and there is some evidence of their efficiency and the satisfaction of users. Evolution of the product testing, evaluation, and certification process is also often cited as sufficiently tied both to liability and innovation so that additional research and efforts could be effectively focused.

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APPENDIX A

Methodological Comparisons

A civil lawsuit begins with the filing of a complaint in either the federal or state court having jurisdiction. The magnitude of filing activity at the federal level is summarized in annual reports of the director of the Administrative Office of the U.S. Courts (1). These reports draw on machine-readable records created on all cases filed in federal district and circuit courts. Cases are classified according to the Administrative Office's nature-of-suit codes. This code system consists of general categories, such as contract, real property, torts/personal injury, and torts/personal property damage and numerous subcategories that vary in number and description depending on the general category.

The machine readable records were first created in mid-1970. Over time, the number and nature of subcategories have been modified to reflect the changing characteristics of litigation. For example, product liability subcategories were first introduced in 1974 for contracts, real property torts, personal property damage torts, and personal injury torts. The latter has four subcategories: airplane, marine, motor vehicle, and other. In 1984, asbestos was added as a fifth subcategory (2).

Unfortunately, the Administrative Office's annual reports have several shortcomings with respect to addressing important policy related questions, such as the number of product liability suits filed each year or the annual growth rate in product liability filings. First, the reports contain multiple counts of the same cases. Cases remanded after appeal, transferred from one federal district to another, or closed and then reopened, are each counted as a separate filing, even though it is the same case. Second, the nature-of-suit codes are limiting in that they do not contain product information other than asbestos. Third, no information on industries or number of businesses involved in litigation can be obtained from the annual reports (2).

In an effort to provide better empirical data, Terence Dungworth of The RAND Corporation's Institute for Civil Justice undertook the task in the mid-1980s of creating a modified database of federal filings that minimizes multiple counting of the same case and that contains more detailed information on products, businesses, and industries involved on

product liability litigation (Dungworth). Dungworth's period of study was July 1, 1974 through June 30, 1986. His first interest was in estimating the number of product liability lawsuits. By examining individual case records to determine the origin of each case, Dungworth was able to build a product liability database containing only filings new to the federal court system. These cases included original proceedings, that is, cases not previously filed in any court, and cases removed from state to federal courts. Filings that produced multiple counts, such as cases transferred from one federal district to another were eliminated.

Table A-1 presents Dungworth's estimate of product liability filings in federal courts by stage in the litigation process for the period July 1, 1974 through June 30, 1986. He cautions that his work is an estimate due to the product liability subcategory not being fully integrated into the Administrative Office's coding system until 1976. Of the 95,959 filings classified as product liability cases by the Administrative Office, Dungworth estimates that 10.3 percent or 10,265 filings, are multiple counts. He states that the significant shares of filings in the two categories: (1) removed from state court and (2) transferred from other districts, are consistent with his expectations on the nature of product liability cases. His conjecture is that many suits initially filed in state court involve nationally distributed products. Hence they are more likely than other kinds of suits to be removed to federal courts on a diversity of citizenship jurisdiction basis. Interdistrict transfers may also be more common for product liability suits due to the higher likelihood of multiple actions from different jurisdictions against the same defendant. These multiple actions then may be consolidated (2). Dungworth also examined individual case records of other types of civil litigation to eliminate double filings. One of the end products of this portion of his efforts was Table 1, in chapter 1.

At this time, there does not appear to have been an effort similar to Dungworth's undertaken with state level data. In April 1995, however, the Bureau of Justice Statistics (BJS), U.S. Department of Justice, issued a report that includes the

TABLE A-1
ORIGIN OF RECORDS IN THE FEDERAL DISTRICT COURTS DATA BASE, SY74-86 (16)

Stage of Litigation Process	Product Liability Actions	
	Number	Percent
Original proceedings	69,219	72.1
Removed from state court	16,475	17.2
Remanded from appellate court	332	0.3
Reinstated/reopened	3,008	3.1
Transferred from other district	6,912	7.2
Other	13	< 0.1
Total	95,959	100.0

classification of tort cases by type in the largest U.S. counties (3). The report is the product of the Civil Trial Court Network Project conducted by the National Center for State Courts and the Bureau of Justice Statistics to examine the nature of civil litigation in the state general jurisdiction trial courts in 45 of the 75 most populous U.S. counties. Unlike Dungworth's effort, this project sampled cases to derive its estimates. The 45 counties from which cases were drawn included the 14 largest. Only torts were sampled, thus other civil litigation, such as contracts and real property rights, were excluded. The exclusion of contracts may be significant to product liability counts because there are likely product liability cases contained within the contracts classified cases. Dungworth estimates that contracts constitute 6.5 percent of all product liability litigation at the federal level.

Also excluded were cases from federal courts, cases in states' limited jurisdiction courts, and cases in courts outside the largest 75 counties. Other than the federal court cases, these exclusions probably work to heighten the proportion of product liability cases in the study's case type distribution estimates. The BJS estimates that the 75 counties represent approximately 50 percent of the national tort caseload. Although unknown, it nonetheless seems unlikely that the proportion of product liability cases is any higher in lower populated areas than in the largest counties. The fact that products cases are more complex than most torts would lend weight to the argument that the proportion of products cases may be higher in the most populated regions where the most experienced and competent plaintiffs attorneys practice. Cases in limited jurisdiction courts tend to involve financial stakes below certain thresholds; while there is likely to be some product liability

litigation in these courts, the number of cases is likely to be small and as a proportion, significantly less than in general jurisdiction courts because products cases tend to involve higher costs.

Several additional methodological differences from Dungworth's study include that the BJS sample was drawn from case dispositions while Dungworth's work was based on case filings. Whether and how this might affect the mix of case types is unknown, although the difficulty in making an argument one way or the other suggests that the effect may be insignificant. Another difference between the two studies is that Dungworth's analysis covered a 13-year time span while the BJS sample was drawn from cases for just one year, 1992. Finally, it is not evident from the information given in the report as to whether or not individual cases may be counted more than once in the disposition classifications used for the study.

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2. Dungworth, T., *Product Liability and the Business Sector: Litigation Trends in the Federal Courts*, R-3668-ICJ, The Institute for Civil Justice, The RAND Corporation, Santa Monica, California (1988).
3. *Tort Cases in Large Counties*, Civil Justice Survey of State Courts, 1992, Special Report, NCJ-153177, Bureau of Justice Statistics, Office of Justice Programs, U.S. Department of Justice (April 1995).

APPENDIX B

General Tort and Product Liability Overview[†]

PRODUCT LIABILITY THEORIES

Warranty Liability

A warranty is an affirmation of fact or a promise of performance made in any product sale governed by Article 2 of the Uniform Commercial Code (UCC), which is now law in all 50 states. In both warranty and strict liability tort cases, it is unnecessary to determine who is “at fault.” Warranties are often stated in contract terms and they impose particular duties on both the seller and buyer. There are three general types of product quality warranties: (1) the express warranty, (2) an implied warranty of merchantability, and (3) an implied warranty of fitness for a particular purpose.

Express Warranties

Express warranties are contractual promises relating to the future performance of goods. Goods are considered defective if they fail to meet the express warranty standards. Warranty liability arises if the seller agrees to provide a remedy to the purchaser. The buyer need not prove any seller misrepresentation or fault. An express warranty arises under UCC §2-313 if the seller’s promise forms a basis of the bargain. This means that the parties must consider the warranty a part of the description of the goods although no specific reliance by the buyer on the description needs to be proved for the warranty to be enforceable. The promises that form the terms of the express warranty may come from (1) an affirmation of fact or any promise relating to the goods, (2) a description, (3) a sample, (4) technical specifications, or (5) a model used by the seller to influence the buyer.

Express warranties are formed by the seller’s promises or by other conduct. For example, an express warranty is formed if the seller presents technical specifications or a blueprint to the buyer. An express warranty may also be inferred from past deliveries that lead the buyer to presume that future deliveries will involve similar goods. A sample of the goods, such as grain, chemicals, or aggregate drawn from a larger bulk, may represent the expected average quality. A model may be used when the actual goods to be delivered are not available.

Generalized statements of value are usually too vague to be warranty promises; such expressions are a seller’s *puffing*. For example, when an auto dealer claims that an automobile is

“great” or “a bargain,” no warranty arises. For a warranty to be valid, however, warranty statements need not be in any special format, nor labeled as a warranty or guarantee, nor must the seller intend to create warranty obligations. Express warranties are enforceable to the extent that the seller promises satisfaction. The precise timing of the seller’s promise or the seller’s display of a sample is not important; even promises made after the sale can create or modify the warranty. What is important is that the statement becomes part of the contract description.

Warranties often create duties on the seller that extend into the future. However, it may be difficult to distinguish (1) the seller’s duty to remedy goods which later fail due to defects existing when originally delivered, from (2) the seller’s promise to provide future maintenance under the warranty. Such interpretation problems may have been the basis of former federal regulations prohibiting warranties by suppliers of highway products. The blanket prohibition may have been intended to prevent federal funding of maintenance under a future performance warranty.

An express warranty may be made in written or oral form as long as the parol evidence rule does not require that it be in writing. The *parol evidence rule* applies when a written contract of sale is intended to be the complete contract between buyer and seller. If the written contract is considered such an *integration* and it contains no written warranty, then no oral evidence of an express warranty will be admissible at trial. Nevertheless, promises create a warranty, so a car dealer’s statements made while showing a car are considered a warranty, even if there is no formal written contract.

Implied Warranty of Merchantability

A warranty of merchantability is implied under UCC §2-314 whenever goods are sold by a *merchant*. A merchant is a seller or buyer who deals in goods of the kind involved in the contract. A merchant is also someone who professes to be an expert in the particular trade or business. Sellers are considered merchants when they use agents who are merchants. Even secondhand goods must conform to the merchantability standard when sold by a merchant. In isolated sales, those occurring out of the ordinary course of business, no merchantability warranty applies. For example, if a person sells his or her personal car to a neighbor, there is no implied warranty of merchantability.

An implied warranty may be inferred from trade customs such as either a *usage of trade*, which is a common practice among most of the firms in a particular business or a *course of dealing*, which refers to a common practice followed by two contracting partners determined from their previous dealings. For example, an obligation to provide pedigree papers to sub-

[†]This appendix is provided to familiarize the reader with technical aspects of product liability law. This appendix is adapted from Chapter 10 “Product and Service Liability,” of *Irwin’s Legal and Regulatory Environment of Business*, F. William McCarty and John W. Bagby (3d ed. 1996, McGraw-Hill/Irwin Co., Homewood, Illinois) and is used by permission.

stantiate the lineage of a show dog or a blooded bull may arise from a usage of trade. The trade might consider an animal merchantable only where adequate pedigree is demonstrated. Merchantable goods must at least conform to the characteristics of merchantability stated in UCC §2-314(2).

Characteristics of Merchantability
[UCC §2-314(2)]

- Pass without objection in the trade under the contract description
 - Are of fair average quality if fungible (i.e., all units equivalent or interchangeable (e.g., grains or chemicals), lose separate identity when mixed).
 - Are fit for the ordinary purposes for which they are used
 - Are of even kind, quality, and quantity within the variations permitted
 - Are adequately contained, packaged, and labeled as required by the agreement
 - Conform to the label or container description.

The various definitions for merchantable goods may also provide guidance for the interpretation of an unclear express warranty. Products should be fit for the ordinary uses expected by consumers.

Implied Warranty of Fitness for a Particular Purpose

The *implied warranty of fitness for a particular purpose* may be made by any seller, whether or not the seller is a merchant. This “fitness” warranty arises under UCC §2-315 whenever the buyer relies on the seller’s expertise to select goods suitable for the buyer’s intended use. For example, if a paint dealer is asked to select nontoxic paint for use in a child’s room, this implies a warranty that the paint contains no lead. The fitness warranty may arise even if the buyer does not directly communicate the particular purpose to the seller. Therefore, the fitness warranty arises even when the seller has reason to know the buyer’s purpose and then helps select the goods. The buyer must actually rely on the seller’s expertise and selection decision before there is a fitness warranty.

The particular purpose at issue in a fitness warranty is distinguished from an ordinary purpose under the merchantability warranty. Particular purposes are specific and planned uses peculiar to the buyer’s household or business. Ordinary purposes are the uses customarily made by most buyers. For example, shoes are merchantable when made for walking on normal ground. However, a special pair of shoes might be necessary for mountain climbing so the seller’s selection guidance for mountain climbing would trigger a fitness warranty because of this special and particular purpose. However, no fitness warranty arises if the buyer ignores the seller’s suggestions by insisting on a particular brand or model of goods. In that case, there is no buyer reliance on the seller’s expertise.

What circumstances might surround a seller’s understanding of the buyer’s business, permitting an inference that the buyer is relying on the seller’s selection expertise? In *Northern Plumbing Supply, Inc. v. Gates*, 196 N.W.2d 70 (N. Dak. 1972) Gates sought to purchase pipe from Northern Plumbing Supply for use in making a farm implement. Northern’s president, Luxem, knew of Gates’ purpose because he had visited Gates’ farm. Gates showed Luxem a section of pipe with a wall thickness of 0.133 inch as a model for the pipe he desired, but Gates simply requested “standard” pipe. Northern supplied Gates with “standard” pipe with a thinner wall thickness of 0.116 inch than the one Gates had shown. This thinner pipe was too weak for the farm implement attachments that Gates made. Even though Luxem conceded at trial that the thinner wall pipe would not hold up to the stress of Gates’ use, he claimed it was not his responsibility to second-guess Gates’ request for “standard” pipe. The court held Gates was a farmer with no way of knowing “standard” pipe had an insufficient wall thickness for his purposes. As a seller, Luxem should know all about pipes and about Gates’ intended use. This case illustrates that the elements of an implied warranty of fitness were present.

Warranty Exclusions

Although it would seem advisable for sellers to exclude warranties whenever possible, there may be competitive pressures on the seller to offer a warranty to distinguish its products from its competitors. Some sellers may orally claim warranty coverage, but then in a fine print provision in the sales contract, exclude the oral warranty. UCC §2-316 is intended to prevent such misunderstandings by requiring the seller act in good faith. A warranty remains in force if a seller engages in any unconscionable conduct in excluding a warranty.

All implied warranty exclusions must be conspicuous in the sale contract. An exclusion must be written in common language that draws the buyer’s attention to the exclusion. The exclusion of the implied warranty of merchantability must mention the word *merchantability* or otherwise clearly exclude the warranty. The wordings *as is* or *with all faults* are examples of language that in common understanding call the buyer’s attention to the warranty exclusion so all warranties of quality are excluded.

A SAMPLE WARRANTY EXCLUSION

THE SELLER HEREBY DISCLAIMS ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Buyer’s Inspection of Goods—A warranty is automatically excluded to the extent that the seller gives the buyer a reasonable opportunity to inspect the goods before contracting to the extent the inspection would reveal the defect. The seller

can reinforce this right by demanding the buyer inspect. For example, if a salesclerk requests the buyer of a stereo to test its FM reception while the unit is on display, but the buyer refuses, the warranty on FM reception will be excluded. The scope of the examination necessary is based on the buyer's opportunity to inspect and on the buyer's expertise to discover a particular type of defect. A usage of trade, a course of dealing, or a course of performance may also exclude a warranty.

Inconsistent Warranties and Exclusions—Where the terms of an express warranty are inconsistent with an exclusion or a disclaimer, the inconsistency is resolved in favor of the buyer. For example, a two-year express warranty in bold typeface is inconsistent with a fine print exclusion of an express warranty. In that case, the buyer will still have the benefit of the express warranty. By contrast, it is permissible and consistent to provide a warranty on some aspect of the goods while disclaiming warranty on other aspects. For example, automobile manufacturers often provide warranties limited to the car's drivetrain (engine and transmission) while expressly excluding any warranty on the tires and battery. The excluded parts are usually covered by warranties from their separate manufacturers, so the buyer's warranty claims must be made against these separate component parts manufacturers.

Warranties and Privity—Many states apply warranty liability to any business in the chain of distribution. However, some privity requirements still exist for warranty actions in nearly a third of the states. UCC §2-318 permits states to adopt a form of privity or to permit a warranty suit by even remote parties. UCC §2-318 Alternative A, chosen by most states, gives standing to sue to the consumer, any immediate family member, and any guest in the consumer's home who suffers personal injury if their use of the product was reasonably foreseeable. UCC §2-318 Alternative B expands liability beyond the family to include any natural person's personal injury if their use of the goods is reasonably expected. UCC §2-318 Alternative C expands warranty coverage to any person or corporation expected to use the goods, it includes property damage and it prohibits the seller from disclaiming liability for personal injuries.

Negligence

Negligence was the first tort theory used in product liability cases. The plaintiff must prove the damage sustained was the "fault" of the defendant's negligent conduct by establishing a prima facie case of negligence. This is generally a more difficult burden of proof than under the "faultless" theories of strict tort liability or contractual warranty. The plaintiff must prove the defendant had a *duty to exercise due care* and to foresee any unreasonable risk of harm posed by the goods sold. The seller must minimize risks of injury by adequately designing, manufacturing, and inspecting the goods. Primary responsibility to minimize product defects rests with the product manufacturer or assembler. However, in some situations the law may require wholesalers and retailers to inspect, assemble, or prepare the goods before delivery to the customer. For example, auto dealers have the duty to inspect new cars before delivery to consumers.

Manufacturers must warn consumers and give instructions for safe use. Failure to warn is now a prevalent negligence product liability theory. The *Cipollone v. Liggett Group, Inc.*, 112 S.Ct. 2608 (1992) tobacco liability case exemplifies that the tobacco industry had a duty to warn smokers once dangers of tobacco use became known. Breach of these duties may result in liability to any person who might reasonably be expected to use or be affected by a defective product. For example, it is negligent not to inspect empty beverage bottles before filling them because it is reasonable to expect they could contain a foreign substance that might injure a consumer. By contrast, it is natural to find fish bones in fish chowder so it would probably not be negligent for such a product to contain them.

A wide range of injured victims may sue under negligence, including the purchaser, members of the purchaser's family, the purchaser's guests, and even bystanders if they fall within the zone of foreseeability. Foreseeable bystanders are persons reasonably expected to be affected by defective products. For example, it is foreseeable to expect a defective automobile could injure a pedestrian.

Strict Liability

The most common theory of product liability used today is based neither on fault nor on the sales contract. Under the strict tort liability theory, a manufacturer, wholesaler, or retailer that is in the business of selling products may be liable for injuries resulting from defects that make the product unreasonably dangerous. Many states have judicially adopted strict liability as found in §402A of the Second Restatement of Torts.

Restatement of Torts Second, §402A

1. One who sells a product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if
 - a) the seller is engaged in the business of selling such a product, and
 - b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold.
2. The rule stated in Subsection (1) applies although
 - a) the seller has exercised all possible care in the preparation and sale of his product, and
 - b) the user or consumer has not bought the product from or entered into any contractual relation with the seller.

Unreasonably Dangerous and Defective

The strict liability claimant must prove the product was (1) defective and (2) in an unreasonably dangerous condition.

These standards are purposely vague to cover a wide variety of products and situations.

Defectiveness generally depends on the customer's expectations for product performance. First, the merchantability standards may provide some guidance for defectiveness. Products with inadequate safety warnings, which are unfit for ordinary purposes, have inadequate packaging or labeling, or which could not pass without objection in the trade are probably defective for strict liability purposes. Second, a product dangerous beyond what an ordinary consumer would expect is unreasonably dangerous. Therefore, products with weak parts or mechanical limitations are usually defective. By contrast, consider alcohol, caffeine, tobacco, and other common substances with dangerous side effects when used improperly or excessively. Most consumers know these risks, so the products are not unreasonably dangerous unless adulterated such as when they contain foreign substances.

The strict liability theory exposes suppliers to the broadest potential liability of all product liability theories because of its lesser burden of proof. The privity doctrine and the defenses of contributory and comparative negligence are inapplicable. However, many states recognize defenses such as product misuse, assumption of risk, and the plaintiff's failure to discover a defect that should have been discovered. Comment k to §402A of the Restatement exempts products that are unavoidably unsafe, such as prescription drugs. This means plaintiffs in product liability suits for defective drugs must prove negligence because drugs are exempt from strict liability. A few courts have expanded this to exempt defective medical devices from strict liability (e.g., prostheses, IUDs, implants, pacemakers). Commonly, plaintiffs allege all three product liability theories, breach of warranty, negligence and strict liability, when bringing suit. They also often name all sellers in the chain of distribution as defendants.

Misrepresentation

Merchants and others engaged in the business of selling goods to the public may be liable for misrepresenting the quality or characteristics of products. Such misrepresentations may result from either negligence or conscious and knowing misstatements. Section 402B of the Second Restatement of Torts is a common basis for this misrepresentation theory of product liability. Misrepresentation may present an expanding potential liability risk given recent successful use by plaintiffs in tobacco and keyboard repetitive motion disorder cases.

Restatement of Torts Second, §402B

One engaged in the business of selling chattels who, by advertising, labels, or otherwise, makes to the public a misrepresentation of a material fact concerning the character or quality of a chattel sold by him is subject to liability for physical harm to a consumer of the chattel caused by justifiable reliance upon the misrepresentation, even though

- (a) it is not made fraudulently or negligently, and
- (b) the consumer has not bought the chattel from or entered into any contractual relation with the seller.

Although the misrepresentation theory is similar to a breach of express warranty, the two differ in several important respects. Misrepresentation is a tort; it is not based on the UCC or other contract principles. The tort statute of limitations applies, and contractual limitations of remedy, exclusions of warranty, or exclusions of consequential damages are ordinarily inapplicable. There is no privity requirement making the manufacturer, wholesaler, retailer, or other distributor potentially liable. Consumers entitled to sue under misappropriation are broadly defined to include employees who use the goods on the job and family members with permission to use the goods.

There is liability exposure for misrepresentations that are material and concern the goods' characteristics. In one case, a windshield misrepresented as "shatterproof" shattered when hit by a stone. The matter misrepresented must be factual and susceptible to exact knowledge. Mere statements of opinion and dealer puffing do not subject the seller to liability. Consumers unaware of the misrepresentation cannot sue. Only publicly made misrepresentations or advertisements are actionable; individual misrepresentations made only to a particular consumer are not covered by Section 402B.

In one case, a mace weapon was represented in a brochure as capable of "instantaneous incapacitation . . . [of] entire groups." The manufacturer was held liable for injuries suffered by a motel's night auditor who was attacked when the mace weapon failed to repel attackers. In another case, a wire rope failed, permitting a hoisted weight to fall on a consumer. The manufacturer's manual was distributed to dealers for review by buyers. It misrepresented the rope's strength, and formed the basis for liability.

Misrepresentations may be inferred from the way goods are merchandised, even if the marketing efforts are only directed toward a segment of the population. A policeman purchased a riot helmet from his department, relying on a package illustration showing a motorcyclist wearing the helmet. The policeman wore the helmet while riding his motorcycle. The helmet was designed to release quickly on impact and came off his head in a motorcycle accident. The manufacturer was held liable based on the misrepresentation because the helmet was unsuitable for motorcycling. Many plaintiffs often allege one or more of the four major product liability theories.

LIABILITY OF PARTIES IN THE PRODUCT DISTRIBUTION CHAIN

Selection of the proper parties as plaintiffs and defendants is an important part of product liability cases. Substantive laws applicable in the state where the wrong occurs and procedural laws from the forum state may restrict or expand the number of potential plaintiffs or defendants. The clear trend has been to expand the classes of persons entitled to sue for injuries caused by defective products, which exposes business

to increasing risks. Possible plaintiffs include both the purchaser and others who are affected by the use of such products. Mass torts and class action suits brought by one person representing all injured plaintiffs has also raised the risk of business and its insurers.

After final distribution of products to the ultimate consumers, there are three classes of persons who may be affected by a defective product. The first group consists of the purchaser and the purchaser's family. The second group consists of the employees of a commercial consumer who use or may be affected by the product. The third group consists of bystanders who may be affected by the product if it fails. UCC §2-318, discussed above, permits the states to choose among three privity rules for expanding liability beyond the buyer.

Product liability law has also expanded the number of defendants potentially liable for defective products. Most entities in the chain of distribution are potential defendants, including component part manufacturers, assemblers, wholesalers, and retailers. Most products begin with the refinement of raw materials or the manufacture of component parts. The manufacturer or assembler then combines components into finished products. A wholesaler may then purchase the products for resale to retailers and retailers purchase with a view to resell to ultimate consumers. Service providers may then install these products into building projects under construction contracts.

Manufacturers

Component part manufacturers and assemblers of finished products can be held liable under all product liability theories. However, component part manufacturers may be shielded from liability if (1) the finished product assembler converted the component to an unexpected use or (2) the component reached the consumer after the assembler, dealer, or buyer made substantial changes in it. For example, a punch press manufacturer sold a machine without safety devices, expecting the industrial customer to add appropriate safety devices. The punch press manufacturer was not held liable when an employee was injured after the customer's safety device failed.

Wholesalers

Wholesalers are not named as defendants in product liability actions as often as manufacturers or retailers. However, they may be held liable under any of the product liability theories. Suits are often brought against the domestic distributors of foreign-made goods. For example, the domestic subsidiaries of foreign automakers are liable for injuries from automobile defects.

Retailers

Retailers are likely to be sued because they have privity with the buyer. Retailers are held liable under all product liability theories. However, some vestiges remain of a defense

known as the sealed container doctrine. Under this theory, the retailer has no duty to discover concealed or latent defects. For example, some states relieve retail food stores from liability if a sealed container (e.g., bottled liquids or soft drinks) explodes or leaks out, causing injury or slippery conditions. Certainly, it would be impractical for a retailer to conduct scientific tests or regularly dismantle all goods for inspection. However, a retailer's inspection duty arises when the sealed container is opened, when the retailer suspects poor quality, or when the retailer provides some assembly or installation service that actually introduces the defect. Manufacturers may also be liable for defects introduced by a dealer if final production steps are delegated to the dealer, a common practice in the sale of vehicles. The liability of sellers of used products is still uncertain but is expanding, particularly if the seller has made an express or implied warranty.

Allocating Product Liability Among Sellers

Several additional legal doctrines affect the liability of participants in the distribution chain, including joint and several liability, subrogation, indemnification, successor liability and market share liability problems. Employees who are injured while using industrial machinery for their employers' operations may have a product liability claim against the machinery manufacturers as well as a workers' compensation claim. When the employer or a workers' compensation insurer is required to pay these claims, they are given the right of subrogation to sue the defective equipment manufacturer. For example, if the injured employee's claim is paid by workers' compensation, the insurer is substituted as the claimant in the product liability suit against the defective equipment manufacturer. Thereby, subrogation is a form of reimbursement from the equipment manufacturer for the workers' compensation claim payment. Any party ordered to pay a product liability judgment may have the right of indemnification from some other responsible party. For example, if a wholesaler were held liable for a defectively manufactured product, it could seek indemnification from the manufacturer if the wholesaler can prove the manufacturer was ultimately responsible for the defect in design, manufacture, handling, or warnings.

The trend in the 1980s to restructure businesses has led to mergers, acquisitions, and corporate breakups involving the sale of various product lines. This raises the question of successor liability: are the purchasers of these businesses liable for defective products previously manufactured or designed by the selling corporation? Generally, business purchasers are liable only for debts they consciously assume, so defective product claims remain the selling corporation's liability. However, if a corporation files for bankruptcy or the seller of a product line is liquidated, product liability claimants could be left with nothing. Some states hold the purchasing corporation liable for these product liability risks, requiring it to inherit these liabilities irrespective of terms to the contrary in the acquisition agreement. For example, the purchaser may be liable if the transaction is designed as a sham to avoid liability, the transaction in substance amounts to a merger, or the purchasing

corporation inherits the same management and owners of the selling corporation.

DEFECTIVENESS

The central issue in most product liability suits under nearly all theories is whether the product is defective. In a negligence case, the seller may be liable which failed to exercise due care in: (1) the product design, (2) manufacturing, (3) handling, (4) inspection, (5) packaging, (6) providing instructions, (7) installation or (8) warning of known dangers. Under strict liability, there must be proof the product was rendered unreasonably dangerous by its defect. Warranty theory requires the plaintiff to prove the goods failed to conform to the warranty. In all cases the plaintiff must still prove the defect caused the injury.

Defective Designs

Products must be designed to eliminate defects that could lead to injury. Under warranty or strict liability, a defective design is considered a condition of the product. By contrast, negligently designed products result from a lack of due care by the designer or manufacturer. The practical difference is that in negligence suits the design process is examined closely for considerations of the foreseeability of danger. The inquiry is simpler in strict liability suits because foreseeability and fault are irrelevant, only the presence of a defect must be proven. A reasonably acting designer may escape negligence liability if the design appeared reasonable at the time it was designed. However, reasonable design activities are still subject to strict liability if the products are unreasonably dangerous. Interaction between the warranty and negligence theories also creates some apparent conflicts. If a buyer specifies a particular need to the seller, then the warranty of fitness arises. In such a situation, the manufacturer may nevertheless be negligent, because during the manufacturing process the manufacturer is in the best position to assure that a design is not faulty. By contrast, a useful design that is inherently dangerous and thereby unavoidably unsafe may nevertheless be free from defects. For example, although knives are inherently dangerous, they are not defective simply because they can cut things effectively. The manufacturer may limit its liability for such obvious dangers by providing safety devices or warnings. For example, chain saws are inherently dangerous because of a tendency to "kick back," so chain saw manufacturers must issue warnings or install chain-stop safety devices to limit their liability.

Duty to Warn

Sellers are shielded from liability where adequate directions and warnings of known dangers are provided. However, warnings alone do not replace the manufacturer's duty to provide obvious safeguards. For example, a conspicuous warning about the dangers of a punch press would be insufficient if a

simple guard device would protect the operator from serious injury. To be effective, warnings must be understandable and conspicuous. Sellers are often reluctant to place too many warnings on products because this might alarm purchasers or be ignored. However, this is often an inadequate justification for a failure to warn of known dangers or known allergic reactions. If serious danger would arise when directions are disregarded, then the warning must be made more conspicuous. A warning must be calculated to reach the likely users of the product. In one case, employees used machinery purchased by their employer, but a separate warning to users was required in addition to the warnings given only to the employer.

In the case of a machine tool used in a factory, the warnings must be conspicuously noted on the machine tool and be made understandable to the average worker. Warnings placed in a bulky user's manual may be insufficient if users are unlikely to ever consult the manual. Hazardous processing machinery is often covered with many warnings. Manufacturers should foresee and warn against dangers attendant to all uses and even to the service procedures. In *Nelson v. Hydraulic Press Mfg. Co.*, 404 N.E.2d 1013 (Ill. Ct. App. 1980) a maintenance worker was injured while attempting to repair an injection molding machine. Melted plastic was placed through a feed tube and forced into molds to manufacture various plastic parts. Nelson climbed a ladder to observe a hardened plastic plug when molten plastic suddenly erupted causing him severe injury. No warnings appeared on the machine. The court said:

The jury, as reasonable persons, could have concluded that the defendant manufacturer knew or should have known of the danger to maintenance men from exposure to hot plastic material erupting through the feed hole during maintenance operations to purge the machine of hardened plastic, and that as a result of the failure to warn or instruct concerning said danger the machine in question was unreasonably dangerous and in a defective condition when it left the control of the defendant and that the defective condition was a proximate cause of plaintiff's injuries and damages.

Establishing Defectiveness

Proof of a product's defects may come from several sources. Conflicting expert testimony is often heard from engineers, scientists, designers, and production experts concerning the product's performance and design characteristics. Many documents from the seller's files are produced during the pre-trial discovery phase of litigation that may show whether a particular design or warning was considered and rejected as too costly during design or production. Defect databases are kept by insurers and by some federal and state regulators like the Consumer Product Safety Commission and the National Highway Traffic Safety Administration. Their regulations may impact the standard of defectiveness used in the courts. Many other groups accumulate defect, injury, and incident data. For example, consumer groups often track litigation and organize efforts for recalls or class action suits. The Insurance Institute for Auto Safety and various industrial and

insurance trade associations also collect extensive defect and claims settlement data. Some plaintiffs' lawyers assemble "litigation kits" with incriminating documents that suggest strategies for trial or settlement. These are often sold to other plaintiffs and their counsel. Some critics argue this is champerty, an illegal contract to promote litigation. A number of defendants have been successful convincing trial judges to issue a protective order to withdraw from the public record all court papers filed in a product liability suit. This effectively raises other plaintiffs' costs in accumulating similar evidence, identifying witnesses, and duplicating strategies used in previous successful product liability trials. Confidentiality agreements are often a required part of product liability settlements. They probably function like protective orders by reducing some defendants' risk exposure. Clearly some groups seek to restrain the flow of such information while others try to distribute it widely for personal gain or as part of a personal crusade.

Regulatory Noncompliance and Damage Suits

Plaintiffs in traditional product liability recovery actions can lessen their burden of proof by simply proving the product fails to meet regulatory standards. In a case involving a poisonous chemical, for example, the manufacturer's failure to include the skull and crossbones or other warning symbol as required by regulations triggered liability even though a textual warning was provided. The package failed to adequately warn two migrant workers who could not read English.

Negligence liability may also be established under the doctrine of negligence per se. Whenever a statute or regulation is violated, the product liability plaintiff may have a lighter burden of proof if the plaintiff is the type of person that the statute is intended to protect. Some courts hold that negligence per se provides only a rebuttable presumption of the manufacturer's negligence. A violation may be justified if some other protective measure, safety device, or warning is sufficient. Negligence per se only establishes negligence and the plaintiff must still prove causation and injury.

Several state and some federal statutes provide for private damage suits. For example, the Consumer Product Safety Act has an additional private right of action independent of common law product liability theories. The Swine Flu Act relieved the manufacturers of the swine flu vaccine from liability for mass inoculations in the 1970s. The U.S. government was substituted as the defendant in place of the drug manufacturers. Similar proposals are sometimes made to encourage deployment of innovative highway products.

Regulatory Compliance as Due Care

Product liability defendants often provide proof of their compliance with safety regulations and then argue this should be evidence of their due care. Many courts reject this contention reasoning that government regulations are only minimum standards. Above these minimums there may still be negligence,

breach of warranty, or unreasonably dangerous defects. However, compliance with regulations may be evidence of reasonable care and some product liability reform laws discussed below may move in this direction.

Res Ipsa Loquitur

The legal doctrine *res ipsa loquitur*, which stands for "the facts speak for themselves," permits an injured plaintiff to shift the burden of proof to the defendant that the defects caused the injury even if there is no direct proof of causation. An injured plaintiff may sometimes prove a defect this way even if the product's failure causes a destruction of the product. In *Escola v. Coca-Cola Bottling of Fresno*, 150 P.2d 436 (Cal. 1944), a waitress was injured when a bottle of Coca-Cola exploded in her hand, because of carbonation pressure, due to a weakness of the bottle or both. The injured plaintiff's burden of proof under *res ipsa loquitur* was established for product liability actions: after excluding all other reasonably likely causes for the injury . . . "The question is whether under the evidence there was a probability that defendant was negligent in any of these respects. If so, the doctrine of *res ipsa loquitur* applies."

AFFIRMATIVE DEFENSES

Sellers may assert several defenses to prevent or lessen their liability. Many are typical of the traditional contract or tort defenses. Disclaimers of warranties and lack of privity are defenses to a breach of warranty suit. Situations in which plaintiffs place themselves in peril are the most widely recognized defenses under tort law. These defenses include contributory and comparative negligence, assumption of risk, and misuse of the product. If the plaintiff failed to exercise due care in using the product, contributory or comparative negligence may completely or partially bar recovery in a negligence or warranty case.

Since strict liability and breach of warranty are not based on fault, the courts may be hesitant to apply the negligence doctrines of contributory or comparative fault. However, assumption of risk and product misuse are generally recognized defenses to both strict liability and warranty actions. In many cases involving latent (hidden) defects or the delayed manifestation of injuries (prolonged incubation), the plaintiff may have trouble proving causation. Successful defendants challenge the plaintiff's weak evidence that the defect led directly to the injury. This is particularly true in novel areas where scientific research is inconclusive to link the use of some drug or substance to an injury like that of the plaintiff's. Abnormal use or misuse of the product by the plaintiff is similar to the assumption of risk defense. A misuse is an unreasonable use of the product in a manner that was not intended by the seller or designer. A misuse is sometimes foreseeable by the seller, so warnings or design changes may be necessary. The courts have not been consistent in their application of the misuse defense. Some courts have recognized this defense in strict liability

cases, whereas others have refused to apply it. In one case, the manufacturer of a chair claimed that it was misuse for the buyer to stand on the chair and use it as a stepstool. The court found this use to be foreseeable and required that the chair be designed to remain stable even under the pressures of a person standing on it.

The state-of-the-art defense has been successfully asserted by manufacturers where all known safety improvements have been included in products and further refinements were unknown at the time of manufacture. The state-of-the-art defense might relieve a seller from liability based on negligence. However, it usually has no applicability to strict liability because

§402A of the Restatement clearly provides for liability whenever a defect exists, irrespective of the manufacturer's fault. This means products manufactured many years ago may be judged by the technology prevailing later. This added liability exposure suggests why states are experimenting with statutes of repose that limit the time during which there can be product liability. It effectively creates a technological useful life that enables manufacturers to innovate without fear that any improvements must be installed into all products previously sold. The statute of limitations for negligent torts, often a 2-year period, is usually applied to product liability actions based on negligence.

APPENDIX C

Private Sector Questionnaire

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

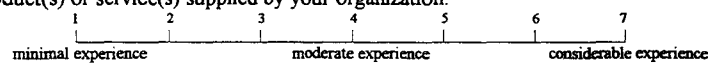
Project 20-5, Topic 27-07

Managing Product Liability to Achieve Highway Innovations

QUESTIONNAIRE

There is continuing interest in better understanding what impact that specific tort and product liability problems have on highway innovation. While there has been considerable tort and product liability reform by many states, there remains uncertainty about the specific tort liability experience of public agencies and private organizations involved in introducing new products to the highway program. The purpose of this survey is to better understand the barrier to innovation imposed by existing tort and product liability laws as they apply to innovative highway products and services. Please assist in this effort by answering the following questionnaire as completely as possible and return it at your earliest convenience to Dr. Gary L. Gittings, Nittany Transportation Research Associates, 313 Fairfield Drive, State College PA 16801. Direct inquiries to Dr. Gittings at (814) 466-7704 or by e-mail at glg@psu.edu.

I. Respondent Profile:

- a. Please provide a brief job title & job description of your areas of responsibility:
- b. Please provide a brief description of the principal products or services provided to state or local highway agencies:
- c. Does your company supply products and/or services to other markets in addition to the public highway market.
- d. In approximately how many states does your firm supply highway products or services?
- e. Approximately how many products or services does your firm supply to the highway industry?
- f. Characterize your organization's product liability litigation experience for at least one highway product(s) or service(s) supplied by your organization.

- g. Was your firm a start-up company when your innovative highway products could have been first marketed to state highway departments?

NCHRP Project 20-5, Topic 27-07

Firm name (optional): _____ page 2

Directions: Please respond to the following scaled questions by circling the number corresponding to your opinion of the statement made. Please respond to the open-ended, qualitative questions in the space provided and extend to the reverse side if necessary.

Definitions: For the purposes of this questionnaire the following working definitions as used. However, please explain if they are limiting, misleading or overbroad.

Innovative highway technologies - new technologies, processes, materials and products supplied to state agency(ies) for experimentation, demonstration or permanent deployment in the highway infrastructure, specifically excluding in-vehicle systems (i.e., in-vehicle ITS/IVHS components)

Proprietary product - product or service from sole-source provider, might be protected by patent, trade secret, copyright or other intellectual property rights

In-service environment - use of an innovative highway technology where there is direct exposure to the public, i.e., not a "test track" closed to the public

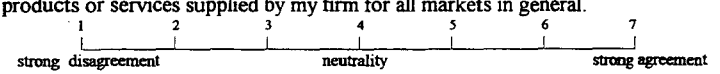
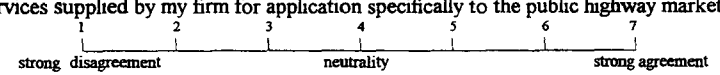
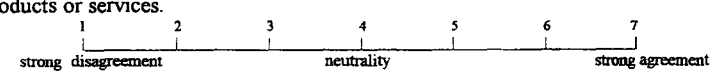
Experimental deployment - first use in an in-service environment to test for problems in performance, installation, maintenance, costs, etc. prior to clearance for regular procurement

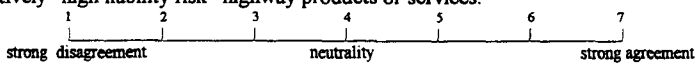
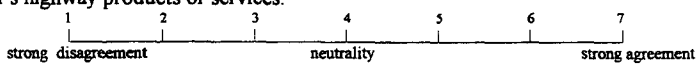
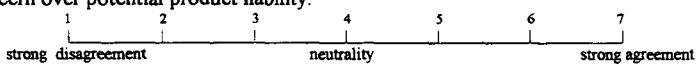
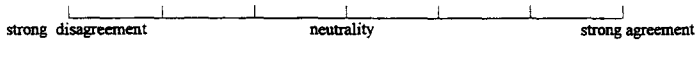
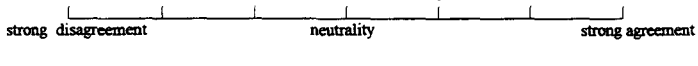
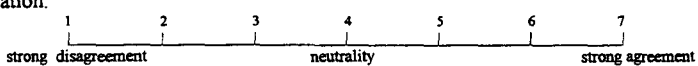
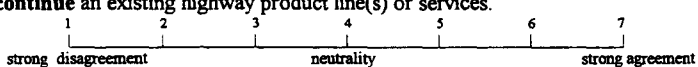
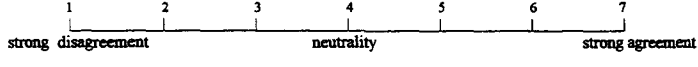
Demonstration project - in-service use of "known-to-work" product or process before clearance for regular procurement through mandatory testing

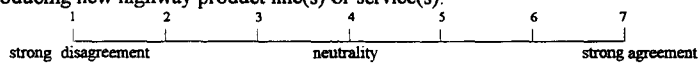
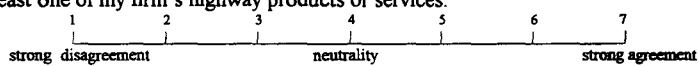
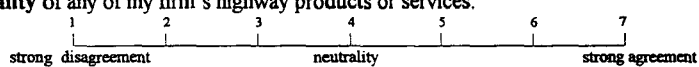
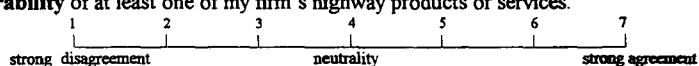
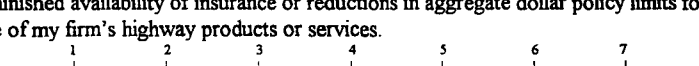
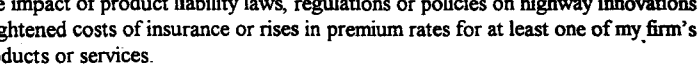
Permanent deployment - in-service use of products or processes after clearance for regular procurement after mandatory testing

II. Relationship Between Potential Product Liability and Highway Supplier Creativity

Please answer the following questions with respect to YOUR firm.

1. Product liability litigation is an important factor in management decisions concerning the types of products or services supplied by my firm for all markets in general.

2. Product liability litigation is an important factor in management decisions on products or services supplied by my firm for application specifically to the public highway market.

3. If there is a higher importance for product liability litigation in products or services destined for the highway market than in other markets in general, then please explain.
4. My firm has concern with potential product liability for at least one of my firm's highway products or services.


- 5. My firm's concern over potential product liability tends to be concentrated on a set of relatively "high liability risk" highway products or services.

- 6. My firm's concern with potential product liability extends across a **broad spectrum** of my firm's highway products or services.

- 7. Innovation in **at least one** of my firm's highway products or services is inhibited by my firm's concern over potential product liability.

- 8. Innovation is concentrated in relatively "high liability risk" highway products or services.

- 9. Innovation across a **broad spectrum** of my firm's highway products or services is inhibited by concern over potential product liability.

- 10. My firm is **not** willing to invest resources into research & development necessary to create innovative highway products or services due to concern over potential product liability litigation.

- 11. Concerns over potential product liability litigation is **not** a factor in my firm's decisions to **discontinue** an existing highway product line(s) or services.

- 12. If liability has been a concern in such decisions, please give specific examples:
- 13. My firm has **not** offered existing products for application to public highways due to concerns over potential product liability litigation.


- 14. If liability has been a concern in such decisions, please give specific examples:
- 15. Concerns over potential product liability litigation is **not** a factor in my firm's decision against introducing new highway product line(s) or service(s).

- 16. If liability has been a concern in such decisions, please give specific examples:
- 17. Laws, regulations or policies permitting product liability litigation have improved the **safety** of at least one of my firm's highway products or services.

- 18. Laws, regulations or policies permitting product liability litigation have **not** improved the **quality** of any of my firm's highway products or services.

- 19. Laws, regulations or policies permitting product liability litigation have improved the **durability** of at least one of my firm's highway products or services.

- 20. The impact of product liability laws, regulations or policies on highway innovations has led to diminished availability of insurance or reductions in aggregate dollar policy limits for at least one of my firm's highway products or services.

- 21. The impact of product liability laws, regulations or policies on highway innovations has led to heightened costs of insurance or rises in premium rates for at least one of my firm's highway products or services.


22. Potential product liability litigation is the most important factor explaining any reluctance my firm has to provide innovative highway products or services.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

23. Is your firm's concern over product liability litigation risk based on **actual experience** or **supposition** (speculative apprehension of liability risk but not from my firm's actual product liability litigation experience):
 ___ actual experience
 ___ supposition

III. Impact of Product Liability Litigation on Innovation by the Highway Supplier Industry

Please answer the following questions with respect to the highway supplier INDUSTRY IN GENERAL.

24. State agenc(ies) have delayed or canceled deployment of innovative highway technologies due to concern over potential product liability litigation.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

25. Suppliers are reluctant to provide innovative highway products or services due to concern over potential product liability litigation.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

26. What factors indicate resistance to provide innovative highway products or services among established suppliers for traditional highway technologies:

<input type="checkbox"/> restrictions on proprietary products	<input type="checkbox"/> risk of litigation/liability
<input type="checkbox"/> restrictions on sole sourcing	<input type="checkbox"/> cost
<input type="checkbox"/> multitude of testing & certification standards between the states	<input type="checkbox"/> low-bid purchase requirement
<input type="checkbox"/> domestic/local content requirements	<input type="checkbox"/> insurance cost/availability
<input type="checkbox"/> no single government agency in charge within each state	<input type="checkbox"/> procurement procedure complexities
	<input type="checkbox"/> thin profitability deterring R&D
	<input type="checkbox"/> other, please

27. Suppliers are not willing to invest resources into research & development necessary to create innovative highway products or services due to concern over potential product liability litigation.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

28. Laws, regulations or policies permitting product liability litigation have improved the **safety** of highway products or services.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

29. Laws, regulations or policies permitting product liability litigation have **not** improved the **quality** of highway products or services.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

30. Laws, regulations or policies permitting product liability litigation have improved the **durability** of highway products or services.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

IV. Procurement, Testing and Acceptance

Please provide your opinion on the following questions with respect to the procurement, testing and acceptance of highway products and services BY STATE HIGHWAY AGENCIES.

31. State agenc(ies) have policies restricting experimental, demonstration or permanent deployment of innovative highway technologies due to concern over product liability litigation.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

32. State highway agency concern about product liability restrains **experimentation** with highway innovations in an in-service environment?

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

33. State highway agency concern about product liability restrains **demonstration** with highway innovations in an in-service environment?

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

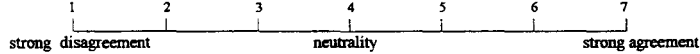
34. State highway agency concern about product liability restrains **permanent deployment** with highway innovations in an in-service environment?

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

35. Is concern expressed in the above three questions (Nos. 32, 33 & 34) based on **actual experience** or **supposition** (speculative apprehension of liability risk but not from actual product liability litigation experience); if actual experience please provide examples:

<u>Question #32</u>	<u>Question #33</u>	<u>Question #34</u>
<input type="checkbox"/> actual experience	<input type="checkbox"/> actual experience	<input type="checkbox"/> actual experience
<input type="checkbox"/> supposition	<input type="checkbox"/> supposition	<input type="checkbox"/> supposition

36. Suppliers are encouraged by the public sector to provide products or systems that perform above the minimum performance standard.



37. In a competitive bidding environment, are suppliers of such higher performing products or services given credit for the extra merit from the additional service life or performance potential of their products or services?

No Yes (please explain how)

38. What states or state agencies are considered leaders in refining their testing and procurement to encourage deployment of innovative highway technologies?

39. What innovations in public testing and procurement procedures are needed to better encourage deployment of innovative highway technologies?

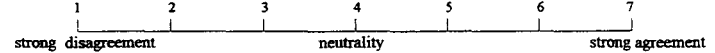
40. Consider the evolution of pre-deployment testing from the duplicative efforts of 50 separate state DOT's, through regional consortia like SASHTO, then ultimately to national testing consortia like HITEC and NTPEP. If this evolution continues, please comment on the impact this might have on product liability risks, concerns and costs.

V. Tort and Product Liability Reform

Please answer the following questions with respect to the need for product liability reform.

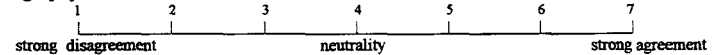
41. What tort or product liability reforms are needed to encourage deployment of highway innovations?

42. The primary states where you supply products or services have instituted tort or product liability reforms that encourage deployment of innovative highway technologies.

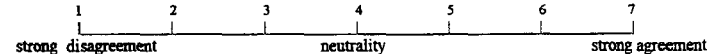


43. What other state(s) are progressive in such reform efforts or are reputed to have instituted tort or product liability reforms likely to facilitate deployment of innovative highway technologies?

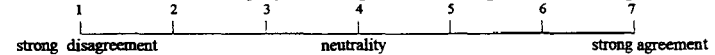
44. Indemnity provisions in state procurement contracts, in the primary states where you supply products and services, require suppliers to indemnify the state for product liability or tort damage payments or settlements.



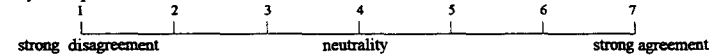
45. Suppliers require indemnity from the state for product liability or tort damage payments or settlements.



46. Tort or product liability insurance is required, in the primary states where you supply products or services, for demonstration projects using innovative highway technologies.

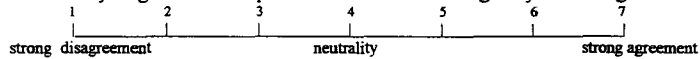


47. In the primary states where you supply products and services, mandatory procurement provisions in contracts for innovative highway technologies require supplier warranties for quality and performance.

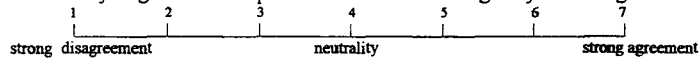


48. If such warranty provisions are specified, who has the benefit of the warranty coverage, e.g., the state, construction or maintenance firms, their employees, motorists, commercial vehicle operators, bystanders?

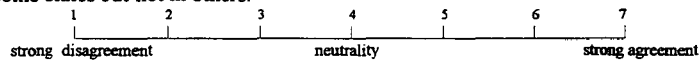
49. The statute(s) of limitation applicable to personal injuries arising from tort or product liability incidents, in the primary states where you supply products and services, are adequate to limit product liability litigation risk exposure from innovative highway technologies.



50. The state's damage caps applicable to personal injuries arising from tort or product liability incidents, in the primary states where you supply products and services, are adequate to limit product liability litigation risk exposure from innovative highway technologies.



51. Differences in product liability laws, regulations or policies explains why suppliers do business in some states but not in others.



52. Please explain the most significant differences in product liability laws, regulations or policies mentioned in question #51 above.

Thank you for you kind participation in this important work. Please return your completed survey as soon as possible to:

Dr. Gary L. Gittings
Nittany Transportation Research Associates
313 Fairfield Drive
State College PA 16801

Responses to this survey will be kept strictly confidential, only aggregate data will be compiled. If you have no objection, please provide your name, your firm's name, mailing address, business and fax phone numbers.

APPENDIX D

Public Sector Questionnaire

NCHRP Project 20-5, Topic 27-07

Agency: _____

page 1

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Project 20-5, Topic 27-07

Managing Product Liability to Achieve Highway Innovations

QUESTIONNAIRE

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Dr. Gary L. Gittings
Nittany Transportation Research Associates
313 Fairfield Drive
State College PA 16801

Direct inquiries to Dr. Gittings at (814) 466-7704 or by e-mail at glg@psu.edu

I. Respondent Profile:

a. Which of the following best describes your primary role in the development, deployment and maintenance of highway infrastructure? (please check only one)

- | | |
|--|---|
| <input type="checkbox"/> policy-level administrator at state highway agency | <input type="checkbox"/> counsel for state highway agency |
| <input type="checkbox"/> safety & materials/product testing for state highway agency | <input type="checkbox"/> office of state attorney general |
| | <input type="checkbox"/> other, please explain: _____ |

b. Your name, mailing address, state agency, business phone and fax numbers:
_____ phone # _____
_____ fax # _____

c. Characterize your agency's product liability litigation experience for highway products.

1 2 3 4 5 6 7
minimal experience moderate experience considerable experience

NCHRP Project 20-5, Topic 27-07

Agency: _____

page 2

Directions: Please respond to the following scaled questions by circling the number corresponding to your opinion of the statement made. Please respond to the open-ended, qualitative questions in the space provided and extend to the reverse side or additional pages as necessary.

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Demonstration project - in-service use of "known-to-work" product or process before clearance for regular procurement through mandatory testing

Permanent deployment - in-service use of products or processes after clearance for regular procurement after mandatory testing

II. Procurement, Testing and Acceptance

Please answer the following questions with respect to the procurement, testing and acceptance of highway products and services by YOUR state highway agency.

1. Your agency restricts experimental, demonstration or permanent deployment of innovative highway technologies due to concern over product liability litigation.

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

2. Your agency's concern about product liability restrains **experimentation** with highway innovations in an in-service environment?

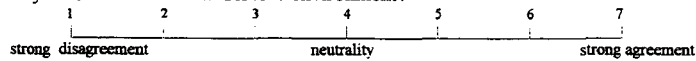
1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

3. Your agency's concern about product liability restrains **demonstration** with highway innovations in an in-service environment?

1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

Agency: _____

4. Your agency's concern about product liability restrains **permanent deployment** with highway innovations in an in-service environment?

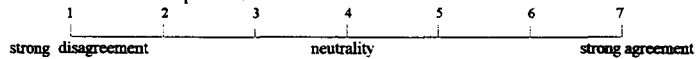


5. Is the concern expressed in the above three questions (Nos. 2, 3 & 4) based on **actual experience** or **supposition** (speculative apprehension of liability risk but not from actual product liability litigation experience); if actual experience please provide examples:

<u>Question #2</u>	<u>Question #3</u>	<u>Question #4</u>
<input type="checkbox"/> actual experience	<input type="checkbox"/> actual experience	<input type="checkbox"/> actual experience
<input type="checkbox"/> supposition	<input type="checkbox"/> supposition	<input type="checkbox"/> supposition

6. What innovations in testing, evaluation and procurement procedures are needed to better encourage deployment of innovative highway technologies?

7. Vendors and/or suppliers are encouraged to provide products or systems that exceed the established standard or specification.



8. In a competitive bidding environment, are suppliers of such higher performing products or services given credit for the extra merit from the additional service life or performance potential of their products or services?

No Yes (please explain how)

9. What other states or state agencies are considered leaders in refining their testing and procurement to encourage deployment of innovative highway technologies?

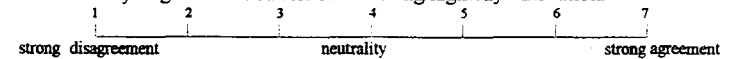
Agency: _____

10. Consider the evolution of pre-deployment testing from the duplicative efforts of 50 separate state DOT's, through regional consortia like SASHTO, then eventually to national testing consortia like HITEC and NTPEP. If this evolution continues, please comment on the impact this might have on product liability risks, concerns and costs.

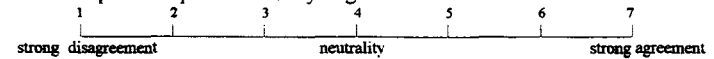
III. Impact of Potential Product Liability on Suppliers Willingness to Furnish Highway Innovations

Please answer the following questions with respect to the HIGHWAY SUPPLIERS for your state.

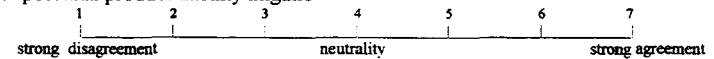
11. Product liability litigation is a barrier to achieving highway innovation.



12. Your state has delayed or canceled deployment of innovative highway technologies due to concern over potential product liability litigation.



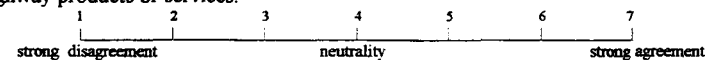
13. Suppliers are reluctant to provide innovative highway products or services due to concern over potential product liability litigation.



14. What factors indicate resistance to provide innovative highway products or services among established suppliers for traditional highway technologies:

<input type="checkbox"/> restrictions on proprietary products	<input type="checkbox"/> risk of litigation/liability
<input type="checkbox"/> restrictions on sole sourcing	<input type="checkbox"/> cost
<input type="checkbox"/> multitude of testing & certification standards between the states	<input type="checkbox"/> low-bid purchase requirement
<input type="checkbox"/> domestic/local content requirements	<input type="checkbox"/> insurance cost/availability
<input type="checkbox"/> no single government agency in charge within each state	<input type="checkbox"/> procurement procedure complexities
	<input type="checkbox"/> thin profitability deterring R&D
	<input type="checkbox"/> other, please

15. Laws, regulations or policies permitting product liability litigation have improved the safety of highway products or services.



16. Laws, regulations or policies permitting product liability litigation have **not** improved the **quality** of highway products or services.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement
17. Laws, regulations or policies permitting product liability litigation have improved the **durability** of highway products or services.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement
18. Concerns over potential product liability litigation is **not** a factor in suppliers' discontinuance of existing product line(s).
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement
19. Suppliers have **not** offered existing products for application on public highways due to concerns over potential product liability litigation.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement
20. Concerns over potential product liability litigation is **not** a factor in suppliers deciding against introduction of a new product line.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement
21. Please provide examples of innovative highway products, processes or services that have been discontinued, restricted from highway use or restricted from initial introduction due to concerns over potential product liability litigation.
22. The impact of product liability laws, regulations or policies on highway innovations has led to diminished availability of insurance or reductions in aggregate dollar policy limits for suppliers.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement
23. The impact of product liability laws, regulations or policies on highway innovations has led to heightened costs of insurance or rises in premium rates for liability coverage for suppliers.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

24. Potential product liability litigation is the most important factor explaining supplier reluctance to provide highway innovations.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement
25. Is concern over product liability litigation risk by highway suppliers to your state based on **actual experience** or **supposition** (speculative apprehension of liability risk but not from the firm's actual product liability litigation experience):
- actual experience
 supposition

IV. Tort and Product Liability Reform

Please answer the following questions with respect to the need for product liability reform.

26. Your state has instituted tort or product liability reforms that encourage deployment of innovative highway technologies.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement
27. Indemnity provisions in your state procurement contracts require suppliers to indemnify the state for product liability or tort damage payments or settlements.
- 1 2 3 4 5 6 7
never sometimes always
28. Suppliers require indemnity from your state for product liability or tort damage payments or settlements.
- 1 2 3 4 5 6 7
never sometimes always
29. Tort or product liability insurance is required by your state for demonstration projects using innovative highway technologies.
- 1 2 3 4 5 6 7
never sometimes always
30. Mandatory procurement provisions in your state's contracts for innovative highway technologies require supplier warranties for quality and performance.
- 1 2 3 4 5 6 7
never sometimes always
31. Differences in product liability laws explains why suppliers do business in some states but not in others.
- 1 2 3 4 5 6 7
strong disagreement neutrality strong agreement

32. Please explain the most significant differences addressed in question #31 above.
33. In the table below, please check whether each of the following tort or product liability reforms have been instituted in your state. Next, indicate what reforms are needed in your state. Finally, indicate if reforms are known to have been instituted by other state(s), perceived as progressive in reforms, so as to facilitate deployment of innovative highway technologies.

REFORM: type of tort or product liability reform	THIS STATE HAS	THIS STATE NEEDS	PROGRESSIVE STATES HAVE please name states
Sovereign immunity			
Specialized forums or courts for product liability damage claims			
Alternative dispute resolution (ADR) for product liability damage claims			
Statutory mandate to deploy technology			
Regulations or guidelines for pre-qualification by testing &/or certification			
Liability limitations for product liability			
Liability limitations for highway innovations			
Liability limitations for suppliers			
Damage caps: punitives			
Damage caps: medical malpractice			
Damage caps: product liability			
Damage caps: suppliers of highway innovations			
Damage caps: pain & suffering			
Damage caps: economic damages			
Damage caps: non-economic damages			
Liability limits: architects			
Liability limits: builders			
Liability limits: engineers			

Thank you for your kind participation in this important work. Please return your completed survey as soon as possible to:

Dr. Gary L. Gittings
 Nittany Transportation Research Associates
 313 Fairfield Drive
 State College PA 16801

24919

TE 7 .N26 no. 265

Gittings, G. L.

Managing product liability
to achieve highway

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Transportation Research Board
National Research Council
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