

Effects of Tort Liability on Roadway Design Decisions

DANIEL S. TURNER AND JOSEPH D. BLASCHKE

Tort liability has become a major issue for today's highway designer. The nature of tort liability, current tort trends, and several tort issues that affect highway design are reviewed in this paper. Highway tort claims and losses have grown at a rate of 16 percent per year since 1972. During 1990, an estimated 33,000 to 35,000 claims were filed against state highway agencies. During the same year, state departments of transportation paid out between \$200 and \$300 million to defend and settle these claims. Government units at all levels probably lost more than one-half billion dollars to tort claims in 1990. Forty-four percent of the states responding to a 1988 AASHTO survey indicated that they had asked their legislatures to adopt or strengthen a "design immunity" statute. Without design immunity, they could be sued for improper roadway design. Thirty-six percent of the states indicated that they had tried to adopt (or strengthen) "economic defense" legislation. States without this defense find that the courts will not allow them to plead that they did not have enough money to fix all the deficient locations on their roadways as the reason that a roadway hazard was allowed to exist. One of the largest areas of current tort concern involves design practices for resurfacing, restoration, and rehabilitation (RRR) projects. Suits in virtually all of the states are helping to determine whether old roads may be partially improved to provide more capacity and safety without bringing them up to current standards.

Yesterday's highway engineer lived in a much simpler environment than the one that exists today. Strong environmental regulations, wetland policies, extensive public involvement, and similar issues have made the design of highways a much more difficult task. Perhaps the most frustrating issue for today's designer is tort liability.

The number of suits against highway agencies is growing at an astonishing rate. Rumors circulate of huge financial judgments against highway agencies. Designers often do not understand the law and dread the possibility of being called into court.

Even when designers understand the law, it changes with time. The body of common law expands each time there is a new ruling on a case. New code is adopted each time the legislature meets. Design decisions made today may have disastrous results 20 years from now if the legal system changes and the design is no longer acceptable.

In light of the current legal climate, designers may tend to become very conservative. If they do not understand the law or are afraid of what might occur in the future, they may retreat behind ancient and conservative design standards. On the other hand, roadway designers who are unskillful, who do not exercise care, or who approach their duties in a haphazard manner, face a good probability of a future court date.

NATURE OF TORT LIABILITY

A tort is a civil wrong. The liability associated with a tort is the responsibility to restore the damaged party. In a highway tort liability case, the court will attempt to determine whether the highway agency committed a wrong, and if so, what action (or what payment) is necessary to restore the damaged party.

Negligence

Usually, the plaintiff alleges that negligence on the part of the highway agency caused or contributed to a traffic accident. Negligence involves the failure to use due care in the treatment of others. The issue is often paraphrased as what a "reasonable man" would have done in the circumstances of the case. The term "reasonable man" is very important, and the jury must decide what would have been reasonable. Legally, the plaintiff must prove the following to establish negligence:

- Defendant had a duty to use reasonable care toward plaintiff,
- Defendant breached that duty,
- Defendant's negligence was the proximate cause of plaintiff's injury, and
- Plaintiff incurred resulting damages.

Depending on the state where the suit is brought, the plaintiff's contributory negligence may bar recovery, or the plaintiff's comparative negligence may limit the amount of recovery.

Standard of Care

In trying to establish negligence, the judge or jury must determine whether the defendant acted reasonably, that is, whether the defendant's actions were appropriate for the circumstances. The actions are measured against the prevailing standard of care. The standard may be a published document, such as an AASHTO design manual. It may also be a previous court ruling on a topic. Where the standard has not been previously established, the court will attempt to determine one.

Both the plaintiff and the defendant will try to establish what standard of care applies to the case. Then both sides will attempt to prove whether the defendant acted within the standard of care.

TORT TRENDS

The Administrative Subcommittee on Legal Affairs of AASHTO addressed their strong concerns about the highway tort situation in the late 1970s. This subcommittee performed a survey and pub-

D. Turner, Department of Civil Engineering, The University of Alabama, Box 870205, Tuscaloosa, Ala. 35487-0205. J. D. Blaschke, Transportation Engineering Analysts, 1722 Broadmoor, Suite 212, Bryan, Tex. 77802.

lished the results (1). This survey was repeated periodically, and reports were published in 1979, 1981, 1983, 1987, and 1988. The survey dealt exclusively with state-level highway agencies. Local governments were not represented.

AASHTO used a lengthy questionnaire to gather data on sovereign immunity, tort liability, insurance, and other issues from the states. All of this information was self-reported. After 1981, there was wide variability in the number of states that responded to the survey in any given year, and to the completeness and quality of the responses. For two of the surveys, only about one-half of the states responded. To overcome partial or incomplete reporting, the authors developed maximum and minimum estimates for states that did not reply to the survey. This involved extrapolating previously reported values based on the trends of the other states.

The original AASHTO survey asked the states to supply information back to 1972. The subsequent AASHTO surveys provided data through 1987. The University of Alabama supplemented this information with a telephone survey to gather 1988, 1989, and 1990 data.

Number of Claims

Claims and suits filed against state highway agencies have been tabulated in Table 1. The values through 1981 are those reported by the states. After 1981, the values indicated in the table are the midpoints between the author's estimated maximum and minimum values.

Several conclusions may be drawn from the data. In 1990, an estimated 33,000 to 35,000 claims were filed against state highway agencies, for an average of about 675 claims per state. The increase in claims has been rather consistent from 1972 through 1990. In fact, the rate of growth corresponds to a 16 percent compound interest curve. A conservative estimate is that since 1972 at least 310,000 claims have been filed against state highway agencies. The number

TABLE 1 Number of Tort Claims Against State Highway Agencies

1972	2,168
1973	2,740
1974	3,230
1975	4,053
1976	4,700
1977	5,607
1978	7,104
1979	9,362
1980	13,276
1981	13,195
1982	13,800
1983	18,702
1984	20,960
1985	21,810
1986	24,959
1987	27,313
1988	32,692
1989	28,970
1990	32,948

Source: AASHTO surveys (1972-1987) and the authors' survey (1988-1990).

of claims continues to grow. It definitely has not reached a plateau or a peak. Based on the reported data, state highway agencies will continue to experience more and more suits in the future.

Settlements and Judgments

Financial amounts spent by the states to pay settlements and judgments from tort claims have been listed in Table 2. The data was treated in the same manner as that for claims. Before 1981, the values are those reported by the states. After that date, the values are the midpoints between the author's maximum and minimum estimates.

The states responding to the author's survey indicated that financial information was more difficult to accumulate than other tort data. Less than 70 percent of the states were able to respond to this portion of the survey, and those that did respond did not always have good data. Consequently, the author's estimate of maximum and minimum values was quite wide (ranging from \$134 to \$228 million in 1990). In addition, state highway agencies spent well over \$60 million defending liability claims and suits in the same year. This means that the total cost for tort activities was between \$200 and \$300 million for state DOTs in 1990.

It is reasonable to assume that local government highway agencies probably have tort losses equivalent to those of state highway agencies. When state and local government losses are combined, the total highway tort picture becomes \$400 to \$600 million in 1990.

Since 1972, the states have devoted \$1.2 to \$1.7 billion to tort issues. Local government agencies have probably devoted an equivalent amount.

Summary of Tort Situation

Tort claims and tort losses continue to grow rapidly. Since 1972, the number of claims has increased 16 percent per year. No end is in sight, and highway agencies should plan for tort liability to become an even bigger issue in the future.

TABLE 2 Costs of Tort Settlements and Judgments

1974	\$ 9,847,000
1975	\$ 6,297,000
1976	\$12,416,000
1977	\$11,123,000
1978	\$15,052,000
1979	\$15,996,000
1980	\$36,026,000
1981	\$39,015,000
1982	\$49,262,000
1983	\$111,029,000
1984	\$139,997,000
1985	\$205,824,000
1986	\$162,420,000
1987	\$180,449,000
1988	\$130,540,000
1989	\$167,242,000
1990	\$190,654,000

Source: AASHTO surveys (1972-1987) and authors' survey (1988-90).

One simple observation may place the tort picture in perspective. At the end of 1990, the states had somewhere between \$12.3 and \$14.1 billion worth of suits pending in the legal system. Interestingly, this is about the same amount as the total FHWA budget for the same year. Of those states that have closely tabulated and monitored tort claim data, estimates range from 10 percent to 30 percent for the payout compared to face value. This means that \$1.3 to \$4.2 billion will be needed to pay off pending suits, or that 10 to 30 percent of next year's FHWA funding has already been spent.

Concerted management efforts will be necessary to slow the liability juggernaut. Larger and larger portions of state transportation agency budgets will be devoted to paying liability claims. Designers at all levels of government need to be aware of the consequences of their decisions and of the impact that they might have on their agency's future liability situation.

TORT ISSUES AFFECTING DESIGN

Several current issues will be introduced to indicate how the changing highway tort environment can affect design. These are not the only prominent tort issues, but they provide good illustrations of the problems faced by designers.

Loss of Design Immunity

At one time highway engineers enjoyed unparalleled authority. Their decisions could not be challenged when it came to selecting the location of a roadway, choosing the criteria for the design, or making the detailed design decisions. Roadway design was a special category of decision making protected by the discretionary immunity of government officials. The highway engineer was thought to be in a unique position, to possess special knowledge, and to have all the data with which to make an important decision. As the designer had the authority and responsibility to make a discretionary design decision, he or she was immune to suit. This discretionary immunity was a matter of the judicial branch of government not wishing to interfere with the function of the administrative branch of government. The courts felt that if they overturned the individual decisions made by designers, the designers would quit making them, and society would be left in a worse position.

This has changed, and in some states it has changed drastically. In many locations, design immunity has eroded. In other states, it has been completely removed, usually through a court decision. The most recent survey by AASHTO (2) had attempted to have their state legislatures adopt (or strengthen) design immunity legislation. Table 3 indicates that of the 25 states responding to the 1988 AASHTO survey, 11 had tried to adopt design immunity legislation. This is 44 percent of the states that answered the questionnaire in 1988.

Example of a "Design Suit"

A rural highway in a southern state was designed and built in the early 1950s. The roadway was constructed to follow the topography of the area, and there were several vertical curves in the rolling terrain. At one particular location on the roadway, the minimum criteria for the "K" value of a vertical curve was used for the selected design speed of 50 mph.

TABLE 3 Responses to AASHTO Question About Whether States Attempted Legislation Related to Design

State	Design Immunity		Economic Defense	
	Yes	No	Yes	No
Arizona	x			x
California	x		x	
Florida		x		x
Hawaii	x		x	
Idaho		x		x
Indiana		x		x
Iowa	x			x
Kentucky		x		x
Louisiana		x		x
Maine		x		x
Minnesota	x		x	
Mississippi	x		x	
Missouri	x			x
Nevada		x		x
New Jersey	x		x	
New Mexico	x		x	
Ohio		x		x
Oklahoma		x		x
Oregon		x	x	
Pennsylvania	x		x	
Texas		x	x	
Utah		x		x
Vermont		x		x
Wisconsin		x		x
Wyoming	x			x

By the early 1980s, a large city had extended its boundaries and incorporated a portion of the roadway within its city limits, including the particular vertical curve mentioned above. Significant urban development had occurred in the area and the old two-lane rural highway was widened to a six-lane divided urban roadway. The original alignment of the roadway was maintained.

A large apartment complex was located adjacent to the six-lane roadway near the crest of the subject vertical curve. One night, the driver of a vehicle who was attempting to turn left into the apartment complex was hit broadside by a vehicle that approached over the crest of the vertical curve. The driver of the turning vehicle was killed. His wife sued the state and the city claiming that the roadway was improperly designed and that an improper speed limit was posted.

The plaintiff argued that inadequate sight distance caused by the "improperly designed" vertical curve was the primary cause of this accident. The plaintiff alleged that the state's design engineer should have known that minimum design criteria should only be used when better design conditions could not be provided. The plaintiff stated that the terrain was not so rugged that a longer vertical curve was impossible to provide, that a longer vertical curve should have been provided, and that the longer vertical curve would have provided additional sight distance.

The city was sued for posting a speed limit that was "improper." The speed limit was posted at 45 mph based on the measured 85th-percentile speed of traffic. However, the current state design standards (which were based on AASHTO Green Book design guidelines) indicated that the "K" value for the vertical curve was only appropriate for design speeds below 45 mph.

The state and the city were also sued for not bringing the roadway up to current design standards when the roadway was widened. The plaintiff claimed that the state and city should have been required to flatten the curve to increase sight distance when the roadway was reconstructed.

The plaintiff's claims in this case seriously challenged the discretionary decision making of the design engineers. However, the state and city argued that the design decisions were discretionary in nature and exempt from liability, a position that was supported by the state's torts claims act. The judge did not accept this argument and did not grant the defendant's request for summary judgment based on the claim of discretionary immunity. The state and city continued their defense by switching to other issues.

Even though the sight distance at the location of the accident was less than desirable, it was sufficient for typical operating conditions. The accident that led to this case occurred at night on dry pavement. The defense argued that the "glow" from the approaching vehicle could have been observed by the deceased driver before the headlights could be observed, that the dry pavement conditions afforded shorter stopping sight distances than what was selected for design, that the deceased was under the influence of alcohol (which was documented), and that the primary reason for this accident was the speed of the ramming vehicle. Accident reconstructionists estimated the speed of the ramming vehicle from 80 to 90 mph. The jury agreed with the defense and did not assign any negligence to either the state or the city.

Economic Defense

Another interesting observation may be drawn from Table 3. Thirty-six percent of the states that answered the 1988 AASHTO questionnaire had attempted to have economic defense legislation adopted (or strengthened). This defense is when a government agency pleads lack of resources as the reason it did not correct a roadway hazard. Even when the agency knew that the condition existed and did not fix it, if the government can establish that it was reasonable in using its funds, the defense can be adopted. Usually, the government attempts to prove that it was doing a reasonable job of using its budget by indicating that: (a) it was aware of the sites that needed treatment, (b) it had developed a program of corrective treatments for these sites, and (c) it was correcting the sites as funds became available using a priority scheme that treated the most hazardous sites first. This procedure is reasonable because it provides the greatest safety improvement per public dollar spent.

The concept is deeper than the simple example cited here. In a specific suit, the agency might have enough money to pay the plaintiff's claim and to fix the location that was the basis of the suit. However, it would not have enough resources to pay all similar claims and to fix all similar locations on its highways. Even if the agency could shift its funds so that it could pay off all of these claims, some other facet of its activities would suffer. For example, there might not be enough funds left to conduct the pavement overlay program. The quality of existing roads would suffer and accident rates would go up.

The economic or budgetary defense is often used to explain why the highway agency should not have to bring all of its roads up to the most recent standards. If AASHTO were to publish a new standard tomorrow, the agency would not have enough funds to instantly upgrade all of its roads. Even if it could accomplish such an upgrade, AASHTO might publish a new standard again next

year (the "pink" book?), and another round of upgrades would be required.

The prevailing rule used to be that if a road was designed and constructed according to the accepted standards of its day, then it did not have to be upgraded if the standard later changed. However, if conditions of the road changed (such as a large increase in traffic volume), then it might be necessary to upgrade the road.

Several states lost their economic defense because they failed to demonstrate to the court that they were reasonable in expending their funds. For whatever the reason, loss of economic defense poses a serious handicap for a highway agency.

RRR Practices of the States

History of the Federal RRR Program

When the Federal-Aid Road Act was passed in 1916, it signaled the first time that the federal government became directly involved with highway design standards. Before that time, the federal government only collected and distributed information relative to roadway design practices. After 1916, the federal government provided funds to states for construction of new highways or reconstruction of existing highways. Specific design standards were not developed or even sought at that time (4).

Through trial and error and research efforts, roadway design policies and guidelines were developed and selected by AASHTO, and then adopted as standards by the federal government for federal aid projects. These AASHTO policies and guidelines were documented in the late 1930s and early 1940s. AASHTO eventually developed recommended design criteria and published the same in policy manuals (Blue, Red, and Green Books). Because these early standards selected by the federal government could not be incorporated in every roadway project in every state, design exceptions were constantly requested by the states during the federal aid requesting process.

In 1956, the federal government passed the Federal-Aid and Highway Revenue Act to accelerate construction of the Interstate and Defense Highway System and to provide funds for other federal aid systems. Similar to previous federal funding acts, this legislation provided federal funds for new roadway construction and for reconstruction of existing roadways.

In the mid-1970s, concern arose over the condition of the country's roadway system, and the emphasis shifted from new roadway construction to preservation of existing roadways. As a result of this growing concern, the Federal-Aid Highway Act of 1976 was passed to authorize the use of federal funds for major roadway repair work on the federal aid highway system, classifying this work as RRR. The type of improvements contained in the RRR Program included resurfacing, pavement structural and joint repair, minor lane and shoulder widening, alterations to vertical and horizontal alignments, bridge repair, and roadside hazard elimination.

Initially, states and local governments were totally responsible for RRR-type projects. Minimal standards were set for these types of projects, and specific and unique designs were often selected as well. When the 1976 Act was passed, there were no federal RRR design standards or guidelines in place. AASHTO developed a policy on geometric design for RRR projects which was published in 1977. It was called the "Purple" Book and was immediately controversial because its recommended design values were considerably less stringent than AASHTO design policies for new roadway construction.

Safety Versus Cost-Effectiveness

Roadways initially designed in the 1920s and 1930s were often selected for improvements under the RRR Program. Many of these roadways had narrow rights-of-way, narrow lanes and shoulders, and relatively severe horizontal and vertical alignments. They frequently had large volumes of traffic. Also, many of these roadways were located in places where considerable development had taken place and where additional right-of-way was virtually impossible or very difficult (and expensive) to obtain. Expansion of these types of facilities to meet "current" recommended design guidelines or standards was usually excessively expensive or just plain impossible. However, the RRR Program provided lesser improvements on such roadways, which made them safer and more efficient. Some individuals felt that the lower level of improvements were unsatisfactory and that more extensive improvements should have been made.

Members of various safety organizations and safety-oriented transportation engineers generally opposed the policies of the RRR Program from the beginning. These individuals favored federal funding for work on "deficient" roadways only when these roadways could be reconstructed to meet current recommended guidelines and standards. Other transportation engineers favored making minor improvements, where possible, to make roadways safer and more efficient, even though less than desirable geometric conditions might remain in place.

Safety-oriented individuals concentrated on the safety benefits that would be derived from spending considerable funds to upgrade individual projects. This attitude conflicted with those individuals who preferred to spend funds on a larger number of projects that made less significant roadway improvements but normally had higher cost-benefit ratios. States generally supported AASHTO's lenient RRR design guidelines. Safety organizations generally supported more stringent RRR standards developed by the FHWA. After much discussion, a decision was made to allow states to develop their own standards for RRR projects, with the standards subject to approval by the FHWA.

The argument that safety is sacrificed in some RRR projects still exists. Although it is accepted that the current geometric design criteria adopted by AASHTO provides the safest possible roadway and roadside environment, this concept contains the assumption that there is a direct relationship between safety and roadway features. Even though numerous research studies have been performed, these relationships are not always clearly identified. For example, it is obvious that widening a 9.5-ft-wide travel lane to 12 ft should result in improved safety and operational conditions. However, how much safety is gained from realigning a horizontal curve from a 4° curve to a 3.5° curve? Researchers probably never will be able to develop definitive safety relationships for all of the various roadway features because of the numerous factors that influence infrequent accident occurrences, including driver behavior, vehicle characteristics, traffic regulations, and enforcement policies.

States Seek Categorical Design Exceptions

In general, states have attempted to use cost-effectiveness as the primary factor when selecting and prioritizing RRR projects. Upgrading older roadways to current design standards, as suggested by safety proponents, normally requires substantial funding to obtain the necessary right-of-way and to make substantial geometric changes. State engineers often prefer to make some lesser level of

roadway modifications to improve safety and operational capacity at a much lower cost. Because RRR funds are usually limited, states prefer to spend smaller amounts of money on several projects instead of spending a considerable amount of money on only a few projects. This procedure normally results in a more cost-effective use of public funds, even though the completed projects may contain several locations that do not meet currently recommended design standards.

To implement these projects, the states frequently request that FHWA grant exceptions to design standards when applying for RRR funds. If the proposed project results in an operational or safety improvement, the funds often are approved even though the project will not bring the roadway's geometric features up to desirable values or correct all deficiencies. The state and FHWA apparently believe that some improvement is better than no improvement at all.

Example RRR Suit

An example suit will illustrate the problem faced in the design of RRR projects. A southeastern state rehabilitated a low-volume, two-lane, rural highway. There was a restricted amount of right-of-way and a very restricted budget. The RRR project involved widening the highway surface by expanding it onto the existing shoulders. The net effect was a wider paved surface with narrower shoulders.

The plaintiff ran off the roadway, his vehicle overturned, and he was seriously injured. In the resulting suit, he contended that his accident would have been prevented if the shoulders had been re-established at their original width and that the RRR project resulted in a road less safe than before the project.

The state's defense was supplied by the designer who handled the project. His decision on the width of pavement and width of shoulder had been based on information contained in an FHWA report on accident rates and roadway elements. He had found a table in a research report (3) that indicated that wider pavements decreased accidents, whereas narrower shoulders increased accidents. The designer was able to demonstrate his previous calculations, based on the table, to select the pavement width and shoulder width that would produce the least amount of accidents for his site. The defense was effective because of the restricted right-of-way, the limited budget, and the designer's use of authoritative information to make critical decisions while considering the safety of the public.

Additional Design Considerations

Standard or Guideline?

Design-related tort cases have become more common in the United States in recent years. In many states, design immunity has eroded or is no longer an acceptable defense. In tort cases, plaintiff experts generally state that the AASHTO design manuals are national design standards even though these manuals clearly indicate that they are guidelines. Even the word "standard" is often misunderstood. To the legal profession, a standard is some minimum requirement that must always be satisfied. To the engineering profession, a standard is generally considered as an ideal condition that engineers try to obtain. When the standard cannot be obtained, a good design may still result if engineers compensate to offset any defi-

ciencies. For example, extra signs, markings, or other warning devices may alert the driver and compensate for a sharp curve that must be left in place.

Reconstruction or RRR?

Many design-related court cases pertain to older roadways that have been improved to some degree but not brought up to current recommended design criteria. In one southern state, the travel lanes of a roadway were widened from 10 to 12 ft, whereas the shoulders remained at a width that was less than desirable. A lawsuit resulted from an accident on the improved roadway. The plaintiff argued that the roadway-widening improvement was a major reconstruction project and that the state was required to bring the roadway up to current design standards because it was a reconstruction project, not an RRR project. The plaintiff claimed that a wider shoulder would have prevented his accident. The state argued that it was not a reconstruction project and that the state was not required to bring the roadway up to current state standards. The court agreed with the state's argument.

Example Suit Involving a 40-Year-Old Design

Another southern state was sued for failing to provide a median on a divided roadway at a width in accordance with the state's 1950 standards. The state designed a four-lane divided roadway with a minimal median width because there was an existing road bed available for use. The construction of a roadway with a wider median would have required additional right-of-way, considerable drainage improvements, and much higher roadway construction costs. However, no documents existed that explained the decision making process that took place over 40 years before trial. No engineers who worked on the project were alive to testify.

The plaintiff argued that the standards approved by the state should have been used. The state argued that the 1950 decisions must have been based on cost-effective measures and other factors that were unknown to anybody in 1991. The definition of standard as previously described was an issue in this case. Did the state engineers in 1950 view a standard as a minimum requirement or as a desirable condition? Did they even recognize the safety benefits associated with medians? The desire to separate high-speed traffic with wide medians was not much of a design issue until safety research studies were conducted in the 1960s and 1970s. These are tough questions, made even tougher 60 years after the fact. At the time of preparation of this paper, the court had not reached a decision on this case.

Are Older Standards Unsafe?

If a lawsuit results from an accident that occurred on any roadway that does not meet current recommended design criteria or current state standards, the plaintiff may be able to argue that the roadway was deficient. The AASHTO policy manuals clearly indicate that roadways designed in accordance with previous recommended design criteria or older standards are not unsafe. Undesirable features do not necessarily make a roadway unsafe. Each condition is different and requires an analysis of operating conditions, accident history, and compensating elements (such as a curve warning sign with advisory speed on a relatively "sharp" curve).

DOES TORT LIABILITY STIFLE DESIGN INNOVATION?

A Perceived Threat

The threat of a tort lawsuit has caused many transportation engineers to become very cautious and careful when selecting roadway design features and when making traffic engineering or operational improvements. Actually, this fear has caused many engineers to do their job more thoroughly and deliberately, which is good. However, this same fear has sometimes produced an excessive amount of caution, which is not good. Designers have sometimes reverted to using the same very conservative methods over and over again. They tend to hide behind their (archaic) standard drawings instead of diligently searching for the best design for every roadway site and every traffic situation. Design based on fear of doing something wrong is not the answer.

Engineers should use their abilities to solve problems. Sometimes the best solutions to a problem may not be what is conventional or typical. Innovation encourages better methods and technological advancements, which usually benefit society. Because of the fear of litigation, some transportation engineers are no longer willing to "risk" new innovations. They believe that if a future traffic accident could somehow be related to a new engineering concept that is being tested, a lawsuit could result. Plaintiffs' attorneys might claim that the innovative concept had not been proven to be effective and should not have been tested on their clients. Because of this perceived threat of litigation, many transportation engineers are tempted to keep applying conservative and proven methods even though innovative and unique solutions might be better for certain situations.

Innovation Is Still Possible

The perceived threat of future litigation should not be a barrier to thoughtful design. In normal circumstances, the designer gathers and interprets data to determine which "standard of care" is applicable and what type of design best fits the situation. In the majority of all roadway design and operational improvement situations, the tried and true procedures will be applicable and will best handle the situation. In situations in which the engineer possesses the education and skills and uses due care in executing the design, the chances of being involved in a suit are minimal. Thus, highway designers may proceed with confidence in conducting their daily business.

When the designer's evaluation reveals some unique aspect at the site, or when some new or innovative technology appears to offer the promise of a better way to accomplish this design, some method other than the tried and true traditional design may be more appropriate.

The fear of litigation does not have to pose a threat to the development of innovative engineering practices simply because such innovation might result in tort liability. Design engineers may turn to agency attorneys to provide preventative legal advice and subsequent legal defenses that allow the use of innovative techniques. The legal services provided to transportation agencies must be of the quality and have the foresight that allow advances within acceptable tort liability management. Attorneys for state agencies must avoid placing themselves in the policy making arena and restrict themselves to advising and defending their agencies.

Importance of Documenting the Design

Innovations should not be adopted and used indiscriminately. They should be adopted when the designer (by virtue of education, experience, or other expertise) has a firm reason to believe that the new procedure or new technology will do a better job of moving the public safely and efficiently. Deciding when and where to try a new design procedure is difficult. Only the designer has all of the applicable data and is aware of all of the implications of his or her decisions. When the designer concludes that the normal design practice or agency standard is not the appropriate design, it becomes very important that documentation be preserved to indicate why something different was selected. The important factors in making the decision may not be obvious to a jury several years after the design was executed. If the agency is sued, it is important that the defense attorney have access to the designer's thoughts and to the reasons for the particular design. If the suit occurs 40 years after the project was completed, the designer may not be available to testify to a jury. In this instance, the design file may contain the only evidence to indicate that the project was conceived in a thoughtful manner and that the designer used due care in selecting the innovative procedure or design.

SUMMARY AND CONCLUSIONS

Tort liability has become an issue of major concern for today's highway designer. Some of the reasons for this trend have been discussed in this paper.

In 1990, there were between 33,000 and 35,000 claims and suits against highway agencies. In the same year, these agencies paid at least \$400 to \$600 million to defend suits and to pay off claims and judgments. The problem is getting worse, not better. The number of claims has been growing at the rate of 16 percent per year since 1972.

In light of these tort trends, the authors have drawn some simple conclusions about the effects of tort liability on roadway design decisions.

1. Tort liability is here to stay. Instead of fearing or ignoring it, the highway engineer must learn to accept it and deal with it in a professional manner.

2. The highway designer needs to become aware of the consequences of his or her decisions, and of the impact of these decisions on the agency's future liability situation.

3. The highway designer should learn more about tort liability through activities such as attending seminars, reading, and developing an inquisitive attitude. The designer needs to understand the basic concepts of the legal system, become aware of the grounds on which a suit may be brought, know the reasons for each step in processing a claim or conducting a trial, and master good techniques for giving testimony.

4. The engineer must remember that tort liability is more likely to become a reality in situations in which he or she failed to conduct assigned duties and responsibilities in accordance with sound engineering principles.

5. At the same time, there is a (small) chance of involvement in a tort liability suit even when all activities performed by the engineer were in conformance with sound engineering practices and principles.

6. It is becoming essential to document engineering design decisions, especially when a unique or nonstandard design is selected

for implementation or when a nonstandard design is adopted for an RRR project. Such documentation is more important in the distant future than in the present.

7. The "best" roadway design for the specific conditions at each site should be the goal of all construction and reconstruction projects. The best design possible may not be the "standard" design adopted by the responsible agency. RRR projects should not be scrapped simply because "standard" roadway design is impossible, impractical, or prohibitively expensive for the roadway segment in question.

8. The engineer should not sacrifice the safety of the motoring public for cheaper but inferior design. However, low-cost improvements that result in good but less than standard designs may be a better alternative than a specific and very costly reconstruction project that results in a single "standardized" roadway. The engineer's discretion should be used to select the best alternatives for each project.

9. Design immunity has been weakened or removed in many states. Even where it still exists, there may be future changes in the laws that affect the immunity issue. Plus, design discretion may be challenged in court as discretionary abuse.

Engineers may be well advised to pursue their designs as though design immunity did not exist. This calls for actions such as careful consideration of options and alternative designs, using the agency "standard design" when it is appropriate but not being afraid to use alternative or innovative designs if they are more appropriate, and preparing documentation to support design decisions.

10. Economic defenses have been removed by the courts in many jurisdictions. Where they still exist, they may be difficult to present and explain in a courtroom. Until a better, more rational basis is found for making design decisions, economic (cost-benefit) analyses remain the most logical procedure for selecting roadway improvement projects.

11. Engineers should not let tort liability stifle innovations. The transportation engineering profession could become stagnant or die without innovation, improvement, and growth. An engineer is still allowed to investigate and experiment with new concepts to determine whether "better" methods exist. As long as the innovation is credible, there is a rational basis for it, safety has been adequately considered, and the design does not place the motoring public in danger, the experiment should be supported.

The growing number of suits and continuing changes in the legal system may intimidate some highway engineers and may stifle design innovation. This does not have to be the case. When the highway engineer possesses the education and skill, and uses due care in executing the design, the chances of being involved in a suit are minimal. When the designer has a firm reason to believe that an innovative or new design will best serve the public, it may be used. In this situation, it is a good idea for the designer to leave proper documentation in the design file.

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