Expert Witness Information Notebook

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PREFACE

The *Expert Witness Information Notebook* is provided by the Transportation Expert Witness Council of the Institute of Transportation Engineers (ITE). The Transportation Expert Witness Council, as a functional sub-unit of ITE furthers the objectives of ITE, fosters association of ITE members, encourages technical activities related to expert testimony and cooperates with other professional and scientific groups with related interests. The *Expert Witness Information Notebook* has been developed to provide guidelines, suggestions, ideas and information to members of the ITE Transportation Expert Witness Council for use in their activities as experts in the transportation profession.

The information prepared by the individual authors represents only the opinions and thoughts of that author. Any questions on the written material should be directed to that person. ITE and the Transportation Expert Witness Council neither endorse nor subscribe to the positions and opinions expressed in this material. Additionally, this material does not represent standards, recommended practices, or procedures of ITE or the Transportation Expert Witness Council. It is intended that this material be used by individual Transportation Expert Witness Council members as they feel is appropriate.

It should be recognized that the *Expert Witness Information Notebook* is an ongoing project with new material to be added when it has been prepared. A number of ideas have been provided for subject matter, and the Transportation Expert Witness Council is searching for authors to prepare the material. If you have an interest in developing material for this publication, you are invited to contact the chair of the Transportation Expert Witness Council.

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Section 1
Liability Information

TORT LIABILITY BACKGROUND

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Liability lawsuits are founded in a particular area of law called "tort law." A tort is a private or civil wrong that results in an injury or loss to another party. It is not a criminal act or a breach of contract, which have their own area of the law. It is the injury that one inflicts upon another because of an overt act or omission of an act.

The tort liability law originated under William the Conqueror, King of England, in 1066 A.D. with the Common Peoples Court. In this court, a neighbor could bring action against another neighbor for a tort. However, King William, with the establishment of the Common Peoples Court, made sure that he was protected against lawsuits. After all, King William ruled by divine right and, therefore, could do no wrong.

The first recorded English case to discuss sovereign immunity was *Russell* v *the Men of Devon* in 1788. Mr. Russell owned a horse and wagon that broke through a defectively maintained bridge in Devon, England, killing the horse. The Men of Devon, equivalent to a county, were sued for the damages to Mr. Russell. The court handed down a multiple ruling that formed the basis for sovereign immunity First it ruled that the said *Men of Devon* governed with the authority of the king and had the same immunity as the sovereign. Thus, they were not required to answer in court for any wrong that they did in their government operations. Second, the court said that if parliament wanted government to be held responsible it would have passed enabling legislation. The court further indicated that it was reluctant to permit suits against the government because, if governments were required to be responsible for the repair and maintenance of their public works projects, they might not be inclined to provide future projects. Finally, the court said that to allow a suit to be successful against the government might open the gates of litigation.

A similar case was litigated in 1812 in Massachusetts under *Mower* v *the Inhabitants of Leicester.* A stagecoach owned by Mr. Mower on the Boston Post Road broke through a bridge and a horse subsequently died from its injuries. The court held that Mr. Mower could not sue the town because, as in the case of *Russell* v *the Men of Devon,* the town of Leicester could do no wrong because it had the immunity of the ruling sovereign, the Commonwealth of Massachusetts. U.S. law closely followed the English legal system and, accordingly, the doctrine of sovereign immunity became well established.

The defense of sovereign immunity emerged in the United States because of practical or policy considerations and, possibly, because of a misunderstanding of the doctrine as it existed in England prior to the American Revolution. Several legal historians have concluded that the English sovereign was not immune from suit for the many acts done in the name of the crown. The English have had a "definite conception of private rights and a profound conviction that an impairment or violation thereof by public authority constituted a wrong for which redress must be accorded." The claims took the form of writs against the king himself, brought as petition of right requiring his consent. This type of remedy has been over-

generalized into the broad abstraction of sovereign immunity The English sovereign was answerable for numerous wrongs when the proper procedures were followed, but the sovereign was not responsible for torts of officers or servants.

The basis of U.S. jurisprudence was the English common law that departed from the English tradition with the question of sovereign immunity In England, a petition of right depended on the king's assent as sovereign; but in U.S. jurisdictions the only authority that could grant consent to suit, by analogy, must be the legislature. Ultimately, in a series of U.S. decisions, the doctrine of sovereign immunity was held to be applicable to the federal and state governments. The doctrine's perpetuation is said to be founded on Justice Holmes' famous dictum, which placed the sovereign, the lawmaker, above the law:

> "A sovereign is exempt from suit, not because of any formal conception or obsolete theory, but on the logical and practical ground that there can be no legal right as against the authority that makes the law on which that right depends." *Kanananakoa* v *Polybank,* 205 U.S. 349, 353, 27 Sup. Ct. 526, 527 (1907).

It has been held that an action would not lie against a state unless consent to suit was given by the legislature. The doctrine of sovereign immunity has been eroded by series of court decisions and by the decision of the legislatures in many states to allow tort liability by specific liability legislation or state claims acts. Some states still maintain their immunity from tort claims; others have restricted basis for claims; others have imposed a limit on the recovery for damages.

The erosion of sovereign immunity began with Congress passing the Federal Tort Claims Act in 1946, which provided for the litigation of tort claims in federal courts. The individual states' tort claim provisions began to change dramatically in the 1960s with only a few states currently retaining any immunity. The tort laws in the states are continuing to change with each state having its own limitations on claims and provisions for remedy. It is necessary to review the tort claims acts for those states of interest to understand the tort claims provisions. It is recommended that an expert witness be aware of any tort claims provisions within those states where they may regularly work to avoid any conflicts with the law and unnecessary work. The methods that the states use for tort claims commonly fall under one of the following:

- Doctrine of immunity still in force
- Limited liability by means of a tort claims act
  - Suits may be instituted as prescribed by the act
  - Suits may be before a special tribunal
  - Suits permitted only within prescribed limits
- Legislative claims boards
  Additional relief through the courts may be permitted.
- Abandonment of immunity

The immunity of counties, cities and towns may differ slightly from the state because of variations in the state law. However, in most cases, the local jurisdictions have the same tort

claims provisions as the state government because they derived from state government. In some cases, incorporated municipalities are fully responsible for their actions just like a corporation.

Individuals have been subject to tort claims for their actions since the emergence of common law. Government employees, as individuals, had no immunity and provided the only avenue for the recovery of damages. Therefore, they were frequently subjected to many of the early tort claim actions. With the loss of government sovereign immunity and the large government assets versus minuscule individual resources, tort claims against individuals have reduced. Juries have been more sympathetic toward government employees than large government agencies. Corporations have the same legal status as an individual and, therefore, are subject to tort claims. However, juries view corporations as a better resource for large judgments than the individual.

Tort liability activities have become a growing and dynamic business. It is estimated that the number of tort claims has grown at about 15 percent per year since 1972. An estimate from Transportation Research Board (TRB) Synthesis 206, *Managing Highway Tort Liability,* projects that the cost of tort actions against highway agencies at all levels of government cost between $400 and $850 million in 1991. The liability exposure is dynamic as government makes modifications to the liability laws, court rulings explore new avenues for consideration and attorneys flock toward those types of cases that have been the most successful. At the same time, highway agencies are recognizing the liability problems and doing a better job of risk management. It is expected that tort law will go through additional metamorphoses before it fully stabilizes into a reasonably predictable outcome.

The tort liability activities in transportation have produced some trends that reflect the changing picture of this field. It has been noted that an increase in attorneys during the late 1970s and early 1980s parallels the increase in highway tort claims as these new attorneys searched for business opportunities. As a result, the number of tort claims has generated a proliferation of experts, leading to the allegations of limited expertise and credibility An increased retirement of government employees has reduced the experience level of the agencies and their capability to deal effectively with liability. This has encouraged public agencies to initiate risk management programs for a more effective approach of balancing safety needs with limited resources. The court judgments have influenced agencies to not only modify practices but also structure a successful defense of some claim allegations. These same judgments have influenced the legal field to note significant judgments, cite favorable arguments and select those issues that provide reasonable rewards with the minimum of effort.

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LIABILITY DOCTRINE AND CONCEPTS

By James L. Pline, P.E., PTOE, President, Pline Engineering Inc.

A number of approaches and concepts are applied under the tort liability law both to prosecute and to defend a damage claim. Those concepts are addressed in this section to provide a brief summary of the particulars and to assist in the understanding of these concepts. Specific details and the relationship to an individual case should be reviewed with legal counsel on the case.

NOTICE

The courts have uniformly held that a dual duty arises once the public entity that has the responsibility for a roadway has notice of a defect; it has the duty to repair it or, if unable to do so within a reasonable time, to warn the public adequately. Reasonable people would not act until they know there is a problem. Once informed, however, there may be an obligation to respond. Some states may have a statutory response period, such as five days, within their tort law. Notice is not required where the defect has been caused by the public entity's own act. For example, if the agency improperly maintained or repaired the roadway, it does not have to receive notice that the defect existed. The courts uniformly say that the entity that performed the act is aware of its own act and thus, if it created a defect, is responsible.

ACTUAL NOTICE

No firm rules are laid down in the cases as to what constitutes actual notice of a defect. However, it is probably safe to say that proof of knowledge of the defect on the part of a person or persons employed by the agency and charged with maintenance duties and responsibilities will, absent special circumstances, suffice to constitute actual notice to the agency. Notice is generally considered to have been received once a report, complaint call, or other communications have been filed with the agency having responsibility. Accordingly, there is a need for rapid and effective communications within an agency because a filed police report or a telephone call may constitute notice, although there may be some delay in getting that notice to the responsible people who determine what action is needed. A filed police report may be actual notice, even though the highway agency may not get a copy of the report for several weeks.

CONSTRUCTIVE NOTICE

The concept of constructive notice implies that the agency should have known that a defect existed and had sufficient time to take corrective action. The courts have held that a public agency has personnel, including enforcement people, who travel the roadways every day and should observe the defect and provide notice to the maintaining agency. The courts have held that repeated repair of potholes or knowledge of a poor roadway surface is notice of a defect. The courts have not provided any firm rules on constructive notice; but the longer the lapse of time between the existence of a defect and the cause of an accident, the greater the likelihood that constructive notice will be used as an issue. A time frame has not been specified as being sufficient to constitute constructive notice. Previous cases where elapsed time was a factor have varied from weeks to days or even a brief span of a few hours, and they have been deemed sufficient to impute knowledge of the defect. It could be generalized

that the time frame is probably shorter on a heavily traveled roadway in a populated area than on a little used roadway in a rural area.

NEGLIGENCE

The most common of all tort cases is the negligence case. Negligence is the failure to use reasonable care in the dealings one party has with another party. In a negligence suit, the plaintiff (injured party) must prove the following five elements:

- Duty: It must be proven that the defendant owes a legal duty to the plaintiff, which is the easiest to prove. Most laws and statutes establish the authority of a public agency for a road system and require that it be operated in a reasonably safe condition. Therefore, there is a duty on the part of the responsible road agency to the user of that roadway
- Breach of duty: It must be proven that the defendant in one way or another breached the duty it owed to the plaintiff. This breach of duty can be failure to repair a defect, lack of repair in a timely manner, inadequate repair, or failure to warn of the defect.
- Proximate cause: The breach of the duty owed to the plaintiff must be the proximate cause of the damage to the plaintiff. Proximate (legal) cause is more difficult to establish because it is a natural sequence of events that led to the damages. The actual cause may be the fact that the traffic signals were not operating or the carelessness of two drivers. The underlying or proximate cause that may be addressed is the failure of the public agency to properly maintain the traffic signal or provide adequate warning of the signal malfunction.
- Absence of contributory negligence: There is no contributory negligence on the plaintiff's part. In some states, if a plaintiff has contributed to his or her own injuries, he or she is precluded from any recovery. The courts have moved away from this concept toward comparative negligence. Therefore, the proof will be that the plaintiff was in no way negligent or was only to a minor extent negligent.
- Damages: There must be proof of damages to the plaintiff. Damages can include personal injury, vehicle repairs, medical expenses, rehabilitation, lost income, pain and suffering. The purpose of the court award and nature of the lawsuit is to put the injured parties back in the position they were originally in prior to the accident.

CONTRIBUTORY NEGLIGENCE

One defense that has often been cited is that the driver shared a responsibility for the accident through carelessness or contributory negligence. In some states, the doctrine of contributory negligence bars any recovery by a driver whose actions contributed to an accident, even if another party was primarily at fault. The current trend is away from this doctrine because it unfairly penalizes those parties who were only slightly negligent. The following limitations have evolved on the use of contributory negligence as a bar to government liability:

- Foreseeability has been held to be a necessary element of contributory negligence. Thus, it must be shown that a reasonable person would have foreseen the exact consequences of negligent driving.

- There is reluctance to find that the violation of a safety statute by the motorist is, in and of itself, negligence (for example, exceeding the speed limit).
- The negligence of the government agency may be judged an intervening cause between the motorist's negligence and the accident that is sufficient to exonerate the motorist.

Public agencies cannot assume that the roadways are used only by alert, intelligent and cautious drivers. Highways are to be designed and maintained as sufficiently "forgiving" to accommodate the vast mainstream of drivers.

COMPARATIVE NEGLIGENCE

Comparative negligence, where negligence is measured in terms of percentages, has replaced contributory negligence. Still, in some jurisdictions, the plea of contributory negligence operates as a partial defense where the plaintiff is found guilty of less than 50 percent of the total fault and a complete defense where more than 50 percent of the negligence is attributable to the plaintiff. Comparative negligence proportions the damages based on the percentage of negligence attributed to the person seeking damages. Where negligence exists for two or more parties in the lawsuit, the recovery of damages is not barred, but it may reduce the plaintiff's damages proportionately. The application of comparative negligence varies between the state's and the previous courts' decisions.

JOINT AND SEVERAL LIABILITY

The doctrine of joint and several liability under the laws of many states requires that the defendant who is liable for a portion of a claimant's injuries is jointly and severally liable for all damages with any other defendant who is also held responsible. This means that the plaintiff can collect all or a large part of the damages from any one of the defendants that are held liable. This doctrine makes the government agencies especially vulnerable. Defendants such as other drivers may have limited resources and minimum insurance, shifting the entire burden to the public agency. Juries are not always aware that even a small percentage of negligence assignment under comparative negligence can, with joint and several liability, result in payment of the total damages.

EQUITABLE INDEMNITY

The concept of equitable indemnity holds that parties responsible for an injury are entitled to partial indemnity from each other in an amount proportionate to their percentage of fault. With joint and several liability, where the public agency is required to meet an inappropriate high amount of the settlement, it may then sue the other defendants to recover its proportionate share. However, these other lawsuits have little value if the other defendants are without assets. Recent cases have held that the right of equitable indemnity is not limited to the parties sued by the plaintiffs. Therefore, any defendant can seek indemnity against other parties and bring those parties into the lawsuit by means of a cross-complaint. In states where this concept is permitted in the courts, many public agencies, utility companies and contractors may find themselves in a lawsuit years after the accident, attempting to shift the financial burden of a court settlement.

TYPES OF FUNCTIONS

Two types of functions are provided by government, and there may be immunity based on the type of function performed. Originally, a discretionary exemption was provided in the law for judges with respect to the performance of their official duties. The discretionary exemption has been extended to other government officials under personal liability law. Additionally, the dichotomy of discretionary function from personal liability law has been extended over into government entities, making them immune from liability for discretionary functions based on judicial decisions or in some states by statute. A satisfactory definition of "discretionary" and "ministerial" has not been formulated, but they relate to discretionary powers or independent judgment when making a decision. However, most liability cases address certain acts by officials rather than decisions, so the decision-making of an individual to carry out established functions is usually not an element. Rather, attempts are made to classify the acts of an individual as to falling in the discretionary area or ministerial area. The following discussion will clarify the differences in the two functions, but the courts will make the final determination.

MINISTERIAL FUNCTIONS

Ministerial functions are those activities that involve clearly defined tasks. They are performed with a minimum leeway for personal judgment and do not require the weighing of alternatives. Highway maintenance is usually cited as an example of ministerial functions where the work is well defined for each maintenance activity. This generalization is not always valid because some independent judgment is required with respect to the need or necessity of repairs; time and place for making repairs; materials to be used; and method of making repairs that are widely held to be discretionary in nature. The maintenance activities at the planning stage as opposed to the maintenance activities at the operational stage generally have the discretionary exemption. In maintenance procedural manuals, the states have clearly outlined operational maintenance activities that define the work, equipment, material and traffic control as well as other details making these functions ministerial with very little room for individual judgment or decision-making by the maintenance worker. The persons involved in ministerial functions are generally open to tort liability suits as an individual. The defense of the individual in these cases will be along the lines that they followed the maintenance procedures exactly, the maintenance activities were in an area not addressed by the procedures, or there were others factors involved that made the specific maintenance procedures inappropriate.

DISCRETIONARY FUNCTIONS

Discretionary functions are those acts requiring the exercise of independent judgment in arriving at a decision or choosing a course of action. The terms "discretionary function" or "duty" mean the power and duty to make a choice among valid alternatives; this requires a consideration of alternatives and the exercise of independent judgment in arriving at a decision or in choosing a course of action. The common law exempts discretionary activities from liability. Under the separation of powers doctrine in the United States, the courts are reluctant to second-guess discretionary decisions made by executive bodies. It is also believed that a jury of untrained laymen is not competent to evaluate the appropriateness of discretionary decisions.

It is generally held that highway planning and location decisions are a discretionary function. The design activities are also generally held to be a discretionary function and thus provide common law immunity from liability. However, there are exceptions to design immunity either under statute or court decisions. Maintenance activities may or may not have discretionary function and be immune from liability as noted above for maintenance planning functions versus operational functions.

DESIGN IMMUNITY

The courts in many states have determined that the development of a roadway design is a discretionary function and, accordingly, there is design immunity under common law provisions. However, the courts have held that there is no design immunity if the design itself was arbitrary, unreasonable, made without adequate care, or if it is dangerous or manifestly unsafe after use and the agency has received notice of that fact.

Some states have further strengthened the design immunity provisions by providing for the immunity of design decisions in the tort liability law. It should be recognized that the design immunity provisions are constantly challenged in the courts. Therefore, it is usually necessary to prove that the design was approved in advance by a public body or employee exercising discretionary authority. The New Jersey plan or design immunity statute provides that:

> "Neither the public entity nor a public employee is liable under this chapter for an injury caused by the plan or design of public property, either in its original construction or any improvement thereto, where such plan or design has been approved in advance of the construction or improvement by the Legislature or the governing body of a public entity or some other body or a public employee exercising discretionary authority to give such approval or where such plan or design is prepared in conformity with standards previously so approved."

It is now relatively common to require proof that the design complied with the applicable standards at the time that the plan or design was approved.

However, questions have been raised: If the design immunity is perpetual, what is the duty of the public entity to improve or change an existing roadway where actual use or changed circumstances later indicate that the design is no longer satisfactory? Exceptions to design immunity have been shown where the design creates peril to the road user from the very beginning, where there is some manifest danger in the design that becomes known to the public entity and where the design lacked any reasonable basis or was not prepared with due care. The rule is not clear as to whether or not there is continuing duty to review the plan or design in light of actual operations.

The principal case relied on against perpetuity of design immunity is *Weiss* v *Fate* [N.Y. 2d 579, 167 N.E. 2d 63, 200 N.Y.S. 2d 409 (1960)], where the *Weiss* court seemed to recognize a rule that there was a continuing duty to review the plan in the light of its actual operation. However, the *Weiss* court made no specific ruling in that regard because there was no proof either of changed conditions or of accidents at the intersection that required the city to modify the traffic signal clearance interval. The issue in the case was the reasonableness of

the signal clearance interval that had been approved after ample study and traffic checks. The *Weiss* court held that the states general waiver of immunity did not extend to areas of lawfully authorized planning and that it would be improper to submit to a jury the reasonableness of the plan approved by an expert body.

The *Weiss* rule was ultimately applied in California in the case of *Baldwin* v *State* [Cal. 3d 424,491 P 2d 1121,99 Cal. Rptr 145 (1972)] to emasculate the California statute's design immunity provisions. The *Baldwin* case used the *Weiss* rule claiming that the omission of a left-turn lane, which the state later knew was dangerous, in actual practice did not permit the state design immunity. The *Baldwin* court held:

> "Having approved the plan or design, the government entity may not, ostrich-like, hide its head in the blueprints, blithely ignoring the actual operations of the plan. Once the entity has notice that the plan or design, under changed physical conditions, has produced a dangerous condition of public property, it must act reasonably to correct or alleviate the hazard."

Another California case, *Cameron* v *State* [102 Cal. Rptr 305,497 P 2d 777(1972)], noted that the mere passage of time is insufficient to constitute a change in conditions.

The *Baldwin* case provides the basis to challenge design immunity in other jurisdictions on specific cases. Therefore, appropriate defense would not only support design approval to acceptable standards and practices but also support the belief that the plan or design operated adequately for a reasonable and safe driver.

ECONOMIC DEFENSE

Government entities have pleaded economic limitations in liability cases, but this defense has relatively little credibility with the courts. In many cases, a minor improvement or a warning device may be deemed adequate and necessary to prevent the accident. The small cost of these improvements versus the large budget of the agency does not support the plea that the agency could not afford the improvement. The fact that an improvement at a specific site under litigation may lead to other similar improvements throughout the jurisdiction is usually overlooked by the courts. An acceptable alternative defense to economics is the establishment of a program for safety improvements with a priority system of program implementation. The courts will usually recognize that it is more prudent to expend time, efforts and funds at those sites that have more accidents or operational problems.

RESPONDEAT SUPERIOR

This doctrine is concerned with the personal liability of an individual supervisor or highway official for the tortuous acts of subordinates or employees. As a general rule, supervisors would not have personal liability if their subordinates committed a tortuous act. The doctrine of respondeat superior has no application to public officers, and they should not be held accountable for the tortuous acts of subordinates based on *Robertson* v *Sichel* [127 U.S. 507, 32 L.Ed. 203, 8S. Ct. 1286(1988)]. In reaching its decision, the court stated that to allow recovery "would be to establish a principle which would paralyze the public service. Competent persons could not be found to fill positions ... if they knew they would be held liable for all the torts and wrongs committed by a large body of subordinates." The public

official may be held liable if he/she has participated in the tortuous conduct of his/her subordinate or if it can be shown that he/she has not exercised due care in the selection of subordinates. Also, the public official can be held responsible for his/her own misfeasance and negligence.

PROXIMATE CAUSE

In any action for damages based on alleged negligence, it is necessary for the plaintiff to prove that the act or omission complained of was the proximate cause of the injury suffered. Proximate cause is defined as a cause that in a natural and continuous sequence, unbroken by an efficient intervening cause, produces injury and without which the result would not have occurred. The rule stated in *The Law of Torts,* by Prosser, Third Edition, is as follows:

> "An essential element of the plaintiff's cause of action for negligence ... is that there be some reasonable connection between the act or omission of the defendant and the damage which the plaintiff has suffered. This connection is dealt with by the courts in terms of what is called 'proximate cause'... On the issue of the fact of causation, as on other issues of the fact of cause of action for negligence, the plaintiff, in general, has the burden of proof. He must introduce evidence which affords a reasonable basis for the conclusion that it is more likely than not that the conduct of the defendant was a substantial factor in bringing about the result. A mere possibility of such causation is not enough; and when the matter remains one of pure speculation or conjecture, or the possibilities are at best evenly balanced, it becomes the duty of the court to direct a verdict for the defendant."

The question of independent cause was before the court in *Cregger* v *City of St. Charles* [11 s.w 2d 750 Mo. App. (1929)], wherein the court stated the following in respect to the intervening cause:

> "In determining whether the continuous sequence of events has been broken by an efficient intervening cause so as to constitute the latter the proximate cause of the injury, it is understood that for a cause to be properly denominated as efficient and intervening it must be a new and independent force or agency which breaks the chain of causal connection between the original wrong and the final consequence. Such intervening act or event must be sufficient to stand of itself as the cause of the injury, and be one but for which the injury would not have occurred; and if the new cause serves merely to accelerate the effect of an original cause which alone was sufficient to produce the injury, the first cause will still be considered the proximate cause."

The question of causation is a troublesome doctrine for the courts and may be difficult to establish. Most accidents are the result of multiple factors, and the courts may downplay the proximate cause when the injuries are large, emotions significant and a search is being made for the "deep pocket" agency. The connection to proximate cause may be minimal such as to prove that traffic control did not meet acceptable standards and hence was negligent, and an accident occurred at the site.

STANDARD OF CARE

The standard of care is those actions of an individual or agency that were done in a manner that reflects the normally accepted methods and practices of other persons or agencies

performing the same activities. There is a responsibility to act in a manner that is reasonable based on the information at hand and the resources available. There is always good "hindsight" after an accident to determine that an individual did not act in reasonable manner when he/she observed or was notified on a potential defect, failed to take some action and the accident occurred. The following factors should be considered when determining reasonableness of action and the standard of care owed the public:

- Gravity of harm posed by the condition
- Likelihood of harm to someone
- Availability of a method to correct the situation
- Usefulness of the condition for other purposes
- Burden of removing the condition
- Temporary measures to protect the public

A lot of information will be introduced in the court to establish the prevailing standard of care. The strongest evidence may be the agency's own guidelines, policies, or procedure manuals that outline in detail the appropriate actions under various circumstances. A reasonable person must follow the rules and guidelines of the agency unless there are strong "overriding" reasons for not following those requirements in a specific situation. In which case, the individual must be prepared to explain the overriding circumstances, the rationale of his/her decision-making and the reasonableness of the action he/she took. Sources of information that may be used to support standard of care are as follows:

- Nationally approved standards, guidelines and policies
- Agency directives, policies and procedure manuals
- Directives of a higher agency (federal or state)
- Guidelines and policies of other agencies to demonstrate the state of the art
- Publications of national and professional organizations
- Engineering texts and publications
- Research publications
- Opinions of experts in the field and expert witnesses

The significance of the above information relative to standard of care and the requirement to comply with all of the above data are discussed in greater detail in a later chapter. It should be recognized that there is information to support nearly any standard of care that a person desires to prove in a specific case. It is more difficult to prove what was reasonable and acceptable under the circumstances.

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TRANSPORTATION TORT LAW—
A LOOK FORWARD*

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As we enter 2000, state and local transportation agencies are experiencing a dramatic increase in tort litigation involving claims for personal injury and property damage. These claims have added greatly to the cost of constructing and maintaining the nation's highway transportation infrastructure. As the costs associated with the claims against state and local highway agencies increase, the percentage of funds available for construction, reconstruction, safety enhancement and maintenance to improve highway safety decreases. The estimated hundreds of millions of dollars paid to claimants each year decreases the funds available to make the highway infrastructure safer for the great majority of nonclaimant drivers.

The single greatest reason for the explosion of claims against state and local transportation agencies over the last 50 years has been the abolition of the doctrine of sovereign immunity by most states. Today, sovereign immunity runs the gamut from absolute immunity to no immunity at all. Between those two extremes are limited forms of immunity such as discretionary immunity, design immunity and caps on damage awards.

The loss of sovereign immunity by public entities is only one part of the picture of the evolution of tort liability over the last century. Beginning as far back as the Progressive Era, legislatures and courts have led a movement to protect and compensate injured persons at the expense of business and government. Product liability, medical and legal malpractice and class action suits, as they have evolved, are only a few examples. In most states, the absolute bars to recovery, such as contributory negligence and assumption of risk, have been eliminated and replaced by the doctrine of comparative negligence.

Public entities' exposure to tort liability has increased as the practical science of transportation engineering has improved, resulting in greater public expectations from government. During the period of rapid highway expansion, national engineering organizations were formed, the primary one being the American Association of State Highway and Transportation Officials (AASHTO) and its predecessor, the American Association of State Highway Officials. These organizations established and adopted standards, which are actually guidelines for the design, construction and maintenance of safe roads, highways, streets and bridges. AASHTO also developed the *Manual on Uniform Traffic Control Devices* and other guidelines pertaining to highways and bridges. These guidelines have been adopted by most states.

Guidelines change as new engineering techniques for construction and safety are developed. If roads, streets, highways, or bridges are not designed, constructed, or maintained according to these guidelines, the states or their political subdivisions may be found liable under tort law. Courts appear to overlook the fact that many of the older roads were constructed for fewer, smaller and slower vehicles. No state, municipality, or county transportation department has the resources to immediately bring all older roads and bridges up to current AASHTO guidelines. The issue of AASHTO guidelines has become a fertile field of tort litigation and is raised often by plaintiff attorneys in an effort to establish negligence on the part of transportation departments.

As this millennium ends, an established legal principle in tort law is that transportation departments owe a duty to the public to maintain transportation facilities in a reasonably safe condition, or at least to provide adequate warning of dangerous or defective conditions. The most common, but not the only, activities of transportation departments giving rise to tort claims are the following:

- The design, construction and reconstruction of roads, streets, highways and bridges;
- Maintenance of the driving surface and shoulders of roads, streets, highways and bridges;
- Erection and maintenance of signs, signals, warning devices and traffic control devices;
- Design, construction, maintenance and operation of movable bridges and ferries (which may also give rise to actions in admiralty);
- Design, erection and maintenance of guardrails and barriers;
- Control of and warnings involving weather-related conditions, such as ice, snow, fog and rain;
- Control of and warnings involving erosion and falling rocks;
- Removal of and the placement of warnings about and devices protecting from obstruction on roadway and adjacent right-of-way, including but not limited to trees, rocks, utility poles, culverts, signs, mailboxes and debris; and
- The signing, signaling and maintenance of at-grade railroad crossings.

Notwithstanding the foregoing activities, the human element cannot be overlooked as a factor in the increased number of claims against transportation departments. Very few accidents are solely the fault of highway conditions or transportation department employees. Drivers cause or contribute to highway accidents through negligence, the use of drugs and alcohol and general fatigue. These causal or contributing factors are defenses that can be raised by transportation departments.

TRANSPORTATION TORT LAW

The most significant effect on the practice of transportation tort law in the 21st century is expected to come from technology and innovations in the use of technology. They will present new issues and challenges for the transportation lawyer. Some of those issues will arise when new technology is implemented, and others will arise when the innovation or technology fails and a loss results. The transportation tort lawyer must develop new methods

of practice to address these issues and new ways to use existing and emerging technology in the organization and presentation of the facts and information needed to represent the transportation agency.

As a result of advances in technology, the transportation lawyer will face new challenges in both the application of technology and its results. Systems such as traffic management systems hold great potential for improving the safety and efficiency of our transportation infrastructure. At the same time, these systems create the potential of new duties, risks and liabilities for the transportation agency. The monitoring of traffic flow and congestion is becoming fairly common on crowded urban transportation networks. Along with the ability to monitor traffic flow and congestion come the ability and, arguably, the responsibility to advise users of traffic conditions ahead. Once the agency begins providing this warning service, it then may have assumed the *duty* to provide those warnings. It can be expected that the plaintiff's bar will argue that the transportation agency also assumed liability in the events that the service fails to live up to some standard of care and timeliness. There have already been instances where transportation agencies have faced claims based on the contention that the agencies failed to warn of dangerous traffic conditions ahead. As the next logical step is taken from monitoring and warning to positive control of traffic flow through such measures as closing ramps and alternative routing, the agency may very well be assuming additional duties and corresponding liabilities.

In the very near future, sets of plans may be created and retained only in an electronic format. For the transportation tort lawyer trying to establish design immunity, this procedure will present additional hurdles in providing the authenticity of hard copies of those plans and designs.

The transportation tort lawyer also will likely encounter new issues in commercial motor vehicle operations. Systems that automate the checking of a vehicle's credentials and weight are already in place. In the near future, we could see the implementation of technology that would allow for automated safety checks of vehicle systems. Along with these systems should come concerns about the possible tort liability of the transportation agency if it fails to detect and stop an illegal or dangerous vehicle that is subsequently involved in an accident.

Vehicles that use the transportation infrastructures are also changing. Pressure, in the form of federal legislation and regulations, state and local requirements, and public demand, continues to increase for safer, cleaner and more efficient vehicles of every type. Improvements in existing technology and the implementation of new technologies not currently available will be needed to fill these demands.

The benefits of cleaner, safer and more efficient vehicles are self-evident, but some of these technologies will have effects on transportation beyond the demands they are designed to fulfill. Alternative-fuel vehicles, such as electric cars, reduce the amount of pollutants in the atmosphere, but they also reduce the traditional motor fuel tax funding base used to build and maintain the transportation infrastructure. Whether the electric car or a different alternative-fuel engine becomes accepted into general use, the new technology will force revisions in the funding of the transportation infrastructure of highways and mass transit. Failure to meet this

challenge will initiate a series of consequences: reduced funding, leading to reduced maintenance and new construction, leading to deterioration of the highway system, leading to increased accidents and claims, leading to increased tort exposure and payouts, leading to further reduced funding for transportation infrastructure, and so forth.

TORT LITIGATION

The transportation tort lawyers' litigation practice can also be expected to change in the 21st century. Today, there are jurisdictions where it is no longer necessary to race to the mailbox or the courthouse to file court documents. Documents prepared on a personal computer can be transferred to the court clerk and filed with a "click of a mouse." Opposing counsel can receive a copy simultaneously with the electronic filing with the court. In the near future, voice recognition technology will begin to replace those hours spent at the keyboard or with a pen and a yellow legal pad drafting documents, and word processing systems will format and formalize the draft into a final document. It is hoped that, with the elimination of some the mechanical burden, practitioners will be able to devote more effort to the art of creating clear, more comprehensive and more convincing documents.

Going to court will likely take on new meanings in the future. Already, a significant number of disputes are settled through one of the many forms of alternate dispute resolution without a lawsuit being filed. In those instances when a case is filed, courts are encouraging, and even requiring, various forms of alternative dispute resolution before trial. Appearances for motion dockets, discovery conferences, status conferences and even oral argument on an appeal may, in the future, be handled from an office videoconferencing center. With a little imagination, it is easy to foresee trials taking place with the judge, witnesses and attorneys interacting through video from different locations. It is even possible that a jury will hear evidence and view exhibits through an electronic hookup. The technology, albeit somewhat expensive, already exists today that makes this possible. It may be only a matter of refinement of the technology and the willingness of some innovative court to try an experiment to start a trend in this direction.

Technology will affect not only the physical location of court proceedings, but also the transportation tort lawyer's methods used in the discovery and presentation of evidence. Documents such as studies, contracts, plans, photographs, specifications, surveys and field books, which often play a significant role in transportation tort cases, are more and more frequently found to exist on a disk rather than as a paper copy. The discovery production of such documents on a disk has both advantages and disadvantages. There is a certain attraction to being able to fulfill discovery demands with a couple of disks rather than boxes of paper documents, but this raises questions relating to alteration of the documents after production, and even whether they can be accessed without the sometimes very expensive programs and hardware by which they were created. Before the wise use of discovery in electronic format becomes the norm, jurisdictions may need to impose programs and format rules. However, with the speed at which current technology and software become obsolete, mandatory requirements may not be a practical answer.

The ability to present documents directly from the computer disk on which they are stored to a courtroom video display for the trier of fact to see already exists, and it will become more

common as the technology becomes more common and affordable and as more courtrooms become equipped with the necessary hardware. The ability to use this and other new technology in the trial of a case will allow for better-organized and more effective presentation of evidence, while eliminating the search through boxes of documents and stacks of exhibit boards for that document or exhibit.

In the area of both fact and expert witness, the technology that enables tort lawyers to illustrate their testimony through graphics, reproductions and simulations continues to evolve, and through it, even semiskilled advocates can take a trier of fact to an accident scene and present what they believe occurred.

Whereas the advance of technology will enhance the transportation tort lawyer's ability to represent the transportation agency more effectively, the same technology will be used against the agency in the presentation of the opposing party's case. Lawyers cannot afford to be left behind as the technology of effective presentation progresses.

TRANSPORTATION LAWYERS MUST ADJUST

With each technological advance in transportation, issues will arise that challenge transportation tort lawyers. Technology will free them from some of the time-consuming tasks faced today and allow for better organization and use of available information and resources. Technology will also allow transportation tort lawyers to devote more of their knowledge and experience to defending the agency in tort litigation, thereby protecting its resources. It will be incumbent upon transportation tort lawyers to meet these challenges of the 21st century.

ANATOMY OF A LAWSUIT

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Trial practices and procedures vary from state to state and under the various court systems. The rules of procedure generally parallel the following discussion. However, it is desirable to be aware of the specific requirements and procedures for your court system of interest.

NOTICE OF CLAIM

Some jurisdictions require that a notice be given of the intent to file a claim when an injury occurs. The notice must be filed within a specified time frame or the claim is barred from further legal action. Provisions for exceptions to the specified time period may exist under the liability legislation or tort claims act.

The notice of claim will probably be received by the risk management or legal offices and should be referred to knowledgeable persons that are most aware of the circumstances that resulted in the claim for damages. The basis for the claim should be investigated by a technically qualified person in a candid and factual manner relative to causes and circumstances leading to the claimed damages with a report made to the office responsible for claim administration. The claim can either be negotiated for settlement or rejected. If a settlement is not attained, the action will likely proceed into litigation.

It should be stressed that records and facts are important not only to the settlement negotiations but also to any future litigation of the claim. Litigation is a time-consuming process and may not be actively pursued for several years after injury or damages. Therefore, it is important to establish and retain important records relating to the claim. The knowledge and memory of key personnel soon after the incident prepared in a written statement format are usually more accurate than their recall several years later. It should also be understood that the records may be detrimental to the agency indicating that the claim may have some basis in fact. It is better to know and understand these liabilities early in the litigation process so that the negotiation and settlement processes by the agency, insurance carriers and court system can function effectively.

PLEADINGS

The lawsuit begins with a filing of a complaint with the court having jurisdiction. The complaint and the responses to that complaint are known as “pleadings.” The complaint will usually contain the circumstances relating to the injury or damages of the plaintiff; the named and unnamed (e.g., John Doe) defendants; jurisdictional responsibilities; alleged defects and negligence of the defendants; and financial range of the complaint. Agency employees may also be named individually as defendants depending on local rules and practices. The John Doe defendants are other individuals, agencies, or business that could be parties to the lawsuit; but their involvement and names have not been determined in sufficient detail for specific citation in the complaint.

The court will issue a summons to each defendant named in the complaint advising them of

the complaint. The summons must be served on the parties named and generally must be a personal service on that named individual. It should be noted that some complaints and summons are not technically correct because of improper service, jurisdictional responsibilities, or other technicalities. These should be brought to the attention of the counsel and the court so they can be corrected. In some cases, the plaintiff's attorney may drop the named defendant from the lawsuit.

It is necessary in a required period of time to answer the complaint to the court. This response can agree with or deny specific complaint allegations. For example, the jurisdictional responsibility for the roadway or the name of the individual (i.e., traffic engineer for the agency) may be agreed to by the defendant's attorney. The attorney may deny other facts or allegations contained in the complaint leading to the basis for the lawsuit to resolve these issues that cannot be agreed to.

It is appropriate at this time in the lawsuit to identify other parties that should be considered in the action. This would include other parties not identified in the complaint that had jurisdictional responsibilities, contracts, or other involvement in the case unbeknownst to or overlooked by the plaintiff. These other parties should be discussed with the attorney for possible cross-claims in the lawsuit. Other defendants have the potential to offset judgments against the individual or agency because of adverse court decisions.

It should be noted that attorneys may do extensive work in preparing the complaint or responses to the complaint to determine if they have a case. Their investigative work might include preliminary and informal contacts with agency employees, request for documents and interviews. Agency officials and their employees need to be aware of the notice of claim, potential lawsuit and how to respond to these contacts. Frequently, the attorneys may contact an expert to discuss the case, determine specific basis for allegations and weigh the potential success of the litigation. Individual experts should limit the discussion; be careful in rendering opinions; and document the contact, any discussions and compensation because this involvement may preclude future employment by other parties in the litigation.

DISCOVERY

The discovery process begins once the pleadings are completed. It is now accepted court procedure that the attorneys have the opportunity to know the strengths and weaknesses of the case before trial. This provides the opportunity for settlement based on the attorney's knowledge of the facts in the case prior to a costly trial. The guiding principles to discovery are that every party to litigation is entitled to secure all evidence, information and documents germane to the issues, even if they are in possession of an adverse party; and such evidence, information and documents should be made available before trial. All discovery techniques are endorsed by the courts and usually include written interrogatories, production of documents, requests for admission and depositions. The court can intervene if the discovery process is refused or hampered in any manner.

INTERROGATORIES

Interrogatories are a series of questions and requests for information posed by parties to the litigation, plaintiff, or defendant. They have an advantage because they are in writing and

provide more time for response or the gathering of requested information. It is important that the client's response to interrogatories be carefully prepared and reviewed with counsel. Objections can be raised to specific interrogatories to avoid answering them. Following is a list of some possible objections:

- The information is not relevant to the case.
- The information is privileged.
- The material is for trial preparation, for which the necessary demonstration of substantial need and inability to obtain the equivalent has not been made.
- The interrogatory seeks information about specifically retained non-witness experts concerning whom the necessary showing of need and inability to obtain the substantial equivalent has not been made.
- The inquiry places an unreasonably great burden on the respondent.

As an agency employee, an individual may and, in some cases, should be involved in the interrogatory process. A person with technical expertise and knowledge in the transportation area can prepare appropriate draft interrogatory questions for the attorney to elicit the desired response or be of assistance in locating and providing only the interrogatory information requested and nothing more.

PRODUCTION OF DOCUMENTS

The term "documents" is all-inclusive to include writings, drawings, graphs, charts, photographs, photographic records and computer memory devices relevant to the litigation. This discovery process is limited to parties to the legal action as a specific request or as part of the interrogatory or deposition request. Access to documents under control of nonparties to the litigation usually includes material required from that individual for production at their deposition. Documents are items specifically related to the case and not a library research of all documents pertaining to the issues. The attorneys or their experts will usually do a thorough search of other documents that may be pertinent to the litigation issues. It is appropriate that some documents such as project records, procedure manuals and critical files not be "carte blanche" relinquished to the attorneys, but they should be either copied or made available for inspection if too bulky to copy. It is desirable that a knowledgeable person review the documents being produced so the agency is aware of their content. Specific statements or correspondence that is adverse to the case should be called to the attention of the attorney so that actions can be initiated to offset those documents. It is embarrassing to be confronted in court with correspondence that you did not know about recommending against the roadway features that are litigation issues.

REQUESTS FOR ADMISSION

These requests are written statements of fact addressed between parties with an inherent demand for admission that such statements are fact. There are usually facts in the case that are not at issue by the parties, such as jurisdiction, responsible parties and other accepted information that can be resolved in the discovery process without using unnecessary court time.

DEPOSITION

The courts generally permit the taking of a deposition from anyone, whether a party to the lawsuit or not, as long as they have information germane to the case. A deposition is a sworn statement of a witness taken during the discovery process relative to his/her involvement in the case, factual information and opinions and basis for those opinions. The deposition is taken by the opposing attorneys, with questions and answers recorded as a portion of the court records on the case. An individual should always be represented by their attorney, and he/she shall have an opportunity to cross-examine to clarify any misconceptions from previous answers. Depositions are useful to the attorneys in preparing their case, but they can also be used in court. Depositions are read in court to present evidence from those witnesses not available for the trial. Your deposition can also be published as a court record and used to impeach your court testimony if the answers in court do not agree with the answers provided in the deposition. Impeachment challenges the truth of any statements you have made on the case, destroys your credibility as a witness and could affect the court decisions.

TRIAL

The purpose of the trial is to resolve the remaining issues between the parties in the lawsuit. Trials can be just before the judge in some minor cases or a jury trial if requested by the plaintiff. Jury trials are usually requested in tort liability cases because it is expected that the jurors may be more empathetic to the plaintiff in determining negligence and damages. The parties to the lawsuit are usually represented with their attorney in the courtroom and will be seated at the plaintiff's or defendant's table. If you are employed by one of the parties, you may be requested to be the courtroom representative of that agency. That activity will require your attendance at the trial most of the time and be available to assist the attorney on witness coordination, exhibits, tentative questions for witnesses and other duties he/she may request. Being a representative provides the opportunity to become better acquainted with the court system and the litigation process.

JURY SELECTION

The first order of business in the trial is the selection and seating of a jury. The attorneys are permitted to question potential jurors to determine bias or other conflicts that may prejudice a fair decision. Some attorneys may go through a research process to determine information prior to the jury selection. In smaller communities, if the attorney is not a resident, he/she may ask a local agency employee for comments on individuals on the jurors list for some insight into appropriate qualification questions. In most cases, the attorneys have their own methods of questioning and determining the best jurors for their client with their own intuition applied to the process.

OPENING AND CLOSING STATEMENTS

The attorneys have the opportunity to present to the court their opening and closing statements relative to the lawsuit. It should be understood that these statements are not evidence but reflect the attorneys' thoughts, their interpretation of the facts, how they will proceed in the case and, as closing remarks, what they proved. It has been said by some attorneys that the case is won or lost after the opening statements. Hopefully, the jury listens to the facts and makes an intelligent decision on the case.

PRESENTATION OF EVIDENCE

The bulk of the trial is associated with the presentation of evidence by all parties. This will include the questioning and cross-examination of the involved parties, incident witnesses, investigating officers, factual witnesses from an agency, expert witnesses in a number of subjects, accident reconstructionists, medical people and economists. This will include the presentation of factual evidence to the court, supporting or discounting the plaintiff's claims. The jury will not only assess the evidence presented, but also the credibility of the witness and the support of expert opinions.

MOTIONS

Motions are applications to the judge to make rulings or decisions relative to the trial activities or the lawsuit. The attorneys will usually make frequent motions during the course of the trial, and they are usually heard outside the presence of the jury. The purpose of motions is to resolve issues where the attorneys are in general agreement. However, there are frequent motions made to invalidate testimony or evidence, circumvent the court proceedings and arrive at judicial decisions to the advantage of that attorney. If motions affect your testimony or the presentation of evidence, counsel will explain the limitations imposed by the court's decision.

JURY INSTRUCTIONS

Jury instructions are the court instructions to the jury that provide guidance on consideration of evidence, the findings they must make relative to judgments and clarification of law to facilitate the jury deliberations. Jury instructions are frequently prepared for the legal code provisions commonly known as the "Rules of the Road," which is the judge's interpretation of the applicability of the code and appropriate road user actions under those provisions. The attorneys in the case are provided an opportunity to review the jury instructions and object to the wording and propose amendments thereto. The close relationship between the Rules of the Road and the application of the *Manual on Uniform Traffic Control Devices* makes it advisable to be aware of the specific jury instructions proposed by the judge. Sometimes the court's view of the driver's requirements is not consistent with engineering practice. Thus, the manual needs to be corrected.

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GLOSSARY

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ABATE
To decrease, reduce, remove, or destroy. To abate a nuisance is to remove or destroy the thing that causes it.

ABROGATE
To repeal, annul, or abolish. A law, for example, is abrogated by legislative action, constitutional authority, or usage.

ACCORD AND SATISFACTION
An agreement between parties to accept something less than the amount actually due and the delivery of that new amount.

ACCUSED
A person charged with a crime or misdemeanor; the defendant in a criminal case.

ACT
An enactment, as of a legislative body; a law, or statute.

ACTION
A judicial proceeding to enforce or protect a right.

ACTIONABLE
Giving legal grounds for an action, such as trespassing, slandering, or breach of contract.

ADJOURNMENT
The act of putting off, postponing, or suspending business or session, either temporarily or indefinitely.

ADJUDICATION
The pronouncement of a judgment or decree by the court.

ADMISSIBLE
Of such a nature that the court or judge must allow it to be introduced, as certain evidence or testimony.

AFFIANT
A person who makes and swears to an affidavit.

AFFIDAVIT
A voluntary statement or declaration of facts, written or printed and sworn to by the person making it before an officer authorized to administer oaths.

AFFIRM
To confirm, ratify, or approve. An appellate court (one to which appeals are taken) may affirm the judgment or decree of a lower court.

ANSWER
A pleading by a defendant in a lawsuit in response to the summons or complaint.

APPELLANT
A person who appeals a decision, against him/her, from a lower court to a higher court.

APPELLEE
The party in a litigation against whom the appeal is taken; also called the respondent.

AVERMENT
A positive statement of facts in a pleading, without argument or interference.

BRIEF
A written statement prepared by the legal counsel arguing a case in appellate court; also used on occasion in trial court.

BURDEN OF PROOF
The obligation to prove affirmatively a disputed fact or facts related to an issue raised in a case being tried before the court.

CAUSE OF ACTION
The grounds upon which an action is based.

CERTIORARI
A writ from a superior to an inferior court, directing that a certified record of its proceeding on a particular case be sent up for review.

CHANGE OF VENUE
The change of the place of a trial, for good cause.

CIRCUMSTANTIAL EVIDENCE
Evidence consisting of facts and circumstances that furnish a reasonable ground for inferring the existence of some other connected fact or facts.

CIVIL ACTION
A lawsuit brought by a private individual or group to recover money or property, to enforce or protect a civil right, or to prevent or redress as civil wrong.

CLASS ACTION
An action brought by one or more plaintiffs on behalf of other persons who are similarly situated or have suffered a similar wrong.

COMPARATIVE NEGLIGENCE
A legal doctrine applicable in negligence suits, according to which the negligence of the plaintiff as well as that of the defendant is taken into account. Damages are based upon the outcome of a comparison of the two and are those proportioned.

COMPLAINANT
A person who files a bill of complaint; the party who starts a legal action; also called the plaintiff.

CONCURRENT JURISDICTION
A situation in which each of a number of different judicial bodies has the authority to deal with the same subject matter at the discretion of the person starting the legal action.

CONFLICT OF LAWS
The disagreement between the laws of different states as it affects the rights of persons acting under the laws of more than one jurisdiction.

CONSTRUCTIVE
Assumed or inferred by legal interpretation.

CONTINUANCE
The adjournment of the proceedings in a case from one day or term to another.

COUNTERCLAIM
A claim alleged by a defendant, which seeks to reduce the plaintiff's claim.

CROSS-ACTION
An action brought by a defendant in a suit against a plaintiff in the same suit.

CROSS-CLAIM
A claim brought by a defendant in an action against the plaintiff or co-defendant or both.

DECLARATORY JUDGMENT
A judgment that declares the status, rights, or duties of the parties involved, or that does not order any action to be taken.

DE FACTO
A Latin expression meaning “in fact”, accepted by the fact that it exists, rather than that it is according to law.

DEFENDANT
The person or agency against whom the legal action or proceeding is brought. The defending party.

DE JURE
A Latin expression meaning “by right” or “by law” as opposed to de facto.

DEPONENT
A person who, under oath, gives testimony that is set down in writing.

DEPOSITION
Testimony of a witness taken outside a court and set down in writing for use as evidence in court.

DISCOVERY
The disclosure of facts, documents and the like by one party to a suit at the request of the other party to a suit, for use as evidence in a case being prepared for trial.

DISMISSAL WITHOUT PREJUDICE
The dismissal of an action or proceeding in a way that does not prevent the plaintiff from bringing another suit based on the same cause of action.

ENJOIN
To direct, command, or forbid some act by court order (called an injunction).

ESTOPPEL
A condition in which a person is prevented by law either from contradicting what he/she has previously stated or from stating or claiming what he/she has previously denied.

EX PARTE ORDER
An order granted by the court at the request of one party to a proceeding without prior notification to the other party involved.

HEARSAY
Secondhand evidence; evidence derived from something a witness has heard others say. Can be admissible under certain circumstances.

HOSTILE WITNESS
A witness who, under direct examination, displays such prejudice or hostility toward the party that called the witness that such party is permitted to cross-examine him/her.

INDEPENDENT CONTRACTOR
A person who contracts to do certain work according to his/her own methods without control by the employer except as to the result or product of the work.

INTER ALIA
A Latin phrase meaning “among other things.”

INTERROGATORIES
A series of questions in writing used in the judicial examination of a party or witness.

JOINDER
The joining of two or more legal proceedings; the uniting of two or more persons as plaintiffs or defendants in one suit.

JOINT AND SEVERAL
Binding two or more persons both collectively and individually. Thus, a successful plaintiff under this doctrine could recover damages from any one defendant or from all of them.

LAST CLEAR CHANCE
A doctrine in the law of negligence according to which a person who has the last obvious opportunity to avoid injury to another person, or himself/herself, is liable if he/she does not do so.

LEADING QUESTION
A question intended to suggest or elicit the reply desired by the questioner.

LIABILITY
The legal obligation or responsibility to pay money damages to persons injured or damaged.

MALFEASANCE
The commission of an unlawful act or an act one has no right to commit; used most often to describe official misconduct.

MANDAMUS
A writ issued by courts directed to public officials or inferior courts commanding them to do or not to do something specified in the order that is within the scope of their office or duties.

MISFEASANCE
The doing of a lawful act in an unlawful or improper way.

MITIGATE
To make less severe; to lessen.

MOTION
An application to a court or judge to obtain an order or rule directing some act to be done.

MOTION IN LIMINE
An application to a court or judge requesting reduction of scope or limiting the inquiry at the trial.

NEGLIGENCE
The failure to exercise the standard of care that would be expected of a normally reasonable and prudent person in a particular set of circumstances.

NONFEASANCE
The failure to perform some act that one ought or is required to perform.

NON SUIT
Termination of a lawsuit without any judgment on the issues.

NUISANCE
Any thing or practice which by its existence or use causes annoyance, harm, inconvenience, or damage. A nuisance is often a valid basis for a civil suit.

PLAINTIFF
The person who begins an action at law; the complaining party in an action.

PLEA
A pleading; also, more specifically, a defendant's first pleading.

PLEADlNG
The system of preparing formal written statements of a party to a legal action.

PRECEDENT
An adjudged case or judicial decision that furnishes a rule or model for deciding a subsequent case that presents the same or similar legal problems.

PREPONDERANCE OF EVIDENCE
In a case of contested facts, superiority in weight (determined by value and not amount) of the evidence presented by one side over the other (all that is required to prevail in a civil suit).

PRIMA FACIE CASE
A case strong enough that it can be overthrown only by contradicting or rebutting evidence.

PROXIMATE CAUSE
A cause that which, in a natural and continuous sequence, unbroken by an efficient intervening cause, produces injury and without which the result would not have occurred.

PUNITIVE DAMAGES
Damages awarded to a plaintiff over and above those to which he/she is entitled, because the defendant has violated one of his/her legal rights. Such damages are awarded to punish and thereby make an example of the defendant to deter others from acting in the same way.

QUASH
To make void or set aside; to abate or annul, as an indictment or a summons.

SOVEREIGN IMMUNITY
The immunity of a government from being sued in its own courts except with its consent or other exceptions.

STANDARD OF CARE
The degree of care that a reasonably prudent person should exercise in same or similar circumstances.

STARE DECISIS
The judicial policy of following legal principles established by previous court decisions.

STATUTE OF LIMITATIONS
A statute that imposes time limits upon the right to sue in certain cases.

STAY
A stopping or suspension of judicial proceedings or the execution of a judgment.

SUBPOENA
A writ commanding a person to appear in court.

SUBPOENA DUCES TECUM
A writ commanding a person to appear in court with particular documents or paper.

TORT
Any private or civil wrong by act or omission, but not including breach of contract. Some torts may also be crimes.

TORTFEASOR
One who commits a tort.

VOIR DIRE
A preliminary examination of a person, especially of a proposed witness or juror, as to his/her qualifications for the function or duty in question.

WRIT
A written order issued by the court, commanding the person to whom it is addressed to do or not to do some act specified therein.

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Section 2
Expert Practice

WHAT IT TAKES TO BE AN EXPERT

By Sheldon I. Pivnik, J.D., P.E., Deceased (formerly Attorney and Engineering Consultant)

THE BEGINNINGS OF EXPERTS

One of the most technical phases of trial work is the presentation of evidence based on expert opinion. The opinion rule of evidence and the use of expert testimony evolved with the development of the English court system. The early English courts adhered to civil and canon law rule, which limited the testimony of witnesses to matters of personal observation. The English courts, however, used expert opinions as an aid in reaching decisions. The rules of opinion evidence and of expert testimony were set out to some extent in England in 1782. The court then stated: "For in matter of science the reasoning of men of science can only be answered by men of science; in matters of science no other witness can be called; I cannot believe that where the question is whether a defect arises from natural or artificial cause the opinions of men of science are not to be received." Generally, an expert is needed if the jury will be helped appreciably and if the general experience of an ordinary person is not sufficient.

THE ORDINARY WITNESS VERSUS THE EXPERT

The difference between the ordinary witness and the expert witness and their respective testimony is awesome, relative to a courtroom environment. The ordinary witness can only testify to what he/she has seen (touched, tasted) and only with some exceptions to what he/she has heard. The expert, although he/she may have never witnessed an incident, can testify as to his/her opinions of how the incident occurred and to what extent the incident could have been avoided or as to conclusions based on facts in evidence. Of course, the weight that a jury will give to expert testimony will depend upon the extent of the expert's learning, skills, experience and primarily the foundation and the reason that he/she gives for his/her opinion in drawing conclusions.

WHO IS AN EXPERT?

Whether the witness shall be qualified as an expert is up to the trial court (the presiding judge) to determine at the very outset. This decision generally will not be overturned by an appellate court unless it can be shown that the presiding judge, in making this decision, abused his/her discretion. Many people seem to shy away from saying they are experts; or they feel they just do not qualify as one—perhaps because they do not have a degree or are not a registered professional in some specialty. However, an expert witness needs none of these. An expert is one who has acquired by study or experience a special skill or a superior knowledge in a particular field about which persons (usually the jury) who do not have special training are incapable of forming an accurate opinion or of deducing correct conclusions.

QUALIFYING THE EXPERT

Regardless of area of expertise, particular items will be required in order to provide the necessary information to the judge so that he/she can qualify you as an expert.

The format for qualifying as an expert witness should be discussed with the attorney you are working for. This ensures that the appropriate information is given to the judge and avoids any omissions that can create a doubt in the minds of the jurors concerning your credentials as an expert. In qualifying as an expert, the following checklist of information should be provided to your client, such that he/she will be in a position to properly ask you questions, before the judge, to ensure your qualification as an expert.

- Education
- Specialized training
- Registration/certifications/licensing
- Experience
- Publications (e.g., presentations)
- Technical activities
- Professional and technical organizations

Education
In this area, include degrees and particular courses related to your area of expertise.

Specialized Training
Any special training beyond the normal education for your area of expertise should be included, including continuing education courses and seminars (both those attended and any given as an instructor).

Registration/Certification/Licensing
While not all areas of expertise require this, some do require it. However, if you are testifying as an engineering expert, registration is clearly a plus. If you are testifying, for example, as a human factors specialist, you might find licensing as a psychologist will be a plus. Certification is now available from various organizations, attesting to competency in a specific field and supporting your expert qualifications.

Experience
Many of us have experience across a wide area. Unless the experience is pertinent to your area of expertise or in an area you will testify to, you should not go into complete detail, unless you are asked to be complete.

Publications
Within this item, you should include any and all publications written, particularly those related to your area of expertise, along with seminars conducted and panel participation; research conducted relating to your area, both published and unpublished; and participation in the development of individual standards and guidelines.

Technical Activities
If you have ever served on a committee, particularly one that is involved in your area of expertise, it should be noted. In fact, any activity that enhances your knowledge in your area should be addressed.

Professional and Technical Organizations

This is an area where the adverse attorney likes to attack the credibility of the opposition's expert. This is usually done under cross-examination after the expert recites his/her qualifications, particularly in the area of professional and technical organizations. It is done simply by asking, "These organizations you belong to, did you participate actively in them or just join to enhance your résumé?" To avoid this pitfall when you recite your memberships in related organizations, include all offices held, locally and nationally; committees served on; and if chair of a committee, include that as well. Above all, when qualified as an expert and you enter that courtroom, do not be intimidated by the courtroom or its participants. You have some knowledge and opinions in the case and have been qualified to present your information.

PREPARING AND PRESENTING EXPERT TESTIMONY

By Lawrence M. Levine, P.E.

CASE PREPARATION

As traffic engineers, our goal is to provide safe movement on highways and streets. However, accidents occur all too often, resulting in injuries and property damage from which lawsuits may arise. The lawsuit, which in this case would either be criminal or civil, is the basic manner in which justice is served and money is distributed to the injured parties. In a criminal case (for instance, involuntary manslaughter) the questions are: "Who dunnit?" "Was it intentional?" "Was there a motive?" "Why did they do it?"

A civil case, however, involves the question: "What were the proximate cause(s) that enabled the injuries and damages to occur?" An example of a civil case is if a party's vehicle hit a signal pole that is unprotected and installed too close to the road, and as a result became injured. These are two fundamentally different issues. The criminal case generally deals with investigating people, determining wrongdoings and consequently assigning blame and doling out punishment accordingly. Traffic engineers can become involved in criminal cases as accident reconstructionists or in determining if there was some sort of criminal malfeasance in the construction of a project that consequently failed and caused injury. However, generally, traffic engineers are involved as experts in civil cases where the injured party seeks relief through monetary judgments.

Historically, individual accident investigation and reconstruction has been the venue of police agencies charged with enforcing the vehicle codes, but traffic engineers can serve a vital role as expert witnesses in the determination of the causes of individual vehicle crashes. In doing so, it is vital to have developed an understanding of issues such as human factors, positive guidance, violation of expectations and design/construction and maintenance in relation to the question of "proximate causes" of accidents.

Accident investigation and reconstruction classes are offered by Northwestern University's Traffic Institute, George Washington University, the Florida Institute of Police Traffic Management (IPTM) and privately via professional institutes and organizations. These courses are offered many times to agencies on site and take three weeks for the basic reconstruction classes. The courses are well suited to traffic engineers who find themselves having to provide expert testimony.

Professional organizations also offer in-depth training, certification and field testing. Among these, most engineers are familiar with the Society of Automotive Engineers, the Institute of Transportation Engineers and the National Academy of Forensic Engineers.

How can a traffic engineer best assist an attorney in either developing the basis for a suit to be filed by a plaintiff attorney or defending a case, which would be the province of government agency attorneys or outside defense counsel? As such, each attorney has a

different bias and, therefore, a different agenda. They are supposed to take sides, no matter how they might feel personally, to provide their client with the best possible representation. This is *not* the case for the traffic engineer who the attorney chooses to use either as a fact witness or as his expert witness. The traffic engineer in either case is expected to be totally objective, have no bias and state opinions they have developed "within a reasonable degree of engineering certainty."

The most valuable information an expert can give an attorney is first, to be absolutely and completely honest about *all* aspects of a case. It is very rare that there are not two sides to an issue. This is where the judge and jury come into play; they are the final arbiters. Their task is to determine which facts are to be accepted, which information is to be ignored and the weight to be given to each expert's opinion.

An old and established rule of thumb for attorneys is that the best prepared attorney wins, and a good attorney never asks a question for which he does not already know the answer. It can be devastating to the expert's reputation and to the attorney's case should a topic be undiscovered prior to submission of expert opinions. It can also be devastating to a case for the expert to have a pre-formulated opinion; in other words, for the expert to start at the end (with his opinion) and then work backward to uncover "how the accident must have happened." It is crucial to always approach a case with an open mind. Start with all the facts, including depositions and witness statements; see the site and allow the case to build itself naturally.

In most jurisdictions, expert opinions are required to be submitted and exchanged at least 30 days before trial, although this may vary. The submission is either in the form of an affidavit signed by the attorney, an affidavit of opinions signed by the expert, or an Expert Witness Response signed by the attorney. *Never* allow an attorney to prepare and submit an Expert Witness Response without a thorough review. Attorneys have been known to prepare Expert Witness Responses for cases in which they do not even have an expert—hoping to settle the case. Be on guard that this does not happen. On the whole, attorneys are very honest and, as officers of the court, do not engage in unsavory behavior.

The attorney for the defense typically will submit his/her expert opinion response to a pending case after the plaintiff's expert has submitted his/her opinion, to ensure the claims that are being presented are answered with specificity. Attorneys should request that an expert not prepare a report until after a verbal opinion is rendered over the phone or in person. This is because all documents in an engineer's file, done in preparation for a case, are discoverable at trial. This includes correspondence and e-mails. It is wise to verbally discuss with the attorney the need for a report, the due date and the format in which to prepare it. This does not and should not create a bias on the part of the engineer.

It is in the expert's best interest to maintain his or her reputation, to demand the right to seek out additional information if necessary, including site visits, testing, or whatever is felt to be necessary in order to render an opinion on the matter. To do less would be a disservice to the client, the plaintiff, the agency and the court. It opens the expert to potentially embarrassing questions: "Why didn't you do this or that?" "Isn't it accepted practice in the field of accident

reconstruction and investigation to do this or that?" Just as the attorney must prepare his case, the expert he/she is depending upon must be prepared and thoroughly know his/her subject and case.

To a jury or a judge who is trying to determine the merits of a case as well as the reliability and truthfulness of the witness before them, questions about available relevant information not considered by the expert can undermine his or her credibility. Once credibility is lost, jury members often discount the witness's opinions.

GATHERING OF INFORMATION

For the traffic engineer who will appear as an expert witness, opinions will be required. Therefore, it is expected that they will have familiarized themselves with the following:

- An understanding of why an expert is being retained to testify and render opinions, what they are being questioned about and the knowledge that the attorney they are working for understands these issues. The most important item of all is to understand what the proximate cause issue is for the case. It is possible that an intersection can be improperly designed, constructed, maintained, or controlled. It can be the worst intersection you have ever seen. Yet, if these "problems" were *not* a proximate cause of the injury sustained, there may not truly be a case. Attorneys are not engineers and vice versa. They do not speak the same language. It is the job of the engineer to instruct and inform the attorney about the engineering terms and issues involved. If you cannot get the attorney you are working for to understand what you are saying, what chance do you have of informing and convincing a judge or jury of what you want to get across? You will only be able to answer questions posed by an attorney who doesn't know what or how to ask what you need.
- The history of the location involved, including the road history, original plans, reconstruction plans, maintenance history, photo logs and traffic control history. All measurements, photographs and investigation pertaining to the site and/or vehicles involved.
- The expert must make his own determination regarding accidents based upon accident report data, not federally-funded summaries and reports by others. That may be excluded as evidence by federal law. Also, the courts generally will only accept as example/reference accidents that are similar to the one at issue during trial to substantiate an opinion. Although work done at a site or changes made *after* an accident are normally not admissible, in some instances the information contained in post-accident documents can be used to show a pre-existing condition. The expert must know the relevant state and standards in effect or used at the time of each road history event, plan or construction document and installation of a sign or other traffic control device.
- The issues of the case, including all the pleading documents and expert witness exchanges.
- An understanding of the legal responsibilities of the agencies involved to construct, design and maintain the site and the specific items drawn into question by the suit. If it is a signal control case, it is essential to be aware of all the legal aspects of signal control per the *Manual on Uniform Traffic Control Devices* (MUTCD). It is also

essential to know when the signal was installed to reference the correct edition of MUTCD; the state of the art at the time; and any bulletins or engineering instructions or chief engineer's letters, etc. that pertain.

PROXIMATE CAUSATION

In simple terms, the final question in a lawsuit always boils down to: "But for this roadway condition, the accident would not have occurred, and therefore the injuries would not have resulted." Proximate cause is not always clear-cut. As an example, a driver fell asleep and drifted off the road, just missing the end anchor of a guide rail. The vehicle slipped behind the guide rail and went down the ravine. A child was rendered a quadriplegic. Based on the design plans, the rail was found to be 100 feet too short. The obvious conclusion was that the vehicle was able to go behind the rail because it was too short. However, the extremely shallow angle by which the vehicle left the road combined with its speed, size and type of vehicle were critical to the case. The guide rail was a W-section weak post design with the Texas twist type end anchored to the ground. Based upon actual testing performed (when this end section was developed) of a similar vehicle of similar weight striking the end section at virtually the same angle, had the extra 100 feet of the guide rail been installed, the vehicle in this case would have struck the end twist, been caused to vault into the air and rotate side to side such that it would have landed on its passenger side roof, crushing the roof and subjecting the occupants to catastrophic and potential fatal injury force levels. Thus, given the precise details, path of travel, markings in the grass and reconstruction of the likely outcomes, it was clear that the apparent cause of the accident (the lack of guide railing), even though an obvious error, and the proximate cause of the accident, could not be called the sole proximate cause of the injury. But for the missing guide railing, in this instance, the injuries would have been the same or maybe even worse.

HOW TO ASSIST THE ATTORNEY

Whether you are working for an agency attorney or not, the following items are recommended be done to assist the attorney in developing and investigating any case:

- Go to the site as soon as possible before items vanish or become altered. Bring a ball-bank indicator, a VC2000 or (other decelerometer) to determine coefficient of friction, a survey instrument, engineers tape and a level and ruler for cross-slope measurements.
- Document everything possible, including signs, markings, controls, slopes, tire marks, gouges and highway items that may or may not be involved. Speak with locals; invite the investigating officer to meet with you; go with the attorney; and bring the police accident report if available.
- Find the vehicles involved as soon as you can—before they are destroyed, altered, or sold. Photograph and measure them. Use crush measurement tools. Bring along a mechanical expert and work as a team if possible. Measure the plaintiff's height of eye location and seat location; check the light bulbs for hot shock; check brakes and evidence in and out of the vehicle; and generally follow checklists included in standard accident investigation and reconstruction texts (see Northwestern University and IPTM Web sites for catalogs).

- Look at historical photo logs of the location if available. Go to state agencies and check for any traffic accident studies and ask for any and all documents relative to the location.
- Request information through the attorney in a list of all the items you want. Many times it is a good idea to ask for a list of the names of documents that are used to ensure the correct item is requested. Ask for accident history from the state and from the local municipalities. Many times they are not the same.
- Create and maintain your own reference library of standards, authoritative texts, engineering bulletins, engineering instructions, chief engineer letters and articles on topics. Create your own technical file cabinet; ask attorneys to share case research they do on each case; look online for additional information (see American Association of State Highway and Transportation Officials publications, MUTCD, Transportation Research Board, Institute of Transportation Engineers, American Institute of Architects, Society of Automotive Engineers, U.S. Department of Transportation, Federal Highway Administration and others); and read magazines from the various agencies as well as *Accident Reconstruction Journal* (which documents vehicle defects and crash testing results), *Accident Investigation Quarterly* and other authoritative journals. Every year, update your collections by obtaining highway design manuals, maintenance guidelines, traffic volume reports and other publications of state departments of transportation and local municipalities. Make sure you are aware of the "authoritative" source documents used for each contract and all the work done at the site you are investigating. Copy those portions for the attorney, so that they can understand and will have this as a resource to rely upon.

COURTROOM DEMEANOR

Be prepared. Do your homework. Bring your file and notes. Bring your resume. Act professionally: Be confident, dress conservatively and respectfully for court and be polite and patient.

Be mindful of who you are addressing. Do not speak down to the judge or jury, but act with patience, remembering you are taking on the role of teacher. Understand that engineers speak a different language; terms like superelevation, banking and cross-slope all mean the same thing to an engineer, but are likely to be misunderstood by the jury without explanation.

Be aware that you and the attorney have lived with this case for months or even years and know it well. This is the very first and only time that the jury and judge will hear what you have to say. Speak clearly, slowly and carefully. Look at the jury when you are speaking. If you make a misstatement, correct or clarify it.

Do not be cocky. It is always a good idea when on the stand to wait a few seconds before answering each question. This will allow the rest of the courtroom to absorb the question; allow time for the attorney you are working with to object to the question; and also allow you time to think. There is no rush, and you want to appear calm, cool and collected during questioning. Drinking water will help you think. Be focused, be alert and be early.

Never under any circumstances argue with the attorneys—no matter how abusive their questioning or repetitive their questions appear. Know that this is a technique to make you appear like you must defend yourself before the jury. Emotional outbursts or confrontation with the attorneys must be avoided at all cost.

During direct testimony, try to answer the questions asked as specifically as you can. If the answer calls for a yes or no answer, give that answer. The attorney will inquire further if necessary. If you have prepared well with him or her, they will know what to ask and when.

During cross-examination, you will be allowed more latitude by the judge to explain your answers. Do so with discretion. Ask to use court exhibits if they will assist you.

If you do not know something, say you do not know the answer. If you do not understand a question, say you do not understand the question.

If you need a drink or to use the bathroom, inquire so of the judge to avoid becoming uncomfortable and distracted.

Be aware that if this trial decision is appealed, only the transcribed record will be shown to the appeals court. Thus, it is imperative that you speak slowly, clearly and cohesively, remembering you are ultimately dictating a final report to a recording machine.

CONCLUSION

To best help the attorney you are assisting on a court case, clearly state your intention to investigate all avenues thoroughly, leave no stone unturned, determine the accurate facts of the matter and research all aspects of the case before rendering a final opinion. Explain to the attorney what this will entail and your expectations, as the investigation proceeds, so that there are no misunderstandings. A thorough, honest and knowledgeable expert is a good expert.

An expert's credibility and trustworthiness is on trial at every trial. It is unacceptable and can ruin an engineer's reputation as an expert to walk into court or to prepare an investigation for an attorney that is incomplete or insufficient. Be prepared.

DEPOSITIONS

By James L. Pline, P.E., PTOE, President, Pline Engineering Inc.

INTRODUCTION

A deposition is a legal proceeding conducted in accordance with court rules for the purpose of obtaining and preserving the testimony of the witness. A deposition can serve the same testimony purpose as your testimony on the witness stand in court. If a witness cannot appear at trial, your deposition may be read at trial into the record for the jury. Therefore, the preparation and statements made during a deposition are as important and as binding as any testimony you may give in a case.

The deposition is usually requested by one or more of the opposing attorneys to be held in their office, at a court recorder's facility, or other convenient location. You should receive a Notice of Deposition advising you of the time and place for your deposition and the items that should be brought to the deposition. When the notice is received, you should confer with counsel. You and counsel should discuss the notice, a possible meeting prior to deposition and items to be taken into the deposition.

The procedure for a deposition is relatively simple, and it is usually a relaxed atmosphere. The persons present will be you as a witness; a court recorder to record and transcribe your testimony; lawyers for all parties represented in the lawsuit; and any parties represented in the lawsuit, although they seldom appear. The expert for the opposing side may attend your deposition with the concurrence of the attorneys. After all parties have arrived and been seated, you will be asked by the court recorder to raise your right hand and swear to the standard witness oath, that all statements you may make shall be the truth, the whole truth and nothing but the truth so help you God. The deposition will be started by the attorney requesting your appearance for deposition, followed by any questions by the other attorneys, including your own attorney: An attorney may skip his/her turn for examination or, after all attorneys have had their turn, may request an opportunity for additional cross-examination. The court recorder will record all questions by the attorneys and your response to those questions. Additionally, they will mark any information you may have relative to the case as an exhibit to your deposition, which will be published as a part of your deposition.

The taking of depositions is usually an informal process with breaks taken whenever you feel a need, attorneys walking around and refreshments if you desire. It is not necessary that you dress as you might for court testimony in front of a jury because it is a limited audience discovering what you know about the lawsuit and circumstances. The attorneys are usually acquainted with each other, have been involved in other depositions for this lawsuit or others and will make side comments or wisecracks at each other. Every attempt will be made to lead toward a relaxed, informal conversation between you and the attorneys. Be careful about making statements that were never intended to be a part of your deposition. Depositions are an important part of a lawsuit and the attorneys are serious about finding the information you may or may not know about the case. They want to document your credibility as an expert witness.

PURPOSE
The purpose of the deposition is to discover what will be the witness testimony and to preserve that testimony for use in trial. A deposition serves a number of purposes for the attorneys, as detailed in the following paragraphs.

EVIDENCE
The objective is to discover what you know about the lawsuit, the source of your information, your expert opinions and the resources that support those opinions. The attorneys are legitimately searching for evidence in the lawsuit.

FAVORABLE STATEMENTS
The examining attorney is looking for statements that you may make favoring his/her client. This can result in a number of repeat questions in the same context, designed to obtain your agreement to a favorable representation for his/her client by you as an expert.

STATEMENTS UNDER OATH
The deposition documents your statements under oath. If you change your testimony later in trial, the attorney will have that portion of your deposition read to the jury and question your credibility as a witness.

DISCREDIT TESTIMONY
An attorney can be looking for ways to discredit your testimony or the testimony of other witnesses. An attempt is made to have you make statements that conflict with the statements of other witnesses. You should be aware, if possible, of statements by other witnesses, recognize any conflicting statements and soundly support any conflicting opinions. Minor conflicts or views will usually occur in a case, but major contradictions can significantly affect the outcome of the case. Even though you may not agree with the opposing expert, it is neither appropriate nor professional to make disparaging remarks about his/her qualifications.

DISCOVER DEFENSES
The deposition is an information discovery process that can affect the direction of the lawsuit. Based on deposition information, the attorneys may shift their approach to the case, settle the case in lieu of trial, or drop the case entirely. Additionally, the attorney, through questioning, may attempt to discover counsel's approach to the case, providing an opportunity to modify the case with new claims and different theories.

PRESERVE TESTIMONY
Depositions are taken to preserve testimony for trial if a witness is ill or unavailable for trial. If the witness is not available at trial, the attorneys can request that your deposition be read at trial into the court records. However, the attorneys prefer that their expert be available at trial to physically appear in front of the jury, answer questions and provide clarification of issues raised at trial. Occasionally, if an expert is not going to be available at trial, the attorneys will schedule the deposition on video to facilitate its use at trial.

RULES OF CIVIL PROCEDURE
In every state there are rules under which lawsuits and trials are conducted. A portion of

those rules is directed toward depositions. Understanding the rules makes you a better player in the justice system and protects your rights as a witness.

The *Federal Rules of Civil Procedure* are used by some states. Other states have similar rules. You should expect that counsel would protect your interests when dealing with other attorneys and the court system. Usually, attorneys are willing to explain the legal system and provide clear directions on your involvement in any lawsuit. Additionally, they will intercede with objections if they feel you are being improperly questioned or harassed.

Selected excerpts from the *Federal Rules of Civil Procedure* are provided in Table 2-1 for your information and background knowledge relative to discovery, depositions and procedure requirements. Detailed information and clarification of any of the procedural requirements should be discussed with counsel.

DEPOSITION PREPARATION

As an expert, you should be totally and completely prepared for your deposition. You should thoroughly understand the case and be clearly advised of your specific role in the case. Normally, it requires some time to become acquainted with the case, review all the available data and research information that may be pertinent to the case.

ATTORNEY VISITS

Usually, you will be engaged by counsel sometime prior to scheduling your deposition. This provides an opportunity to review the material discovered by your client; discuss the theory of the case; research and discuss other information and data that might have a bearing on the case; and determine the need for additional field data. The lawsuit will include a filed claim and interrogatories that outline some of the technical aspects of the case. Usually, the expert's deposition is not taken early in the evidence discovery process so the depositions of other parties and witnesses to the case are usually available for review. It is desirable to review the deposition of the opposing expert and most depositions of the other people involved in the case so you can indicate that you have reviewed all sides of the case rather than having a limited view. This review of depositions also provides a better perspective of the case, guards against overlooking other views of the circumstances and may provide minor comments to improve your insight into what happened. The opportunity to review these other depositions should be discussed with counsel. If working for the defense, the plaintiff's expert testimony is also usually available prior to your deposition, providing an opportunity to understand the other experts' opinion. You and counsel should have an understanding of your role in the case, the technical expertise you can provide, your opinions in the case and what both parties are attempting to establish as evidence through your testimony.

In some cases, the attorney may prefer to limit your preparation for deposition to reduce the potential discovery from you during deposition. A witness not prepared for deposition will have limited recall of specific facts, having to resort to either "I do not know" or "I do not recall" as responses to inquiries. This strategy could serve the purpose of limiting the education of the opposing attorney. However, unless you are specifically requested to limit your preparation, you should do the necessary work to be fully prepared for deposition.

DOCUMENTS

The case is measured against the standard of care and recommended practice for the situation

in the case. These standards and practices are addressed in a number of nationally recommended publications regularly used by a public agency. Additionally, public agencies usually have policies and procedures that direct the actions of their personnel. Agency records are available that document the actions of the agency, such as correspondence, reports, studies, diaries, plans and computer records. These records should be researched and examined thoroughly to support or offset the case allegations. All documents found should be reviewed and discussed with counsel prior to deposition. You will be asked in the deposition what documents you have reviewed and what bearing they may have on the case. It is important to have other documents that support your expert opinions. As the documents are reviewed, make copies of the cover page and the document or pertinent sections for the record. If these documents are used in your review and opinions on the case, copies should be made available at the time of deposition. It eliminates the necessity of taking the complete document to the deposition, and the attorneys will want a copy as an exhibit to your deposition. Copies of these documents should be made available to counsel prior to your deposition.

The examining attorney may request other information from you to be provided after the deposition. Keep in mind that you are permitted to be paid a reasonable amount for researching and providing the requested information. However, permit counsel to handle the issue of what information will be furnished, and he/she will usually request that you mail the information.

TELEPHONE DISCUSSIONS

It is good engineering practice and desirable documentation to note the time, date and person's name when having a telephone discussion with notes on the major issues discussed. The jury would expect that, if you called a number of people to obtain information, you would have a record of those discussions. The attorneys will ask if you discussed the case with anyone and, if so, what the nature of the discussion was.

Until recently, it was expected that conversations between you and the attorney were work product and, accordingly, excluded from discovery. Amendment of the *Federal Rules of Civil Procedure* in 1993 requires an expert to disclose the data or information considered in forming his/her opinion. The courts are interpreting this to mean almost all interaction between the attorney and the expert. This creates a dilemma for the expert when his/her discussion notes must be disclosed. The notes could disclose the attorney's strategy in the case or indicate that the attorney is leading the expert to examine specific areas rather than make an independent evaluation. It should be understood that the expert may take notes, but they should only include information that is readily available elsewhere in the lawsuit. The attorney should recognize that, if asked, the expert must be truthful and acknowledge any discussions and items covered as he/she recalls them and disclose any notes taken. In some cases, it is appropriate to advise the attorney that he/she may want to think carefully before you enter into further conversation.

ENGINEERING REPORT

The attorney who has engaged you may request an engineering report covering your analysis of the case, opinions and the basis for those opinions. Note that this engineering report is made available to the other parties in the case as part of the discovery process. You will be expected to defend your engineering report during both the deposition and the trial. The

report can be a very detailed analysis as addressed elsewhere in this notebook or a very brief statement of opinions. Your legal counsel should provide you guidance on whether he/she wants an engineering analysis and a full report, an abbreviated statement of opinions, or no report relative to your work on the case. If your attorney does not provide you with those requirements, it is appropriate to review your analysis of the case with the attorney and request clarification on the type of report desired. Regardless of the information prepared, you will be expected at deposition to provide your analysis of the case and opinions with the basis used to support those opinions.

SITE VISIT

It is always desirable to make a visit to the location of the incident resulting in the lawsuit. There is always field information that cannot be accurately reflected in roadway plans and photographs. The accident report, plan sheets, photographs and other documents should be taken on the site visit. Roadway features, plan measurements and traffic control should be verified in the field. Other data that may be pertinent to the case should be collected during the site visit or requested as a result of the field review.

It is not always convenient to make a special trip for a site visit for out-of-state cases. This can be offset by requesting the opportunity to visit the site the day before the deposition if the site is located in the vicinity of the deposition location. A few attorneys may request your deposition occur at your place of business, to reduce the possibility of your site visit prior to trial or until after changes have been made to the site. If you feel that a site visit is important to your review of the case and of assistance to forming expert opinions, it should be coordinated with counsel at the appropriate time and usually prior to the deposition.

FINAL PREPARATION

The final preparation for deposition includes a review of your files, all the documents and formulation of your opinions in the case. It is beneficial for the attorneys and court recorder to have a copy of the following items to be marked as an exhibit to your deposition:

- Your curriculum vitae
- Fee schedule
- List of information, data, depositions and other items reviewed in the case
- Copies of documents and information relied on to form your opinions
- Photographs, field measurements and data collected during the site visit
- Engineering report (if prepared) or written statement of opinions

Any notes, telephone conversations, or other records relative to the case (note that some correspondence from counsel is privileged information and can be withheld from disclosure at deposition; counsel will be the judge of privileged information).

You will be asked for the above information during the deposition. It is more efficient to have the information prepared ahead of time because it gives counsel the opportunity to review all the information before deposition, and it can limit the scope of inquiry by the attorneys at deposition.

The Notice of Deposition may require that you produce all files on the case at deposition.

Any information you have in the file, including inappropriate comments and notes on depositions, are discoverable. Consequently, there should be some care in taking notes and reviewing the material in the case.

You should schedule a final visit with counsel prior to the time of deposition. This will give counsel an opportunity to review what you are taking into the deposition, but he/she should already be fully aware of the information. Counsel may sort out some correspondence as lawyer-privileged information. Counsel may discuss how the opposing attorney is approaching the case and the type of questions you may be asked. Be aware that counsel may spring a question or two on you that you have not previously discussed to gauge the nature of your response—in which case he/she may provide some advice on the most appropriate way of responding to the question if it is asked during deposition. As preparation for the deposition, you should consider the questions you may be asked and should have some idea of your appropriate response.

OBLIGATION AS A WITNESS

The primary duty as a witness is to tell the truth. It does not make any difference if the truth will hurt your side of the case. Your duty as an expert witness and obligation to the system of justice is to tell the truth. If you always tell the truth as you know it in every case in which you are involved, you have no worry that what you may have said in a previous case may be raised as an issue in the current trial.

There is a secondary obligation as an expert to be fair. That does not necessarily mean that you have to provide each side of the case equal treatment. Your testimony can be entirely one-sided, but you do not have to color the facts to favor one party or overstate your testimony. Avoid any exaggeration or graphic descriptions that tend to play on the court's sympathy. Just tell the facts as they are.

A third obligation is to be completely accurate with the facts as you interpret them.
The judge and jury are viewing the facts of the case through your eyes as an expert. The facts should not be distorted, omitted, or expanded to suit your testimony. It is not necessary to cite deficiencies that had no bearing on the incident.

You do not have to persuade the opposing counsel because he/she is committed to his/her side of the case. Additionally, there is no chance for you to win at a deposition; you can only lose the case or reach a draw. Your purpose is to provide the truth in the clearest way possible.

DEALING WITH ATTORNEYS

In a deposition, you will be responding to an attorney who will emphasize the strong points of his/her case; try to ignore the weak points; ridicule your findings and suggest to the jury that you do not know what you are talking about; and suggest that you are a hired gun or may even be lying. Some of the following points will help you deal with the opposing attorneys, make them focus on the items at issue and encourage them to treat you fairly under inquiry.

Never Volunteer Information

It is normal for a person to want to move the deposition along by being helpful. Because of

their technical background, engineers have a tendency to not only answer a question but also to provide a lengthy explanation so that they are sure the answer is understood. *Do not volunteer additional information.* If possible, answer the question with a simple yes or no. Most questions can be answered as "Yes," "No," "I do not know," "I do not remember," "I do not understand," or by stating a single fact. If the attorney needs some additional explanation he/she will ask for it. The attorney may not understand the subject sufficiently to ask an intelligent question. You are under no obligation to explain the subject or educate the attorney. If he/she asks for an example, give only one—not two or three. You are not being paid to help the opposition.

Do not indicate that, although you do not know the answer, Mr. Jones in the office may. Mr. Jones will then also be appearing for a deposition based on your comment. A simple "I do not know" is appropriate.

You may be asked for certain information relative to records or files. Respond to the ones you have and know about without reference to possible records in other offices or locations. If you do not have those other documents or have not used them, you have no knowledge of those other documents.

Understand the Question

You are required to respond to the questions only after they are fully understood. Make sure that the attorney has completed the question. If you do not understand terms, general references to items, or unclear portions, ask for clarification or rephrasing of the question. Typically, you may be asked to respond to a hypothetical situation with several qualifying provisions. Make sure that you understand all portions of the question before you respond. You can always ask for the question to be repeated. Do not be intimidated by his/her show of irritation when he/she asks the recorder to read back the question. If you do not understand the question, indicate that you cannot answer the question in the form that it was asked.

Use Time to Think

Listen to the question fully, consider your answer carefully, mentally phrase your answer and then state your answer. You should not rush the thinking process. Attorneys like to get you into a fast rhythm of responses and then obtain agreement on an issue that is not your intent. It is good to break up the pace of the attorney by giving yourself time to think about the appropriate answer.

Never Guess

"I do not know" is an appropriate and complete answer to some questions. Just because you are an expert witness does not mean that you know everything or are aware of all the facts in the subject case. If you do not know the answer, just say so. You may be asked to guess or estimate a distance, size of sign, or other measurement. If you have a basis to make a judgment on the measurement, indicate it is your estimate or best judgment that it was about so many feet. You do not have to come up with a guess; just say "I do not know."

Lack of Recall

It is not necessary that you remember all the facts in the case or the details of various conversations with other people. As an expert working on a number of cases concurrently, you are not expected to know or remember all the specifics of a case. If data, conversations,

or other information are important, they should be recorded in your records so you can refer to that data when responding to an inquiry. However, if the information is not included in your files and you do not remember, then it is appropriate to respond with "I do not recall" or "I do not remember." The only difficulty may be some discredit in the court when you now recall all these items you did not remember at deposition.

Be Patient

Do not be too eager to respond quickly to all the questions and assume that the deposition will end sooner. If you are answering quickly and volunteering information on what you know about the case, the attorney will continue until he/she is sure that you are not going to divulge any additional information. As a witness, you may have suggested many new areas of inquiry that could keep the attorney going for a long time. Be patient and do not try to rush the deposition. The attorney may, on occasion, attempt to drag out the deposition to wear you down as a witness. Do not show your impatience. If you are tired and believe that your testimony is being affected, call for a break. Frequently, the attorney is going over areas that have been previously answered. Counsel can object to the questioning, indicating that the question has been asked and answered.

Never Lose Your Temper

It is the practice of some attorneys to work on your emotions and try to make you angry. When you are angry, you will make mistakes. Take a deep breath and control your responses. If necessary, take a break to cool down and obtain control of your emotions.

Be Polite and Firm

The judge and jury are not impressed by an expert that is flippant, sarcastic, or cute. A witness will never win in an argument with an attorney. Do not attempt to embarrass the attorney with your response. The attorney will get even, and you will come out on the short end.

An effective expert shows his/her expertise by being polite to all parties, being expert in his/her responses and not becoming emotionally involved in the case. However, it does not require you to back away from the truth as you know it in the case. Provide a firm and polite response to the inquiry, repeating the same answer as before if necessary.

Speak Clearly

You must always respond with a verbal answer rather than shaking your head. The response should be a clear yes or no, not yea, uh-huh, nope, or nah. If you refer to an object, refer to an exhibit or indicate a distance with your hands. If at all possible, provide a verbal reference. It can be answered as: "The symbol stop ahead legend as indicated on Exhibit X." Otherwise, your response will be followed with the attorney stating: "Let the record reflect that the witness is indicating approximately three feet."

Frequently, the court recorder may not be familiar with some technical terms, the spelling of names or places and words that sound one way but are spelled differently. If you think this is a problem, pronounce the word clearly and spell it out for the recorder. Occasionally, the recorder may ask you after the deposition for clarification on some terms that you used in your deposition.

Finish Your Answer
A skillful attorney may interrupt your answer to lead you in another direction before you have finished your response. The attorney has a good idea of what you are going to say, and he/she does not want the information on the record if he/she can avoid it. As an example, you may be citing a number of reasons or basis for your opinion with the key item being last in the list. The attorney will interrupt, asking a question for clarification of a portion of your answer. You may never get back to finishing your response or being able to recite the key item.

The appropriate approach is to wait until the attorney is done with his/her interruption and then say, "I am sorry sir [or madam]; you interrupted my last answer before I finished. Let me finish that answer and then we will address your next question." Most attorneys will avoid cutting you off again or will ask if you are finished with your response.

Recognize that it is acceptable to be slow and deliberate in your responses. But it is better to be silent while thinking of your answer before you start and try not to leave breaks in the middle of responses.

Occasionally, an attorney will interrupt and attempt to block a continuation of your response by suggesting that you move on to a new subject. He/she knows the answer, does not want to hear it and does not want the full answer on the record. You may refuse to answer any more questions until you have been provided an opportunity to fully respond to the previous question. Counsel will probably intervene and require the attorney to give you the chance to finish your answer.

Correct Your Answer
Sometimes during the deposition you may discover that you have previously provided an incorrect or inaccurate answer. You have the right to correct your answer at any time. Simply speak up and indicate that you misunderstood the question, that you were confused, or that you answered incorrectly: It is better to correct the answer during the time of the deposition than trying to explain an incorrect answer several months later at trial.

Read the Fine Print
The central issue of most cases is the document(s); therefore, the document(s) is subject to examination during the deposition. You will be asked if you are familiar with the document and, if you acknowledge that you are, you can expect detailed questions relative to the document. If you have the document available prior to deposition, be sure that you have read it completely and understand what it addresses.

The attorney may hand you a document and ask if you are familiar with it. You may be only acquainted with the document but not the contents. Or the attorney may read a portion of a document and then ask you questions regarding the document. The rules for dealing with documents are:

- Never testify to the contents of a document if you are not fully familiar with the document, unless it is before you and you have an opportunity to read it.

- Read the document carefully before testifying about it. Insist on having a copy of the document in your hands while you are being questioned about the document. If the attorney needs the document for reference to ask the question, ask for the document back before you respond.
- If the attorney suggests that the document states a certain fact, check the document first to see whether or not the facts are stated in those terms. The attorney may inadvertently read too little or too much from the document or paraphrase his/her question on what the document says, in which case you should clearly recite what the document says relative to the question.
- Never respond to just a copied portion of a document that an attorney may provide to you. Insist that you be provided the complete document before you respond.
- Take your time in reading and understanding the document at a speed that is comfortable to you.

Documents are used to attack the credibility of a witness, pointing out that the expert's opinion is in conflict with the opinions of authorities on the subject. You may well be asked whether or not you recognize certain publications as an authority or a learned treatise on the subject. You may be asked whether or not you agree or disagree with specific contents in the document. Mere publication does not establish the recognition of the document or its validity as an authority. You need to understand the development, approval process and application of the document before these questions can be fully addressed. Be very judicious in your recognition of a document as an authority, without discussing the document with the source and counsel prior to deposition. However, as an expert in a specific field, you should be well acquainted with the documents regularly used in the profession and their application as standards, guidelines, or reference information.

Listen to the Objections

The attorneys may object to questions raised in the deposition. If there is an objection, *stop*. Do not respond to the question until the objection is resolved.

Listen carefully to the objection. It provides you with an indication of why the question may be improper and a clue to the appropriate response. It may indicate that the attorney is asking an unfair question. There may be grounds that the question is vague, ambiguous, confusing, or misleading. Be sure that you understand the question before you respond. You can request that the question be clarified or reworded before you respond. Counsel may object on the basis that the question misstates previous testimony. If the testimony is misquoted, point out the errors before you attempt to answer.

Counsel may object that the question is redundant and repetitious or that the question has been asked and answered previously. It is a frequent strategy of attorneys to ask the same question in many different ways during the deposition in the hopes that he/she will get conflicting answers. The attorney will then use the conflicting answers to impeach the witness at trial. Be consistent in providing the same answer for repeated questions.

There may be an objection because a double question was asked. You can ask that the question be split into two questions, that the question be reworded, or respond that the answer

is ... to the first part and ... to the second part.

If counsel asks you not to respond to a question, do not respond. Let the attorneys work through the objection and wait until counsel tells you that you may respond. Make sure you recall the question or have the recorder read the question and then respond.

Watch the Lawyer's Style

Attorneys adopt a particular style when examining a witness. Do not be led astray or into response by their approach or method of examination. A few of the personalities you may have to deal with are as follows.

- **The poor country boy:** These attorneys profess that they are poor country boys and do not understand all the procedures and terms. Rest assured that these attorneys know more about you and the transportation business than you will ever realize. Do not volunteer and explain your answers unless the attorney phrases a question to obtain the information. You will end up divulging information.
- **The good 'ole boy:** These are the good-time attorneys who go out of their way to welcome you, provide refreshments and ask you about your family, hobbies, or state. These attorneys try to disarm you with smiles, encouragement and charm in an attempt to have you drop your guard and be extra helpful.
- **The hurt hound dog:** These attorneys appear hurt by all objections when you make statements counter to their strategy, and they show suffering with your responses. They build on your sympathy so you may temper your responses so they will feel better.
- **The prosecutor:** These attorneys approach you with an accusing tone, making you feel like you are on trial. They may be loud, point fingers and indulge in other theatrics. Frequently they will lead a statement: "Isn't it true that..." They want to intimidate you so that you will become defensive, or they may even make you mad. Ignore the tactics and respond in a professional, deliberate fashion.

The Theory of Relativity

Your answers do not have to be precise or accompanied by a detailed explanation of the terminology or reasons for the response. Your response can be to the same relative detail as the question. When the question is general, the response can be general. If the lawyer desires explanation or more detail, he/she will ask for it. Some questions cannot be answered with a precise fact, such as "All drivers comply with the speed limits." The facts may be very detailed based only on the day and time that someone collected the data, but they do not represent the total population of users on that roadway. It is appropriate to phrase your answer with "about," "approximately," or a range of values. If the question asks for preciseness, it is appropriate to indicate that, in your experience you have found that there is a wide variety of drivers on the roadway, but you would expect a range of ...

Check Your Baggage

Take the information and documents into the deposition that you have been requested to bring or that you are relying on to support your expert opinions. It is easier to carry if you copy the cover and appropriate sections of publications. This is particularly appropriate for documents that are commonly used in the profession. For new or not widely used

publications, it is desirable that you bring the full document to the deposition for examination. Review the items you are taking into deposition with counsel. The opposing attorney has the right to inspect all documents you have brought into the deposition. For that reason, you never want to hold a deposition in your office because they may search your bookcase to determine other publications that have a bearing on the case. If you do not want to give up your only copy or the original of a document, have a copy for the attorney that can also be marked as an exhibit.

It is normal practice for experts to take other documents or material to review when you are out of town providing a deposition. Do not carry these items into the deposition in your briefcase because they are also subject to inspection and inquiry.

Hypothetical Questions

It is frequently the practice of attorneys to ask you to assume a hypothetical situation and provide an opinion. You will be asked to assume certain facts to be true and base an opinion, render a conclusion, or deduce results on those assumed facts. First, make sure you understand the facts and even repeat them back to the attorney if they are unclear. Second, make sure that you have sufficient facts to make a decision. If the premise is impossible, the facts are incomplete, or the premise is contrary to known physical and scientific principles, decline to answer on the basis that you cannot accept the premise as stated. You are under no obligation to expand or clarify the premise so that you can render an opinion or conclusion or deduce a result.

Be Consistent

The attorney will ask you the same question several times from different approaches or at different times during the deposition. He/she is looking for the answer he/she wants and, if you provide it, he/she will ignore your other responses at trial and only go with the favorable response. You need to be consistent on your response to these repetitious questions.

Consider the question carefully each time, and stick to your guns by providing the same response each time. Counsel may object by indicating that the question has been asked and answered. If so, do not respond until you are directed to. It may be appropriate to indicate "As I stated previously …," which may stop the repetitious questions or provide a clear signal to counsel to object the next time it is asked.

You do not have to change or modify your answer just because the question has been changed slightly. If, after consideration, you believe that your previous response was not totally correct or the best answer, you should indicate that you were mistaken on the previous answer and provide the correct response. Try to be consistent and correct on your responses.

It is also necessary that you be truthful and consistent between cases and court jurisdictions. In this age of electronic records and search methods, the examining attorney may have spent last night reading your last deposition or trial testimony in a similar case.

Watch the Absolutes

Engineers are trained to deal with facts and detailed information. Nothing is necessarily impossible because it could happen. If you are asked whether or not something is

impossible, do not deny it but rather indicate that “In my years of engineering practice and experience, I have never known it to happen.” Be cautious of questions that include the words “absolutely” (there are no exceptions) or “positively” (you may want to qualify your answer later on).

Be Comfortable

You have the right to be comfortable during the deposition. You can ask that the heat or air conditioning be adjusted, the blinds pulled to block the sun, for a break for a drink, or for a rest break. Some attorneys may run a deposition for an intolerable time just to put you under stress. A break can be requested if you feel a need or want to have lunch. There should be an understanding at the start what your schedule is relative to other appointments or airline schedules. You should provide ample time for the deposition, but it is also appropriate to indicate the cut-off time when you must leave the deposition. You should not feel stressed from the facilities or arrangements associated with the deposition.

Do Not Fear the Experience

Some people would rather take a beating than testify and have the same symptoms as the first-time speaker. In fact, some first-timers will say anything just to get out of the hot seat and not face anymore examination. Recognize that you are in control of the situation. Everyone wants and is looking for your response as an expert. The attorney is also on shaky ground and may be more nervous than you, because he/she must come up with the right questions that you only have to answer. You should know many of the answers you are going to give, you are going to tell the truth and your opinion is based on the facts and your analysis of the case. What is there to fear? Relax! Life goes on no matter how poorly you may have performed in the deposition.

TRICK QUESTIONS

You will be confronted with indirect questions, gimmicks and other approaches to produce wrong or vague answers. You need to understand these trick questions so that you have very little trouble responding to them.

The Shell Games

The attorney may play the shell game with you by shifting time, date, or location of subjects. In the middle of responding to one time period, he/she may start directing questions to you about facts at another time. You can ask the attorney for clarification if there appears to be some discrepancy or if you think your answer may be construed to represent a different situation. You can also clarify your response by indicating the situation to which it is applicable.

The Sham Question

The sham question is usually leading and suggests the response that the attorney wants (i.e., “You know that this roadway is extremely hazardous”). You may not know this, and the facts may not support this conjecture. The appropriate response is “I do not know” or “The information does not support that allegation.”

Another question might be: “Isn't it true that you were not at the intersection at the time of the accident?” Everyone knows you were not there, and there is no reason to explain why you

were not there. Just answer yes.

The Vanity Question
This question plays on the witness's vanity by expecting that he/she, as an expert, should know something that in reality he/she may not. The question may take the form: "As an expert or as chief engineer, didn't you know that...?". You may agree to nonexistent facts just to protect your vanity. If you do not know, say you do not know. You are not expected to know everything in the profession, and the lack of knowledge on some obscure fact or study does not reduce your credibility as an expert.

Misquote of Testimony
You need to be especially watchful for questions that misquote your previous testimony. The mistake can be either intentional or unintentional to get the answer they want. Sometimes, the question comes as a summation of your testimony: The facts may be altered, the testimony incomplete, or the opinion slightly modified. Watch for questions that begin: "You have testified ...." or "Is it your testimony that…" You should immediately correct the attorney in a polite but firm manner, providing a correct statement of your testimony.

Have You Talked To Anybody about the Case?
This is a nonsensical question that should never be asked. As an expert, you surely discussed the case with counsel. Answer: "I have discussed the case with counsel." Everyone knows and expects this to be the case. You may be asked, "Did the attorney coach you or tell you what to say?" The correct answer is: "He/she told me to tell the truth, being as fair and accurate as I could be."

How Much Are You Being Paid/How Much Have You Earned?
This question is frequently directed at the expert to infer that you are the hired gun paid to provide specific testimony in the case or are getting rich through the misery of others. It is appropriate to provide your rate schedule at the deposition if they want to make it an exhibit. You do not have to defend your charges to the case. You were hired to review the facts, render an opinion and provide testimony in the case. You do not have to provide your billings on the case unless requested, and it is not recommended that you bring the billings to the deposition. An appropriate response is: "I do not know how much I have earned on the case because I do not have my records with me at this time."

Open-Ended Comparisons
Beware of the open-ended comparisons that are relative, for example: "Didn't the traffic travel fast on this roadway?" How fast is "fast"? You can answer by providing a range of speeds, for example: "Most traffic traveled between 28 and 38 miles per hour on this roadway," or indicate that it is a relative type term that cannot be answered.

The Classic: Have You Stopped Beating Your Wife?
This is the classic trick question that cannot be answered yes or no because it infers that you beat your wife. Counsel should object to the question. If not, you should answer that you cannot respond to the premise of the question and will not answer.

You Could Have Done Better
No matter the skill and expense applied to a situation, you could have always done better

because the system failed and his/her client was involved in an accident. This may take the form: "You know that impaired drivers operate on the roadways. Shouldn't you have a roadway design that prevents them from colliding with other drivers?" The appropriate answer might be: "Yes, we are aware of impaired drivers. The roadway design guidelines recognize these impairments and provide a margin of safety in the design but, unfortunately, we are unable to totally prevent this type of accident."

The "If You Remember" Question
The attorney will lead or follow a question with the clause, "if you remember." He does not want you to remember, and he wants to infer that your recall of facts and events may be questionable. He is also suggesting that you may want to respond: "I do not remember." A lack of recollection to a series of questions could indicate that your knowledge of the case is sketchy and your opinions may not be credible.

The Double Negative
The inquiry with a double negative is usually inadvertent on the lawyer's part, but it can create confusion. It takes the form: "You're not telling us that you didn't …" You can phrase the answer as to what you were telling him/her or you can ask the attorney to reword the question in a more understandable format.

The "To Your Knowledge" Question
The phrase "to your knowledge" may lead or be tacked onto a question. The question may be whether or not an agency followed certain procedures "to your knowledge." It is not appropriate to respond "not to my knowledge," because it infers that the agency never followed the procedures. It is better to say that you do not know.

The Primrose Path
The primrose path begins with a broad, overly-simplified statement, very carefully worded, that will elicit a positive concurrence from you. Then you are led through a series of questions worded to provide your concurrence until you find yourself in a dead-end, trapped into a conclusion that you cannot concur with and that you know is wrong. For example, you might be asked the following series of questions:

- "Would you agree that it is the responsibility of the design engineer to identify and eliminate the roadway hazards on a project?"
- "Would you agree that anyone of these hazards has the potential to cause an injury or fatality?"
- "Would you also agree that it is part of the training of an engineer and his/her job responsibility to recognize these hazards and their consequences on the public?"
- "Would you also agree that, if there are reasonable means to eliminate or protect against these hazards, those means should be used?"

These are objectionable questions because they ask for your opinion on the duties of a professional position; the questions are too general and need to be clarified; and it is not relevant to the case. Counsel should object to the questions, but if not, you should respond negatively with an explanation of why the premise of the question cannot be applied across

the board to all situations or the lawsuit specifically. Following are additional tricks you may encounter.

The Silent Treatment
Occasionally, an attorney will try to intimidate you with the silent treatment. After you answer, he/she will look at his/her notes and then look back up at you and say nothing, hoping that you will say more. The attorney may even encourage you with gestures such a tilted head, raised eyebrows, or another look at his/her notes and an expectant stare to get your response. You become uncomfortable, believing that your answer was incomplete or not responsive to the question. Do not start to provide a defensive explanation of your answer. That is exactly what the attorney is looking for with this tactic.

As indicated previously, if the attorney wants more information, he/she should ask for it. If the attorney needs an explanation or clarification, he/she should ask for it. Sit there silently and wait for the next question.

The Last Question
The examining attorney will ask if there are any other items relating to the case that have not been discussed. It is a legitimate question because the attorney wants to know what you know about the case. As a witness, you may not readily recall everything about the case, and you want to protect your options for trial if you note or recall further information. Be fair to the attorney and either say yes if that is all; or say "That is all I can remember at this time" if you are uncertain. The attorney will usually advise you that if you recall additional information or formulate more opinions prior to trial that he/she should be advised.

After the Bell or the End
This tactic is intended to put you off guard and make you susceptible to continued examination. It occurs when the attorney says, "Give me a moment to look at my notes" and then, "Well, I guess we are through," but then fires more questions at you for the next hour. You felt relaxed because you thought it was the end, but now you have to face the hardest hour of the whole deposition. Do not let your guard down until the deposition is completely done and you have left the room. Even after a deposition with no court recorder, the attorney may ask some innocuous question, such as about your other trips to the locale that could give him/her leads on information to help his case. Do not talk with the opposing attorney "off the record." You can be sure that you will be asked questions for the record if your off-the-record discussion even hints at any possible discovery leads.

WITNESS TRICKS
It is not wise to play tricks with the examining attorney. Recognize that he/she examines people all the time and has more experience with examination than you have with answering questions. Be fair and professional in your responses. The following conduct is not acceptable:

Extending Deposition Time
The witness fails to bring a curriculum vitae (CV) and desires to talk excessively about his/her background and experience as it relates to the case. Some people could talk for days about themselves, but that is not very professional considering inflated deposition costs. Frequently, the attorney will have some knowledge of your background and

experience, so he/she may only ask a few questions for clarification or will ask you to send him/her a copy of your CV.

The Wild Goose Chase
A witness may attempt to lead the attorney off on diversionary tactics in a wild goose chase of issues that are not relevant to the case. It is possible to lead some inexperienced attorneys astray for awhile, but they will usually go back to question they asked and look for a responsive answer pertaining to the lawsuit.

The Nonresponsive Answer
Have you ever heard the comment: "Please listen and respond to my question" from the examining attorney? It is a clear indication that you are not listening and responding directly to the question. You may get by with an unresponsive or evasive statement once in a while because the attorney did not listen to your answer. However, he/she will keep asking the question until you provide a clear answer.

The Delay Routine
Some witnesses delight in slowing the deposition to a snail's pace with excessive reference to documents, files and notes for response. It is particularly frustrating to an attorney who is on a tight schedule. The attorney may indicate in the record that you appear to be having some difficulty answering the questions, which reflects on your credibility as a witness, or he/she can always recess the deposition and reconvene it for the next day or whenever everyone is available, which does not endear you to counsel or other attendees.

AFTER THE DEPOSITION

Following the deposition, you should spend a little time with counsel. This provides an opportunity to discuss the points raised at the deposition, additional information that may be needed, items that require additional review and consideration prior to trial and possible trial court exhibits. It also gives the opportunity for the attorney to provide some constructive criticism on your deposition statements and improvements that can be made prior to court testimony.

You should request that the transcript of the deposition be transmitted to you for review and signature. You are permitted to correct errors and misstatements in the deposition by indicating the changes on the correction sheet provided. Note that you cannot rewrite your answers so that they sound better. How would you explain those changes when you are on the stand during the trial testimony?

Review the deposition carefully and make those corrections that are appropriate. The correction sheet needs to be signed and returned to the court recorder as indicated in the transmittal letter. The transmittal letter may indicate that you can retain the deposition for your reference. Otherwise, they will advise you to return the deposition also. The one advantage of requesting the deposition for signature is that you have the opportunity to make a copy of the deposition. In most cases, counsel will provide you a copy of your deposition if you request it. Prior to the trial, carefully review your deposition to refresh your memory on what was said and recorded.

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TABLE 2-1

FEDERAL RULES OF CIVIL PROCEDURE SELECTED EXCERPTS

Rule 26. General Provisions Governing Discovery

Parties may obtain discovery by one or more of the following methods: depositions upon oral examination or written questions; written interrogatories; production of documents or things or permission to enter upon land or other property, for inspection and other purposes; physical and mental examinations; and requests for admission. The frequency of use of these methods is not limited.

Parties may obtain discovery regarding any matter, not privileged, which is relevant to the subject matter involved in the pending action, whether it relates to the claim or defense of the party seeking discovery or to the claim or defense of any other party, including the existence, description, nature, custody, condition and location of any books, documents, or other tangible things and the identity and location of persons having knowledge of any discoverable matter.

A party may through interrogatories require any other party to identify each person whom the other party expects to call as an expert witness at trial, to state the subject matter on which the expert is expected to testify and to state the substance of the facts and opinions to which the expert is expected to testify and a summary of the grounds for each opinion.

The court shall require that the party seeking discovery pay the expert a reasonable fee for time spent in responding to discovery.

Upon motion by a party or by persons from whom discovery is sought, and for good cause shown, the court in which the action is pending or alternatively, on matters relating to a deposition, the court in the district where the deposition is to be taken may make any order which justice requires to protect a party or persons from annoyance, embarrassment, oppression, or undue burden or expense, including one or more of the following: (1) that the discovery not be had; (2) that the discovery may be had only on specified terms and conditions, including a designation of the time or place; (3) that the discovery may be had only by a method of discovery other than that selected by the party seeking discovery; (4) that certain matters not be inquired into, or that the scope of the discovery be limited to certain matters; (5) that discovery be conducted with no one present except persons designated by the court; (6) that a deposition after being sealed be opened only by order of the court; (7) that a trade secret or other confidential research, development, or commercial information not be disclosed or be disclosed only in a designated way; (8) that the parties simultaneously file specified documents or information enclosed in sealed envelopes to be opened as directed by the court.

A party who has responded to a request for discovery with a response that was complete when made is under no duty to supplement his response to include information thereafter acquired, except as follows:

(1) A party is under duty seasonably to supplement his response with respect to any question directly addressed to (A) the identity and location of persons having knowledge of discoverable matters; and (B) the identity of each person expected to be called as an expert witness at trial, the subject matter on which he is expected to testify, and the substance of his testimony.
(2) A party is under a duty seasonably to amend a prior response if he obtains information upon the basis of which (A) he knows that the response was incorrect when made, or (B) he knows that the response though correct when made is no longer true and the circumstances are such that a failure to amend is in substance a knowing concealment.
(3) A duty to supplement responses may be imposed by order of the court, agreement of the parties, or at any time prior to trial through new requests for supplementation of prior responses.

Rule 28. Persons Before Whom Depositions May Be Taken

Within the United States or within a territory or insular possession subject to the jurisdiction of the United States, depositions shall be taken before an officer authorized to administer oaths by the laws of the United States or of the place where the examination is held, or before a person appointed by the court in which action is pending.

No deposition shall be taken before a person who is a relative or employee or attorney or counsel of any of the parties, or is a relative or employee of such attorney or counsel, or is financially interested in the action.

Rule 30. Depositions Upon Oral Examination

A party desiring to take the deposition of any person upon oral examination shall give reasonable notice in writing to every party to the action. The notice shall state the time and place for taking the deposition and the name and address of each person to be examined, if known, and, if the name is not known, a general description sufficient to identify him or the particular class or group to which he belongs. If a subpoena duces tecum is to be served on the person to be examined, the designation of the materials to be produced as set forth in the subpoena shall be attached to or included in the notice.

Leave of court is not required for the taking of a deposition by plaintiff if the notice states that the person to be examined is about to go out of the district where the action is pending and more than 100 miles from the place of trial, or is about to go out of the United States, or is bound on a voyage to sea, and will be unavailable for examination unless his deposition is taken before expiration of the 30-day period.

Examination and cross-examination of witnesses may proceed as permitted at the trial under the provisions of the Federal Rules of Evidence. The officer before whom the deposition is to be taken shall put the witness on oath and shall personally, or by someone acting under his direction and in his presence, record the testimony of the witness. The testimony shall be taken stenographically or recorded by any other means ordered. If requested by one of the parties, the testimony shall be transcribed. All objections made at the time of the examination to the qualifications of the officer taking the deposition, or to the manner of taking it, or to the evidence presented, or to the conduct of any party, and any other

objection to the proceedings, shall be noted by the officer upon the deposition.

At any time during the taking of the deposition, on motion of a party or of the deponent and upon a showing that the examination is being conducted in bad faith or in such manner as unreasonably to annoy, embarrass, or oppress the deponent or party, the court in which the action is pending or the court in the district or where the deposition is being taken may order the officer conducting the examination to cease forthwith from taking the deposition, or may limit the scope and manner of the taking of the deposition. If the order made terminates the examination, it shall be resumed thereafter only upon the order of the court in which the action is pending. Upon demand of the objecting party or deponent, the taking of the deposition shall be suspended for the time necessary to make a motion for an order.

When the testimony is fully transcribed, the deposition shall be submitted to the witness for examination and shall be read to or by him, unless such examination and reading are waived by the witness and by the parties. Any changes in form or substance which the witness desires to make shall be entered upon the deposition by the officer with a statement of the reasons given by the witness for making them. The deposition shall then be signed by the witness, unless the parties by stipulation waive the signing or the witness is ill or cannot be found or refuses to sign. If the deposition is not signed by the witness within 30 days of its submission to him, the officer shall sign it and state on the record the fact of the waiver or of the illness or absence of the witness or the fact of the refusal to sign together with the reason, if any, given therefore; and the deposition may then be used as fully as though signed unless on a motion to suppress, the court holds that the reasons given for the refusal to sign require rejection of the deposition in whole or in part.

The officer shall certify on the deposition that the witness was duly sworn by him and that the deposition is a true record of the testimony given by the witness.

Documents and things produced for inspection during the examination of the witness, shall, upon the request of a party, be marked for identification and annexed to the deposition and may be inspected and copied by any party, except that if the person producing the materials desires to retain them he may (A) offer copies to be marked for identification and annexed to the deposition and to serve thereafter as originals if he affords to all parties fair opportunity to verify the copies by comparison with the originals; or (B) offer the originals to be marked for identification, after giving to each party an opportunity to inspect and copy them, in which event the materials may then be used in the same manner as if annexed to the deposition. Any party may move for an order that the original be annexed to and returned with the deposition to the court, pending final deposition of the case.

Upon payment of reasonable charges thereof, the officer shall furnish a copy of the deposition to any party or to the deponent.

If the party giving the notice of the taking of a deposition fails to attend and proceed therewith and another party attends in person or by attorney pursuant to the notice, the court may order the party giving the notice to pay to such party the reasonable expenses incurred by him and his attorney in attending, including reasonable attorney’s fees.

Rule 32. Use of Depositions in Court Proceedings
Any deposition may be used by any party for the purpose of contradicting or impeaching the testimony of deponent as witness, or for any other purpose permitted by the Federal Rules of Evidence.

The deposition of a witness, whether or not a party, may be used by any party for any purpose if the court finds: (A) that the witness is dead; or (B) that the witness is at a greater distance than 100 miles from the place of trial or hearing, or is out of the United States, unless it appears that the absence of the witness was procured by the party offering the deposition; or (C) that the witness is unable to attend or testify because of age, illness, infirmity, or imprisonment; or (D) that the party offering the deposition has been unable to procure the attendance of the witness by subpoena; or (E) upon application and notice, that such exceptional circumstances exist as to make it desirable, in the interest of justice and with due regard to the importance of presenting the testimony of witnesses orally in open court, to allow the deposition to be used.

Rule 33. Interrogatories to Parties
Any party may serve upon any other party written interrogatories to be answered by the party served or, if the party served is a public or private corporation or a partnership or association or government agency, by any officer or agent, who shall furnish such information as is available to the party. Interrogatories may, without leave of the court, be served upon the plaintiff after commencement of the action and upon any other party with or after service of the summons and complaint upon that party

Interrogatories may relate to any matters which can be inquired into under discovery provisions, and the answers may be used to the extent permitted by the rules of evidence.

Rule 34. Production of Documents and Things and Entry Upon Land for Inspection and Other Purposes
Any party may serve on any other party a request to produce and permit the party making the request, or someone acting on his behalf, to inspect and copy, any designated documents (including writings, drawings, graphs, charts, photographs, phono-records and other data compilations from which information can be obtained, translated, if necessary, by the respondent through detection devices into reasonably usable form), or to inspect and copy, test, or sample any tangible things which constitute or contain matters within the scope of discovery and which are in the possession, custody, or control of the party upon whom the request is served; or to permit entry upon designated land or other property in the possession or control of the party upon whom the request is served for the purpose of inspection and measuring, surveying, photographing, testing, or sampling the property or any designated object or operation thereon, within the scope of discovery.

Rule 37. Failure to Make Discovery
If a deponent fails to be sworn or to answer a question after being directed to do so by the court in the district in which the deposition is being taken, the failure may be considered a contempt of that court.

If a party or an officer, director, or managing agent of a party or a person designated under Rule 30 or 31 to testify on behalf of a party fails (1) to appear before the officer who is to

take his deposition, after being served with a proper notice; or (2) to serve answers or objections to interrogatories; or (3) to serve a written response to a request for inspection submitted under Rule 34, after proper service of the request, the court in which the action is pending on motion may make such orders in regard to the failure as are just.

In lieu of any order or in addition thereto, the court shall require the party failing to act or the attorney advising him or both to pay the reasonable expenses, including attorneys fees, caused by the failure, unless the court finds that the failure was substantially justified or that other circumstances make an award on expenses unjust.

PREPARATION FOR TRIAL

By Ronald W. Eck, Ph.D., P.E., Professor Emeritus, West Virginia University

INTRODUCTION

It has been said that the three most important things to do to testify effectively at trial are prepare, prepare and prepare. While this is certainly true, a successful appearance at trial requires more than simple individual preparation by the expert. Joint preparation involving the expert, the attorney and other members of the litigation team is essential for a successful outcome. This section points out how the expert can prepare effectively in trying a case.

Preparation for trial actually begins when the expert is retained by the attorney. In addition to testifying as a witness offering technical opinions, the expert can help in preparing the case. The expert can assist in developing liability and defense theories and issues; identifying other experts; identifying relevant items to request through discovery; evaluating the strengths and weaknesses of the case; and conducting research and other preparation to avoid surprises at the trial.

EARLY ON

Early in the case, the division of labor should be clarified. The attorney who has engaged the expert is the leader of the team; the attorney will make the final decisions as to the extent of the investigation, use of exhibits at trial and other similar questions that might arise. If the expert disagrees with these decisions, they should be discussed with the attorney. For example, if the limitations being put on an investigation prevent an expert from forming a valid opinion for trial, this should be pointed out. However, the attorney has the final right of decision.

Once the expert's responsibilities are agreed upon and understood, a schedule of regular communication should be established. Because the attorney's strategy may depend heavily on the expert's findings, it is important to keep the attorney informed of the progress of the work on a regular basis. Likewise, the attorney should keep the expert informed of major developments, such as the engagement of other experts or the discovery of new evidence relevant to the investigation.

If other experts are working on the case, it is important to coordinate the work, conferring jointly with the attorney. In some cases, the work of experts may involve a certain amount of conflict. Such problems should be solved in conference with the attorney. Because of these potential conflicts, it is essential that each expert and the attorney be kept informed of the other's planned activity.

Before an expert prepares a report or gives deposition testimony, the expert should have carefully reviewed and studied all available evidence. This includes any accident and incident reports, witness statements, photographs, videotapes, interrogatories, deposition transcripts, documents, records, plans, drawings and other tangible evidence. Prior to testifying at trial, the expert should *always* visit the site in question.

Early on, the expert should be encouraged to criticize and dispute any weakness in the factual theories put forth by the attorney. Such a critique serves at least two purposes: First, the attorney may be able to adopt a new theory of liability and defense. Second, by identifying and discussing potential weaknesses before the trial, the team is alerted to likely topics for cross-examination.

AS TRIAL APPROACHES

Because the expert's opinions will be carefully scrutinized not only by the opposing attorney but also by the opposing expert, one cannot over-emphasize the importance of thorough investigation and preparation. Materials relied on by the expert must be verified as current or appropriate for the time period in question. Calculations should be triple-checked to assure that no mistake has been made. Errors in conversion factors or decimal points often lead to large miscalculations when they are carried over a series of steps. If tests or experiments are performed by the expert, the procedures must be well documented and carefully followed.

Demonstrative evidence is a powerful tool to help the expert convey theories to the judge and jury. Courtroom exhibits should be professional. The exhibits for courtroom use should be made by skilled people. However, because the exhibits are frequently the expert's products and support his/her opinions, they should be made under the expert's direction and supervision to be used effectively in court. Determine who will have custody of physical evidence and exhibits. A later section discusses the various types and desirable characteristics of demonstrative evidence.

Chances are, when the trial date approaches, it has been a relatively long time since the expert thought about the case. Since then, other witnesses may have been deposed and new evidence may have been produced. Furthermore, some of the parties may have been dropped from the suit or settled out of the case, thereby altering the case for both plaintiff and defendant(s). If the expert was not informed about these developments earlier, now is the time to get updated. The expert should consult with the attorney before starting final preparation to make sure that he/she is preparing to testify only on the issues that will be tried. With the trial date approaching, it is time to begin a thorough review of the materials.

The expert should begin pre-trial preparations by going through the file and examining every item in it. Anything that is clearly irrelevant to the testimony should be separated; the rest should be organized in a logical fashion. Carefully review each remaining item to assure that the information is either pertinent to the testimony or may be needed during cross-examination.

In reviewing the file, the expert should note the dates items were received and when work was performed. Ascertain that all available data were provided and that no detrimental data were withheld, except for data purposely withheld from you by the attorney at the attorney's discretion. For example, make sure you have read all relevant depositions in their entirety, not just excerpts. The expert is advised to re-read every document and deposition transcript in the file, noting the location (page and line number) of each piece of evidence that supports his/her theory and each piece of evidence that opposes it. The expert should read his/her own deposition transcript last, identifying the statements the expert intends to emphasize in court and those the expert may have to defend under cross-examination.

Once the expert is able to clearly explain his/her theories and satisfactorily address questions asked by opposing counsel, it is time for an in-depth review with the attorney. This should happen with sufficient time before trial to allow the witness to refine the presentation. Try to avoid a situation in which the first definitive discussion about the testimony occurs just before the expert is called as a witness.

Before trial, review a current copy of your CV that includes your educational background; a detailed list of projects with which you have been involved; and your current duties, professional registration and membership in professional societies. Specific items to be covered or emphasized at trial can be highlighted. Experience dealing with problems similar to the one in question is highly respected by the court. Where possible, always indicate such experience.

During cross-examination, it is probable that your entire life, particularly your professional career, will be subject to intense review. If there are any skeletons in the closet, tell counsel beforehand.

Remember that the cross-examiner may confront the expert with his/her former testimony as reported in Appeals Court or Supreme Court records or depositions from other cases. This can lead to questions such as the following:

- What is the difference in your testimony then and now?
- Is not your opinion in this case completely contrary to this other case?

It is important that the attorney and the expert draw up a plan for direct examination. Be aware that, if the case is complex, this can be very time consuming. To guard against critical omissions, it is advisable to write out in full the questions and answers that the attorney and expert agree constitute the direct examination. If other technical experts are working on the case, all of the testimony needs to be coordinated. The attorney should also provide a feeling for the types of questions to expect under cross-examination.

The expert's working relationship with the attorney is really a mutual education. The attorney should instruct the expert about the remaining legal issues and about how the law is interpreted in the jurisdiction where the case is to be tried. The expert should be sure the attorney understands exactly what the testimony means as well as what it does not mean. Neither should overestimate what the other understands. A communication breakdown at trial usually produces unfortunate results.

For a variety of reasons, the attorney may not take the time to thoroughly understand the expert's opinions prior to trial. The attorney may assume that the expert will carry them during the testimony. Sometimes the attorney may not take the time to prepare, leaving the expert to fend for himself/herself during the trial. Be aware that a proactive approach on the part of the expert may be needed to assure the joint preparation necessary for a successful outcome.

JUST BEFORE TRIAL

The expert should review with the attorney the case file that he/she intends to take to court. It

should contain everything that supports the expert's position and anything the expert may want to use to help on anticipated cross-examination. The file should be arranged and indexed so that needed items can be found quickly and without fumbling. Remove extraneous material that does not bear on the testimony; for example, do not take the list of direct examination questions, which you and the attorney developed, to the witness stand.

The attorney should prepare the expert for what to expect in the courtroom. The expert needs to know the sequence of events in courtroom examination and the rules governing behavior as a witness.

With the help of the attorney, the expert should try, where possible, to visit the courtroom where the case is to be tried. Choose a time when court is not in session so experts can move about freely. Observe the layout of the room with particular attention to spatial relationships that exist between the judge, the jury and both counsel and witnesses.

Determine where to place exhibits so that they can be clearly seen by the judge and jury. The expert should visualize how he/she will explain the exhibits without interfering with the view of the judge or any of the jurors.

It is advisable to check any facilities that are part of the courtroom and that the expert intends to use (e.g., a chalkboard or flipchart). If the courtroom lacks any facilities the expert will need, make sure they will be available at the time of his/her appearance. Always carry some chalk, broad-tip marking pens (more than one color) and a telescoping pointer into the courtroom because such items are frequently not available.

The attorney should be able to provide guidance as to what pleases and what irritates the judge who will preside. Likewise, as soon as it is known, the attorney should make the expert aware of the jury makeup. By knowing the education, orientation and skills of the various jurors, the expert can express his/her thoughts and form analogies in a manner to which the jurors can relate.

The expert should be careful of his/her behavior at all times when in or near the courthouse. One can never be sure who is friendly to the opposite side or who may be a juror. Expect anything said or done in hallways, elevators, restrooms, or even nearby streets and restaurants to be observed by hostile eyes and related to opposing counsel. Avoid any public display of humor and by all means avoid jesting in the courtroom. Anything other than a serious demeanor will detract from the expert's credibility. Something as simple as jaywalking may destroy your credibility in the eyes of a juror.

The expert should consult with the attorney before trial about subjects that should and should not be addressed. Know what words are considered out of bounds.

Last but certainly not least is mental preparation. Mental preparation provides an anchor against the stresses and strains of testifying. Devise your own techniques that are not apparent to onlookers for remaining calm and focused. For example, you can release tension

physically by pressing your toes down in your shoes. Another relaxation method is to take an occasional deep breath while visualizing a peaceful scene.

IN THE COURTROOM

Clothing

Your appearance and demeanor will probably have as much to do with the court believing you as anything else. The jury may not take a person seriously who cannot dress properly. Avoid loud clothes and flashy jewelry. Beware of big plaids. Dress tastefully, not flamboyantly. Sports coats with open-necked shirts are too informal.

Proper dressing demands close attention to detail. People perceive a sloppy dresser as a person who is also careless in the details they report during testimony. Make sure your clothes are neatly pressed. Check to see that your jacket is buttoned and your shoes clean and polished. Make sure that your hair is neatly trimmed. You are a professional; you should present a professional appearance and demeanor in the courtroom.

Posture

Walk confidently to the witness stand. If you are carrying notes or a report, carry them in a fresh file folder in your left hand. That way, when you swear in, you will not have to switch the folder to the other hand.

At the witness stand, take your seat carefully (do not dive into it) and place both feet flat on the floor. Look attentive by leaning the trunk slightly forward. Your legs should form a 90-degree or right angle. Do not stretch your feet forward.

Sitting upright suggests that you are attentive to what's happening. Slouching suggests you are not interested.

If there are arms on the chair, use them. Place your forearm flat on the chair arms; hands should be palms down. This suggests an attentive, receptive, aware attitude and is conducive to it.

Voice

Speak in court as you would in any other large public room (i.e., in a relaxed tone of voice), at a comfortable rate of speed and at an appropriate volume. If there is a microphone at the witness stand, speak into it. If there is no microphone, make sure that your voice is loud enough for all of the jurors (and the attorneys) to hear you clearly.

It may be helpful to tape record yourself prior to trial to help you improve articulation and timing and to eliminate "uhs" and "ahs" and nervous mannerisms such as coughing or clearing your throat. Avoid slang, jargon, excessive use of technical terms, poor grammar and awkward expressions. Never chew gum, smoke, or eat candy. Do not drink to strengthen your nerves and be aware of the effects of medication you may be taking. Use clear, understandable language in a natural, narrative style. Answer all questions in a sincere and direct manner. Talk to the judge and jury as equals, as colleagues, never condescendingly. Use gestures minimally or preferably not at all.

Mannerisms
Probably the most important aspect of courtroom demeanor is professional, competent, nonverbal communication. The knowledgeable communicator, who knows what meaning people can give to nonverbal signals, controls those signals as much as possible.

Nervousness appears in a variety of ways but can be checked if you are alert to it. Do not fiddle or play with anything such as your hair, tie, ring, pin, pencil, paper clip, or other objects. Knee-pumping, finger-drumming, fist-making and knuckle-cracking are signs that are more likely to appear during difficult questioning. Judges and juries notice these things; they may be taken by many as signs of lying or truth-stretching. If you sit in a swivel chair, do not rotate or rock back and forth.

Maintain optimal eye contact—neither too much nor too little. Do not glare angrily at the attorney, but do not be a scared rabbit either. If it is upsetting for you to look at the opposing attorney or anyone else, look out at the court, in the aisles, at empty seats, or to the back wall. Remember that looking directly at the jury will give them a greater feeling of sincerity from the witness.

Everything you do around the courthouse is significant, including your dress, speech, actions in the courtroom and meetings in the elevator. Jurors are sensitive to behavior on and off the witness stand. Do not talk to members of the jury outside of the courtroom. Do not talk to the press.

Giving Testimony
Address the judge as "Your Honor." Address the attorneys by title and last name. The court will have more respect for you if you present an air of humility.

If you do not hear the question asked or do not understand it, say so. However, do not make a practice of having questions repeated. It indicates that you may be taking time to frame your answers.

Do not start answering a question before it is finished or interject words while a question is being asked. Wait until the question is finished. When one of the lawyers objects or if the court interrupts, stop your answer immediately and wait until the court gives its ruling.

Give responsive answers; do not beat around the bush. If necessary, answer a question with a yes, no, or otherwise very specifically; then ask for the opportunity to explain your answer. Answer only the question asked; do not volunteer information.

Direct *answers* to the attorney and *explanations* to the jury. If your answer is going to be over three sentences, turn to the jury. Limit your answers to 10 sentences or the jury will turn off. Explain a technical answer as carefully as possible, using visual aids as needed to make it understandable to the laypersons on the jury. Courtroom exhibits are addressed in a separate section.

Because attorneys know that an angry witness makes a poor witness, the cross-examiner may try to arouse the witness's anger. Avoid attempting to destroy the questions of the cross-

examiner by being sarcastic. Remain polite and courteous at all times. Avoid arguing or trying to compete with the cross-examiner. If you remain polite and courteous, the court will be on your side.

CONCLUDING REMARKS

This section describes some of the essential features of preparing for trial. While a number of specific points are discussed, two key elements stand out.

In preparing for trial, the key to success is regular, clear and explicit communications between litigation team members. If each team member knows precisely what each expects of the other, each can proceed with their own work, confident that they will not encounter unpleasant surprises when it is too late to do anything about them.

Conscientious preparation is critical. Preparation includes both individual effort as well as the attorney-team effort that is so vital to a successful outcome. Building this attorney-expert relationship may take a long and sometimes arduous effort. However, it is necessary if the expert is to fully use his/her abilities in the courtroom.

PROFESSIONAL ETHICS CONDUCT

By Paul L. Streb, P.E., Consulting Engineer

Ethics is defined as the moral principles of conduct that govern an individual or group. An expert's opinion must properly reflect the standards and recommended practices of the transportation profession and the public good. Truth, honesty and objectivity are the foundations for the integrity of the expert witness. A good test of the expert's opinion is that its content would pass the judgment of a committee of recognized professionals in his/her field.

This does not prohibit an expert from giving differing opinions on the same matter, as long as they are based on facts. For example, some engineers strongly believe that more mass transit is the answer to eliminating congestion. Others strongly feel that more road capacity to accommodate private cars is the solution. Their opinions differ, but they can be justified based on the factual knowledge of each expert, and both opinions would be fully ethical.

Remember, when an attorney first hires you, you are a consultant. If he/she decides to use you at trial, you are the attorney's expert. You are obligated to tell him/her the strengths and weaknesses of the case and any facts that may affect his/her client's case. The expert is responsible to uncover both favorable and unfavorable information. If the attorney is not aware of the information and the opposing side brings it up at the trial, his/her case may be in jeopardy. Even if the disclosure of harmful information before the trial results in the expert's termination from the case, it will enhance the re-employment of the expert on future cases. Courts operate on an adversary system of justice. At trial, it is not the function of the expert to volunteer information over and above what the attorneys ask you to give. It is not appropriate for the expert to be or appear to be a strong advocate of his/her side of the case. That is counsel's responsibility. A professional expert must deal with the facts and his/her opinions without becoming emotionally involved in the case.

However, if you write a report that is discoverable by the opposing side, it is ethical to list only the strong points of the case. It is the duty of the opposing attorney to ferret out other relevant information from you in depositions or cross-examination at the trial. Listed below are the dos and don'ts of ethical behavior.

DO

You must only perform services in your area of expertise. This requires that you be thoroughly familiar with the standards, recommended practices, state of the art and normal practices for that area of expertise.

You must preserve client confidence. If you have information, even from previous depositions on the case you are working on, you do not want to publicly disseminate this information, although it is technically public. This prohibition includes social conversations at professional meetings you attend.

You may represent a client you previously opposed without a conflict of interest, providing any privy information from the previous case is not exposed. Switching sides in succeeding cases is not an ethical issue, but it can affect employment in future cases.

The expert may provide reports and testimony critical of the actions of government agencies and the work product of consulting firms.

If the client does not give you a certain fact in a case in which you developed an opinion, you are obligated to admit this when asked by opposing counsel. An example would be if you did not know the alcohol level of a person in the case.

Allow yourself enough time and support to complete reviews and investigation of the case. The legal system is notorious for scheduling difficulties, but you as a professional have a right to expect due consideration.

An expert may assist an attorney by preparing cross-examination questions, evaluating the credibility of lay witnesses and opposing experts and analyzing the arguments of opposing counsel.

Express an opinion only when founded on adequate knowledge of the facts. Sometimes there may not be enough information. When an expert states that his/her opinion is based on a reasonable degree of certainty, it means that the chance of being correct is more than 50 percent.

Take cases from a diversity of clients to demonstrate your independence as an expert. This would include plaintiffs and defendants. You may ethically defend a government case, such as in a particular state, and be working on different plaintiff cases against the same government. However, you should inform your client of this situation before you are engaged because some clients may not like this contradiction.

Make your primary employer aware of your outside consulting work. Follow any rules that the primary employer has for this outside work. Any outside consulting work should not conflict with your primary position. Some possible conflicts to consider are cases in which an attorney has or could have other lawsuits against your primary employer, or lawsuits in an area where you have some responsibility, such as being on a committee that could approve funding for projects that could affect the case.

DON'T

Do not take compensation that is contingent on the outcome of a case. Types of contingent fees include a percentage of the recovery or may be hidden by higher hourly fees and any other perks. An expert is paid for the number of hours and expenses when working on the case. An expert is not paid for his/her opinion. The expert is paid win, lose, or draw.

Do not exaggerate your qualifications and expertise in testimony or on your CV. If the opposing attorney successfully challenges your credentials and the court finds you are not qualified, you may be permanently barred, and your reputation could be tarnished in future cases.

Do not hide documents if counsel reviews your file and wants you to remove some before bringing your file into a deposition or court. To solve this problem, retain documents that support your opinion and destroy those that are unnecessary or not relied on. Note that some correspondence from the attorney may be privileged information and may be excluded from deposition and discovery.

Do not agree to testify and reach an opinion before you review the facts and all appropriate documents. Do not offer an opinion that is contrary to existing standards or practice. An example would be to state that a STOP sign is warranted at a location where its installation is obviously in contradiction with recognized published warrants. Otherwise, you will be labeled a "whore" who will give favorable opinions without knowing the facts or offering a plausible basis.

Do not have a selective memory when, at the trial, an opposing attorney asks you what you and your client talked about at pre-trial meetings. The expert's credibility will be suspect if the expert says that he/she cannot remember.

Do not have a conflict of interest. If you are not certain, resolve this issue before any engagement. You may have discussed and then declined to work on a specific case with an attorney and then be asked to work on the same case with a new attorney representing the opposing side. Alternatively, you may have been or are currently working with opposing attorneys on other cases. You must disclose these contacts with your new attorney. It is also necessary to advise clients of your previous testimony and authored articles that may be construed as a conflict of interest.

Do not use other primary employment to permit you to charge lower fees or gain other advantages. You may be working in a full-time position and offering your services, where they do not conflict with your primary job, to attorneys. You should charge rates that are comparative with other consulting engineers. You should never charge fees that are lower than the salary plus overhead cost rate that is used by your primary employer for your services.

Do not give an opinion in court contradicting your previously stated opinion in a court or in a deposition on the same subject. Your previous court testimony is recorded and can be retrieved by search firms used by law firms to gather information before trial.

Do not use false or altered data or deliberately ignore commonly available data. The most current, accurate and available data before the incident date must be used. This data must not be altered or manipulated to suit your purpose.

Do not offer unreasonable or unrealistic reports or opinions to an attorney.

Do not take a case that you find personally distasteful or marginal. For any personal reason, you may not want to be involved in a specific lawsuit. That is your decision. Often you will be asked about the merits of a case based on a brief verbal description of the incident. If it is obvious to you that there is no case, tell counsel why and that you will not be able to help. It

is extremely unfair to an attorney and the client to lead them on and make them think that they have a winnable case in order to provide an employment opportunity.

Do not publicly injure or discredit the reputation of another professional. It is adequate to indicate that you do not agree with his/her work and opinions.

EXPERT VERSUS P.E. LICENSING

You are not required to be licensed in a state to provide expert testimony. However, under the laws of some states, if you collect field data, analyze that data and produce an engineering report, that is the practice of engineering and you should be licensed. Most states permit a temporary 30-day license that can be obtained through the P.E. licensing board. In the west, some of the experts have been challenged in court on this basis, and their attorney/client has been reluctant to ask very many questions on their field findings.

COMPLAINTS ABOUT ETHICAL BEHAVIOR

What is the appropriate method to issue a complaint against a fellow professional and ITE member? First, you must have documents that support your complaint. Second, it should be a strong case of unethical behavior. Third, have another professional review your allegation and documentation to see if he/she agrees. Last, if you still believe in your ethics allegations, you and whoever else you can enlist for support must stand up, speak up and make the allegation known to the ITE board and the appropriate state licensing board.

ATTORNEY/EXPERT/CLIENT RELATIONSHIPS: CONTRACT AGREEMENT

By C. Derek Wild, P.Eng., Principal, D.W. Engineering, Limited

First, it is most important to realize that the success of any relationship, particularly a three-way relationship such as an attorney/expert/client relationship, will ultimately depend very much upon the clarity of the contract or agreement reached between the three participants. A full understanding of the project scope, the information needed and who is to provide what is required from all participants. Any limitations imposed by poor quality of data must be clearly expressed. When "firm" data are not on-hand and one is requested to deal with scenarios making certain assumptions, these assumptions must be thoroughly discussed with the attorney. Ultimately, the attorney will have to lead evidence in court that shows the assumptions made by the expert are most likely the facts of the case. His/her success in that endeavor should help the trier of fact (the jury or judge, in a jury's absence) to believe the expert's opinion.

Expert witnesses can be retained to undertake a task either by an attorney or directly by a client. In Canada (the author's home), it is usually by an attorney on behalf of the client. Very often, there is an element of rush involved, and a report is required in the very near future. Therefore, on many occasions, there is little time to reach any formal agreement as to what is needed and what is necessary to complete the task properly. That is why most attorneys build a relationship with an expert over time and keep returning to that person. A verbal assignment is common in such circumstances but, obviously, this method is not fully desirable if the assignment extends to a written report. Even among attorneys with whom a long-term working relationship has been forged, things can go wrong.

To avoid problems later, a written agreement or contract is recommended. What type of contract or agreement should be used, and what does it cover? Short-form agreements (contracts) may be appropriate with familiar clients; with a new attorney relationship, more items, such as a retainer, may need to be covered. Our profession needs to work on standard written agreements as others have in the past (e.g., consulting engineers, professional associations). Unfortunately, these other organizations' standard agreements are usually not appropriate (or are too cumbersome) for expert/attorney agreements. They also tend not to cover contract or tort liability issues and the problem of limiting liability. However, they do form a base upon which a start may be made when writing a contract agreement. The following discussion also suggests an approach.

To this point in time in motor vehicle accident reconstruction work, a commissioning letter by the attorney (the expert's client) indicating the terms of reference (i.e., what the lawyer requires from the expert) is sent. This letter usually requests a verbal opinion before any written report is sent. The letter will also include information on the case. The included information may be things such as discoveries, other experts' reports, statements, police reports, plans and so forth. This attorney letter usually does not deal with a contract agreement between any of the three persons involved, except that time deadlines and a

budget may be mentioned in the letter of commissioning. In this respect, an approximate cost may have been given by the expert during or after the first phone contact. The information given with the letter may be insufficient for analysis, and scenario assumptions may require discussion. As mentioned above, data available only as a "probable range" can, of course, lead to a range solution, which may be unsatisfactory to the client.

For example, the rest positions and the post-impact trajectory of the two vehicles after impact may not be too accurately established, but a probable range is available by witness statements. The resulting speed established by analysis may establish a low-range figure (lower than the speed limit). The high side of the range and the average, however, may both end up above the limit. Several "sensitivity" computer runs are needed, which cost more money than if the needed "facts" were all firm and clear. Such analysis problems due to unclear data definitely need full discussion at the outset to avoid building unrealistic expectations.

The existing methodology does not appear to have created too much of a problem to date, at least not in the author's experience. Canada's record of litigation against experts appears to have been minimal. However, Table 2-2 presents a copy of a summary of a landmark decision in *Halifax Insurance Company* v *Donald T Matheson Engineering Ltd. and Murrey Barrett* [S.H. 93-4777]. In this case, the expert was successfully sued for almost $100,000. Legal opinion now expressed is that the findings of this case could open the door to other suits against experts, possibly involving much more money.

Therefore, it is likely that the above case will not be the first case involving experts, and that others will be using the *Halifax* case as a precedent. It becomes most important to use written agreements phrased in such a way that any misunderstandings might be avoided. Table 2-3 is provided to assist in the task of building a recommended Terms of Engagement (short form). This sample was developed for soil mechanics and foundation engineers and will require a rewrite for expert witness use. Table 2-4 could be used on drawings and possibly up front in reports as amended by the expert to suit the particular project. It is suggested that this contract agreement be sent to the expert's client after the commissioning letter along with an expression of thanks for the assignment. The return of a signed copy should be requested in order to enable a timely start on the project.

"Liability" should be defined at this stage. It is defined as the exposure one is subject to when found deficient in performing or not performing acts or obligations that affect others. Performance is measured by what is reasonable or prudent under a given set of circumstances. The extent of professional liability is subject to ever-changing standards by which the performance of professional acts is measured.

The professional liability of design consultants, for example, finds its source in two different aspects of the law. The first is the *liability in contract,* whereby the engineer or architect will be answerable for his/her failure to perform with due care and diligence the service described in the contract. Contract liability is incurred only toward the party with whom the engineer has a contractual relationship, whether written or verbal. This is the area to which the expert witness is likely to be most exposed should he/she provide poor advice to the client. Such

poor advice could arise from inadequately discussed data deficiencies, scenario assumptions and so forth, which in turn could lead to falsely high expectations. Rest assured that cross-examinations in court will expose such problems if they are present. In this respect, the last thing an attorney (or client) appreciates is last-minute surprises in terms of opinion reservations or limitations.

The second exposure lies in *tort liability,* which might be defined as a civil wrong other than a breach of contract for which the law will grant a remedy that is typically a monetary award. This liability in tort is incurred toward the public at large in Canada. The principles of tort liability are the same in the case of a shopper attempting to recover from a design consultant for bodily injury suffered as a result of the partial collapse of a ceiling in a shopping center and in the case of a person attempting to recover damages for bodily injury as a result of his/her neighbor's dog biting his/her child. It becomes more complex when one looks at design consultants in private practice and those who do not provide consulting services directly to the public. Suffice to say at this point in time that we, as experts in the transportation area, most often undertake studies *offering conclusions that guide the actions of our clients,* who are usually attorneys representing their clients/others. Clearly, expert witnesses could be sued for both contract liability and tort liability. Examples of the latter are not known to the author but, clearly, any legitimate methods to reduce exposures to all such actions, contract or tort, should be used. The best advice that can be given is to be frank up-front regarding any limitations of the analysis that can be seen at that point and as the analysis proceeds.

It is obvious that foundation engineers as well as structural engineers have borne the brunt of litigation against the engineering profession in the past; we, as expert transportation engineers dealing mainly in the field of motor vehicle accident reconstruction and so forth will be wise to learn from the lessons of our fellow engineers. We will have to make changes to some of the words, but these documents are a start.

Table 2-5 presents the (so-called) "Ten Commandments of Good Practice." Bear in mind again that this covers all types of engineering, and many of the strictures given here apply to construction work or design services.

In summary, contract agreements produced by organizations like the Consulting Engineers of Canada and the Canadian provincial professional engineering associations are often complex and in many cases clash with those of the clients themselves. The author suspects that U.S. equivalents will have the same problem. It is the author's opinion that we should start with something that has been produced by our own professional body's insurers' "loss control" staff, such as the short-form contract given in Table 2-3 together with appropriate report and drawing waivers tailored to the project. We should build upon that start as time goes by and experience is gathered.

Generally speaking, it has been found that the major claimants in professional liability suits are clients. Some are run-overs (e.g., pass-ons from contractors and so forth—about 26 percent). A similar proportion involves claims from public-sector owners, and 48 percent involve claims from private-sector owners (thought to be Canadian data). Thus, if major claimants regarding professional liability insurance are our clients, our contracts should be

very specific in items such as those covering limits on liability and so forth. The contract should be at least as specific in these respects as most contracts now are in performance items, such as time for completion. It is noted that Table 2-3 is largely concerned with professional responsibility and the limitation of liability—which, in addition to quality, are the main interests of the professional providing services. Contract agreements in the past have tended to be provided by (and thus mostly protect) major clients.

It is now obvious that expert witnesses must be more concerned about the need for written contracts and about setting realistic expectations, avoiding the dangers of superlatives and using overly impressive CVs. Remember Table 2-5, which presents The Ten Commandments of Good Practice (e.g., sell your firm and your services fairly; insist on an equitable written contract; do not play lawyer; have a specific project plan; keep one's client informed; deal promptly with problems; use written records; do not certify that which one has not seen; and, finally, think before suing for fees and so forth). I think it would benefit all of us to learn how to develop a good standard contract and sell the fact that using the same is good practice for ourselves as well as our own client, whether they are attorneys or others.

One final word about what is required in Canada with respect to liability and other insurance: The Association of Professional Engineers of British Columbia, for example, presently only requires its members to reveal to their clients whether or not they have "errors and omissions" liability insurance. They do not say that they must have the same or how much the insured amount should be. Members are, nevertheless, advised to obtain this type of liability insurance (as we would consider the case in most of North America). Any professional person or firm must now appreciate that he/she could face civil liability for a negligent act, error, or omission arising out of the provision of professional services.

Contracts or agreements therefore should be written to help avoid possible litigation later and promote cooperation and satisfaction between the transportation engineer expert witness, the attorney and the client. Until a satisfactory standard agreement can be developed, however, Table 2-3 provides, in the author's view, a basis upon which a draft attorney/expert/client contract agreement can be achieved. Perhaps ITE's legal department can assist further? Certainly, the warnings on the second page of the Sample Terms of Engagement (Table 2-3) must be heeded. The same warning should be heeded when using waivers or disclaimers on drawings or in reports.

TABLE 2-2: LANDMARK DECISION EXCERPT, "SUING YOUR EXPERT"

By Glenn A. Urquhart and John R. Singleton. Presentation at the Encon Loss Control Seminar, Ottawa, Ontario, Canada, March 1996.

SUING YOUR EXPERT

On March 17, 1995, Mr. Justice Gruchy of the Supreme Court of Nova Scotia handed down a landmark decision in *Halifax Insurance Company* v *Donald I Matheson Engineering Limited and Murray Barrett* [S.H. No. 93-4777].

In this case, the plaintiff retained the defendant engineering company to investigate the house fire loss for possible electrical causes. The defendants' engineers reported that while a stove was on, with a pot of water simmering on the stove, it was set at a low temperature and therefore was not the cause of the house fire. Halifax defended the insured's claim. The insured produced expert reports that the stove had been set on high and was therefore a probably accidental cause of the fire. The plaintiff reinvestigated the stove setting and concluded that the defendant engineer's report was wrong. The plaintiff insurance company then sued the defendant engineering company for negligence in the investigation and report.

The court held that the defendants were negligent in performing their duties and failed to take a professional standard of care. Accordingly, the court held the defendants liable for all costs incurred in the defense of the insured's action, awarding the plaintiff the total sum of $97,000.00.

Matheson Engineering is an important case for everyone in the litigation process to bear in mind when dealing with experts in the future.

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TABLE 2-3: SAMPLE "TERMS OF ENGAGEMENT" (SHORT FORM)

TERMS OF ENGAGEMENT

General

___ Inc. ("XXX") shall render its services to the Client for this project in accordance with the following terms of engagement.

In rendering services to the Client, XXX may, at its discretion and at any stage, engage subconsultants to perform services necessary to enable XXX to carry out its duties and responsibilities as set forth.

Compensation

Charges for the services rendered will be made in accordance with our Schedule of Fees in effect at the time the work is performed. Our current Schedule of Fees is included in our Budget Estimate. All charges will be made in and will be payable in Canadian dollars. Invoices will be due and payable in 30 days without hold back. Interest on overdue accounts is at 1 percent per month or 12 percent per annum.

Notices

XXX will designate a project manager who shall be responsible for the project. The Client shall designate an authorized representative to act with respect to the project.

Termination

Either party may terminate this engagement with cause upon 30 days' notice in writing. The Client shall forthwith pay to XXX its fees for all services performed, including all expenses and other charges payable that are associated with obligations incurred by XXX for this project.

Environment and Pollution

The XXX field investigation, laboratory testing and engineering recommendations will not address or evaluate pollution of soil or pollution of groundwater. XXX will cooperate with the Client's environmental consultant during the fieldwork phase of the investigation.

Professional Responsibility and Limitation of Liability

XXX will provide the standards of care, skill and diligence normally provided by a Professional Engineer in the performance of engineering services as contemplated for this project.

XXX shall not be responsible for a Contractor's failure to perform work in accordance with the relevant contract documents; for design of or defects in proprietary equipment; for loss of earnings; or for other consequential damage, however caused.

Notwithstanding anything to the contrary, the aggregate liability of XXX, its directors, officers and employees—including liability for negligence, negligent misrepresentation and breach of contract—shall be limited to the amount of professional liability insurance

available to XXX at the time any claim is made.

The Client's failure to accept the professional recommendations and advice of XXX shall relieve XXX from any and all legal liability, whether in contract or in tort, to the Client for all manner of loss and damage accruing to the Client, including consequential loss and damage that arise out of the XXX services.

XXX's liability in contract or tort shall be limited to a period of 2 years from the date of completion of the project.

Documents

All of the documents prepared by XXX in connection with the project are instruments of service for the execution of the work. XXX retains the property and copyright in those documents, whether the project is executed or not. These documents may not be used on any other project without the prior written agreement of XXX.

Field Services

Where applicable, field services recommended for the project are the minimum necessary to ascertain whether or not the Contractor's work is being carried out in general conformity with the intent of our recommendations; any reduction from the level of services recommended will result in XXX providing qualified certifications for the work.

XXX Inc.
Soil mechanics and foundation engineering
[Address]
[City, Province, Postal Code]

NOTE: Substitute "XXX" with name of party rendering services where applicable.

SAMPLE TERMS OF ENGAGEMENT

General

The Consultant shall render the Services, as specified in the attached Scope of Services, to the Client for this Project in accordance with the following terms of engagement. The Consultant may, at its discretion and at any state, engage subconsultants to perform all or any part of the Services.

Compensation

Charges for the Services rendered will be made in accordance with the Consultant's Schedule of Fees and Disbursements in effect from time to time as the Services are rendered. The Consultant's current Schedule of Fees and Disbursements are included in the Consultant's Budget Estimate. All Charges will be payable in Canadian Dollars. Invoices will be due and payable by the Client within thirty (30) days of the date of the invoice without hold back. Interest on overdue accounts is 12 percent per annum.

Representatives

Each party shall designate a representative who is authorized to act on behalf of that party

and receive notices under this Agreement.

Termination
Either party may terminate this engagement without cause upon thirty (30) days' notice in writing. On termination by either party under this paragraph, the Client shall forthwith pay to the Consultant its Charges for the Services performed, including all expenses and other charges incurred by the Consultant for this Project.

If either party breaches this engagement, the nondefaulting party may terminate this engagement after giving seven (7) days' notice to remedy the breach. On termination by the Consultant under this paragraph, the Client shall forthwith pay to the Consultant its Charges for the Services performed to the date of termination, including all fees and charges for this Project.

Environmental
The Consultant's field investigation, laboratory testing and engineering recommendations will not address or evaluate pollution of soil or pollution of groundwater. The Consultant will cooperate with the Client's environmental consultant during the fieldwork phase of the investigation.

Professional Responsibility
In performing the Services, the Consultant will provide and exercise the standard of care, skill and diligence required by customarily accepted professional practices and procedures normally provided in the performance of the Services contemplated in this engagement at the time when and the location in which the Services were performed.

Limitation of Liability
The Consultant shall not be responsible for:

(a) the failure of a contractor, retained by the Client, to perform the work required in the Project in accordance with the applicable contract documents;
(b) the design of or defects in equipment supplied or provided by the Client for incorporation into the Project;
(c) any cross-contamination resulting from subsurface investigations;
(d) any damage to subsurface structures and utilities that were identified and located by the Client;
(e) any Project decisions made by the Client if the decisions were made without the advice of the Consultant or contrary to or inconsistent with the Consultant's advice;
(f) any consequential loss, injury, or damages suffered by the Client, including but not limited to loss of use, earnings and business interruption;
(g) the unauthorized distribution of any confidential document or report prepared by or on behalf of the Consultant for the exclusive use of the Client.

The total amount of all claims the Client may have against the Consultant under this engagement—including but not limited to claims for negligence, negligent misrepresentation and breach of contract—shall be strictly limited to the amount of any professional liability insurance the Consultant may have available at the time such claims are made.

No claim may be brought against the Consultant in contract or in tort more than two (2) years after the Services were completed or terminated under this engagement.

Documents
All of the documents prepared by the Consultants or on behalf of the Consultant in connection with the Project are instruments of service for the execution of the Project. The Consultant retains the property and copyright in these documents, whether the Project is executed or not. These documents may not be used on any other project without the prior written agreement of the Consultant.

Field Services
Where applicable, field services recommended for the Project are the minimum necessary, in the sole discretion of the Consultant, to observe whether or not the work of a contractor retained by the Client is being carried out in general conformity with the intent of the Services. Any reduction from the level of services recommended will result in the Consultant providing qualified certifications for the work.

Dispute Resolution
If requested in writing by either the Client or the Consultant, the Client and the Consultant shall attempt to resolve any dispute between them arising out of or in connection with this Agreement by entering into structured, nonbinding negotiations with the assistance of a mediator on a without prejudice basis. The mediator shall be appointed by agreement of the parties. If a dispute cannot be settled within a period of thirty (30) calendar days with the mediator, the dispute shall be referred to and finally resolved by arbitration under the rules of (insert name of arbitration center) or by an arbitrator appointed by agreement of the parties or by reference to a Judge of the Court.

NOTE: The information presented is for professional liability risk management guidance. It is not legal advice nor should it be construed to be a determination on issues of coverage for specific claims. Contract language establishes legal duties and rights and should be reviewed by competent local legal counsel.

TABLE 2-4: SAMPLE WAIVER SUITABLE FOR DRAWINGS/REPORTS

This report was prepared by _____

for the account of _____

The material in it reflects best judgment in light of the information available to it at the time of preparation. Any use that a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

_____ accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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TABLE 2-5: THE TEN COMMANDMENTS OF GOOD PRACTICE

1. **Sell your firm and your services fairly.**
   - Corporate brochure: THE DANGERS OF SUPERLATIVES
   - Impressive CVs: CAUTION
   - Upbeat feasibility study: REALISTIC EXPECTATIONS
2. **Educate your client.**
   - About time and cost ESTIMATES
   - About your services as a CONSULTANT versus as a CONTRACTOR
   - You are NOT a GUARANTOR of the work
   - Certification without proper field services: DANGER
3. **Insist on an equitable written contract.**
   - Oral contracts: ENFORCEABILITY: reliance on memory?
   - Advantages of standard documents CCAC#6 and ACEC#31
   - If you deviate, seek legal advice
   - Cut-and-paste contracts: DISASTER
   - Deal in depth with the issue of FIELD SERVICES
   - Dealing with uninsurable risks
   - Hold harmless clauses: may VOID coverage
   - Contract review service
4. **Do not play lawyer when:**
   - Client hires a lawyer for contract
   - In doubt about bylaws and regulations
   - Writing special legal clauses
   - Writing insurance and indemnity specifications
5. **Have a specific project plan.**
   Develop and enforce:
   - Early identification of human resources
   - All team members to FULLY understand job mandate
   - Interdisciplinary coordination: one individual/senior
   - Design and calculation checks
   - Field services: when and by whom
6. **Keep your client informed.**
   - CLIENT makes DECISIONS
   - Based on your advice, you are the CONSULTANT
   - Informed clients = no claims
   - Check risks re:
     - Low bidder
     - Extras
     - Delays
     - Changes or substitutions
7. **Deal promptly with problems.**

- Sweeping under the rug: invitation to disaster
- Keep client informed: work **WITH** client
- DO NOT allow contractor to accumulate differences for later
- Again, CLIENT makes DECISIONS
- Persistent problems: Inform your INSURER

8. **Maintain written records.**
   - Changes or contract or mandate
   - Design changes
   - Changes in scheduling
   - Substitution of materials
   - Job site meetings
   - Communications with contractors
   - Communications with manufacturers
   - Manufacturers' and suppliers' written material
   - After an incident or accident, state objective facts only—no opinions
   - Preserve written records
9. **Do not certify that which you have not seen.**
   - Discuss at the outset certification required.
   - Field services mandate commensurate with required certification
10. **Think before suing for fees.**
    - Billing practices
    - Self-analysis: Why is client not paying?
    - Suing for fees—inevitable results: countersuit for malpractice

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AN OUTLINE FORMAT FOR ACCIDENT INVESTIGATION REPORTS

By Paul C. Box, P.E., President, Paul C. Box and Associates Inc.

INTRODUCTION

A prospective expert witness who has been retained to investigate and report on an accident reconstruction or alleged defect case must at some point transmit the findings and opinions to the client. Where discovery depositions are taken (in nearly all states), certain basic items are customarily required:

- Understanding of the accident
- Identification of material received
- Summary of work performed
- Findings
- Conclusions and opinions
- Qualifications of the expert
- Copies of references cited

While some attorneys object to expert reports, such a report contains the information that the expert is required to divulge anyway, whether by deposition or in court testimony. Reports also may be prepared for an attorney who has requested investigation to determine whether an agency is at fault in a particular accident and, where no fault is found, as a protection against any possible malpractice charge. Insurance companies may request reports to assess liability in preparation for either settlement or rejection of a claim.

In developing reports, an outline format offers several advantages. It organizes and focuses the writer's materials and thoughts. It simplifies referral to the source of a particular finding (by the outline code rather than having to repeat the name of the person, agency, or document). For the reader, areas of specific interest (usually the opinions and references) are easily located. Reviewing a report prior to taking a deposition can greatly expedite the process for all parties. In one case, this author appeared for a deposition and handed a copy of his report to the opposing attorney (which his client had failed to do). The attorney scanned the report, identified it as covering all the material he had intended to ask about and terminated the deposition without a single formal question being asked. In numerous other cases, reports have led to early settlements or greatly reduced deposition time.

FORMAT

Some experts prefer to start a report with a brief introduction identifying why and by whom the expert was retained, the area of general expertise and the scope of subject to be addressed (accident analysis or reconstruction, alleged defect evaluation, etc). Material typically contained in body of the outline type report is reviewed in the following sections.

Accident Details

Data in this section are typically drawn from the police accident report, if a vehicular type

accident. In a slip or trip-and-fall case, the data may come from ambulance reports, witness statements, or a summary of alleged facts from the plaintiff. Whatever the source, this section contains basic information relative to location, date, time, weather conditions (if appropriate), names of principal parties, their activity (driver, pedestrian, etc.) and a simplified statement as to the occurrence. A list of witness names, ages and sex may be given. For vehicular accidents, basic vehicle identification and other information on vehicle occupant age, sex, seat position and whether they were wearing seatbelts is often included.

It should be stressed that this section contains a *brief* summary and is not to be confused with findings, where data such as vehicle damage, skid marks, highway or sign information, etc. are more appropriately included for vehicular accidents.

Material Received
The foremost item is the police accident report or general statement of alleged facts. This is followed by a numerical listing identifying other material such as photographs, statements, depositions, construction plans, specifications, etc. For depositions or statements, a series of subsections (a, b, c, etc.) are used. Where more than 26 depositions are reviewed, succeeding ones carry aa, bb, etc. identification.

As discovery continues, additional material is entered into updated versions of the report by the expert.

Work Performed
The first item under this category is the expert's review of the materials, as received. The next item is typically the date of site inspection with subheadings listing work performed at the site, such as observations, surveys and photos. Other items include a review of pertinent references, calculations, preparation of any drawings and, finally, drafting the subject report.

The outline format calls for basic investigation and analysis activities to be identified but does not include office functions such as transmittal letters, telephone calls, or bookkeeping.

Findings
The findings should flow in a logical fashion from the materials received and the work performed. Except in the simplest cases, findings should be separated from any conclusions or opinions of the expert. The findings should be factual, to the degree that the expert can identify them. When findings are based upon statements or allegations, they should be clearly identified as such. The major findings should have a reference to sections B or C, identifying by specific number the source of the information. Each finding should be stated as tersely as possible and should generally contain a separate thought from each of the other findings.

Conclusions and Opinions
Again, these should flow logically from materials covered under the previous four sections of the report and most directly from findings. These conclusions and opinions should be tersely stated and referenced as appropriate to either findings or references. Some opinions by their very nature may come from experience of the witness. This is where qualification is important.

It should go without saying (although too often this is not the case), that the expert's opinion should be based on both adequate and thorough investigation of the case plus an appropriate professional and technical background in the subject area.

Qualifications of the Expert
A brief summary of pertinent elements of the expert's experience in the subject area is appropriate, in addition to the resume, which is included as one of the references. The resume should list:

- Education
- Professional affiliation
- General experience
- Technical committee activities
- Publications
- Lecturing and educational work
- Awards

References
The references are generally listed numerically in the order that they first appear in the findings and conclusions/opinions. Of *critical* importance is attachment of the references (identified as G-l, G-2, etc.) as appropriate. The minimum material for each reference is the cover sheet or page identifying the publication and date, plus each page on which a specific item of information is being utilized. Bracketing or underlining the specific sentences or paragraphs is helpful to quickly find the citation.

SUMMARY
Sections B to E and G are open-ended. As material is added, the report date should be changed and earlier editions discarded.

Accident investigation reports (sometimes identified as Accident Analysis or Accident Summary) utilizing the outline format have been well received by both attorneys and insurance companies. Objections to reports on the grounds that they open up the expert to possible impeachment, or that they reveal information that opposing council should be required to "drag" from the expert, are arguably without merit. In fact, reports should reduce the likelihood of this occurring.

Rule 26 (B) of the Federal Civil Judicial Procedure and Rules, 1994, on Disclosure of Expert Testimony, states:

> "Except as otherwise stipulated or directed by the court, this disclosure shall, with respect to a witness who is retained or specifically employed to provide expert testimony in the case or whose duties as an employee of the party regularly involve giving expert testimony, be accompanied by a written report prepared and signed by the witness. The report shall contain a complete statement of all opinions to be expressed and the basis and reasons therefor, the data or other information considered by the witness in forming the opinions, any exhibits to be used as a summary of or support for the opinions; the qualifications of the witness, including a list of all

> publications authored by the witness within the preceding ten years; the compensation to be paid for the study and testimony; and a listing of any other cases in which the witness has testified as an expert at trial or by deposition within the preceding four years."

The outline format includes the principal disclosure requirements of the Federal Rules (from which state Supreme Court rules may be developed), with two exceptions. The expert compensation rate usually is not identified because it may change over the years a litigation can last. Evidently, it can be added to the references, if required by the local state rules and, in any case, is revealed at deposition if asked. The total amount of compensation is unknown for an expert who presumably does not charge a lump sum for the study and testimony. To this degree, the Federal Rule language could be improved by adding "hourly or daily rates."

The four-year listing of prior deposition or trial testimony is an excellent addition and can be readily added to references. This offers the potential for discrediting and impeaching those "experts" whose testimony is inconsistent from case to case or client-specific rather than honest and factual.

PURSUING UNETHICAL PRACTICE

By James L. Pline, P.E., PTOE, President, Pline Engineering Inc.

INTRODUCTION

Most of us at one time or another has had concerns about another expert's testimony in a case or his or her professional practice of engineering. The thought of unethical practice allegations against that individual has been a consideration. The allegation of unethical practice is a very serious charge that can impact a person's earnings and result in counter-allegations against you as an individual. Therefore, you should not take the consideration of unethical practice lightly. Do not inappropriately discuss a person's discrepancies unless you are willing to formally support and publicly take a stand against that person's practice. If you have thoughts of alleging unethical practice, the following information and documentation should be considered before you proceed.

This section primarily relates to professional engineering practice and testimony as an expert witness in the courts. However, portions of the discussion can be modified to relate to other experts although they may not be licensed by a state board to practice engineering. A review is provided of what may be considered as unethical practice, but the decisions relative to professional discrepancies, errors, or omissions rest with the judgment of the courts, professional organizations, or state professional engineer license boards. Allegations relative to competency or professional practice can be pursued through several different venues. The appropriateness of a court challenge, professional organization actions and state professional licensing boards are addressed. If a decision is made to pursue the allegations of unethical practice against an individual, some suggestions are provided relative to documentation, professional review and responsibilities. The most important considerations relative to allegation of unethical practice is to ensure you have sound support of your allegations and maintain some confidentiality of your actions.

WHAT IS UNETHICAL

As a licensed professional engineer, you have the obligation to protect the health, safety and welfare of the public. This includes practicing engineering to the standard of care, skill and diligence as others in that profession would ordinarily exercise under like circumstances. Most engineering licensing boards and professional engineering organizations have also incorporated canons of ethics into their laws, rules and standards of practice. These canons address competency, public statements, conflict of interest, work solicitation and improper conduct. You would be unethical as a member of the organization or as a licensed professional engineer to take actions, fail to act, commit fraud, practice deceit, perform negligently, be incompetent, or violate the rules of the organization or state licensing board.

It is not the intent of this section to describe unethical practice because that is a judgment to be made by your fellow professionals, the courts, professional organizations and/or state licensing boards. As a professional engineer and a member of ITE, you are expected to understand the ethical practice of the engineering profession. You must decide as an

individual relative to your practice if you have performed in an ethical manner and also be prepared to defend that position if called to account for your actions.

As a professional engineer you also have the obligation to communicate the discovery of a discrepancy, error, or omission in another professional's activities. The usual procedure would be for a person to inform the registrant of their discrepancy, error, or omission and request their response to your concern relative to professional practice. If the response is not received from the registrant or is not satisfactory, you have an obligation to notify the professional organization or licensing board relative to that individual's professional practice.

COURT CHALLENGE

In the expert witness field, you have an opportunity working with your attorney in the legal proceedings to challenge another expert's statements and professional competency. That challenge can be through cross-examination of the individual's qualifications or the cross-examination of the person's statements and opinions. Your concern about another professional's ethical practice should be thoroughly discussed and reviewed with your legal counsel. Recognize that your allegation of unethical practice or lack of competency is a serious charge against another professional and should not be taken lightly. Additionally, if you are pursuing a court challenge against a person, you must have the concurrence and full cooperation of legal counsel to pursue those actions in court.

Experience indicates that the court very seldom declares that a named expert is unqualified to express his expertise in legal proceedings. The court usually indicates that the person will be allowed to testify and the credibility of the expert's opinion goes to the weight of the testimony and that the opposing attorney(s) have the opportunity for cross-examination. Therefore, it is not always productive to challenge an expert's competency as an expert. However, it is important for legal counsel to cross-examine the expert sufficiently to provide the court adequate background and experience to support some court or jury judgment of competency and to also establish a court record of those qualifications. You as an expert can assist the attorney in developing questions that facilitate discovery of those limited qualifications.

The other avenue of pursuit in the courtroom is to cross-examine the individual's testimony and opinions as an expert. The basis for expert testimony can be questioned in detail as well as the rationale for that opinion. This cross-examination can convince the court that the expert has limited qualifications, his/her opinions do not agree with the standard of care of the profession, or that the expert is totally off-base relative to his/her testimony. Again, the cross-examination needs the cooperation of legal counsel, but you can be of assistance in providing appropriate questions for the cross-examination. It is important to create a court record of the expert's testimony and cross-examination because it provides documentation that you may want to use later to pursue subsequent unethical practice allegations. For the specific case under trial, the cross-examination should improve your credibility as an expert on the subject and aid in an appropriate court judgment in the case. You also have the personal satisfaction of assisting in the illumination of the expert's competency in a specific field of practice. These activities are limited to the specific case under trial and do not

transfer to other potential cases. Therefore, this approach does not adequately police the profession and stop the alleged expert from similar practice in other cases.

PROFESSIONAL ORGANIZATIONS

Most professional organizations including ITE have adopted canons of ethics as a membership requirement. Accordingly, ITE as an organization can consider the censure of a member for unethical practice. It requires a hearing and decision by the International Board of Direction based on a formal complaint. However, the only action that ITE can take as an organization is to either publicly censure the member or revoke his or her membership. Similar actions could also be taken by other organizations where the person holds membership if a formal complaint is filed with that organization. Neither of these actions may have much influence on the unethical practice of an individual because it has only limited impact on his/her expert witness activities. The public censure could be detrimental court evidence relative to qualifications if it was known and available.

PROFESSIONAL LICENSING

The state boards of professional engineering licensing are the normal professional practice policing agencies. It is a regular activity of these licensing boards to consider and rule on allegations of unethical practice. Additionally, the licensing boards consider the practice relative to professional engineer licenses they issue and, accordingly, can impact an individual's future practice of engineering. Also, an allegation of unethical practice would involve the same documentation and consideration as the proceeding avenues of actions with the opportunity for a more lasting decision. The licensing board can deny a license and temporarily suspend or revoke an existing license. Therefore, if you are serious about charging a person with unethical practice, the appropriate state professional engineering licensing board may be the proper venue.

DOCUMENTATION

You have the obligation as a professional engineer to communicate your discovery of a discrepancy in a fellow professional's practice. It is important that this responsibility be taken seriously because unethical practice reflects badly on the engineering profession, expert witnesses as a group and ITE and creates a confrontation between you and another person. The members of the Expert Witness Council are in a position to observe the practice of other engineering experts in the transportation field and should take an active interest in challenging the inappropriate practice of engineering. However, this requires that you as an individual **must stand up, speak up and take a position against another engineer** or transportation professional. If you are not willing to take that public stand against unethical practice, you should not verbally criticize another professional during discussions of your practice.

If it is assumed that you are going to challenge another professional engineer or expert regarding his/her practice, the following steps and procedure are suggested as one appropriate approach to protect reputations and ensure proper documentation:

- Obtain the supporting documentation that substantiates your challenge of a registrant's unethical practice, including engineering reports, drawings, depositions, or court testimony.
- Prepare a summary of the discrepancy, error, or omission and address the conflict with the professional standard of care or ethical practice.
- Discuss the situation with at least two other professionals and request their confidential review of your allegations and supporting documentation. If they agree with your position, determine if they are willing to publicly support the challenge of unethical practice. If they do, proceed with your action while maintaining the confidentiality of your allegations.
- Inform the registrant in writing of your concern with his/her practice of engineering or expert witness activities and provide the registrant an opportunity to respond to your challenge. If a response is not received or you and the other review professionals are not satisfied with the response, then proceed.
- Prepare a sworn affidavit covering the allegations and supporting documentation to be signed by you and the other two professional reviewers.
- Submit the affidavit to the appropriate state professional engineering licensing board with documentation and request an investigation of unethical practice. If the individual is not a licensed professional, the alternative action would be to submit the affidavit to the professional organization where the person holds membership.
- Participate in the hearing by the state licensing board or professional organization and be prepared to address your allegations of unethical practice and supporting documentation. It would also be desirable for the review professionals to attend and participate in any scheduled hearings.
- Maintain confidentiality of your allegations throughout the preparation of the charges, hearing and decisions relative to the individual's practice.
- Rely on the state professional engineering licensing board or professional organization to make a proper independent decision and provide appropriate public notification of that decision.

SUMMARY

Allegation of unethical behavior as a professional engineer is a serious action and should not be treated lightly. However, if you are aware of such engineering practice or behavior, you have an obligation to communicate those individual discrepancies to the appropriate organization or licensing board. The compliance with suggested procedures not only ensures that you are making the right decision but also provides other professional support, creates the proper documentation and provides better assurance of an appropriate decision.

The court challenge of a person's expertise is frequently used relative to specific cases. Organizational member censure is seldom considered and usually no action is taken against individual members. Charges against an expert's professional engineering practice are unheard of. The main problem with allegations of unethical practice is that no one is willing to gather appropriate documentation, file a formal complaint and publicly testify to their allegations. All of us have heard the war stories and have even told some of our own about the incompetence of other experts. The outlined procedures may encourage some members to review situations in the future where unethical practice may be a consideration, recognizing

that the suggestions provide a measure of individual protection against counter-claims. More important, we should **stand up and speak up** about unethical practice or stop grousing about these activities.

HOW LAWYERS SABOTAGE THEIR OWN EXPERTS (AND VICE VERSA)

By Robert W. Crommelin, P.E., PTOE, President, Robert Crommelin and Associates Inc.

INTRODUCTION

In many lawsuits, an expert witness can make or break the decision of the jury or opposing counsel regarding your client's claim or theory. The job of the expert witness is to use technical expertise and personality to teach the parties about their field. As civil and traffic engineers, we must explain how roadway design, traffic controls and warnings may or may not relate to accident causation. An expert's working relationship with the attorney/client is exceedingly important in succeeding in that role.

Here is a listing of what to watch for in consulting, how an expert can avoid being sabotaged by a client in the process of a lawsuit and how to avoid being the wrong expert who can sabotage the lawyer.

THE LAWYER'S SABOTAGE OF AN EXPERT

Critical issue/problem (for attorney to understand)	**Expert's need/ reasons why**
1. TIMING (perhaps the most critical)	
Late retention ("Bob, I've got to name experts tomorrow.")	No time to even know if you can help the theory of liability.
Late discovery or production of documents	Inadequate time to finalize opinion for declaration, deposition, or trial. May have wrong, inadequate, or outdated production from the other side.
Late calendar setting for meetings, site visits, depositions, etc.	Good experts have full calendars, too. Hard to be in two places at the same time. Give your expert plenty of notice.
Taking so much of the expert's time in discussing case theory that he/she doesn't have time to prepare.	Must be more familiar with the data relating to their field than all other parties to the trial. It takes time so can't always be available for general discussions. Let the expert work.
2. COMMUNICATIONS	
Not identifying issues, your theories of case, scope of work and other experts involved in the case.	Also at trial. Expert witness needs to know: What is legal theory of liability? Can he/she support that theory with his/her expertise?
Is testimony needed within expert's area of expertise?	Should be answered at first contact. If not, ask expert for referral.

Is there a possible conflict of interest on the expert's part?	Relationship with other parties to the lawsuit; prior to retention or at first contact.
You have knowledge of potential impeachment of the expert but …	… Has other side indicated a problem that could be embarrassing (at best)?
Limiting the expert's information only to facts that support your theory of the case.	Tell the good and the bad so that can be taken into account in analyzing the file. Especially want to know if a driver was impaired.
Demand a written report that is discoverable and may have later changes in opinion.	As discovery goes on, an opinion can change. Give the expert a little slack and rely on periodic verbal reports.
Lawyer hates the client, the case, opposing counsel, the judge and the jury and tells all to the expert.	Experts need a positive attitude about the case and the theories to be effective; must believe in their opinion to be believable to the jury. Don't intrude your problems.
3. PREPARATION/DISCOVERY LET DOWN	
Limit time/cost of experts' work so severely that proper work can't be accomplished.	Experts are expensive but often critical. Keep client informed of what you need to do to come to a final opinion.
Lack of adequate experts from other fields, as part of a team.	Traffic engineers work with accident reconstructionists, human factors psychologists, biomechanical specialists, bicycle/motorcycle experts, construction engineers and street lighting/signal engineers (usually only the defense will pay to get us all together at one time). Each contributes to success of the progress of the analysis.
Send copies of numerous depositions of lay and expert witnesses two days before the expert's deposition is scheduled.	The expert can get tripped up by not fully understanding the case and what witnesses have said.
Take depositions of lay or expert witnesses without finding out what your expert needs to know.	Have pre-input to depositions so important facts you need can be developed. Particularly need to discuss what client may say as it affects theory.
Doesn't send summaries of data or depositions to experts to lessen their preparation time and then complains about the size of billing.	If chargeable hours are reduced, the amount of the bill is reduced. Often the client's summaries are helpful.

4. TRIAL SHORTCOMINGS	
You don't tell your expert what opposing counsel said about his/her testimony in opening statement.	Advance knowledge and discussion of what the other side will ask on cross-examination is a great help to the expert's appropriate answer to a tough question.
You don't tell your expert what the other side's expert testimony was in deposition or trial.	In every case some research is needed to support theories and rebut opposing expert. Takes time.
Younger associate does discovery and has all contact with expert, then the trial lawyer appears at court to take direct testimony.	Lawyer and expert must have rapport—actually spend enough time together so expert knows what the questions and the answers are. Need synergy between both parties.
Attorney doesn't ask the critical question to allow the expert to give an opinion on an important issue.	Often a follow-through question will give a good opportunity to make a point. If not asked, expert can't answer.
Too many or not enough objections that delay or bypass the issue.	The expert can have a great answer to opposing counsel's question, which helps our case, but an upheld objection from the client prevents the expert from answering. (Get to know your expert sufficiently to trust his/her judgment.)
The judge forgets that experts can rely on hearsay and you don't remind him/her when the other side objects.	We miss a good opportunity to get good testimony in what may not be possible by other non-expert witnesses.
Not giving your expert your theory of the grand scheme of the trial from the viewpoint of both plaintiffs and defendants.	Understanding—helps the answers. Must know what needs to be proven.
In initial call from attorney, expert fails to confirm that the issue is in their field and that there is no conflict.	Ensure you have the right expert for the right case. Talk to other lawyers who have had a similar case. Who did they use with success? Who has the proper experience and expertise?
Doesn't tell the attorney what discovery or exhibits are necessary to arrive at opinion or to testify in trial.	Help on interrogatory questions or motions to produce. (Most experts can help draft discovery.) Graphics are essential.
Front loads the investigation costs with field data collection, surveying and research, running up the costs.	Understand the expert's approach to his/her work and help set priorities and costs. Get prior approval of expensive work such as out-of-town site visits.

Goes beyond own area of expertise.	Frequently a problem leading to overlapping and differing opinions on the same side of the case.
Doesn't educate client/judge/jury regarding your field and how it relates to the subject case.	If it can't be explained clearly to those who need to know, it is a waste of time and money (and perhaps the verdict).
So defensive or biased in testimony that they won't answer a simple question.	Attorney must explain what will hurt the case and what will not. Tell expert to give up on the simple logical answers and hang tough on the important ones.
Loses cool on the stand and lacks professional look and manner.	You have the wrong expert.
Not flexible with regard to schedule of testimony.	Give as much notice as possible. Adjust dates if possible.
Uses out-of-date references and support for opinion.	All professional fields change continually. Experts must be up to date but also can use older standards in effect at the time of construction or accident.
Doesn't have a general understanding of what must be proven so he/she can aim testimony to help prove that.	Need to educate expert on your jurisdiction's procedures and law in general concepts.
Doesn't bill frequently so client knows costs (unless prior arrangements are made).	Must have an idea of where budget is on case.
Fails to advise client of current findings and opinions.	Want to know the good and the bad about your case.
Afraid to say "Settle it."	Enough said.

CLOSURE

Timing, communication and educational skills are as important for the expert as they are for the lawyer. Most of us who become involved in a case as an expert want to believe in the theory of the case and to be able to support it from a technical basis. Then we can be an important part of the team, which will lead to a proper verdict.

Hiring the right expert early in the case (pre-complaint) to evaluate whether there is "something to talk about" is an important case-management tool. The earlier, the better. Just a copy of the accident report, photos and a described drive-through video can really help the expert make a preliminary evaluation of whether he/she can support the attorney's case.

USE/MISUSE OF ROADWAY STANDARDS IN LITIGATION

By Richard F. Ryan, P.E., President, R. F. Ryan & Associates

INTRODUCTION

A lawsuit is not necessarily a search for truth but rather an adversarial argument between two (or more) lawyers to a trier of fact (usually a jury), using admissible evidence and according to the laws as they are applied to a specific courtroom.

There are two basic forms of tort liability to be addressed by professionals in civil litigation: duty and negligence.

- **Duty issues:** A specific law, regulation, or other legally recognized standard of care says you are supposed to do something, and it is alleged that you did not do so.
- **Negligence issues:** While there is no statute or regulation that says you have to do something, common sense, a job description, or some level of "professional conduct" indicates you have some responsibility, and it is alleged that you did not adequately or reasonably comply with all or some part of your duty.

DUTY

Congress, the state legislature, the board of supervisors or any other law-creating body directs a government agency do something; it does so by passing a law that says an agency "shall" do something, thus beginning a situation where the public entity, for instance, the agency, may have to inspect a bridge, design a road, plow snow, or be responsible for the "safe" passage of vehicles driven by reasonable drivers. When the law creates the responsibility to do something, it may also create a duty to do the job. In other words, a duty is something you have to do. Sometimes the law will tell you exactly what you have to do. Often, the "what" is left to the experienced professional engineer. A good example is designing a road. The law does not say you have to use 12-foot lanes; that decision is left to the designer using sound engineering judgment and the application of engineering standards.

A legislative body could create a responsibility but specifically exclude the duty. A state is given authority to plow snow, but it may not have a duty to plow snow. Thus the state may decide there is so little traffic on a particular highway that the state simply closes the highway in the winter.

Each state in the United States has a series of legal responsibilities, or duties. The failure to properly or completely fulfill one of these responsibilities may be grounds for a lawsuit.

Finally, there is the difference between a public entity professional engineer and a private professional engineer. Licensing laws and regulations can and do impose a level of duty on private engineers as well as some public entity engineers (some public entities have exempted themselves from licensing requirements). The duty concepts apply to both. The

private engineer's actions have to stand on their own, often without the immunities that may be available to the public entity.

NEGLIGENCE

Negligence is the act of doing something that a reasonable person would not do or not doing something a reasonable person would do. An example is that a law may give an agency the authority to erect a sign, but it does not say how often or how large or even what specific sign should be placed. Professional staff must decide if a sign should be installed, what the message will be, how large and what color the sign shall be, where signs are to be placed and how many signs are to be erected. Once the sign is erected, the duty to do so has been completed with respect to its existence. However, it may be open to discussion as to whether the engineer acted "reasonably" in the manner in which the sign was designed, located, or installed. Did the engineer perform his/her duty reasonable or unreasonably? If he/she failed to do so reasonably, he/she may be negligent.

It is very common to be required to produce job descriptions, agency policies and other written descriptions of work efforts if they exist.

There is rarely only one solution. A balance of needs versus available resources occurs every day. If you properly present the facts in a clear, concise and reasonable manner, juries will come to realize that public entities do their best with the resources available and will return appropriate verdicts most of the time.

ENGINEERING STANDARDS: ENGINEER'S PERSPECTIVE—GENERAL

The term "engineering standards" has two meanings: one used by engineering professionals and another used by lawyers. Many engineering manuals have introductions that state they do not establish a "legal standard." This is the direct result of the difference in how the term is used.

A good example of policy-type guidance on a national level is the various American Association of State Highway and Transportation Officials (AASHTO) guidelines. For any state to receive federal highway construction funds, the guidelines used to develop a project by the approving agency must be in substantial conformance with the various AASHTO guidelines adopted by the Federal Highway Administration (FHWA). Some states have resolved the question of substantial conformance by simply adopting the AASHTO guidelines directly; others adopt a modification of the AASHTO guidelines but still meet acceptable minimum requirements of the federal government to permit their use on federal aid projects. The various guidelines determine where an engineer begins when thinking about the geometric (and other) criteria that will be used.

There is no rule, regulation, or law that says the design of a new road must meet various AASHTO criteria, only that the guidelines provide a basis for an engineering analysis. Conflicting geometric, environmental, funding and other factors can and often do prevent the design from meeting minimum design criteria. An engineer in this position should document why the criteria cannot be met, what comprises the alternatives being considered and the benefits and risks of a less-than-guidelines alternative, and he/she should develop a

recommendation on what should be done. Depending on the issue and the level of exception, there should be an approval process of some kind. This may range from the person's supervisor to direct approval by FHWA to adoption by a legislative body (a city council, for example). This process is often called the "design exception process."

ENGINEERING STANDARDS: ENGINEER'S PERSPECTIVE—LITIGATION

In a roadway related lawsuit, engineers can be required to defend themselves concerning the decisions they rendered during the performance of their responsibilities. Engineering standards or guidelines may be used in a lawsuit to define what a "reasonable" engineer could have done. Manuals utilized by an organization, such as the *Manual on Uniform Traffic Control Devices* (MUTCD) or a state's traffic manual, are often identified in depositions, and engineering staff are asked if they are familiar with the documents. If the engineer says no, the question that follows is often "Why not?" If the testifying engineer says yes, the next question often is "Why did you violate the standards or guidelines?"

Engineering standards may be contained in standard plans. Standard plans eliminate the need to repeatedly develop a detailed plan sheet to solve a common design problem with enough clarity to actually build the item. A further use of standard plans is for details that are included within a design; something that needs part of the details from a standard plan in order to be buildable. The engineer will often refer to the item on the page and intend that only a portion of the standard detail be used.

As a source of potential lawsuits, standard plan sheets can have serious consequences. Any deviation from these sheets can become the focal point of a lawsuit. While a drainage grate will likely be an exact match for such a detail, the location of an advance warning sign may not. It is perfectly reasonable for an engineer who is placing a sign and consequently facing the detail that calls for a certain spacing distance to check the physical locations and see if they make sense. When the engineer is faced with a scenario that does not conform to the usual expectations, the solution may seem simple at the time: Move the sign. However, this creates a discrepancy from the pre-approved plan sheet and can become the focus of a lawsuit.

A second concern about standard plan sheets occasionally arises when the design differs from the standard design. Manually-created plans control over standard plans, and it is perfectly reasonable to modify a standard plan. However, in a lawsuit, the deviation from a standard plan raises an issue. The question will be: "Was this modification a conscious design decision by a competent person or the result of an ignorant oversight?"

Occasionally issues arise over the misuse of a standard plan sheet through ignorance on the part of a professional who may not be aware of the origin, purpose, or thought that was put into a particular plan sheet. In a lawsuit the designer may need to demonstrate consideration of all the issues in the original design.

Finally, there have been numerous instances in which an otherwise reasonable engineer stumbles when he/she is asked to explain exactly what an engineering standard means. The most common answer to the definition of an engineering standard seems to be "it is part of

the manual" but in a court of law it is not. A simple example is the stopping sight distance criteria used to check a vertical curve. What is the explanation of the engineering assumptions behind the AASHTO sight distance table? A design engineer who uses such a table has an obligation to know what the table means, what its limitations are and what assumptions went into creating the table in order to decide whether or not the use of the table is appropriate. You can probably use such an AASHTO table until a lawsuit develops. Be aware of the assumption for all tables, charts and details; do not just adopt them for the design.

ENGINEERING STANDARDS: ENGINEER'S VIEW OF THE LAWYER'S PERSPECTIVE

Most states have some kind of professional responsibility statutes or regulations that surround the concepts of negligence. In layman's terms, negligence arises when the work does not conform to the custom and practice of the profession. Simply put, the lawyer is looking for a yardstick to measure this minimum level of professional responsibility, and the various engineering manuals are a convenient tool with which to prove negligence or a breach of engineering responsibility.

Opposing lawyers attempt to use guidelines as documents that are to be taken literally (i.e., must be implemented without further thought or judgment). They try to create a scenario in which the developer of a manual is somehow remiss if the manual does not cover every conceivable alternative and give detailed explanations for all allowable exceptions by attempting to treat a particular manual as a treatise on a subject; that is, making it into the absolute last word in a given area where any deviation is considered to have created an "unsafe condition." This attempt to convert general guidelines into a combination of textbook and authoritative treatise on a subject elevates guidelines to a status they were never intended to define.

Well-written guidelines include flexibility for the reasonable professional to utilize engineering judgment. A very common example of this is the use of the term "safe." An opposing attorney may take this term in a manual, when associated with policy guidance, and ask a jury to assume that any deviation from how his expert professional defines the intent of the policy direction to mean an "unsafe condition" was created.

Because no manual can describe every situation that exists on our roads today, engineers have to use their best judgment. However, the people who ultimately decide whose interpretation of the situation is correct are not fellow professionals but the jury, which rarely contains even one professional engineer. The words of most manuals are flexible enough that they alone do not shield the public entity or the engineer that made the decision from lawsuits.

Most guidelines originally came about as result of a group of well-intentioned engineers who came together to share their experiences on what worked and what did not. From this collective and with perhaps what would be by today's standards a very elementary level of research, a guideline was written. Today's guidelines are often backed by significant (and

expensive) research. A good attorney (both plaintiff and defense) will use this research to try to "prove" his/her case. Both often try to make more of the research than the data support.

Professional engineers must be familiar with both the language and the limits of guidelines. It is imperative that an engineer not just use the conclusions; he/she must look at and evaluate the data in any given research before incorporating it into a design. Waiting until a lawsuit occurs can lead to some embarrassing as well as expensive lessons.

The ability to articulate the reasoning behind the decision to use or not use a particular guideline is often the key to successfully defending against the assertions of a lawsuit. Decisions made today may make sense when all facts are still fresh. Tomorrow (or years later) the facts are less clear, which may result in the loss of a case due to the unavailability of documentation to support the decision.

DESIGN TERMS: ENGINEER'S VIEW OF THE LAWYER'S APPROACH

During trial testimony, engineering terms and concepts often are not used in the manner they were originally intended. The use of design capacity or design volumes in a given project is an example. The courts tend to apply a more general and common interpretation to all words. This difference can often result in courts making decisions based on inappropriate definitions. Another word often misused is "warranted." For many professionals this term is used to indicate no more than the presence of an engineering guideline to consider doing something further. To a court, the term "warranted" can be and is construed to mean an absolute requirement. Some words will be defined differently in litigation. The professional must take the lead in using these words and must be prepared to address what they mean every time they are used.

CASE ILLUSTRATIONS

Examples of how various standards and guidelines were used in particular situations are an excellent way of illustrating some dos and don'ts concerning engineering standards. The scenarios presented here evolved from specific lawsuits or potential cases. The details have been altered to preclude the identity of the specific case.

Illustration 1: How Not To Install a STOP Sign

An intersection STOP sign was hidden by oleander bushes on a 55-mile-per-hour (mph) rural highway. As the driver was passing a small community he was directed onto a detour in a construction zone. The detour took him from a well-marked, two-lane roadway with 12-foot lanes and 8-foot shoulders onto a poorly-marked, two-lane road with 11-foot lanes and no shoulders.

The driver missed a "Stop Ahead" sign that was clearly posted because of the bright headlights of a passing car. The intersection where the accident was about to happen was located approximately 500 feet beyond the Stop Ahead sign. The intersection had a single street light overhead but a dispute concerning whether it was illuminated. The accident happened late at night with little cross-traffic at the intersection.

The neighboring farmer had planted a thick grove of oleanders on his property line, which, over time, had grown into the county right of way such that they obscured the STOP sign.

The route had been used by local residents with minimal accidents because they were so familiar with the route that they would stop where the roads intersected, even though the sign was obscured. Hundreds of vehicles were detoured each evening, and in the 8 months preceding the subject accident there were about 10 accidents similar to the subject accident.

The responsible engineer in the construction area was faulted for not evaluating the detour route before traffic was diverted to it. While the county attorney and the plaintiff's expert both used MUTCD and traffic manual guidelines to try to meet their burden of proof, the resulting injuries were attributed to the professionals failing to fulfill their responsibilities.

Illustration 2: How Not To Utilize a Protected/Permissive Signal Phase

The four-way intersection of an arterial with a collector was controlled by a traffic signal. The posted speed limit on the arterial at the time of the accident was 25 mph based on a speed survey conducted earlier when a four-way STOP sign controlled the intersection. After the accident, a speed survey showed an 85th-percentile operating speed of almost 45 mph when the signal heads were green and the traffic was free-flowing.

A driver was stopped in a left-turn pocket preparing to make a left turn while a large white van was stopped in the opposing left-turn pocket. The driver started a left turn but was struck by an approaching pick-up with resulting fatal injuries. This was the second such accident since the four-way stop was replaced by signals less than a month before. The issue was the complicated geometry.

The plaintiff expert's presentation demonstrated that the approach alignment curved to the right and downhill, resulting in about 500 feet of westbound lane being hidden behind large vehicles in the opposing westbound left-turn pocket.

The young and relatively inexperienced signal designer testified that he had not considered sight distance between the opposing directions of travel because he was installing a signal that would stop traffic. He was of the opinion that a left-turning driver should not proceed until it was safe to do so, and it was up to the driver to determine when it was safe.

The horizontal and vertical alignment resulted in a hidden area whenever an eastbound driver was attempting to look around a vehicle stopped in the opposing left-turn pocket. After the construction of the permissive left-turn signal system, there were nine similar accidents in about 6 months.

The plaintiff's expert concluded that accidents similar to the subject accident were inevitable. He referenced the MUTCD signal warrants stating that five similar accidents in 6 months, while not an automatic indicator of a problem, is an automatic concern for consideration of a change.

The engineering standards used in this case were sight distance, signal phasing information and signal warrants. The engineer failed to adequately address these engineering standards.

Illustration 3: How Not To Install a Signal Pole
A vehicle spun off the highway and hit a traffic signal pole with flashing lights and a very large sign on it in a relatively sharp horizontal curve on a rural highway. While the profile was generally flat, the road was in a relatively sharp horizontal curve. The road in question was a rural highway with an operating speed over 65 mph.

The breakaway base broke free, the pole snapped down and, given the spinning car and its time to fall, hit the driver in the head leaving her severely disabled.

The plaintiff's expert stated that the driver's injury was caused by the breakaway feature on the pole. The standard plans for this type of signal base were clear; they included a non-breakaway feature. If the base had not been breakaway it would have stopped the car, reversing her direction at worst. Instead the pole broke away and fell on the car.

The signal designer stated that he chose to use a pole-based breakaway design because he did not agree with the non-breakaway design policy. He stated the he developed his own details from a street light pole base because he could not find any plans to copy.

The plaintiff's expert was the designer of the street light pole base that was copied by the engineer. He described what went into consideration of the design, including that the particular light pole base used was for a light consisting of both a pole and a mast arm, and that it consisted of plates that were held in place by bolts that had a specific torque. The necessary torque was found through crash-testing cars of a specific weight, speed and angle of approach.

The designer stated that he was not aware of the policy to test appurtenances on the highway. He was asked if he was aware the intent of the base he used was to be eccentrically loaded so that it moved out of the way of a striking vehicle. He said no. He was asked if he could calculate the forces necessary for the base to slip. He said no. He was asked if he was aware that the torque on the base bolts was critical and needed to be developed by testing. He said no. He was asked what efforts he put into evaluating the design before placing it on the highway, and he said he had not talked anyone.

CONCLUSIONS
Use guidelines for what they are intended to be: guidelines. To do this, one needs to understand the ramifications of such design decisions. It is the supporting information to sound engineering judgment. Most agencies have guidelines they consider standard, and all can be utilized to their limits. By remembering that such guidelines have limits and by knowing what they are, you will minimize the impact in a lawsuit that may not occur for decades after the design is completed. Retain old guidelines available for use years later. Most public agencies keep historical records, but in this day of electronic information there are sometimes daily changes. If your agency has no historical reference, consider keeping the

critical information in the project documentation. It may prove useful 20 years later, even if it is to someone else defending your design.

Section 3
Support Data

FOREWORD

The purpose of this section is to give the expert direction on how to assist the retaining attorney in developing a theory of a case; how to bring together a chain of events leading to the incident in question to be able to determine what may have happened; and the underlying causes of the incident.

Information for the case at hand may come from any number of sources: the expert's own investigations, a hired investigator, public records and the retaining attorney. Much of the information may come through the discovery process or via a "sunshine" law, such as a Freedom of Information Act. Some of these data are better than others. The legal community considers facts differently than engineers. To the legal community almost any information about what happened is considered fact. To an engineer a fact is something physical, such as the length of a tire mark. This section will provide the expert with help in separating true facts from opinions or wishful thinking and guidance in developing a sense for reliable sources.

There is no one right way to collect facts for a case, although some methodologies do not stand up well under either scientific scrutiny or the current rules of evidence. In general, the expert will collect the facts as they come in what ever order they come. It is better to collect too many data rather than too few, but keep in mind that there is a balance between effort and expense to the client.

Do not underestimate the importance of a field visit. The sooner a site inspection is made to the date of the incident, the better. Spending time walking and driving through a crash scene will put the case in perspective from the viewpoints of all parties. The visit gives the expert a feeling for the lay of the land and provides an opportunity to pick up on the undocumented subtleties and details that can often aid the presentation and provide material for a knowledgeable counter-argument if you are blindsided in a deposition or court appearance.

FIELD INVESTIGATION: SITES AND INVOLVED UNITS

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INTRODUCTION

Once the transportation expert has reviewed the available reports, depositions and files and has a general understanding of the facts and issues associated with the case, the next step is to visit the site of the incident. Most collisions significant enough to be selected for detailed data collection will have undergone a basic investigation by the police. The follow-up data collection effort is intended to verify and document more fully the roadway and vehicle information in the police report and to document additional technical information that may be needed at a later date for a reconstruction or cause analysis.

If you become involved in a case soon after the crash occurs, you should inspect the site as soon as possible to record any perishable evidence and establish what the roadway conditions were. However, in many cases, this follow-up investigation will be made months or years after the date of the incident. Therefore it is very important to determine whether or not the site has changed in any way. For example, the road may have been resurfaced or widened, traffic control devices may have changed, or roadside appurtenances may have been added. It is common for pavement markings to be moved from their original locations after resurfacing. These pavement markings are often used as reference points during police investigations. While they do not change a great deal, it is common for them to deviate one or two feet from their previous locations or the locations shown on the original construction plans.

Other conditions may have been unique to the time of the crash. For example, there may have been water on the pavement because of a clogged drainage inlet, a build-up of snow, ice, or sand along the edge of the road, or vegetation that is no longer present.

PREPARATION AND EQUIPMENT

Sullivan points out that conducting a reasonably complete data collection effort requires a commitment of time and equipment. While the time required will vary with the complexity of the crash and the issues raised, an average data collection effort will require two to three person-hours for the site investigation, one hour for each vehicle examined, plus travel time.

Site data collection is generally most efficient with two people. Roadway and sight distance measurements, in particular, are much easier with two people. The second person can also serve as a lookout or flagger while the data collector is taking photographs or making observations from within the traveled lanes. A word of caution on flagging: The 2003 edition of MUTCD contains an entire chapter (Chapter 6E) devoted to the personnel, training, clothing, equipment, procedures and signing associated with the manual control of traffic. There is always some exposure to injury and liability when working along or in the

roadway. When manual control of traffic is involved, this can become a significant risk to the expert. If the required data are on a heavily traveled highway and not readily accessible, consider hiring a professional surveyor to collect the data or a special-duty police officer or temporary traffic control service to provide the necessary protection. Otherwise, the second person should serve as a lookout only. High-visibility clothing, vehicle beacons and portable warning signs are appropriate for all site visits.

If the attorney who retained the expert wishes to be present, he/she can be used as a technician to help in measuring and to watch for traffic. The attorney's presence is a good opportunity to discuss the theory of the case and for the engineer to point out conditions that may help or hinder the case. It should be encouraged whenever possible. However, it is important that all measurements be read and recorded by the engineer for acceptance as admissible evidence. It should also be determined if any persons involved in the incident should be present, such as the investigating police officer or the attorney's client. Each person present at the inspection should be noted in the investigator's field notes.

Prior to leaving for the inspection, the investigator should determine the data he/she wishes to obtain and list the equipment needed for the inspection. While the equipment needed for information-gathering and recording depends on the extent to which the crash is to be investigated, certain equipment and supplies are essential. Table 3-1 lists the major items of equipment needed by a traffic crash investigator.

Personal Protective Equipment

When assembling equipment to go to the scene, do not forget personal protective equipment for yourself. Take and wear a fluorescent yellow-green safety vest meeting the requirements of the International Society of Exposure Analysis "American National Standard for High-Visibility Safety Apparel" or equivalent revisions and labeled as ANSI 107-1999 standard performance for Class 2 or 3 risk exposure. The safety vest should be reflective if used at night.

Work gloves are desirable for vehicle inspections. Surgical gloves are recommended for inside vehicles where there have been numerous lacerations to guard against hepatitis and AIDS. Work zone signs, cones and related traffic control devices conforming to MUTCD and appropriate to the work being performed should also be taken and erected at the site. These can be rented from most work zone contractors at a nominal cost.

Measuring Equipment

The minimum equipment for measurements is a plastic or reinforced fabric tape, preferably 100 feet long. Additional equipment for measuring may include a tape measure, carpenter's rule, measuring wheel, marking material (either lumber crayon or aerosol paint), nails and surveyor's pins or the equivalent. A measuring wheel with a diameter of approximately 12 inches is versatile enough to use on both paved and grass areas and small enough to easily carry around.

It is difficult to measure, photograph and record data in the field under traffic and adverse weather conditions. The use of a mini-recorder provides an opportunity to verbally record measurements or describe photographs in a more rapid fashion. Aluminum sheet holder

clipboards with folding covers are helpful in keeping notes contained and dry under wet or windy conditions.

Sometimes it is necessary to fully document a complex scene with both vertical and horizontal points to determine sight distance constraints or to accurately show complex and/or unusual geometrics and lane arrangements. In these instances, it is often beneficial to hire the services of a professional surveyor who is familiar with collecting roadway data. The engineer will have to set the parameters of the survey. Items to be covered are:

- Area to be covered by the mapping
- Picking up all traffic control items and photographing all signs
- Recording the x, y and z coordinates for each data point
- It is usually not necessary to reference an established coordinate system
- Providing a digital file of all points and point identifying information

The mapping and base drawings can often be provided by the surveying firm, or they can be constructed by a drafting service normally used by the engineer. One strategy that works well is to have a local drafting service that works with you on a regular basis and has become familiar with court and forensic drawings. Surveys from out of town sites are performed by a local surveyor, and the data files are e-mailed to the drafting service. When this arrangement is made, make sure the two companies talk to each other prior to any field work to ensure their data files are compatible and their point identifiers are understandable.

Photographic Equipment

Photography should be an important part of the investigation. A picture is literally worth a thousand words. Photographs record details the investigator failed to note. They are the best way to describe damage to vehicles, tire marks, roadside damage, etc.

Single lens reflex cameras using 35 millimeter film are usually preferred for crash investigation purposes. Color print film is usually more suitable than color slide film or black and white film. Film cameras still provide the sharpest enlargements and produce night time photos that appear much as the scene would to the human eye. A normal focal length (50 millimeters) gives a normal perspective. Longer or shorter focal lengths tend to exaggerate distances. A polarizing filter is helpful to highlight tire marks.

Digital cameras are becoming more and more popular. They are widely used by police agencies, investigators and reconstructionists. Digital images are easy to add to reports and simply stored on computer drives, CDs and other storage media. Fixed focal length digital cameras are not common, which places the burden of keeping a normal photo perspective with the photographer. Image size, which is based on the number of pixels used to store an image, is a tradeoff between storage space and clarity of an enlarged photo. High-density images can be enlarged easily, but not many can be stored in the camera's storage media. High-density images are difficult to e-mail and consume a lot of file space when inserted into a report. Fully automatic cameras tend to distort night time scenes, making them appear brighter than they really are. Digital images are subject to manipulation with widely available photo editing software.

Video cameras can be useful for documenting linear construction work zones. Be careful not to rely solely on video and take still photos of all the important points. The still photos will be of higher quality and easier to use for detailed analysis and communication to the jury. Be careful when recording sound so that extraneous comments by you or your associates are not recorded.

Checklists/Forms

If the investigation will include a vehicle examination, the investigator may want to consider using data forms such as those for vehicle collision damage recording or tire examination recording. These commercially-available forms remind the investigator of the facts to be obtained and make recording the data easy. Reconstruction software often requires specific information. It is helpful to use forms that are part of the software package or custom-made forms based on the software input requirements.

While these forms provide for the documentation of a wide range of data, they are not all-inclusive. Additional data are needed in many cases. Sullivan notes that such information should be recorded, but care should be taken to limit information recorded on the form to facts. Other nonfactual information, observations and personal thoughts should not be recorded on the forms.

Make a list of the items to be checked and the measurements to be made during the inspection. Decide what will be done, how it will be done and the order in which it will be done. If possible, make a sketch of the area prior to visiting the site. While at the site, think through the event as you make the inspection and record data you consider relevant. When you are done, go to your checklist to see if you missed anything. Following this procedure will give you a check on your pre-site and site work.

Discuss the site visit with the retaining attorney. Going over the data requirements will help the expert identify all the pertinent items to look for. The discussion will also help give the attorney a better understanding of the effort and cost involved. Occasionally you may be asked to pick up some information to be used by another expert. In these instances, it is always wise to contact the other expert directly, to obtain mutual agreement on what information is to be obtained and in what format it will be delivered.

INSPECTING THE SITE

The objective of the scene inspection is to enable the engineer to develop a sense of how the roadway system functions and to collect data for analysis and use in preparing a report, which may include a drawing.

The inspection will allow the engineer to gain an overall feel for the site and a perspective into how well traffic flows in the area. Some specific items to look for are:

- Congestion
- Violations of driver expectancy
- Traffic control that is adequate for the prevailing conditions
- Roadside hazards

- Level of maintenance by the responsible agency
- General overall level of care and professionalism exhibited by the operating agency
- Do you feel comfortable driving the scene yourself?

If the investigator is fortunate enough to get to the site shortly after the incident, it is important to document conditions at the site before they are lost or change. Some site data are perishable and become less available or verifiable with the passage of time. The following can be used as a guide relative to the urgency of measuring:

- Temporary marks should be measured first (e.g., position of bodies; tire marks and prints; gas or water on the roadway; and debris).
- Follow with short-lived marks (e.g., skid marks; gouges and scrapes; and damage to fixed objects).
- Finally, measure permanent features (e.g., roadway features; location of traffic control devices; and sight distances).

In the real world, most experts do not visit a scene until some time after the event has occurred. They must depend upon the investigating officers to properly identify and collect the more perishable data. The quality of the data available is highly dependent upon the officer's training, skills and powers of observation in these matters.

DATA ITEMS

In most motor vehicle crashes, various marks are left on the highway as a result of the collision. It is very important that the investigator be able to recognize, interpret and document these marks. Some of the more common types of roadway marks are scratching or scarring of the pavement surface by metal parts of a vehicle. As Black notes, because metal parts of a vehicle do not normally contact the pavement, these marks indicate a severe deformation of the vehicle structure. Scarring or scratching evidence is usually associated with points of impact, post-collision movement of vehicles and vehicle placement at impact. Several types of pavement marks are associated with metal parts:

- **Chips or gouges:** These marks are deep concave cavities in the pavement surface made by a heavy metal protrusion of a vehicle, such as a bolt. They can be measured and matched with the metal part on the vehicle that made them. These marks will remain on the pavement for a substantial period of time, often until the roadway is resurfaced.
- **Grooves:** A groove is a deep rut or channel made by a heavy metal part that shows the direction of travel of the vehicle that made it. These marks can be long and curved. Grooves, like gouges, are fairly durable and will remain visible. They will tend to lose some of their distinctness on asphalt and will fill in as the asphalt surface flexes and moves over time.
- **Scrapes:** These marks, usually made by a large metal part sliding over the pavement surface, are superficial and wide. Sheet metal will often leave scrapes as a vehicle overturns. Paint will be left on the surface. These marks are relatively short lived and prone to rubbing off easily. They are easily erased by rescue and/or vehicle recovery operations. The best source of documentation is from the investigating officer's reports and scene photos.

- **Scratches:** These are narrow, superficial marks left by weak, thin metal parts. Like scrapes, these are easily obliterated by rescue and recovery operations. Scratches are sometimes made by crane outriggers; wrecker wheel blocks; utility hardware that was dropped on the pavement; clean-up and removal of vehicles and debris; or other activity not associated with the crash per se.

Highway features such as traffic control devices, bridge abutments, railings, guardrails and utility poles should be examined for scrapes, scratches and other damage. These should be matched with damaged areas of vehicles, with particular emphasis on paint scrapings and chips to determine which vehicle caused the damage and to determine vehicles paths of travel. The amount of damage can provide information relative to the speed of the vehicle. Highway features are often struck. The investigator has to be aware that the marks may not belong to the incident under investigation but have a good probability of being present at the time of the crash or occurring after the crash.

The absence of marks or other physical evidence on the roadway can also be an indication of what happened in a crash. If it is known that a vehicle followed a certain path but without leaving evidence, it possibly flipped or vaulted over the area where no evidence is present. This flip or vault distance can be used for calculating speeds.

Another situation in marks may be absent is when a braking vehicle is equipped with antilock brakes. These have become more or less standard in vehicles manufactured since the mid-1990s. In these cases, the expert may have to consider braking capability and testimony to estimate speed.

The best-known type of roadway evidence is tire marks. The investigator should be able to recognize and interpret the physical appearance of tire marks left on a roadway. Baker and Fricke indicate that there are two general classes of tire marks:

- A tire friction mark made when a slipping or sliding tire rubs the road or other surface
- An imprint made without sliding by a rolling tire

Marks left by sliding or locked tires are called skid marks. Skid marks are left by wheels locked from rotating by braking and are extremely useful for speed estimates. They are characterized by straight marks that grow darker over their length. It is important to measure the length of all skid marks. Close examination of a skid mark may reveal “shadow” marks that precede black skid marks. Shadow marks are produced before wheel lock-up occurs and before the tire is heated sufficiently to make black marks. Antilock brake activation will also leave shadow marks. The brake control system will release the wheel immediately upon lock-up. This action prevents any one area of the tire remaining in contact with the pavement long enough to heat up and leave a rubber smear on the pavement. If there is any question about what the marks are, document what you measure with photographs.

There are other kinds of tire friction marks besides locked-wheel skid marks. Yaw or sideslip marks are made by tires that are rolling while sliding sideways. Like skid marks, yaw marks

appear differently depending on the road surface material and condition. In general, they are lighter than skid marks because a rotating tire keeps bringing new tread areas in contact with the road, so it does not become as hot as a tire sliding continuously on one spot.

Because they result from steering, yaw marks are always curved. Typically there are two marks from wheels on the outside of the curve. The striations in yaw marks are quite different from those in skid marks. At their beginning, striations are nearly cross-wise of the mark, changing to oblique marks as the yaw progresses. They begin as narrow marks and gradually broaden. It is extremely important to record by measurement and photographs the location and appearance of yaw marks.

Measurement of the radius of the yaw mark is most important. To calculate the radius, the length of a chord (and its corresponding middle ordinate) close to the beginning of the yaw mark should be measured and recorded. If using an electronic data collection process, locate the ends of the yaw mark, the center and several intermediate points. This will provide the necessary information to determine the radius by either the middle ordinate method or by electronically fitting a curve to the points with the CADD software used to produce the mapping. Unfortunately, the data needed to determine the radius of the yaw marks are often overlooked by the investigating officers. Only the two ends have been located. If good scene photos exist, the middle ordinate can be estimated by photogrammetric methods. If estimating the middle ordinate, make a sensitivity analysis utilizing the reasonable maximum and minimum values. A small change in the middle ordinate value can cause a significant change in the calculated radius. If the radius cannot be determined, the reconstructionist can only say that the sideslip speed cannot be determined and point out that the yaw mark should not be confused with a skid mark.

Impact scrubs are marks made when a rolling tire is overloaded by impact and forced sideways during impact. They often show strong striations. These marks are valuable for locating where a vehicle was at impact and the “point of impact.”

Collisions typically are accompanied by debris strewn on the roadway surface. Debris is useful in reconstructing a collision by indicating the area of impact and the direction of travel of vehicles. Debris usually takes the following forms:

- **Underbody debris:** This material comprises mud, soil, and asphalt dislodged from the underside of vehicles at collision. It can define an area of impact.
- **Vehicle fluids:** These include oil, hydraulic fluid, battery acid, gasoline and coolant. When the systems holding these fluids are broken at impact, the fluids are deposited on the roadway. They can be splattered on initial impact and dribbled from that point to where the vehicle came to rest, at which time the fluid(s) will form puddles on the surface at the final resting point.
- **Vehicle parts:** A variety of vehicle parts come loose from the vehicle at impact and are scattered over the crash scene. Broken glass is the most common debris. These parts do no always define the point of impact, but can be directed to other locations by the dynamics of the collision. For example, it has been observed in staged angle

collisions that side glass will ramp over the impacting vehicle and be deposited on the pavement upstream of the point of impact. The projection of some vehicle parts can be used for impact speeds.

After deciding what things need to be located by measurements, the investigator must decide how many points on each mark or object must be located. One point will adequately locate relatively small things, such as:

- A human body
- Gouges or groups of gouges in an area less than 3 feet across
- Grooves, collision scrubs and tire marks less than 3 feet long
- Small scrapes or dents in guardrails and damage to posts or trees
- Spatter areas and puddles less than 3 feet across
- Small debris areas
- Vehicle parts that have come detached

Two points are needed to locate things such as:

- Vehicles: usually locate undamaged corners or wheels on the same side of the vehicle
- Straight tire marks: locate both ends of each mark
- Straight grooves more than 3 feet long: locate both ends of each
- Long sections of railings scraped or damaged
- Dribble patches

Three or more points are required to adequately locate things such as:

- Curved tire marks more than 8 feet long
- Straight marks with angles, crooks, gaps, or other irregularities
- Large debris areas

If in doubt about the number of points needed to adequately document a mark or items, too many points are better than too few. Extra points are very easy to pick up with modern survey equipment.

MEASUREMENTS

After the relevant data points have been identified, the next step is to decide from what to measure. To locate any point, there must be at least two measurements: one from each of two permanent, recognizable landmarks. These two measurements are the coordinates of the point. Select the two landmarks and have them clearly in mind before starting to measure. Document the landmarks well, recording any unique identifiers such as utility pole numbers, bridge identification numbers, etc. For large objects, document which part of the object is the reference, such as the southeast corner of a foundation, the intersection of the south expansion joint and the east curb line of a bridge, etc. When adding to someone else's data set, such as the investigating officer's scene measurements, be sure to identify the original

reference point correctly.

With the coordinate method, one landmark is a reference line and the other is a reference point on the reference line. The reference point is sometimes called the zero or starting point. The direction of the point being located from the reference line (north, south, east, or west) must always be stated along with the direction along the reference line from the reference point to the place on the reference line nearest the point being located. The measurements and directions are the coordinates of the point. Pavement markings or the straight edge of pavement are relatively permanent features and provide a convenient reference line for measurements. Edge lines are often used as the longitudinal reference because they provide a more uniform line than the edge of pavement. If working with old crash data, be aware that edge lines may not be replaced in their original location. They tend to be laterally offset from a few inches to a couple of feet in one direction or another.

Baker and Fricke note that a field sketch is an important part of the record of measurements at a crash site. The field sketch describes and defines the points to be located and the reference points used to locate them and gives a quick, general picture of the after-crash situation. The sketch should be drawn freehand and not to scale. The sketch is usually made on an 8.5 x 11-inch sheet of paper held on a clipboard. The general layout of the road and the results of the crash to be located are shown. Do not crowd a field sketch on a sheet; if necessary, extend the sketch on an additional sheet(s). If an area is too crowded or too complex to show on the base sheets, make a larger scale detail of the area on another sheet, with enough room to record all the dimensions and show what is going on. Reference the detail sheet back to the base drawing(s).

Before leaving the scene, the notes should be reviewed for missing measurements or missing general data. At the same time, look for any weak or illegible lines or words and clarify them as necessary. Often it is helpful to stop at a local restaurant near the scene where the notes can be looked over in a relaxed atmosphere, out of the weather and traffic.

Vertical measurements are sometimes needed at a crash site. These may include the height above the roadway or ground of collision scars on poles, trees, guardrails and buildings; the height of temporary view obstructions; the distance a vehicle or component drops (or rises) without touching the ground when it takes off into the air; and pavement edge drop-off.

With the price of new and used electronic equipment becoming more affordable, many police departments and experts are using total stations. These can operate with a reflector prism and pole or in a reflectorless mode, eliminating the necessity for a person to be in the road. The data points are loaded into a computer-based mapping program, where they are connected and a scene map is produced. The quality of the map is dependent upon both the skills of the investigator in picking up the mapping points as well as the skill of the mapping technician doing the drawing.

A newer development in data collection technology is the use of global positioning system equipment, which effectively allows one person to perform all of the mapping. This equipment is available in three general levels of accuracy and cost:

- Recreational grade: 10–26-foot accuracy
- Mapping grade: 1.5–10-foot accuracy
- Survey grade: .5–2-inch accuracy

The survey grade is the only one suitable for scene mapping. The recreational grade units, which are small handheld devices, are often used by investigating officers to provide accurate crash locations on their reports. These units are relatively inexpensive and can be useful for verifying the location of the crash scene or simply finding out where you are.

SCENE PHOTOGRAPHY

To help describe the site, a number of photographs should be taken of the vicinity of the crash site. It is better to take too many photographs than not enough. Identify each photograph made during the inspection. As a minimum, photographs should be taken of the following:

- Each driver's view as he/she approached the impact area. Usually a distance of several hundred feet can be covered with photographs taken at regular intervals such as every 50 or 100 feet. Photos should be taken not only from the driver's lateral position in the roadway but also at the driver's eye height. A convenient way to take these photos is from the same type of vehicle. If sunlight or shadows are issues, the photographs should be taken under conditions similar to those at the time of the crash. However, photographs taken into the sun will be darker than observed by the human eye. If you have a choice, take pictures with the sun behind you or on an overcast day.
- All fixed objects and traffic control devices relevant to the incident. Photographs of the traffic control devices should be taken from an angle close enough to show details and condition. If the agency responsible for the devices includes installation/replacement information (dates) on the back of the sign, be sure to photograph this as well. If it appears that the traffic control device has been replaced or recently maintained, take pictures to document that work.
- All tire marks, furrows, scratches and gouges. Each photograph should include an object (such as a pencil, coin, or portion of a measuring tape or scale) to give the feature a sense of scale. Keep in mind that some of these items may have been generated by events other than the crash under investigation. If they are noticeably older or newer than the marks generated by the subject crash, this should be noted because the difference will not be as apparent in the photos.

INSPECTING THE VEHICLE(S)

Many areas of vehicle examination involve high levels of technical skill and considerable knowledge of vehicle design and construction. The details of such an examination are beyond the scope of this notebook. Similarly, inspecting vehicles for mechanical defects is outside the scope of this discussion. However, the transportation expert might aid his/her client in engaging a mechanical engineer to evaluate the vehicle for any defects. The examination described here is that which a transportation engineering investigator might reasonably be asked to perform.

Whenever practical, each vehicle involved in the crash should be given at least a cursory

inspection, and photographs should be taken. In most cases, the vehicle(s) will be removed from a crash scene before the investigator arrives. Thus, it becomes necessary to inspect the vehicles in an impound lot or at the storage facility of a wrecker service.

The first step in the inspection is perhaps the most important: identifying the vehicle as the one involved in the collision. The most reliable means of identification is the vehicle identification number (VIN). In most cases, the VIN can be found stamped into a metal plate riveted to the deck of the instrument panel on the left side and visible through the windshield. VINs are also located on the frame and other locations; the manufacturer can tell you where. Once you have the VIN, you can consult a source such as "Expert Auto Stats" for detailed vehicle geometric and mechanical specifications to compare with the damaged vehicle. With the vehicle make and model well identified, various Web sites can be checked for manufacturers' recalls and service bulletins, National Highway Traffic Safety Administration complaints and investigations and enthusiasts' Web sites and blogs, which often discuss common complaints and ways to address them.

Collision damage can be divided into two categories: contact damage and induced damage. Contact damage is the result of direct contact between a vehicle and another vehicle, the roadway, a fixed object, or a pedestrian. It is important because it gives information on the alignment of the vehicles at impact, speeds and what caused the collision damage. Induced damage is distortion (bending or breaking) of vehicle parts caused by transfer of collision forces from an area of contact damage. For example, the front doors of a vehicle might be jammed by an impact to the front of a vehicle.

Distinguishing between induced and contact damage is important because it helps determine the exact position of vehicles with relation to each other during a collision and whether or not the crash involved more than one collision. Diagramming contact damage is the best way to make a record of it. On an outline of the vehicle, draw a small arrowhead pointing to each end of the area and connect these with a loop. Use a large arrow to represent the direction of the vector that would have created the damage. This is known as the principal direction of force (PDF) and is a key component of many of the computer programs available to the reconstructionist.

The interior of a vehicle can be damaged by induced loading, contact damage from outside objects, or secondary impacts from the bodies of passengers or cargo. Many times, these secondary impacts from passengers are essential in determining the pre-crash seating positions of these persons. This is accomplished by matching the occupant injuries to the interior damage. Other vehicle interior evidence includes gear shift lever position, light switch position, radio volume control, alcohol/drug traces and other evidence that might help in reconstructing the crash. Be aware, however, that shift lever and switch positions can be moved by the forces of the crash, the dynamics of the occupants and cargo inside the vehicle, or rescue and recovery personnel.

Other things to look for in the interior of the vehicle are indications of air bag deployment, seatbelt pretensioners that have been activated and the presence of an event data recorder (EDR). Airbag deployment and activation of the seatbelt pretensioners in a modern vehicle is

a complex process involving a considerable amount of data processing by the vehicle's airbag control module, such as if someone is in the seat, how much the person weighs, if the seat belt is buckled, what the deceleration rate is, etc. For the transportation expert, it is important to remember that there is no preset speed at which the airbag or belt pretensioner is deployed. Generally the pretensioner will be activated before the airbag is deployed.

EDRs have been installed in some GM and Ford vehicles since the early to mid-1990s. Most vehicles sold since 1997 have some type of EDR. Some capture a limited amount of data, and many are not publicly accessible. They can record things such as x-axis deceleration, the time of deceleration, vehicle speed, engine RPM and brake switch status over the last few seconds leading up to and after an event. EDRs are not foolproof. Unlike aircraft black boxes, the EDR's recording function is secondary to activating the vehicle's passenger safety system. What constitutes an event is variable among the automobile manufacturers. Many physically undamaged vehicles have been found to contain recorded "events." Data can be lost when the vehicle's electrical system fails during a crash. Data can be added if the retrieval technique is not properly carried out or if the data connector is damaged. Admissibility, privacy and ownership issues of EDR data vary by location. Retrieving and interpreting EDR data is a highly specific skill, best carried out by companies who specialize in this service.

During the detailed examination, the investigator should concentrate on scrapes, dents, gouges and transfers. Scrape marks are wider than deep and longer than wide. A scrape runs parallel to the scraped surface; it does not penetrate deeply and does not come to a sudden, deep stop.

The length, width and position of scrapes should be noted. Examine the area for rust or dirt to determine whether the scrape is old or new. Check for the presence of different colored paint, which may be used to prove that the scrape mark was made by a particular vehicle. The direction of the scrape marks should be carefully noted. If they are parallel to the ground, a sideswipe is indicated.

A gouge is a mark that is deeper than it is wide and that bends or tears the metal in the local area. A gouge is made by a sturdy piece of metal sliding into a lighter piece (e.g., the mark left by a door handle on a fender during a sideswipe). The fender gouge resembles a mold of the profile of the door handle.

Gouge marks should be examined for the same kind of information that a scrape mark would reveal. However, they can be used to determine other things. Because a gouge mark usually becomes deeper the further along it proceeds, the mark shows the direction of travel of the gouging object.

A dent is a mark that tends to go into the metal rather than run along it. Most of the metal movement is along the line of impact of the striking object.

Imprints are dents pressed into body parts by some stronger object that clearly shows its shape. Headlights, bumpers and wheels are most likely to make characteristic imprints. Clear, unsmeared imprints are made only when the surfaces are pressed together with virtually no

sliding between them. Be sure to measure imprints and the parts assumed to confirm any conclusion that they match.

When discussing transfers relative to crash investigation, paint transfers usually come to mind. While paint transfers are included in this category, other transfers are important. Actual automobile parts may be transferred during collision (e.g., the sideview mirror may be lodged on another car's door). This helps locate the line of impact.

Do not overlook a careful examination of wheels and tires. Tires may contribute to crashes in several ways: tread characteristics may affect vehicle performance; rapid loss of air; mixing of noncompatible tires on the same vehicle; and improper tire selection, affecting vehicle control and stability. At-scene notes for each tire should include:

- Brand, model, size, load rating and serial number
- Its position on the vehicle
- Whether or not it was flat, pressure if inflated
- Whether or not there was a visible hole in it
- Whether or not either bead was unseated from the rim
- Whether or not the rim was visibly bent
- Whether or not the wheel could be rotated

The actual examination should include a written description of the tire. Some of the needed information is molded into the outside surface of the tire, including make and name; size; serial number; load rating; and special features such as inner tube, recap, or snow tread. Check the tire pressure on all tires; write down the pressure of each tire with the tire identified.

Examine the tread surface of each tire for skid mark footprints. Note which tires have these footprints and which do not. Note the amount of tread and the general condition of the tread. Look for any uneven wear, tread cuts, rips, or tears.

Examine the sidewalls for signs of weather cracking, marks of collision, cuts, or abrasions. Carefully examine the bead, looking for signs that the bead has pulled away from the rim. Conclude your documentation with close-up photographs of each tire.

Examination of lamps can also yield information on whether or not certain lamps were illuminated at impact. Typically this is determined by examining the filaments of the lamp. An illuminated filament will turn black or oxidize when the glass envelope is broken. An unilluminated filament will remain shiny or silvery looking when the envelope is broken. If the envelope is not broken, an illuminated filament will distort or stretch due to the violent deceleration in a crash. An unilluminated filament usually will not be distorted. Fused silica or quartz glass halogen lamps, semi-sealed beam headlamps, high-intensity discharge (HID) lamps and European lamps are variations of standard automotive lamp technology. These lamps, when subject to shock and/or breakage, exhibit different failure characteristics. Some of the more recent lamp analysis publications cover these in more detail. Newer vehicles are beginning to use light-emitting diode tail lights, brake lights and side marker lights, which do

not lend themselves to any type of filament analysis.

The comments made earlier about site photography also apply to the vehicle inspection. At a minimum, photographs should be taken of the following:

- Overall views of the front, back, both sides and all four corners of the vehicle. In most cases, it is just as important to show that specific areas were not damaged as it is to show what was damaged.
- Mid-range and close-up views of damaged areas
- Mid-range and close-up views of tires, especially if the tires are badly worn or if tire damage exists
- Close-up views of lamp filament condition (if lights are on or off is an issue)
- Elevated views (i.e., taken from the vehicle's roof position or adjacent high spot) to better show crush pattern(s) on the vehicle
- Close-up views of VIN, door plates, license plates, tire serial numbers and other identifying information to supplement and confirm documentation

Note that the use of measuring boards, a level rod, or large face tape in such photographs may help later reconstruction. One can never take too many photos.

If the investigator is working for the owner of the vehicle, arrangements should be made to remove any important parts before the vehicle is released. Such parts might include lamps and lamp parts or debris, tires, a damaged door, a seat belt or shoulder harness, or a damaged seat. Parts should never be removed from a vehicle without specific authorization of the owner or his/her representative and without documenting the before condition to avoid a charge that you spoiled the evidence (spoliation).

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TABLE 3-1: SUGGESTED EQUIPMENT FOR INVESTIGATING TYPICAL TRAFFIC CRASHES

TABLE 3-1: SUGGESTED EQUIPMENT FOR INVESTIGATING TYPICAL TRAFFIC CRASHES

- Orange safety vest
- Orange traffic cones
- Roll-up traffic control devices
- Clipboard
- Pencils
- Data collection forms
- 100-foot tape
- 25-foot tape or carpenter's rule
- Measuring wheel
- Carpenter's level
- Line level
- Nails (common and concrete)
- Surveyor's pins or stakes
- Hammer
- String line
- Lumber crayon
- Aerosol paint
- 35-millimeter camera
- Color print film
- Calculator
- Magnifying glass
- Evidence bags
- Flashlight
- Compass
- Stop watch
- Polarized sunglasses
- Tire tread depth gauge
- Tire pressure gauge
- Surgical gloves
- Work gloves
- Hand radio for communication with helper
- Minirecorder for data

OBTAINING EVIDENCE FROM WITNESSES

By Ronald J. Hensen, Ph.D., P.E., Principal, SEH Inc.

The ability to develop an expert opinion within a reasonable degree of engineering certainty is dependent upon the expert being able to combine sufficient facts and data regarding the event, including witness testimony, with an appropriate background of both technical education and relevant experience. Therefore, the preparation of an expert opinion commonly involves the review and consideration of written or oral testimony obtained from witnesses.

There may be several types of witnesses who offer their observations regarding the sequence of events and/or facts in any particular event. The drivers or passengers in an automobile collision or a construction worker who may have placed materials or erected a warning sign are examples. These witnesses often have sensory observations as to what they saw or heard. Thus, their involvement usually starts with their impression of the event. These impressions can be recorded as a statement written by the witness; a summary of what an investigator heard the witness say; deposition testimony given by the witness; quantitative facts gathered by an investigating police officer or a construction inspector, such as measurements obtained after the event has occurred; or a description of the design, construction (fabrication), or maintenance of a roadway, vehicle, structure, or mechanism. As in most litigation matters, the lines between the roles of these witnesses can often be blurred. Also, there may be statements from all or none of the categories described above.

Generally, on-scene witness statements are taken by an initial investigator for the purpose of establishing whether or not a law or regulation was violated. There are situations where the expert can personally interview witnesses who have relevant facts. However, there are also reasons why a personal interview by an expert is unlikely to be practical. The expert's initial involvement usually occurs months or even years after the event. By that time, a witness's recall of the event is often clouded. Also, a witness may not wish to be interviewed without the benefit of legal counsel. Finally, the expert will seldom be given the opportunity to have an open conversation with a party to the litigation who is adverse to the expert's client.

When obtaining witness testimony, it is imperative that the statement be recorded in a format that can be preserved without the expert becoming part of the "chain of custody" of that evidence. One way to avoid this situation is to record and transcribe the witness statement in the presence of at least one other person and then have the witness review, sign and date the statement as being what the witness told the expert. Should the expert interview a witness one-on-one without the benefit of independent corroboration, the expert's interpretation of the statements may later be refuted by that witness in deposition or trial testimony. Should the expert use those one-on-one statements in the development of an opinion, the result might be an embarrassing if not disastrous situation that could affect the outcome of the litigation. However, even recording and transcribing a statement is not a fool-proof method of gathering information, especially when a statement is taken at or close to the time of the accident event but a deposition is taken years after the event and the respective testimonies conflict.

Because it is the attorney's role to assemble the evidence and the expert's role to interpret it, the better approach to witness interviews is for the expert to review all of the written statements and to discuss their relevance with the retaining attorney. That is not to say that the expert should not discuss the evidence with witnesses but rather that, should a direct interview be necessary, it be conducted by the attorney as part of the preparation for the deposition or trial testimony.

The expert must realize that it is unusual for a witness to be a true "eyewitness," such as to have been alerted to an event prior to its occurrence such that he/she has recorded the facts correctly in sequence, time and quantity. More commonly, people start with their impression of what *must* have happened and develop assumptions to support those conclusions. Their opinion becomes fact to them. Thus, it is important to recognize that their observations of the events are often based upon what they *believe* must have happened rather from actual memory of the specific details and, therefore, to establish the basis for a witness's observations. In that regard, the expert should not be afraid to ask how the witness knows the things he/she is providing in the statement or to question items he/she feels may be false or misleading. For example, interested parties and independent witnesses may bias their version of the facts to reflect in their favor and such bias may be intended to deceive or mislead.

The expert must also recognize that certain observations are likely to be more reliable than others. For example, witnesses can usually describe sequence (the light changed to green and then the car began to move) or relative position (the beam that eventually fell was above the injured construction worker). However, when witnesses must qualify their observations, for example, speeds, time, or distance, the results are commonly a wide range of estimates. The questioning of such witnesses is best framed in relation to consistency or contradiction, in relation to physical facts, such as site measurements, the laws of physics and/or as compared to other witness observations.

When interviewing witnesses, it is usually helpful to meet them at the site of the event to provide reference objects and to improve their recall. It is also a good way to recognize which of their statements are more likely to have been based upon what they actually saw as opposed to what they think or believe. Proper to the site visit, the expert should have reviewed all of the statements, including those of the scene investigators, to be able to compare facts for consistency or contradiction. Again, interviewing witnesses at the site should preferably be done with the retaining attorney present. If the retaining attorney can not be present, the expert should discuss the interview with the retaining counsel and suggest that a written statement be taken by the attorney from the witness, as noted above.

When interviewing a witness, be non-threatening. People will generally provide information more freely if they think you are a nice person. The witness should be permitted to give his/her initial statement uninterrupted and in a chronological order. Clarifying questions can be asked at the completion of the witness's initial statement in sequence: Who, what, when, where, how and how do you know that.

If deceit is suspected, have the witness retell his/her story from finish to start, or by starting in the middle and moving either forward to the end or backward to the beginning. Note any discrepancies, which should then be discussed with retaining counsel.

Four general categories of witnesses are to be considered in evaluating and incorporating statements/testimony: event participants, independent witnesses, scene investigators and designers/constructors/maintainers.

EVENT PARTICIPANTS

Event participants are persons who experienced the event, and their statements usually provide the basis for "what happened." One or more of these persons may be a plaintiff or defendant in the litigation. It is important to recognize that any of the parties to the litigation can and often do look at the expert as someone who should be convinced to adopt their version of the facts. Thus, it is also important to discuss the credibility of their statements with the retaining attorney in an attempt to distinguish between direct observations and bias, as noted above.

INDEPENDENT WITNESSES

Independent witnesses can be of benefit to the expert in establishing the probable sequence and, in some cases, estimates of positions and other measurements necessary in the development of adequate information needed to form an opinion. One or more of these persons may be connected to a plaintiff or defendant in the litigation, for example, as a family member or close friend. Again, it is important to discuss the credibility of their statements with the retaining attorney in an attempt to distinguish between direct observations and bias.

Another type of bias can arise when multiple uninvolved persons discuss among themselves while at the accident scene "what must have happened" without having actually observed the sequence of the event.

SCENE INVESTIGATORS

Scene investigators usually provide the most reliable facts for the expert, especially if they have measured and/or photographed the scene. Their training and experience in the collection of facts can be invaluable, especially when there has been a significant time lapse between the event and the retention of the expert. However, it is important to recognize the role the investigator had at the time of the event.

If the investigator arrives at a conclusion as to the cause of the event too soon, for example, because of time constrains, he/she may limit his/her collection of evidence to just what reinforces his/her findings. In most cases, the scene investigator will have arrived at opinions as to the cause of the event prior to the retained expert being involved. Also, depending on his/her training and experience, he/she may also provide expert testimony that either supports or conflicts with the opinions of the retained expert. Thus, the task of interviewing for facts is a potentially sensitive situation that reinforces the recommendation to include the retaining attorney, preferably in a deposition setting. In these cases, the expert can take a secondary role in such interviews by providing suggested questions to retaining counsel for the scene

investigator. The questions should be limited to any data and information that the scene investigator gathered/observed.

DESIGNERS/CONSTRUCTORS/MAINTAINERS

This category will be identified when the litigation claims that a facility or mechanism was at least in part the cause of the accident event. These witnesses can provide facts regarding the assumptions that were made and the standards that were incorporated at the time of construction or fabrication of the facility or mechanism and/or any subsequent maintenance. Depending upon the extent of their experience, they may also serve as expert witnesses.

It is important to obtain a history of the design, construction, or maintenance sequence without challenging the validity of those actions during the witness interview because persons in this category may feel threatened by inquiries that call into question the intent of their actions, especially when the implication is that they may have caused injury. However, because of the technical nature of the inquiry, it is necessary for the expert to take a more direct role in the interview process, especially because it is probable that only those witnesses who are on the same side of the litigation as the expert will be available for any informal interviews. In the case of an interview of a witness on the opposing side of the litigation, it is important that the retaining attorney be involved, preferably in a deposition setting. Again, in these cases, the expert can take a secondary role in such interviews by providing suggested questions to retaining counsel for the designer/constructor/maintainer.

SUMMARY

Witness statements are commonly used in the analysis of an event and subsequent preparation of an expert report. Thus, the ability to effectively gather witness statements can be a critical component of successful case resolution.

USE OF REGULATIONS, STANDARDS, PRACTICES AND PROCEDURES

By James L. Pline, P.E., PTOE, President, Pline Engineering Inc.
Updated by Richard A. McGuinness, P.E., PTOE, Traffic Department Manger, URS Corporation

The publications used in the planning, design, operation and maintenance of our transportation systems cover a variety of engineering requirements and have a variable level of importance when making engineering decisions. These publications have different levels of importance in the courts as well, because of their regulatory provisions and the legal interpretation of those requirements. This section reviews the significance of engineering standards, practices, guidelines and procedures in the courts.

Government agencies have a reputation for bureaucracy, voluminous regulatory provisions and being virtual paper mills of information. This reputation seems to be characteristic more of state and some large city transportation agencies than it is of local agencies. This characteristic, where it exists, can become a fruitful source of information for the plaintiff's scrutiny.

As noted by California Department of Transportation Attorney Breland Gowen: "One of the most fruitful areas of inquiry for a plaintiff consists of the policies, guidelines and manuals of the public entity. These publications, often called 'bibles' by engineers, carry the imprimatur of governmental authority and mandate. Looking for contradictions, discrepancies and variances from policy or good engineering practice, plaintiffs and their experts search for the scrap of paper or the absence of a record that will impeach the public entity engineering witness."[1] These published provisions become important as to what they say and what they do not say. They may give the impression of mandated requirements that were never intended by the agency.

Agencies are becoming more aware that these interpretations and impressions are causing problems with liability. The publications are beginning to move away from black and white requirements and place more decision-making responsibility on the agencies operating the street or highway. The 2003 edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) states in Chapter 1A: **"23 CFR 655.603 adopts the Manual on Uniform Traffic Control Devices as the national standard for all traffic control devices installed on any street, highway, or bicycle trail open to public travel,"** which is certainly an unambiguous statement of what the various traffic control devices are.[2]

MUTCD goes on the say in the same chapter that: "This Manual describes the application of traffic control devices, but shall not be a legal requirement for their installation … The decision to use a particular device at a particular location should be made on the basis of either an engineering study or the application of engineering judgment."[3] This tells the agencies that they are on their own when it comes to determining the need for any traffic control device.

In the roadway design area, the 2004 Green Book, considered to be the national guideline on highway geometrics, tells its readers that: "Guidance supplied … is based upon established practices and supplemented by recent research. The intent of this policy is to provide guidance to the designer by referencing a recommended range of values for critical dimensions. It is not intended to be a detailed design manual that could supercede the need for the application of sound principles by the knowledgeable design professional. Sufficient flexibility is permitted to encourage independent designs tailored to particular situations."

It also goes on to say: "The fact that new design values are presented herein does not imply that existing highways are unsafe nor does it mandate the initiation of improvement projects."[4] The current text was drafted in a manner to support design immunity that exists in some form in each state except California and to offset the allegations that a roadway needs to be upgraded simply because the standards have changed since it was built. This is in sharp contrast to the statement made in the 1954 Blue Book, a predecessor publication, which states: "This policy develops the guide values and details which best fit the requirements of motor vehicles as they are operated currently and insofar as it is possible to foresee, as they will operated in the future."[5] Clearly, the philosophy of design has changed over the past 50 years and the newer publications no longer claim to have all the answers.

That being said, the legal profession and courts place a higher level of importance on some agency requirements than on others. Engineering standards are viewed as mandatory requirements and infer a level of negligence for noncompliance. Consequently, attorneys frequently refer to items as "standards" when they are not, in an effort to enhance the basis of their arguments. Engineering witnesses are also prone to call items standards to increase the level of importance for references that support their opinions. Unfortunately, this misuse of terminology frequently goes unchallenged in the courts and the difference is seldom explained, creating a distortion of agency requirements. The following information should clarify the appropriate use of terminology and address the legal implications of those terms. It also provides a basis to counteract the unsubstantiated elevation of recommended practices, policies and guidelines to a status that is more in line with the theories of opposing counsel.

STANDARDS

A standard is defined in an ITE internal document as:

> "a prescribed set of rules, conditions, or requirements concerned with the definition of terms; classification of components; delineation of procedures; specification of dimensions, materials, performance, design, or operations; description of fit and measurement of size; or measurement of quality and quantity in describing materials, products, systems, services or practices."[6]

The ITE definition comes close to the dictionary definition of a standard as:

- "something established by authority, custom or general consent as a model or example: CRITERION

- something set up and established by authority as a rule for the measure of quantity, weight, extent, value or quality"[7]

Of course things are messier once these get into the legal system. Certain standards of behavior have been placed upon those responsible for maintaining public highways since colonial times. Generally these started out as common law prescription: What would a "reasonable man" do? Many of these activities became a part of state and local law over many years.

In Ohio, the first statute requiring public highways to be "open, in repair and free from nuisance" was enacted in 1852.[8] These statutes vary from state to state, some referencing or incorporating various national and local publications and documents. Over the years the courts have had ample opportunity to issue opinions on whether or not these publications placed ministerial duties or discretionary guidelines upon the transportation agencies, along with interpretations of what excursions from the recommendations contained in these publications may be negligent and what an injured party's right of action may be. While reading through the following paragraphs on standards, recommended practices, etc., the engineering expert should always be aware that matters of law are best left up to the retaining attorney. Almost every expert has run into a situation in which a defendant agency has been in direct conflict with one of the cited publications only to be told by the retaining attorney that it doesn't matter because of prior court rulings or local statutes.

A number of standard-making organizations are well known, such as the American Society for Testing and Materials, the American Society of Mechanical Engineers, the U.S. Bureau of Standards and the Federal Highway Administration (FHWA). ITE is in the standards development process for traffic control equipment. The U.S. Department of Commerce promulgated some specific standard development procedures and regulations in the 1970s to ensure that a standard did not unduly penalize a product or restrict competition and trade. The provisions provide for public notification, procedural fairness in standards development and a realistic appeals process.

Many standards are addressed in federal and state regulations. The Code of Federal Regulations (23 CFR Article 625.4) addresses "Standards, policies, and standard specifications," which are designated as applicable in the design of federal-aid transportation projects and lists a number of publications.[9] By way of an FHWA memo, the 2001 Green Book was incorporated into the national highway design standards with the following text:

> "The adoption of the 2001 Green Book, effective March 14, supersedes previous editions of the Green Book as the minimum design standard to be used for projects on the National Highway System (NHS)."[10]

This was updated in 2005 to establish the 2004 Green Book as the national standard, somewhat contrary to the American Association of State Highway and Transportation Officials' (AASHTO) intent stated in the foreword of the publication.[11]

The 2003 edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) was adopted as the national standard for traffic control devices for all highways through a rule-making

procedure published in the Federal Register. The adoption text reads as follows:

> "The Manual on Uniform Traffic Control Devices (MUTCD) is incorporated by reference in 23 CFR part 655, subpart F, approved by the Federal Highway Administration, and recognized as the national standard for traffic control devices used on all public roads … The MUTCD, with these changes incorporated, is being designated as the 2003 edition of the MUTCD."[12]

Standards are based upon design principles and dimensions derived from basic engineering knowledge, experience, research and judgment. They are officially designated and adopted by highway authorities as the specific controls for design of highways.

Highway design policies are those procedures and controls that are less specific than design standards, often with a range of acceptable values. They are officially adopted or accepted for application in the design of highways.

It is significant that MUTCD is adopted by FHWA under the Federal Register process that conforms to the administrative rule-making procedural processes. Most of the AASHTO policies and informational guides as adopted by FHWA do not.

The individual state statutes also have provisions that in effect impose applicable standards for transportation facilities. The State Vehicle Code, "Rules of the Road," designates specific traffic control features and defines road users' responsibilities relative to those features. The traffic signal displays, pavement markings, STOP signs and YIELD signs are examples of these provisions. These in effect create standards, but they are presented as statutory requirements because this is the only acceptable way of imposing operational requirements on the road user. Additionally, all states have a statutory requirement to adopt a uniform system of traffic control devices that correlates with and, so far as possible, conforms to the system set forth in the most recent edition of MUTCD. Some states adopt the federal manual directly, some adopt it with addendums to deal with state specific issues and other states print their own version of the manual.

Also, the current practice in many states is that rules, regulations, orders, or standards having the force of law must be adopted under the provisions of Administrative Procedures Act of that state, which mirrors the U.S. Federal Register process and satisfies the U.S. Department of Commerce requirements. These usually include MUTCD and other regulations. Many state departments of transportation, along with larger cities and counties, make these items, along with design manuals, standard drawings, contract inserts and various other forms, available on their Web sites.

In summary, design manuals, standard drawings, contract inserts and other publications may be determined to be a standard by definition if they are readily identified by organizational, procedural and statutory provisions. They will have been developed by a procedural process compliant with the U.S. Department of Commerce requirements. The U.S. Federal Register and states' administrative rule acts would comply with these requirements. FHWA, state departments of transportation and ITE would be standards development organizations.

AASHTO, the Transportation Research Board, the National Association of County Engineers and the American Public Works Association are not standards-development agencies. Private organizations such as ITE have promulgated specific procedures to be followed in the organizational adoption of equipment standards. In specific circumstances, the state code can direct specific requirements on road users that create de facto standards as the only statutory approved means to implement the requirements. Also, existing statutory law requires states to adopt specific publications as standards, which would infer that the adopted publication in itself was also a standard. There appears to be little doubt that MUTCD meets all the requirements to be called a standard and used in litigation as a standard. However, most other policies, guidelines and reports would not meet these requirements.

RECOMMENDED PRACTICE

Specific criteria have been adopted by ITE on selected topics to represent the recommended practice of the profession. These recommended practices cover a variety of topics such as speed humps, pedestrian facilities, right turns on red, pre-emption of traffic signals near railroad-grade crossings, etc. The current recommended practices, which are constantly changing, can be found on the ITE Web site. Historical and outdated practices are more difficult to find.

Recommended practices are procedures and analytical methodologies considered to be an acceptable means of making engineering applications by those knowledgeable in the profession. They are ITE's recommendations for the application of rules, conditions, methods, or requirements to transportation engineering activities and functions.[13] Recommended practices are characterized by:

- A recognized national use
- Consistency with public interest
- A fair, adequate and consensus approach to engineering practice

The adoption of a recommended practice is not taken lightly. It goes through the same procedural process as the adoption of engineering standards. These practices are not the only way to perform engineering functions, and they do not represent minimum requirements. They are not mandated methods so they do not meet the criteria of standards. However, they do provide the assurance that if you comply with the recommended practice you are in reasonable conformance with recognized engineering methods and procedures. The recommended practice by ITE would reasonably equate to the standard of care in the legal system. Standard of care is commonly defined as that level of skill and competence demonstrated by professionals of the same discipline, practicing in the same locale and faced with the same or similar facts and circumstances. This is why it is sometimes difficult for ITE to address national recommended practices because of geographical and cultural differences. A wide variety of facts and circumstances must be considered in some engineering applications.

The recommended practices are not mandated requirements that must be followed explicitly. They demonstrate a nationally accepted approach that, if used, reflects compliance with the standard of care for the profession. Deviation from recommended practices is acceptable based on specific site facts and circumstances. It is recommended that any deviations be

thoroughly documented and provided a basis for defense in the event of future litigation.

NATIONAL POLICIES AND GUIDELINES

AASHTO develops and publishes a wide variety of material related to roadway design, construction, operations and maintenance. These publications become available as AASHTO policy or AASHTO guidelines and have been widely used as references in the transportation profession since 1940. They are updated periodically to reflect the current state of the art in the profession.

AASHTO requires that policies be approved by the AASHTO executive committee and two-thirds of the member states before being distributed.[14] It is generally accepted by the AASHTO member states that if a publication is approved as a policy (two-thirds approval of the 50 states), the individual states will comply with that policy, even though they may have some objections to portions of the information. The AASHTO policy or guide manuals are developed as a function of an AASHTO subcommittee and only approved by the AASHTO executive committee without member department balloting before distribution.

AASHTO does not totally define the objectives of their publications other than through statements that may appear in the publication's preface or foreword. The 2004 *A Policy on Geometric Design of Highways and Streets* (also known as the Green Book) provides some noteworthy statements in the foreword, including:[15]

- "This text is also intended to form a comprehensive reference manual..."
- "The fact that new designs values are presented does not imply that existing streets and highways are unsafe."
- "This publication is intended to provide guidance in the design of new and major reconstruction projects."
- "The intent of the policy is to provide guidance to the designer by referencing a recommended range of values for critical dimensions. It is not intended to be a detailed design manual that could supersede the need for the application of sound principles by the knowledgeable design professional."

It is apparent that AASHTO would not like to see its policies be classified as standards. While AASHTO tends to refer to its policies as guidance, reference and flexibility; FHWA considers some of them to be a minimum standard, as discussed earlier in this section. The noteworthy provisions are that AASHTO policies are generally adopted only by the member state departments, and each policy has some limited applications as outlined in each specific publication.

The more recent AASHTO guides provide some clarification in the preface as to their application. AASHTO's *Roadside Design Guide* provides the following statements in the preface:[16]

- "This document presents a synthesis of current information and operating practices related to roadside safety."
- "A second noteworthy point is that this document is a guide. It is not a standard or a design policy. It is intended for use as a resource document from which individual

highway agencies can develop standards and policies."

- "While much of the material in the guide can be considered universal in its application, there are several recommendations that are subjective in nature and may need modification to fit local conditions."

The noteworthy terminology appears to be that guidelines are resource information, informational background and guidelines. This is also noted in other FHWA publications, such as *Flexibility in Highway Design.*[17] They have optional application unless a jurisdiction develops and adopts more definite criteria or incorporates the guidelines into its own design requirements.

While the guidelines may not hold the force of law or standards, they do educate the designer and maintaining agency on what can happen. Much case law has established all foreseeable substantial causes of a crash as proximate causes.[18] This places a burden of liability upon the party who "should have known" and taken care of the problem prior to the incident. While the plaintiff still has to prove notice, proximate cause and reasonable corrective measures, agency guidelines provide a standard of what they consider competent behavior in both identifying a problem and correcting it.

MUTCD represents a multifaceted regulation in that it contains standards, recommended practices and guidelines all in one document. These variations are clarified in MUTCD through the use of the following terminology in the introduction:[19]

> "When used in this Manual, the text headings shall be defined as follows:
>
> 1. Standard—a statement of required, mandatory, or specifically prohibitive practice regarding a traffic control device. All standards are labeled, and the text appears in bold type. The verb shall is typically used. Standards are sometimes modified by Options.
> 2. Guidance—a statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate. All Guidance statements are labeled, and the text appears in unbold type. The verb should is typically used. Guidance statements are sometimes modified by Options.
> 3. Option—a statement of practice that is a permissive condition and carries no requirement or recommendation. Options may contain allowable modifications to a Standard or Guidance. All Option statements are labeled, and the text appears in unbold type. The verb may is typically used.
> 4. Support—an informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. Support statements are labeled and the text appears in unbold type. The verbs shall, should, and may are not used in Support statements."

As noted earlier, MUTCD both nationally (FHWA) and locally (individual states) is adopted under rule-making procedures and complies with the criteria cited for standards.

Accordingly, the "standard" statements in MUTCD can rightfully be referred to as

standard requirements.

The “guidance” option statements, while appropriately adopted under the rule-making procedures by their definition and usage, provide less restrictive requirements than the mandatory standards. It appears that these MUTCD provisions would be comparable to recommended practice and guidelines as discussed previously.

It is generally understood in the profession that MUTCD “guidance” requirements should be complied with, unless there are circumstances and conditions that would make compliance inadvisable. If this is the case, it is wise to document any decisions that vary from these MUTCD guidance provisions. This approach demonstrates to future plaintiffs that professional judgment went into the decision-making process and the appropriate standard of care was maintained.

The “option” statements in MUTCD provide other possible considerations for traffic control device application subject to the engineering judgment of the user and the standard practices of the agency. These MUTCD provisions are neither mandated nor recommended and, accordingly, appropriately fit the guideline criteria discussed previously. The “support” statements are intended to provide only clarification or background to the user. They carry no hint of requirement, mandate, or recommendation.

AGENCY POLICY AND PROCEDURE MANUALS

It has been a long-standing practice of governmental agencies to develop and publish policy and procedure manuals to direct their internal activities and the activities of their consultants and contractors. These adopted policies and procedures are intended to express the desires of the organization, provide clarification of engineering applications to their facilities, establish a uniform approach to their activities and provide a convenient employee reference for specific courses of action in day-to-day activities. The policies may address specific subjects or provide broad organizational directives. Procedural manuals are frequently extensions of MUTCD, AASHTO policies, or other agency guides to address their application within the organization. They are usually developed in the form of department traffic, design, maintenance, construction, right-of-way and materials manuals.

The introduction noted that plaintiffs and their experts do an extensive search of organizational publications to discredit the agency witnesses. One of the most productive sources of contradictory information is frequently found in the agency policies and procedural manuals. While the agency’s intent was well-founded on a need to correct a problem or provide the public with safe and efficient facilities, the wording may appear differently from actual practice. The text can often be construed as a mandate for the agency employees to perform specific activities. These policies and procedural manuals are developed with the intent of being kept up to date, but this is not always the case. National or agency guidelines, policies, standards and the state of the art are constantly changing, requiring a constant vigilance to correct the internal policies and procedures.

It is noteworthy that agency policies and procedures may modify or extend accepted standards, policies, or guidelines to require specific determinations or actions by the agency personnel. This could impose a standard of care by the agency and its employees that was

not intended under all circumstances.

The above discussion on written manuals applies primarily to the state departments of transportation and some large cities and counties. Smaller agencies, especially those with stable workforces and hands-on management, have ingrained their standards and practices into their occupational culture. Most of their employees know what level of care is expected and what to do in most circumstances, but this is seldom documented. In these cases, the expert witness and the retaining attorney have to be observant of the conditions of the agency's highway system and the work practices of their employees. They can then establish a representation of the prevailing standards and practices (or lack thereof) by interviewing agency employees.

RESEARCH STUDY REPORTS

A significant number of research reports and studies are published each year relative to transportation activities, with the most notable publications by the Transportation Research Board. These publications report on the results of research projects, synthesis of current practice, policy study findings, state-of-the-art reports, conference proceedings, contributed research papers and research needs statements. None of its publications constitute a standard. The Transportation Research Board has no responsibility or authority to establish engineering or design standards.[20] Additionally, many universities, technology centers and private organizations have active, ongoing, research activities that produce important research information. While these publications may support and recommend standard, policy and guideline changes, they do not constitute engineering or design standards, specifications, policies, or product endorsements. The research or study reports are solely informational reports on a specific subject and represent one or more approaches to solving an engineering problem.

The standards-making organizations, such as FHWA or ITE, and guideline agencies, such as AASHTO, are aware of these studies. They are usually active participants and consider the new knowledge in the subject area when developing new or revising existing standards, recommended practices, policies, or guidelines. However, while the research information provide useful data to the profession, the reports have no standing for mandatory, recommended, or suggested application in the practice of engineering until the report criteria are formally considered and adopted under the various processes addressed above. The reports may represent the national state of the art in some cases, which can be used to argue for a standard of care, but they do not require governmental agency compliance.

Research reports provide current data and information on human factors, vehicle characteristics and roadway operational considerations that improve the knowledge and expertise of the profession. These reports are used as an information resource to understand the road user, vehicle, roadway and their interrelationship. The profession and the expert both rely on research information to formulate individual opinions and as a tool in analyzing accident causation.

LEGAL IMPLICATIONS

Liability is determined on the basis of the factual circumstances of each case. The question presented to most juries is whether the governmental entity exercised ordinary and reasonable care under the circumstances and, if not, whether their lack of care caused or

contributed to the plaintiff's injury. In judging reasonable care, the actions of the agency will be compared to duties established under common law and those established under statute. Common law duties are court-imposed and generally broad. They require the agency to maintain its roads in a "safe condition," not expose travelers to "undue hazards" and warn of and correct existing hazards.[21] Statutory duties are defined by the laws spelling out what the agency's functions and responsibilities are. These also include statutes that incorporate MUTCD and other publications into their codes and ordinances. Additionally, the agency will be judged on the basis of compliance with applicable departmental policies, guidelines and procedures. The courts have also reviewed and considered the admissibility of specific standards, policies and guidelines relative to the case with determinations on their application to the case.

The following sections address the means for admitting relevant standards, policies and guidelines with the defense objections to this practice. In some cases the courts have determined that noncompliance with standards or policies has been in effect a violation of the law and as such signifies negligence on the part of the agency. In other cases the courts have not taken this strong a stand, ruling that standards, policies and guidelines are only recommendations for the agency to consider. However, the agency must meet the standard of care to provide a reasonably safe facility for the public; and policies, standards and guidelines presented to the court will have a bearing on the judging the agency's activities relevant to the case. Design standards, policies and guidelines are frequently addressed in liability cases, with the courts' consideration of those publications specifically addressed. A number of relevant court cases are cited pertaining to each subject to illustrate the courts' ruling and provide the citation for additional review if desired. The source of these cases and their discussion has been taken from Larry Thomas's research findings of legal problems arising out of highway programs.[22–23] It should be noted that there may be other court rulings that are more pertinent to a specific case or a particular jurisdiction than the ones cited. The following is intended to provide the expert witness with an awareness that case law and precedent often drive the retaining attorney's theory of the case. Facts of law do not always appear logical or reasonable to the engineer, but understanding them is critical to being able to provide a professional, value-added service to your client.

ADMISSIBILITY OF GUIDELINES IN EVIDENCE

For guidelines to be admissible in court, they must be relevant and material to the issue being tried. "Testimony is relevant if it has a legitimate tendency to establish or disprove a material fact."[24] The guidelines may be inadmissible in some jurisdictions because they fall under the hearsay rule. Most jurisdictions have adopted the Federal Rules of Evidence under Rule 803 (18), which permits standards and guidelines as an exception to the hearsay rule, or Rule 803(24) as a residual exception to the hearsay rule.

The objections to admissibility have been raised by the argument that such codes and standards do not have the force of law and represent only the opinion of the authors. The guidelines have not been delivered by the authors under oath, nor are the authors available for cross-examination. In reference to MUTCD, a state appeals court ruled that MUTCD should be admitted into evidence for the following reasons:[25]

> "The admission of this manual was proper, under either one of two theories: (1) as evidence of standard, custom or usage in this country, to be considered by the jury in

> connection with its determination of whether the state used ordinary care in this specific instance .... ; or (2) as evidence that the state failed to meet the safety standards set for itself by the enactment of A.R.S. Article 28-641(statute requiring highway commission to adopt a manual conforming to system current and approved by AASHO)."

There may be other guidelines, sponsored by governmental or nongovernmental associations, that do not have the force of law (e.g., not adopted statute or ordinance) but are admissible into evidence. An extensive annotation on the subject concludes as follows:[26]

> "While at one time it appeared that one could identify a majority rule that safety codes or standards promulgated by governmental or private authorities and lacking the force of law were not admissible in evidence on the issue of negligence, the modern trend towards greater admissibility of these codes and standards has apparently been great enough to make it unwise to attempt to identify any majority rule or minority rule.
>
> Thus, a number of cases support the view that codes or standards of safety issued or sponsored by government bodies or by voluntary associations and not having the force of law, but relevant to the issue of negligence under the circumstances of a particular case, are admissible in evidence. In support of the rule of admissibility, it has been suggested that safety codes are objective standards representing a consensus of opinion carrying the approval of a significant segment of the industry, and that such codes and standards contain the elements of trustworthiness and necessity that justify an exception to the hearsay rule.
>
> A number of cases, however, support the contrary view—that is, the inadmissibility of safety codes or standards issued or sponsored by governmental bodies or voluntary associations and not having the force of law. In support of the rule of inadmissibility, it has been reasoned that such codes and standards have no compulsive force and represent merely the opinion of their authors, not delivered under oath and not subject to cross-examination."

A particular code, standard, or guideline must be "established as a reliable authority" before one may use it in direct or cross-examination. The standard, policy, or guideline can be established by the testimony of a witness, either by admission of the witness being cross-examined or by one's own expert on direct examination. If a guideline is being offered by an expert under direct examination, a foundation needs to be laid showing that it is "widely followed and highly regarded in the relevant industry."[27]

The guideline may also be established as reliable authority by judicial notice under Rule 803(18). However, the material must still be offered in conjunction with expert testimony before it is read into evidence. Guidelines may also be established as reliable authority by stipulation to the court concurred in by both sides to the litigation. Guideline material may also be used in the cross-examination of an expert witness. It is noteworthy that, while some jurisdictions do not admit standards and guidelines in direct examination of an expert, they

may be introduced indirectly in the cross-examination of the expert.[28]

NEGLIGENCE PER SE

A violation of a uniform law or regulation may be evidence of negligence or may constitute negligence *per se*. In tort law, the violation of a statute or regulation under certain circumstances may result in civil liability.

Most jurisdictions hold that a breach of a statute is negligence *per se.* The defendant's conduct is measured against the standard of care established by the statute. If it falls below that standard, negligence is conclusively proved.[29] The key issue of negligence is decided by the court as a matter of law, and a jury cannot find that a governmental body exercised reasonable care. However, proximate cause and damages still must be proven before negligence will lead to liability.[30]

Some cases which support this view are:

- *American State Bank* v *County of Woodford* (Illinois)*:* A jury was properly instructed that there was prima facie evidence of negligence because the highway did not meet minimum state design standards and policies pertaining to minimum widths and design speeds, minimum stopping sight distances and minimum "no-passing" sight distances.
- *Ehlinger v State*: (Iowa): The posting of a sign warning of the danger of water collecting on the highway did not excuse the state's duty to repair the condition. The condition, known to exist since 1962, was never corrected although it was marked by signs and flags. The court held that the state's failure to repair this location violated state law, the commission's maintenance manual and the commission's established procedure. The court noted that the highway commission's manual specified that the condition should be repaired and did not specify that signs could be used as an alternative to repairing the highway. The court held that "violation of such a safety code is evidence of negligence."

Other courts have held that a failure to conform to the standards does not constitute negligence *per se*:

- *Vervik* v *State Dept. of Highways* (Louisana): The department's manual is merely persuasive and the failure to comply with its requirements does not constitute negligence *per se*.
- *Harkins* v *State* (Louisana): Violation of MUTCD is only persuasive of the standards and ruled that MUTCD's pecifications were recommendations only.
- *Quinn v United States:* Design and construction criteria were adopted by reference to MUTCD by the Corps of Engineers. The court held that "the MUTCD as neither an absolute standard nor as scientific truth, [but as] illustrative and explanatory material along with other evidence in the case bearing on the question of ordinary care."
- *Erschens* v *County of Lincoln* (Missouri):[31] The issue was whether or not MUTCD had the full force and effect of law on the placement of signs and signals by local authorities. The court held that the state statute requiring local authorities to place

such devices as they deemed necessary and place them in conformance to MUTCD, manifested a legislative intent that MUTCD in that instance did not have the full force and effect of law. Because the standard contained in MUTCD did not apply in this instance, it was not necessary to instruct the jury that the county was negligent as a matter of law for failing to comply with the manual's specifications. The court noted that certain parts of MUTCD permitted the exercise of discretion in the erection of signs where less than minimum protection was required; thus, even if the court had ruled that MUTCD had the full force of law, under the circumstances a violation thereof would not have constituted negligence *per se*.

Whether or not the violation of the regulation is negligence *per se* may depend on the way the regulation is structured. Does it permit discretion or is it mandatory? Providing signs, for example, may be discretionary, but once the decision to provide it is made, the type of sign or signal called for may be mandatory. Thus, where MUTCD calls for traffic signs or signals to be placed and maintained as the public authority "shall deem necessary," the agency may not be subject to a finding of negligence *per se* if it chose not to carry out a permitted but not mandatory action. By contrast, where it has been held that the violation of a highway regulation was negligence *per se*, the issue often is the adequacy of the warnings given, not the failure to provide warnings.[32]

The cases appear to hold that, if a regulation allows the public agency to exercise its discretion and does not direct that its action conform to a prescribed, mandatory standard, the deviation from the standard may be considered some evidence of negligence but is not negligence *per se*. In jurisdictions where MUTCD is incorporated into state or local legislation, violation of a "standard" item is highly likely to result in a jury instruction of negligence *per se*, the violation of a "guidance" item (without good documentation) can be considered evidence of negligence for a jury to consider and the failure to carry out an "option" item is unlikely to result in any discussion at all.

STANDARD OF CARE

Those with responsibilities for highways have a broad obligation to design and maintain them so that they will be reasonably safe for travel for all motorists under all anticipated circumstances.[33] Thus, a successful plaintiff must establish that an agency:

- Breached a common law duty, such as the failure to maintain the road in a safe condition, exposing the motorist to undue hazards, or failure to warn of or correct existing hazards.
- Breached a statutory duty, as discussed in the negligence *per se* section above.
- Or is maintaining a condition that amounts to a nuisance. A public nuisance can be defined as an unreasonable interference with any right common to the general public. It has long been held that any man-made device or structure on or adjacent to the highway that poses a threat of injury to travelers is a public nuisance.[34]

Where state law and regulations permit the public agency to exercise some discretion on the application of standards, policies and guidelines, those publications and directives would be admissible but only as evidence of the standard of care. Standard of care is defined as the degree of care that a reasonably prudent person should exercise in the same or similar circumstances. Another more direct reference to professional malpractice relates to whether

the professional exercised the average degree of skill, care and diligence that would be expected of members of the same profession, practicing in the same or similar locality and in accordance with the present state of the art of that profession. The guidelines may assist the jury in deciding what the standard of care is and whether or not there has been a negligent deviation from it. As the court noted in *McCamish* v *DeSai* [42 N.]. 274,200 A.2d. 116, 121 (1964)]:

> "In applying the standard reasonable men recognize that what is usually done may be evidence of what ought to be done. And so the law permits the methods, practices or rules experienced men generally accept and follow to be shown as an aid to the jury in comparing the conduct of the alleged tortfeasor with the required norm of reasonable prudence. It is not suggested that the safety practices are of themselves the absolute measure of due care."

Highway guidelines vary in terms of both specificity and permitted discretion. Some of the materials contain specific, mandatory provisions; others are more general and discretionary in nature. A California court held in that "discretionary" guidelines are admissible, although the court was careful to state that such discretionary rules were but one component of the standard of care to be considered in light of all the circumstances.[35] The court stated in a footnote that a safety guideline may be inadmissible if it is so general and discretionary that it fails "to particularize the standard of care for the jury." Once the more general, discretionary guideline is admitted, it appears that counsel will have to control its impact through testimony, carefully worded instructions and arguments to the court or jury.

Much of what has been said about the effect of a violation of design and safety guidelines applies to violations of departmental procedures. Whether issued as a regulation or an internal memorandum or directive, it appears that rules or procedures adopted by an agency for the guidance or control of its employees in the performance of their duties are admissible in most states.

The most common reason given in support of the theory of admissibility is that the employer's rule is an indication of the care required under the circumstances. Thus, it may properly be considered by a jury in determining the question of negligence.

This brings us to a situation that is becoming more and more common—discretionary decisions being made by non-professionals. These individuals have neither the training nor the understanding of engineering standards and guidelines to be aware of the safety consequences of their actions. Research into the design and/or maintenance decision-making process can provide a wealth of useful information for the plaintiff's attorney. On the other side of this coin, the codes of ethics for professional engineers in all of the states place a high value on the preservation of public health and safety. Agency employees and consultants have at least a moral obligation to advise these discretionary decision-makers of the potential hazards of deviation from established standards of care. The wise ones will document this advice in the event that the final decision may not have been a good one.

GUIDELINES APPLICABLE TO DESIGN SAFETY AND MAINTENANCE

When considering the issue of compliance with standards, there is a question of an agency's liability for design. For a state to have design immunity, it must be shown that the plan or design was approved in advance of the construction by one of the following:

- The legislative body
- Some other body
- By an employee exercising discretionary authority to give such approval

The requirement for immunity is met if the "plan or design is prepared in conformity with standards previously so approved," and if there is substantial evidence that a reasonable public employee or legislative body could have approved the plan or design. The documentation should address what standards were applicable to the project design and what endorsement signifies the standard compliance. That may be certification and signature on the plan's cover sheet, correspondence, or other documentation in the project files or project funding approvals. Many existing roadways were designed and constructed prior to 1940, before there were any nationally accepted design standards or guidelines. In some courts it has been acceptable to document that the roadway design met or exceeded the initial national American Association of State Highway Officials' design standards adopted in 1940.

There have been questions and court challenges to the perpetual nature of design immunity. Some of the exceptions considered by the courts have been as follows:

- The court may require sufficient showing that the design was prepared with ordinary care.
- There may be liability for a highway defect that is "obviously and palpably dangerous."
- There may be liability where the plaintiff is able to show that "changed conditions" have caused the highway design to become dangerous in actual use.

The California case *Baldwin* v *State* is a leading case on the "changed conditions."[36] It was held that the state had a duty to provide a left-turn lane when it became apparent that an intersection was dangerous because of changed traffic conditions. The court held:

> "Having approved the plan or design, the government entity may not, ostrich-like, hide its head in the blueprints, blithely ignoring the actual operation of the plan. Once the entity has notice that the plan or design, under changed physical conditions, has produced a dangerous condition of public property, it must act reasonably to correct or alleviate the hazard."

There is also case law in New York that imposes a duty upon highway agencies to review a plan or design once the public improvement is in operation.[37] In a successful defense, the City of Santa Clara, CA, USA's compliance with required minimum guidelines was a persuasive factor in relative to a pedestrian crosswalk suit.[38] The court held that the city was in compliance with the code and not negligent because the crosswalk pattern was used throughout California, it was in compliance with the vehicle code and it conformed to the planning manual of the California Division of Highways.

The fact that a plan or design met minimum standards or comes within the range of values set by an approved manual may not be sufficient evidence to prove that an agency met the burden of reasonable care. In *Fraley* v *City of Flint* it was the expert's opinion that the traffic signal's clearance was too short a notice for an average truck to stop.[39] The city argued that it was not liable as long as the signal timing fell within the recommended ranges of MUTCD. The court did not agree:

> "Michigan law imposes a duty upon each governmental agency having jurisdiction over highways to maintain and design them with reasonable care. The range of recommended cycles is too broad to allow mere compliance with it to be deemed reasonable without regard to the peculiarities of the intersection involved. The uniform traffic signal statute and manual cannot be used to shield defendant from its statutory liability."

A question usually arises on the need for an agency to upgrade a roadway for compliance with more stringent guidelines. The trend appears to be that if there are no changed conditions or a dangerous situation, the public agency has no general duty to upgrade or rebuild highways merely because the standards or criteria have been revised. In a Louisiana case, the court held that the state was not responsible to upgrade all its "substandard" roads to current standards recognizing the economic infeasibility of such a requirement.[40] In a similar matter in New York the court stated:[41]

> "Although by today's (1966) enlightened criteria the road would possibly not be properly constructed, it is readily evident that it did comply with the standards applicable when it was planned and built in 1911 and the state was not required to rebuild the road at this point, a major undertaking according to testimony, unless the curve could not be negotiated at a moderate speed."

In Kansas, the state had participated in a federally funded project to identify and upgrade hazardous locations including the installation of guardrail at some locations.[42] There was no claim that the bridge or intersection had deteriorated or of any defect in the design. The plaintiff argued that the existence of this federal program and the absence of guardrail at this location established that the highway was defective. The state did not have this specific location on its list of hazardous locations for federal funded improvements. The court held that the state's participation in this federal program to upgrade safety did not mean, ipso facto, that this intersection was defective.

The real thrust of the evidence was to show that the absence of the guardrail was recognized by the commission as hazardous and, thus, defective. As pointed out above, changing standards and wholly laudable efforts to improve the safety of our highways does not make "defective" that which has long been considered adequate. In this case, the decision to upgrade the Kansas highway system did not render defective those portions that the program had not yet reached.

There are several decisions against highway departments where it was shown that the department had not followed its own procedures. In Alaska, a plaintiff lost control on a curve and introduced provisions of the department's Standard Operating Procedure, which required:[43]

> "... the Department of Highways to (1) maintain superelevation on curves, (2) eliminate ruts prior to freezeup, and (3) work overtime if necessary to keep sharp curves well sanded."

The court was convinced that the state's "failure to comply with the Standard Operating Procedure would seem to be operational negligence rather than policy-making discretion." Another significant decision on this subject involved a skidding accident on a frost-covered bridge.[44] At the time of the accident, a highway maintenance manual containing policies and procedures for use by departmental personnel was in effect. The manual addressed actions to be taken when it was anticipated that frost would form on bridges. The section described the conditions under which frost was likely to form, set forth rules of thumb for forecasting frost, directed that certain procedures be followed to obtain weather forecast data and stated that "where there is frost on bridge floors be sure to treat the bridge floors with salt or abrasives."

Thus, the court held:

> "Substantial evidence was introduced to show the procedure was applicable and was violated. In addition, substantial evidence was received supporting the trial courts finding that violation of the procedure was a proximate cause of the accident. If the maintenance personnel had used the procedure, they would have known of the probability of frost and could have taken timely measures to eliminate the danger. Availability of the procedure coupled with weather conditions favorable to frost gave the commission constructive notice of the hazard in time to guard against it or eliminate it."

The existence of the maintenance procedure is itself evidence the state knew frost conditions were predictable.

CONCLUSIONS

A wide variety of publications are used by the engineering profession in the course of making engineering decisions. Most of the information contained in these documents is intended to be a guideline to aid the designer in creating a highway system that is both familiar to the driver and harmonious with the local geography. Guidelines have a specific meaning in the legal world. It is noteworthy that the guideline terminology is frequently misused and often abused in the court setting. It is beneficial for plaintiffs to refer to guidelines as standards because it infers that they have a higher legal standing than merely reference publications. The differences between standards and guidelines have been discussed at length, with the hope to assist the profession in recognizing the difference and to level the playing field when an opposing party attempts to inflate their status.

It appears safe to assume that various guidelines and publications will be admitted into court testimony. This may occur by stipulation, judicial notice, direct testimony, or expert examination. There is very little doubt that the guidelines, criteria and procedures developed, adopted and used by an agency will become a part of the court record.

There is a wide variety of case history on guideline compliance in determining standards of

care, negligence, or negligence *per se*. Negligence *per se* usually requires the direct violation of a regulation or statute that was also the proximate cause of the injury. Discretionary clauses, such as "deemed necessary," tend to place guidelines into the "standard of care" category. Only one case reference, *Dillenbeck* v *City of Los Angeles,* recognized that guidelines fall within various general and discretionary levels. This court noted the difference and indicated that counsel will have to control the guideline's impact on the case through testimony, court instructions and arguments. This paper could be useful in clarifying the terminology and assisting counsel in providing some probative weight on the guidelines.

It should be recognized that agency policies, guidelines and procedures will become court evidence with full examination of their application through testimony. The agencies are expected to comply with these policies, procedures and guidelines that they develop and adopt. It is advisable for agencies to review the wording of their existing and proposed guidelines and procedures to ensure that all requirements can be carried out and do not demand the use of outdated technology or work practices. Of course they must provide some assurance of reasonable and safe facilities for the public. In light of ever-increasing court scrutiny of internal policies and procedures, employee manuals and memorandums are becoming more general and less prescriptive. They provide staff with an overall vision of what the end result should look like, but say very little about how to get there.

Last, it should be apparent from the variety of the referenced cases that most of the questions regarding regulations, standards, admissibility, etc. are legal in nature. The retaining attorney knows how they are treated in the jurisdictions where you are working. Discuss the sources of your supporting documentation with him/her to make sure you are basing your opinion on sources that are valid, acceptable to the legal and engineering professions and admissible in the courts. Be careful about expressing an opinion on the sources themselves. You may not agree with them, or consider them very well thought out, but they represent somebody's way of doing business and establish a standard for their operations. Your primary role will be to determine if the agency complied with them and if they did not, whether their actions contributed to someone's injury.

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COURT EXHIBITS

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INTRODUCTION

Designed to inform, persuade, justify and educate, exhibits can be used to help the jury focus on the critical issues of the case. Demonstrative evidence, in the form of exhibits, is frequently used to support testimony. There are two types of demonstrative evidence: real evidence items that have actually played a part in the case, such as design plans or the remains of a tire blowout, and photographs, diagrams, charts, maps, models and videotapes that are offered to illustrate and clarify oral testimony. Schwartz and Schwartz note that when real evidence is being offered, the primary consideration is whether or not the item being offered can be authenticated as being in substantially the same condition it was in at the time of the subject event. Where evidence is being offered for illustrative purposes, the main consideration is whether or not the item accurately and substantially represents the evidence so that it will assist the jury

TYPES OF EXHIBITS

Photographs

Photographs can make a case seem more real to the jury. By the time the trial approaches, the expert should have a large collection of relevant photographs as well as copies of those offered by the other side. Some of these will be high enough quality to serve as a basis for courtroom exhibits.

Photographs with a glossy rather than a matte finish are desirable because they provide a greater degree of detail. The preferred method of showing a photograph to a jury is to use an enlargement that is clear from a reasonable courtroom distance. Eight-inch by 10-inch enlargements serve this purpose well and can be passed among the jurors. Enlargement to poster size, typically 20 by 30 inches mounted on rigid backing, may be necessary for very special photographs in which you want to point out evidence. This size permits the use of an easel and pointer to explain the significant features to all of the jurors simultaneously. Regardless of size, it is desirable that all photographs conform to the same physical dimensions to facilitate organization and handling of the exhibits.

When photographing a scene, be careful of zoom lenses. They can distort the perspective and provide an opening for opposing counsel to challenge the validity of your exhibits. The 50-millimeter fixed-focus lens is generally accepted as close to reproducing the perspective seen by the human eye. If a zoom lens is used, the photographer can look through the viewfinder with one eye and at the scene with the other. Adjust the zoom until the two images are the same size. With digital camera displays, one pretty much has to guess. The zoom feature is useful for close-up and detail work.

It is difficult to get nighttime photographs that accurately represent the scene. Various films

will react to lighting in different ways. Automatic exposure software found on most cameras will try to compensate for low light by opening the camera aperture and increasing the exposure time. This produces a photo that is considerably brighter than the human eye would have seen it. Be prepared to work with night shots until the proper result is achieved. From past experience, a starting point is to use an ASA 1000 daylight film, with manual camera settings at f4 at one-quarter second. Use a tripod or some other means to steady the camera. Make a few shots at one or two stops up and down from the beginning. Daylight film will replicate the orange color of high-pressure sodium lighting fairly well, but tends to show mercury vapor lighting as overly blue-green. Digital cameras vary in sensitivity. Use the manual settings and box in around the way you think the lighting looks. While digitals will let you see the recorded image immediately, it will usually appear brighter on a computer screen than it does on the camera display. Also remember that each individual's visual response is different. While the scene lighting may be replicated as we saw it, it most likely would have appeared somewhat lighter or darker to the individuals directly involved in the matter at hand.

Videotape

Video presentations are a powerful communication tool available to the expert. Videotape offers the advantages of motion; it can also be stopped and replayed. To be effective, it must be a true and accurate representation of something the jury needs to know.

It is desirable to retain the services of a professional videographer. However, if the expert or the attorney does the "shooting," there are several things to keep in mind:

Use a tripod when videotaping at a site. This reduces bounce and vibration and produces a higher-quality, more satisfactory picture. Cameras with anti-bounce controls can help reduce the problem, especially when shooting from inside a moving vehicle. When panning from one location to another, move slowly and smoothly so that the scene does not appear blurred or rushed to the viewer. A camera mounted on a tripod is much easier to pan than a handheld camera.

Typically, each scene should be started with a broad view of the specific site or horizon, then slowly moved to the details of the site. By replicating the way the human eye works in becoming oriented to the whole scene before focusing on detail, this allows the viewer to become oriented to the site prior to examining the detail of the particular scene.

Use care when shooting scenes with the camera aimed into the sun. Important features will show up as silhouettes unless the camera operator uses care to compensate the exposure. Signs and signals shot looking into the sun may be difficult to read because they appear darker than in real life. Jurors will be led to believe that the sign or signal is always dark and hard to read. With careful planning, it should be possible to select the time of day or camera location to minimize the adverse effects of silhouettes, over-exposure, glare, or shadows. The presence of shadows becomes especially important when shooting shoulder drop-offs, potholes, or steep side slopes. Shadows exaggerate heights and slopes.

Zoom lenses are handy, but they may change the perspective. The apparent closeness of objects and the relationship between objects can be drastically altered by zooming in and out.

If zoom is used, the camera operator should be prepared to testify as to the extent and the effect.

Narration may be either helpful or harmful. If well done, narration can describe the location of the scene and provide useful background information. On the other hand, wind noise, vehicle noise, or poor enunciation can diminish the quality of the tape. Some judges require that narration be removed prior to admission into evidence. The basis for this decision is that videotape, like a photograph, should speak for itself if it fairly and accurately depicts a scene. If additional explanation is desired, it may be given at trial by a properly qualified expert.

Note that in a video picture, the focus is normally very good in the center of the screen and not as good at the periphery. When a video is shot from a moving vehicle, objects near the edge of the screen will not be in good focus. They will also seem to pass very quickly while those in the center will move more slowly. As a result, it is difficult to read signs or to determine the condition of traffic control devices along the periphery. In this case, Turner indicates that it is much better to take a 35-millimeter photograph of a traffic sign than to depend on a videotape to accurately depict its color and condition.

Note also that it is difficult and time consuming to shoot night video that replicates what the eye saw. Any lights pointed at the camera can produce glare, halos, spots and streaks that move within the camera lens barrel. The video camera is not as good at distinguishing contrast as is the human eye, especially at night. Things that can be seen by the eye may not be discernible on videotape. On the other hand, traffic signs that were not noticed at a scene can reflect enough light to produce glare on the videotape, sometimes becoming unreadable.

Another good use of video involves computer-animation of collision sequences. “Today, on a PC or MAC laptop or desktop, anyone can easily and affordably make three-dimensional animations that can rival Hollywood’s best.”[1] Consequently, the price of software has fallen to less than $2,500 in the quotation above, and their use in court has increased. Usually, the animator or professional forensic service produces a video clip based upon maps, measurements and photographs of the site and computer-generated trajectories from a crash analysis software package. For example, the animator may digitize aerial photographs to create a three-dimensional computer database. The database yields animated versions of the sites, along with vehicles and pedestrians moving within the sites, which can be viewed from any perspective desired by the observer. This technique, when combined with an animation program capable of creating realistic moving images, produces high-quality, very convincing evidence.

You should also be aware that computer techniques can be adjusted to present not only a more favorable end result, but a result that is simply not true. The software package referenced above comes with a simple application on how to make a cow fly. A wrongful death conviction, in which a computer-based reconstruction and simulation package was used to explain the events of a crash, was overturned in the state of Washington. The appellant successfully argued that the software was not validated for use in modeling the dynamics of multiple occupants inside a vehicle during a collision.[2] The North American distributor for the software in question stated that the original expert’s application

represented “an overextension of the capabilities model.”

Therefore, it is important to understand and list the factors and criteria used in formulating the animation. Specific notation should be made of those items supported by other factual evidence. Assumed values should be reasonable and their sensitivity to the final animation product should be understood. It is reasonable to request an opportunity to review the computer-animation input data as a prelude to court approval of the showing of a computer-animation sequence. The following quotation from the Michigan state police sums this up nicely:[3]

> “…the reconstructionist not only has to be accepted as an expert in accident reconstruction, but also as an expert in computer animation. Once accepted as an expert witness, the reconstructionist has to explain the way in which the animation was created and how the scene evidence was incorporated into the animation. Everything seen in the animation has been calculated and documented by the reconstruction itself, then put into motion and placed onto a video tape for viewing. Various camera positions can be chosen to give a complete look at the dynamics of the crash.
>
> MSP received their first conviction using computer animation in July 1995 and several more convictions have followed. The animation is the concluding piece, one that ties all the evidence, photographs, diagrams, opinions, and conclusions together into one motion picture of how the crash occurred.”

Animation allows a realistic view of the sequence of events in a collision. Often this cannot be obtained through other methods. Certain events may be difficult for a juror to understand from looking at scattered drawings. In particular, the juror may not grasp the intermediate events occurring between scenes depicted on a series of drawings.

Charts, Maps and Plans

These items can be effective for clarifying your case or opinion. Remember that the average jury comprises ordinary laypersons with no particular knowledge of the engineering field. The diagrams, maps and plans will be of help only if jurors can read them, understand them and believe that they have some factual basis for their decision. For example, the typical highway plan-profile sheet showing old and new geometrics, utility relocations, right-of-way lines, drainage features and a traffic control plan will only be confusing to laypeople. It is better to create a new uncomplicated drawing (diagram) showing only those features and measurements critical to the current case. Because multiple ideas may be confusing, it is best to present just one message per drawing. In some cases, overlays of base drawings are useful in presenting data and concepts. Overlays are especially helpful when presenting comparisons, such as vehicle positions at points in time when it is traveling at different speeds.

Charts are helpful in putting statistics into digestible form. They can also show a chain of events, logic flow and organizational structure. Charts are effective when they are simple. When a chart is complex, it may be more of a burden than a help. To avoid this problem, use more than one chart to simplify what is being presented. Present the information

progressively from one chart to the next, either in flip or overlay manner.

Exhibits should be professionally done but should avoid giving the impression that they were created by an advertising agency. Do not overdo it! Too much in the way of exhibits can be confusing and may be likened to a three-ring circus. Present the case to the jury in the most graphic way without being overly dramatic. Exhibits go with the jurors into the jury room, so think carefully about what you want to leave with them.

On the other hand, jurors, like everybody else, like toys. Dry-mounted diagrams with model vehicles, overlays, working lighting devices, clean vehicle parts and other things they can get their hands on during deliberation will help keep them focused on your side of the presentation.

In the courtroom, keep drawings covered until ready for presentation. Stand to the left side of the easel and do not block it. Encourage the jury to look at your photograph or drawing, then let their eyes drift back to you. Make sure the evidence can be seen; consider size and position. Do not make the display so small that the impact is lost nor so large that transportation and storage become a problem.

The use of CAD equipment to produce drawings, maps and court exhibits has been efficient and effective because of the ease in making revisions, rapid size adjustments and the availability of colors for emphasis. A good CAD drafting service can take a surveyor's data set and overlay the total station data collected by the investigating officer to produce a clear and accurate map of the scene. Unfortunately many police agencies are reluctant to give up copies of their electronic data, and you may be stuck with a printed set of coordinates. These will still work; it just makes data entry a tedious process. The data can also be used to depict sight triangles, roadway profiles and other unique conditions that may be present. Another advantage is that a small, 8.5 by 11-inch or 11 by 17-inch CAD drawing can be prepared for the attorney for his/her files, ease of reference and consultation.

Models

Although they lack the momentary impact of video, models have certain advantages not present with video. Models are always visible during jury deliberation and may be handled by the jury, appealing to the sense of touch. Three different modeling techniques are used with technical testimony:

- **Miniaturization:** This involves using a scale model to depict an object or area too large for introduction into a courtroom.
- **Enlarged model of a small object:** This is useful for objects that are difficult for a jury to examine in detail.
- **Working subassembly:** Such models are usually of those parts of a mechanism that the expert finds relevant. This forces the jury to concentrate on the simple area in question rather than becoming involved with the entire object or mechanism.

Traffic Control Devices

It has been practice to use actual traffic control signs or signal heads as exhibits in the courtroom. These devices appear larger in the courtroom because of perspective standing alongside a device versus a field installation. This is not all bad if you are defending a poor

visibility claim, but the size can work against you if you are trying to convince a jury that visibility was a problem. Additionally, the devices may be bulky and hard to handle, require electrical service and take time to set up. In this day and age bags of electronic devices tend to upset courthouse security personnel.

Paper or cardboard replicas of signs have been used successfully in place of actual signs. These can be created by picking images from the *Manual on Uniform Traffic Control Devices* or creating them with one of the sign design programs. With the widespread use of computer-driven sign cutters, many work zone traffic control companies and traffic control suppliers can manufacture small signs, with actual sheeting on an aluminum plate, at a reasonable cost.

Traffic signals and electronic devices are extremely difficult to model or demonstrate in the courtroom setting. They can be large, hard to set up, do not always function properly and are difficult for the layperson to understand. Unless you are trying to demonstrate a very simple function or action, signal demonstrations are best left to charts and computerized graphic displays.

Working subassemblies can be useful when demonstrating various types of vehicle lighting, the effects of alignment of light-emitting diode displays and signal lenses, the function of sign support slip bases and other similar size components. Any object that is intended to be handled by the jury must be clean, free from sharp edges and electrically safe. Do not expect to get any of your models back. They frequently are retained by the court as trial exhibits.

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DESIGN AND MAINTANANCE OF TRAFFIC CONTROL DEVICES: PUTTING IT ALL TOGETHER

By Richard A. McGuinness, P.E., PTOE, Traffic Department Manger, URS Corporation

So far we have covered techniques for extracting information from field investigations, the subtleties of obtaining information from witnesses and some guidance in finding the way through a bewildering array of standards, guidelines, policies and employee handbooks. We now have some type of business organization, a tax identification number and a client who needs help with a matter concerning a questionable traffic control device. Like the dog that has finally caught the school bus, what do we do now?

We begin fitting the pieces together by looking at physiological and psychological aspects of driving, forming an understanding of why a driver does what he/she does, how he/she stays on the road and how he/she gets where he/she wants to go. We then look at the fundamentals of traffic control and see how properly designed and maintained traffic control devices address the driver's needs and aid in completing the trip safely and efficiently.

THE DRIVING TASK[1]

The basic driving task consists of three performance levels: control, guidance and navigation. Control is the most basic. It refers to the driver's interaction with the vehicle. Information comes in the form of feedback from the vehicle itself. The next level is guidance, which refers to the driver keeping a safe speed and correct path. This task involves judgment, estimation and prediction. Information at this level comes from the highway geometrics and roadside culture, from the behavior of the traffic stream and from traffic control devices. The lowest performance level is navigation. This refers to planning and executing the trip from origin to destination. This information comes from maps, verbal directions, guide signs and land marks.

During the course of a trip, these tasks are not independent but occur at various times and have the potential to occur simultaneously. The driver has to sort out the flow of information and put it in some sort of order. This is known as primacy. Maintaining control is the highest order of primacy, followed by guidance and then navigation. Becoming involved in a collision is far more serious than missing a turn or becoming lost.

Drivers receive most of their information visually. We process the information that comes to us in a serial fashion; that is, one item at a time. We are able to integrate the various driving tasks and maintain an overall appreciation of the ever-changing environment by sampling information in short glances and shifting attention from one source to another. We make some decisions and delay others based on the primacy of the need. We rely on judgment, estimation and prediction to fill in the gaps. Such task-sharing behavior enables effective use of our limited attention span and information-processing capabilities.

When information needs compete, the driver will shed the unneeded and low primacy information and concentrate upon the higher-order tasks at hand. Information that is not

immediately used is stored in short-term memory, where, if it is not used or reinforced, it is quickly forgotten. The information that is immediately needed is compared with the individual's lifetime experiences and expectancies stored in his/her long-term memory. This process results in a standard, predictable response to a standard situation.

DRIVER EXPECTANCY[2]

The key phrase in the previous section is "standard situation." To successfully integrate with other travelers, a driver's response and reaction to situations, events and information on the road must be predictable. The frequency and repeatability of guide path information presented to the driver affects the speed and accuracy of his/her information processing. Road conditions are discernable for several seconds ahead of the vehicle. He/she knows what to expect. Traffic control that agrees with driver expectancy facilitates the driver's task, making driving easy and comfortable.

On the other hand, violated expectancies lead to longer reaction times in responding to changing conditions, confusion, inappropriate responses and driver errors. The results are sloppy tracking, sudden decelerations and sudden changes in lateral force when a curve is entered too fast and, in extreme cases, running off the road. A typical example of the value of expectancy is trying to follow a local driver along a poorly marked rural road. The local, who drives it all the time, knows what to expect through experience. He/she tends to drive fast and fluidly, rarely touching the brake. You, on the other hand, are always into a curve too fast or cresting a vertical curve that is sharper than you thought. Your driving is jerky and you always seem to be on the brake for one reason or another.

Expectancies affect all levels of the driving task, from control through guidance to navigation. They have a direct influence on how the driver responds to the situations and events encountered during the course of a trip. Expectancies are classified in two types: *a priori* expectancies and *ad hoc* expectancies.

A priori expectancies are the expectancies we gain from a lifetime of driving. They are the habits developed from years on the road. We (in North America) drive on the right side of the road and look left before crossing the street. Driving and walking in the British Isles emphasizes how much of our daily travel runs on autopilot.

Ad hoc expectancies are the short-term location and site-specific expectancies associated with a specific location or geographical area. You expect to see some construction or maintenance activity when approaching orange signs and vehicles with yellow beacons. You expect to drive at speeds in rural Montana that would probably put you in jail in urban Connecticut. These are conditioned responses, but once you leave the work zone or Montana, your behavior changes to match the current conditions.

Addressing driver expectancy has a direct effect on highway design and traffic operations. Appropriate expectancies should be reinforced. This is accomplished by uniform design of streets, highways and traffic control devices with appropriate standards applied to each class of facility. It is carried out by a uniform application of traffic control devices. A specific warning sign has the same meaning in New York or California. This includes the advisory

speed plaque suggesting the same speed for the same degree of curve on all highways. Speed limits are consistent along a highway with a similar design and roadside culture, even if it runs through multiple jurisdictions.

Expectancy violations should be eliminated during design. Sharp curves at the end of long tangent sections of highway should be avoided. A lane closure or construction taper should not begin over a hill crest or on a curve with limited sight distance. There are plenty of examples of those responsible for operation and maintenance of the highway system succumbing to lapses of good engineering judgment and common sense.

Driver expectancy is maintained by the use of:

- Consistent, standard design in all cases
- Use of appropriate traffic control devices
- Use of uniform traffic control devices
- Consistency between jurisdictions

The expert, as well as the highway designer and operating agency, should remember that upstream practices affect downstream expectancies. The driver, unless explicitly notified otherwise, expects the road ahead to be the same as the road he/she just traveled.

FUNDAMENTALS OF TRAFFIC CONTROL DEVICES

The purpose of traffic control devices is to ensure a safe and orderly movement of all road users on the street/highway system. Signs are used to notify drivers of regulations such as travel speed; when and where turns can be made; who has the right of way at intersections; the direction of flow on a street; when and where parking is permitted; and a host of other actions that a driver must do or cannot do. Traffic signals also fall into the realm of regulatory devices. Regulatory devices generally have the backing of state or local legislation, and violation of them by a traveler can result in penalties and liability in the event of a collision.

A second major function of traffic control devices is to warn motorists of impending hazards in or near the highway. Signs are the most common devices used for this purpose. Roadway conditions of which the driver needs to be aware in order to safely complete his/her trip are curves, cross roads, a reduction in the number of lanes, unusual pavement conditions, etc. Occasionally these signs are supplemented by flashers, rumble strips, pavement markings and other devices to reinforce the urgency of the message.

A third major function of traffic control devices is to provide guidance to the driver. Guidance here is used in both the sense of providing the driver with sufficient information to inform him/her where the pavement is immediately ahead of the vehicle and the navigational sense of providing the driver with the information needed to travel from one place to another without becoming lost. Pavements are delineated by lines and other longitudinal markings; roadside and barrier delineators; raised pavement markers; roadway lighting; and, occasionally, more sophisticated devices such as light pipes and sequential flashers. These devices tend to the driver’s immediate need for knowing where the boundaries of the travel

path are, so he/she can manage the vehicle's speed and direction in a safe and orderly manner.

The navigational types of devices range from a simple route marker to an in-vehicle global positioning mapping system. These devices provide directions to communities, points of interest, nearby services and information about almost anything imaginable. Their primary purpose is to assist the driver in getting to the desired destination.

The principals of traffic control devices are spelled out—as guidance—in the *Manual on Uniform Traffic Control Devices* (MUTCD) as follows:[3]

- Fulfill a need
- Command attention
- Convey a clear, simple meaning
- Command respect from road users
- Give adequate time for proper response

These are the basic questions the expert will be looking at. They cover all traffic control devices, from delineators to signals and sophisticated intelligent transportation system devices. They form the fundamentals of traffic control.

When evaluating the appropriateness of a traffic control device, one of the initial evaluations should be on its purpose for being there. What need does it address? Would travel be more hazardous, uncomfortable, or confusing without it? Does it compete for attention with another traffic control device that is more important to safety? What need does it fulfill?

The physical characteristics of the device in question also play in important role in the proper operation of the highway system. Some questions to consider about the design of the device are:

- Does it draw attention?
  - Size: Is it large enough for the class of highway upon which it is being used? Can it be recognized, read and understood at prevailing speeds?
  - Shape: Does the shape conform to the requirements of MUTCD? Are warning signs diamond? Are signal indications oriented in the order shown?
  - Color: Does the color conform to the requirements of MUTCD? Is the shape compromised or negated by another sign on the same support? Are warning panels yellow? Are exit number panels on service signs blue? Are yellow-green signs used for pedestrian functions?
  - Composition: Are the symbols, text, or signal patterns arranged in a standard and recognizable pattern? Are the proper letter fonts and stroke widths used? Are standard symbols used?
  - Lighting/retroreflection: Is the device effective after dark? Is the sign reflectivity functional? Is the sign orientation effective (no shiners or fade outs)? Is the sign clean? If lighted, are the lights working?

- Contrast: Does the sign text stand out from the background? Does the device stand out from the surrounding area? Is there a billboard, animated sign, or lighting nearby that will distract the driver or overpower the device?

- Does the device convey a clear meaning?
  - Size: Can it be seen and understood at prevailing speeds? Can the entire message on a variable message sign be read at least twice by approaching traffic?
  - Shape: Is a unique shape such as a STOP or YIELD retained? Is this shape recognizable from the front and back of the sign?
  - Color: Is MUTCD color assignment appropriate (orange for work zones, yellow-green for school zones, black/white/red for regulatory, etc)?
  - Simplicity of message: Is a standard message used? Is an unambiguous custom message used? Can the meaning be understood by most or preferably all drivers?

- Does the device command respect from the motorist?
  - Does it warn of an actual hazard? Is the flagger really present? Is the lane really closed? Is the bump really worth slowing down for?
  - Are posted speeds unrealistically slow? Are advisory speed plaques unrealistic?
  - Is a signal stopping mainline traffic for no good reason (operating on recall or fixed time)?
  - Is the device trying to be "cute"? Speed limit at some odd increment? Duck crossing? Green STOP signs? These are generally found on private property, but MUTCD applies to private property open to the public.

- Is the device placed properly and effectively?
  - Can it be seen by approaching traffic? Is it blocked by vegetation, trucks, parked vehicles, or buildings? Is it over a hill crest? Is it on a sharp curve? Is it on the departure side of an overpass?
  - Is it appropriately positioned?
    - Is it an adequate distance ahead of the hazard?
    - Is the placement the same as similar devices in the area?
    - Is the location free of competing background clutter?
  - Has the device been properly maintained?
    - Is it in place?
    - Is it properly aligned?
    - Is it reflective?
    - Has the color faded?

The second major factor the expert will evaluate is uniformity. Some designers and agencies feel constrained by the concept. They feel that uniformity compels them to "cookbook" their designs and limits their ability to be creative. Sometimes they are correct. When there is a unique issue to be addressed and no standard sign or device is available, it is appropriate to devise something that will assist the motorist. When doing this, make sure the design follows the fundamentals of communication with the traveler and presents a clear and unambiguous message about what the conditions are and what the traveler is expected to do.

Uniformity does have a purpose. As discussed previously, it simplifies the driving task by aiding recognition and decreasing perception/reaction time. When a device has the same meaning wherever you travel and has kept that same meaning over a long period of time, a glance is all that is needed for the driver to know what it is, what it means and what he/she is expected to do. A red, octagonal-shaped sign at an intersection in North America means that the approaching driver does not have the right of way. It does not matter if the words on the sign are in English, Spanish, or French. The meaning is the same, and the expected driver behavior is the same. All drivers know what to do. This almost instantaneous recognition can mean the difference between big trouble and crash avoidance. The faster the driver perceives the need to change his/her behavior, the quicker he/she reacts and begins avoidance. Using the STOP sign as an example again, a quick glimpse of red in the brush growing on an intersection approach will give the driver a hint that he/she may be about to enter an intersection in front of unsuspecting traffic. The rapid recognition and reaction gives him/her the opportunity to stop in time to avoid a potential collision.

Uniformity is also critical to providing a common interpretation of traffic laws and expected traveler behavior. While the laws are not uniformly enforced within and among the various jurisdictions, the meaning of the device is always the same. A red signal indication means that you do not enter the intersection. If you do, and there is no argument about the signal being in a change interval, the officer issuing the ticket and the court hearing the case will have the same interpretation of your action. A red signal indication prohibits entry into an intersection. This meaning is common to the driver, the pedestrian, the officer on the street and the judge.

These two examples are simple and unambiguous. The expert will probably never be called to give an opinion on the meaning of a STOP sign or a red signal indication. However, one does not have to go far to find examples of strange-looking regulatory, warning and guide signs. Many signs are too small to be read from a moving vehicle, contain too much text to be read at prevailing speeds, or are simply confusing. This problem tends to show up frequently with local guide signs and construction signs. Unique symbols and confusing messages show up on warning signs less often. Even signs that are used everyday and are in MUTCD are not well understood by the public. A Kansas study revealed that overall warning sign comprehension in that state was 75 percent.[4] On a good day, one driver out of four will have trouble understanding what the highway communication system is trying to tell him/her.

The expert should also be aware that a uniform device may be used for some application other than for which it was intended. Some of the more common examples of non-uniform application are the use of speed advisory plaques (yellow or orange) in a stand-alone mode; a single chevron (two or more are always required to be visible); and the use of a flashing arrow panel for shoulder work (no lane is closed). Sometimes improper use is worse than no use at all. The motorist begins to question the validity of the device and hence loses the early warning advantage by taking the time to see if it really means what it is saying. Most of us are conditioned not to slow down for work zone signs until we determine if a lane is really closed or the flagger is really present.

LINK TO LIABILITY—ANALYSIS OF EVENTS

The question facing the expert is whether or not an injury to a highway user is attributable to the maintaining agency, one or more of the road users, a third party, or a combination of all of the above. Was a sign misleading or a highway hazard unmarked? Was another driver speeding or in violation of some other traffic law? Was there a contractor or utility company working on or near the right of way? A crash is the result of a chain of events. A change in the behavior of any of the participants would have led to another outcome.

It is up to the expert to research the following questions:

- Was there a defect in the design of the road, the traffic control, or the barrier systems?
- Was there a defect with the maintenance of the road, the traffic control, or the barrier systems?
- Was there warning of the defect or condition ahead sufficient to give an approaching driver time to take appropriate action to avoid a crash?
- Was the motorist driving erratically, too fast, or too slow because he/she was confused by the roadway information system or trying to avoid something in the road?
- Was the motorist driving erratically, too fast, or too slow because he/she was intoxicated, asleep, or distracted?

There is also the question of notice to the agency. If the responsible party had no way of knowing of the hazard, it will not be held liable for damages caused by the condition. However, if it knew or should have known that the hazard was present, it does have a responsibility to compensate an injured party. There are many ways that an agency can receive notification. A complaint from the public is a direct method, as is the investigation of a crash by the agency's police force. A history of crashes at a particular location can constitute notice. The simple fact that an agency employee, any employee, passes by the hazard constitutes notice of a defect. If an agency does not perform and document periodic inspections and/or maintenance of its highways, barrier systems and traffic control devices, it can be held responsible for damages because it should have known of the dangers if it had carried out the inspections. It is helpful for the expert to have an understanding of how maintaining agencies perform their duties, the items they should be aware of, their methods for maintaining their physical facilities and their methods of documenting these activities.

Lastly, it must be determined if the condition contributed to an injury or damages to the highway user. If a genuine hazard exists but nobody was injured and no property was damaged, there is no harm and no foul. Sometimes the motorist is forced off the road and collides with something in the clear zone. While the maintaining agency did not cause the initial excursion from the pavement, it can be responsible for resulting damage if it does not maintain a safe roadside. On the other hand, if the motorist was traveling at a speed that exceeded the design parameters of a protective device, was the speed in excess of what could reasonably be expected or was the device under-designed?

These are some of the many questions the expert will have to deal with as he/she unravels the events of the crash. Some of the conclusions will be supportive of the retaining attorney's theory of the case. Other conclusions will not. However, all of the identified facts and conditions should be thoroughly discussed with the retaining attorney. Some of the non-supporting facts may not be included in the reports or written documentation, but the expert should certainly make the retaining attorney aware of them and be comfortable with discussing them in deposition and trial when they are brought up by opposing counsel.

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DESIRED INPUT TO HIGHWAY DESIGN AND TRAFFIC CONTROL LITIGATION

By Robert W. Crommelin, P.E., PTOE, President, Robert Crommelin and Associates Inc.
Updated by Lance Robson, Consulting Engineer, Encino, CA, USA

INTRODUCTION

The client's attorney and the legal investigator are critical to obtaining the information needed by a traffic engineer consulting in cases involving personal injury where the design of the roadway or the use of traffic control devices is an issue. As in any other investigation, a principal effort is to preserve or re-create the scene and its environment. The expert witness may become involved in the case several years after the actual incident occurred and must re-create the scene in his/her mind based upon what has been recorded or discovered as part of the work of others.

The following outline describes what is of importance to a traffic engineer in an investigation of an accident scene and its background:

General

- Police accident/crash investigation report
- Witness statements
- Photographs of the scene of the crash
- Photographs of the site of the crash, taken both before and after
- Weather records, obtainable by the traffic engineer from Web sites such as www.wunderground.com/ or www.ncdc.noaa.gov/oa/mpp/
- Area map obtainable by the traffic engineer
- Inspection of the site and the involved vehicles by the traffic engineer
- Photos of the involved vehicles, if not available for inspection
- Answers to interrogatories and document requests by the public agency and other parties
- Witness depositions (try to avoid summaries; read the deposition yourself)
- Depositions of representatives of the entities having responsibility for the road and/or traffic control devices
- Depositions of any other experts in traffic engineering, accident reconstruction, or human factors
- The complaint (outlining issues in the lawsuit)

Physical Features

- Geometric features (What geometric features might have contributed to causing the accident?)
  - Use your own site inspection, observation and measurements. Supplement this with the following:
  - As-built construction plans, cross-section and profile
  - An aerial photograph (1 inch = 50–100 feet) of the scene taken close to the date of

the accident (available from the public agency, commercial aerial photographer, U.S. Department of Agriculture/Forest Service, or Web sites such as http://www.terraserverusa.com/, MapQuest, Yahoo Maps, Google Earth, etc.). Some states (Kentucky) have an excellent online global positioning system site. You can enter the coordinates from the crash report and come up with a map or photo with the location pinpointed.
    - Photographs: Ground at 3.5-foot camera height and driver's position. Take at 100-foot intervals back to include all traffic signs and views for at least 600 to 1,000 feet.
    - Sequential pictures (photo log if available) showing approaches and all signing relating to the scene (from the highway agency)
    - Video drive-through (must describe log of road odometer, sign legends, etc.)
    - Survey by the land surveyor (prepare courtroom exhibit showing scene and approach)

- Corner sight distance (What is the view from the side street?)
    - Take photos from 3.5-foot camera height at 5-foot intervals back on the side street looking in the direction of the crash
    - Determine sight distance from the side street (3.5-foot eye height) at 10, 15 and 20 feet back from the edge of the traveled way
    - Locate STOP sign and stop bar

- Construction zone (What did it look like at the time of the incident?)
    - Preserve the scene; it is critical to get pictures of signs, markings, locations of work, etc. If the crash was at night, photograph at night, too.
    - Traffic control plans or diagrams for construction zone accident showing all signs, cones, barricades, etc. (part of plans for project, contractor and inspector daily diaries, etc.)

- Curve warning adequacy (Was the curve signed properly?)
    - Do ball bank tests
    - Determine center line radius and banking of curve
    - Compare with nearby curves (Is this curve the sharpest?)

- Guardrail and median barriers
    - Percent of slope and height of fill
    - Distance between opposing travel lanes in the median (excluding shoulders)
    - Distance off traveled way to roadside objects

Traffic Factors

- Traffic volume (What were the daily and hourly volumes using the roadway?)
    - Traffic volume map often is available from the public agency showing daily counts
    - Actual traffic counts: public agency or special count ordered by you
    - Take sample counts: not necessary to do 24 hours (7:00–9:00 a.m., 10:00 a.m. to 12:00 p.m., 1:00–3:00 p.m. and 4:00–6:00 p.m. = 50 percent of daily; evening

peak hour usually 4:30–5:30 p.m. = 10 percent of daily)
    - Available from the public agency

- Traffic speeds (What are "design" speeds for the roadway? Usually the speed at or below 85-percent travel.)
    - Sample using radar or timing over selected distance with stop watch
    - Hire data collection firm to do study

- Accident history (at least 3 years, preferably 5 years)
    - Computerized summaries (get interpretation key)
    - Collision diagrams
    - Actual copies of accident reports

- Public or agency personal complaints (part of notice to agency)
    - Get actual copies of correspondence
    - City council minutes
    - Traffic commission minutes
    - Inter-department memos (police or other departments to public works)

- Traffic control device history (When were signs, stripes, traffic signals, etc. installed, inspected, maintained, or modified?)
    - Traffic control device (sign, signals and markings) installation, inventories and maintenance records of the public agency

REVIEW OF RESOURCES AVAILABLE FOR INVESTIGATING RAILROAD AND HIGHWAY GRADE CROSSING ACCIDENTS

By Richard A. Ryabik, P.E., PTOE, Ryabik and Associates Inc.

OVERVIEW

Railroad and highway grade crossing accidents are unique events that typically involve severe property damage, personal injury and/or fatality. Due to the magnitude of damage and the high visibility of these accidents, they may be investigated by the National Transportation Safety Board (NTSB). Since 1967, NTSB has investigated more than 10,000 surface transportation accidents. NTSB takes an active role in investigating these types of cases for public safety, transportation research and future prevention.

All published investigations involving railroad and highway grade crossings are available online at www.ntsb.gov under the railroad and highway sections. Any investigations older than 1995 must be ordered directly from NTSB or the National Technical Information Service (NTIS) online at www.ntis.gov. You can find a condensed summary of investigations from 1995 or before online. If your report is in need of other data, a docket is available that may consist of hundreds or thousands of pages of data. A docket can be requested through General Microfilm at 304-267-5830. The date and location of the accident or an accident identification number is needed to obtain the docket.

In addition, accident information is maintained by the Federal Railroad Administration (FRA) through a crossing inventory database that can be searched online at safetydata.fra.dot.gov/officeofsafety/Default.asp.

The purpose of this section is to describe the usefulness and relevance of the NTSB, NTIS and FRA resource tools and how you may integrate those agencies' reports in your investigation.

INVESTIGATIVE STEPS

First, as part of your research**,** it is important to tap into NTSB's resources. NTSB's reports will provide valuable guidance in any analysis you undertake; NTSB is a warehouse of data. Because NTSB studies and reviews transportation safety issues of national significance and public concern, it will prevent you from reinventing the wheel. NTSB studies provide insightful information and will assist you in your investigation. There is a very good chance a report exists with a similar fact pattern or scenario to your investigation. Table 3-2 provides examples of some reports provided by NTSB.

Please review the column entitled "Probable Cause." NTSB clearly states that there are many types of contributing factors in a collision, ranging from operator error to poor agency policy. An NTSB analysis of an accident and its probable cause are not considered authority in a court of law. See Use of Government-Related Reports.

Second, as part of your analysis, facts and statistics can be culled from NTSB reports. You should integrate that information and draw the relevant comparisons. An example of this type of comparative analysis is in Table 3-3 dealing with locomotive operator emergency response characteristics. It reflects data culled from a number of resources describing locomotive operators' response in grade crossing collisions.

Table 3-3 lists additional quantitative information, such as reaction distances, as well as qualitative information, such as witness descriptions and statements provided by the locomotive operators. Information not identified, such as locomotive speeds, deceleration rates and complete stopping distances, is available and if necessary to your investigation should be reviewed and analyzed.

The last entry in Table 3-3 is "ZMA Study" and is based on detailed event recorder data. Event recorder data (similar to a black box) are retrieved from the locomotive. The event recorder records speed, throttle positions, brake handle positions, air brake pipe pressure, horn applications and headlight operation. The data require a special order from the court to retrieve or may be available in the docket information for an NTSB report or from General Microfilm.

Detailed event recorder data were available in Table 3-3 for Report HAR-94/01 and the ZMA study. In order to quantify distances, you may need to cross-reference a number of reports and statements such as witness statements, train position when the horn was applied and/or event recorder data. The investigator will need to apply sound engineering principles when quantifying distances and values.

Third, you need to review FRA resources for additional accident information. FRA maintains a crossing inventory database. All crossings in the United States have a U.S. Department of Transportation crossing inventory number. There is only one exception—temporary activities for construction not to exceed six months. You can search the U.S. Department of Transportation crossing inventory number at http://safetydata.fra.dot.gov/officeofsafety/publicsite/Query/invtab.aspx. You also can search by state, city, county, street and railroad. If you are fortunate to have a crossing number, start your search with that number, such as 628183J.

Table 3-4 lists information culled from the FRA accident report database. This table demonstrates that the 628183J crossing has a collision history. There has been approximately one collision per year for a 6-year period at the 628183J crossing. The typical accident frequency for a crossing with annual average daily traffic greater than 10,000 is about one accident every 16 years.[1,2] When reviewing a collision history, you need to analyze other factors that may have existed at the time of the accident, such as traffic patterns, new construction, highway appurtenances and visual/audio obstructions. It could simply be that the collision history is a regression to the mean effect. Only after a detailed analysis of contributing factors can one draw conclusions regarding an accident.

USE OF GOVERNMENT-RELATED REPORTS IN DISCOVERY AND ADMISSION INTO EVIDENCE

All professional engineers need to exercise caution in the utilization of data and information when developing hypotheses or forming opinions regarding an accident they are investigating. Information such as reports, surveys, or other data from government-sponsored improvement programs are not subject to discovery or admissible into evidence in state and federal court according to 23 U.S.C.S. 148. The Section clearly states government-related reports used in any proceeding for damages "arising from an occurrence of a location identified or addressed in such reports, surveys, schedules and lists" is inadmissible.[3]

Keep in mind that there are exceptions to the rule. You need to consult an attorney and the governing regulations in your state. In Florida, for example, an expert can testify to information normally considered inadmissible provided the expert's testimony is of the "type which similar experts rely upon in forming opinions or drawing inferences."[4] You also need to know that, as an expert witness, if you rely upon inadmissible data, it does not mean a jury will hear or see that data. The judge may rule against it being presented to the jury.

In all instances as an expert witness, you need to adhere to good record-keeping standards when forming opinions. Depending on the venue of your testimony, you may be called upon to use that information to support your hypotheses.

SUMMARY

Utilizing online resources from NTSB, NTIS and FRA is strategic and valuable in any scientific or forensic analysis of a railroad highway crossing accident. It provides insightful information to assist you in formulating theories regarding the investigation. By using thorough comparative analysis, you can develop ideas regarding an accident that will direct your investigation in the proper direction. If you are involved in litigation, be aware that using safety data and other information from government sources may become limited in testimony.

REFERENCES

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Special thanks to NTSB, NTIS, FRA, General Microfilm, Adorno and Yoss, Zook Moore and Associates, LexisNexis, ITE Expert Witness Council members and JMD Engineering Inc.

TABLE 3-2: SAMPLE NTSB REPORTS

Report Number	Date of Accident	Accident Description	Probable Cause Description
HAR-94/01 Fort Lauderdale, FL	3/17/1993	Amtrak train collides w/gasoline tanker truck	"Inadequacy of the precautions taken by the Broward County project manager, the design FL engineer, and the contractor, which resulted in traffic congestion at the railroad/highway grade crossing, and the truck driver's decision to cross the railroad track even though the warning system had activated."
ATL-97-FR-004 Jacksonville, FL	2/5/1997	Amtrak train collides with tractor-semitrailer	"Tractor semi-trailer driver's improper turn on narrow road and the truck driver's failure to use available communication devices to warn authorities that his vehicle was fouling the tracks."
PB2001-916303 McLean, IL	9/26/1999	Amtrak train collides with automobile	"Failure of the signal maintainer to remove a jumper cable grade crossing relay."
PB2001-916202 Glendale,CA	1/28/2000	Metrolink train collides with tractor-semitrailer	"Adequate preparation and route planning for the movement (e.g. oversize tractor-trailer load); poor coordination of the movement among the truck driver, pilot car drivers, police escort and permitting authorities; a lack of recognition of the potential hazard caused by the accident vehicle at the grade crossing. Contributing to the accident was the fatigue of the pilot car drivers and the truck driver."
PB2001-916203 Conasauga , TN	3/28/2000	CSXT freight train collides with school bus	"School bus driver's failure to stop before traversing the railroad/highway grade crossing. Contributing to the accident was Murray County, GA, school district's failure to monitor bus driver performance and its lack of school bus route planning to identify hazards on school bus routes and to eliminate the necessity of crossing railroad tracks."

TABLE 3-3: LOCOMOTIVE OPERATORS' RESPONSE IN GRADE CROSSING COLLISION

Report Number	Advance Notice of Hazard	Emergency Avoidance Attempt Prior to Collision	Comments on Operators' Action
HAR-94/01	Yes 1528 feet	Yes at 422 feet(2)	"The engineer later said that he was about 2 car lengths north of the whistle post, which was 1528 feet north of the crossing. He saw a small white car on the crossing and right behind it was a tractor that was just over the east rail."
ATL-97-FR-004	Yes	Yes at 1721 feet(2)	"When he realized that the truck was not moving, the engineer applied the emergency brakes."
PB2001-916303	Yes	NA NF	"The engineer stated that he was sounding the train's horn when he observed an automobile crossing from the east; the vehicle did not appear to be reacting to the horn."
PB2001-916203	Yes At 952 feet(3)	Yes At 122 feet(2)	"The engineer stated that he saw the bus approaching the crossing and yelled 'Hey, Hey.' The conductor jumped up and both crewmembers were concerned about the action of the bus. The conductor said that the yellow bus was illuminated by sunlight and he noted road dust swirling behind it. The engineer stated that when the bus continued to move toward the crossing, he placed the train in emergency braking using the automatic brake valve."
PB2001 916202	Yes	Yes At 1000 feet (4)	"As the train rounded a slight left-hand - curve, the engineer said that the crossing became fully visible and she saw a large object on the tracks. She sounded the train whistle as a warning."

ZMA study (1)	Yes At 2715 feet(2)	Yes At 600 feet(2)	NA

With permission of Adorno and Yoss, and Zook, Moore and Associates Inc. (ZMA)
Based on event recorder data
Based on event recorder horn data
Based on sand found at the site, which is applied when brakes are placed in emergency
NF: Not found
NA: Not available

TABLE 3-4: SUMMARY OF SELECTED ACCIDENT REPORTS AT NW 62ND STREET CROSSING, BROWARD COUNTY, FL, DOT CROSSING #628183J

Accident Date	Time of Day	Railroad	Narrative Description
8/24/98	5:45 p.m.	Amtrak	"Train #90 with engines 72/6 and 12 cars traveling north on the CSX main struck an automobile at MP1006.31, Cypress Creek Road Crossing."
7/26/99	5:40 p.m.	Amtrak	"Train #90 with engs 71/59 and 13 cars struck an automobile at MP1006.30, NW 62nd Street Crossing"
5/19/00	5:42 p.m.	Amtrak	"Train #90 with Eng 63/24 and 9 cars struck a tractor-trailer at MP1006.3, NW 62nd Street crossing, a male occupant in the car behind truck was injured by debris from truck."
10/8/03	4:08 p.m.	Amtrak	"Train #90 with engines 81 and 6 cars struck an automobile at MP1006.31, NW 62nd Cypress Road Crossing."
12/10/03	4:25 p.m.	Amtrak	"Train #90 operating with locomotive 122 and 6 cars struck an automobile at MP1006.3, Cypress Road Crossing."

Section 4
Miscellaneous Information

HAND REFERENCE NOTEBOOK

By Robert W. Crommelin, P.E., PTOE, President, Robert Crommelin and Associates Inc.

It is convenient to carry a notebook of reference information to the field and when meeting with clients for quick verification of data, formulas, or other information outside the office. The following outline provides some suggestions on information that might be appropriate for a reference notebook. The reference material, however, should be tailored to individual needs and scope of work. It is recommended that the data be consolidated, copied on both sides of the page and cross-referenced for quick review when needed. A 1-inch binder should be adequate without using too much space.

Design Values

- Friction factors—various surfaces
- Traffic investigation manual—Northwestern University
- Portions of *Fundamentals of Traffic Engineering*—University of California
- Stopping Sight distance—AASHTO
- Clear zone guidelines—AASHTO
- Portions of *Traffic Engineering Handbook*

Mathematical Formula

- General motion (e.g., time, distance, acceleration, speed, stopping)
- Curve speed (e.g., comfortable and maximum)
- Determination of speed from skid marks
- Combined speed formula
- Vaulting and fall formula
- Solution to quadratic equation
- Normal vehicle acceleration rates (e.g., cars, trucks, bicycles)
- Normal deceleration rates

Human Factors

Reaction times (e.g., emergency, PIEY; decision)
Driver eye heights (e.g., various vehicles)
Normal cone of vision
Acceptable human acceleration and deceleration limits
Pedestrian walking speeds

Traffic Control Devices

Curves—signs, delineation, advisory speed
Multiway STOP sign warrants
Suggested advance warning sign placement—MUTCD
Guardrail warrants—AASHTO
Traffic signal warrants
Speed zoning worksheet
Safety effectiveness of traffic control devices

Sight Distance (AASHTO References)

- Horizontal curves
- Vertical curves
- Intersection sight distance
- Decision sight distance

Field Measurements—Statistics

- Metric conversion tables
- Volume conversion factors (e.g., hourly, daily, seasonal for various roadway types)
- Statistical validity (e.g., poisson, students test, normal curve)
- Curve radius for various offsets of 50-foot chord
- Trigonometric and curve relationships

Illumination

Sunrise/sunset tables for local area
IES-recommended illumination tables

Typical Accident Rates

- Roadway sections (e.g., classification, access control, urban/rural)
- Intersection (e.g., rural, suburban, urban by type of control)
- Pedestrian
- Accident report coding charts for local agencies

Statute/Code/Ordinance Provisions and Definitions

- Uniform Vehicle Code-definitions and "Rules of the Road"
- Specific local code/ordinance provisions
- American Disabilities Act for Handicapped Facilities

FILE AND LETTER DATABASE
FILE AND LETTER DATABASE

By Robert W. Crommelin, P.E., PTOE, President, Robert Crommelin and Associates Inc.

The use of computers and word processors permits you to set up file databases for case reference and also simplifies letters to your clients by use of letter clause "shopping list." Microsoft Word, WordPerfect and other word processing programs make these programs easy to use for a small office.

FILE

A file should be established early in the case discussion to avoid confusion between cases, to track pending work and to produce a client list. Potential file records are noted below:

- Client: Attorney's name and firm
- File: Last names of plaintiffs versus defendant
- Date of incident: Helps avoid confusion on multiple cases.
- Location: City/county/state or state/route/milepost
- Case type: Principal/design/maintenance/construction/railroad crossing/P&Z
- Subcategory: Sight distance/traffic control devices/channelization/signal timing

LETTER DATABASE

The database format for requesting information from the client can include the following suggestions:

1) As a result of our recent conversation, I would like to indicate my desire to work with you as a consultant on the subject case.
   a) I have reviewed the materials forwarded with your letter of _____.
   b) As indicated at our recent meeting, I am writing you to request additional information on the subject case.

2) For your files, I am enclosing my personal resume and our standard rate schedule that would apply to our fees regarding services on this matter. I also am including a synopsis of the number and types of cases on which I have consulted, given depositions, or testified in court since 1969. By retention of me as a consultant to your firm or agency, it is understood that your firm or agency will be responsible for payment of all billing with regard to our work as well as our costs of collection of those fees should that unfortunate situation arise.

3) I look forward to receiving information on this case.
   a) I recently visited the scene of the accident and took measurements and observations.

4) Some additional information would be helpful in continuing my investigation. Please send me a copy of any of the following that may become available either now or in the future.

a) Some additional information would be helpful in continuing my investigation.
b) Please send me a copy of any of the following that may become available either now or in the future:
- Police accident investigation report
- Police photographs
- Complaint concerning this lawsuit
- Any ground photographs showing the scene, approach signing and views
  (a) Take pictures back from scene on each approach at 100-foot intervals; please call me if you have any questions.
  (b) At 5-foot intervals back from the edge of the through-lanes if corner views are an issue; call me if you have any questions.
- Sequential pictures (photolog if available) showing approaches and all signing relating to the scene, if available
- An aerial photograph (1 inch = 50–100 feet) of the scene taken close to the date of the accident, if available
- Answers to interrogatories and those indicating theories of liability
- Area road map indicating the scene and area street pattern
- U.S. Geological Survey Quadrangle sheet showing scene
- Copy of the street and highway plan for the public jurisdiction showing the functional classification of the involved roadways
- Witness statements and depositions
- Depositions of any experts
- Traffic control plans or diagrams for the construction zone showing all signs, cones, barricades and so forth present at the time of the accident.
- Also diaries of supervisors indicating status and chronology of work
- Include copies of any accident/incident reports prepared for accidents in the construction zone during the course of construction
- Hourly and daily traffic volume counts in the vicinity of the scene, prior or subsequent counts are okay
  (a) I can arrange for a traffic count if you desire.
- Speed studies in vicinity of the scene, speed zoning studies, ordinances setting speed limit
- As-built construction drawing showing typical cross-section: plan and profile of the roadway
- As-built construction drawings for traffic signals
- As-built construction drawings for _____
- A survey of the accident scene that could be used as a courtroom exhibit showing physical features, traffic control and so forth
  (a) I can arrange for such a survey if you desire.
- Records of street lighting in the area (e.g., light size, location, type of source, light distribution, pole height, lumen output)
- Correspondence, public requests (complaints), traffic studies and investigations or similar records of public agency regarding traffic operations in the vicinity of the scene
- Copies of any jurisdiction-wide traffic engineering/safety studies conducted within the past 10 years (e.g., traffic control device inventories, high accident location studies)

- Traffic control device installation work orders, inventories and maintenance records, cover _____ years.
- Any friction tests (friction number) made on _____between _____ and covering the _____ period and _____; include results and description of procedure
- Any memos; work orders, maintenance records, or contracts covering major surface maintenance such as overlay, chip seal on or in the vicinity of the accident from ____ to ____ (minor patching may be omitted); cover the past ____ years.
- Copy of any "road log" listing mileposts or other distance measurements showing the location of various physical features of the road, traffic signs, curves and other characteristics as of the date of the subject accident. The log is to cover within _____ of the scene. If a complete log is not available, provide what is used by the highway jurisdiction for inventories.
- Traffic signal timing records; information on manufacturer and model of intersection controller; phasing diagram as of the date of the accident
- Traffic signal maintenance records for 2 years prior to the accident and 6 months subsequent

Traffic accident data (at least 5-year history) and any "collisions diagrams" prepared for the scene

5) When I receive the materials from you, I will review them and call you concerning my preliminary opinion.
   a) When I receive the materials from you, I will review them and call you concerning my preliminary opinion. We will then coordinate a trip to view the scene.
   b) I intend to view the scene when my schedule permits. If this would not be appropriate, please let me know. When I receive the materials from you, I will review them and call you concerning my preliminary opinion.

6) I would appreciate receiving a nonrefundable retainer in the amount of $_____ that will apply against future charges.
   a) I wish to acknowledge receipt of your retainer in the amount of $ _____.
   b) Please return a signed copy of the Memorandum of Understanding, which retains us and authorizes us to work on this matter.
   c) Please return a signed copy of the Memorandum of Understanding, which retains us and authorizes us to work on this matter along with your retainer in the amount of $_____. This is a nonrefundable retainer and will be applied against future billings.

7) Thank you for contacting my firm. I look forward to working with you on this matter.

8) Very truly yours,

TRIAL NOTEBOOK OUTLINE

By Robert W. Crommelin, P.E., PTOE, President, Robert Crommelin and Associates Inc.

It is expected that an engineer will be well organized and, as an expert, thoroughly familiar with the material pertaining to the case. It can be embarrassing in court to fumble through documents to find a reference or to assure yourself that you are quoting the correct figures. I have found that a prepared notebook, especially for each trial, helps organize information and make it readily available for reference. The following outline includes suggestions on how to organize a notebook.

- **Materials reviewed** (i.e., a list of items to be used during introduction)
- **Summary pages** (i.e., summarization data from more detailed back-up)
- **Accident report/police photos** (i.e., for subject collision)
- **Field notes and expert photos**
- **Other photographs**
- **Plans, maps and aerial photos**
- **Traffic volumes and speeds**
- **Accident history**
- **Public agency records**
- **Deposition summaries**
  - Lay witnesses and police
  - Government and agency personnel
  - Other experts
  - Your deposition
- **References**
  - Roadway design
  - Traffic control devices
  - Ordinances and rules of the road
  - Construction zone

CASE DATABASE

By James L. Pline, P.E., PTOE, President, Pline Engineering Inc.

It is now a frequent practice for attorneys to inquire during discovery or deposition for an expert's records relative to previous cases. The federal court can require you to submit your involvement in cases during the last five years. Inquiries are usually made relative to specific types of expert involvement, jurisdictional representation, number of plaintiff representation versus defendant and other case history information. A case database can also be useful for your reference when contacting repeat clients and searching for previous case information or marketing services. The following items are suggestions for an appropriate case history database:

Case number or designation court filed
Location
General case type (i.e., design, construction, signals, signing, etc)
Key issues
Expertise for plaintiff/defendant
Plaintiff's name, attorneys, experts
Defendant's name, attorneys, experts
Expertise provided, (i.e., consultation, affidavit [date], engineering report [date], deposition [date], testimony [date])
Date employed
Date completed

Section 5

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