Ethics and the Transportation Engineer

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Abstract

Hardly a day goes by without a news story about an ethical lapse by a public official, a corporate leader, or another prominent citizen. A short list might include Bernard Ebbers, Dennis Kozlowski, John Rigas, Kenneth Lay, Randall “Duke” Cunningham, Daniel Rostenkowski, and William Jefferson. This is a sad situation, but fortunately, few of these cases involve an engineer and even fewer involve transportation engineers. But what does this mean? Does it demonstrate that transportation engineers rarely have ethical lapses, or does it imply that the lapses that do occur are not newsworthy?

Consider, for example, a fundamental canon in ASCE’s Code of Ethics: *Engineers shall hold paramount the safety, health, and welfare of the public. . . .* At a time when 43,000 road users die annually on US highways, does it make sense to argue that none were due, at least in part, to poor designs or inadequate traffic operations that could have been corrected by engineers? What is the engineer’s responsibility when recommendations that will enhance traffic safety are rejected by politicians? What about upper management’s rejection of warranted treatments in favor of less-deserving but more glamorous treatments?

This paper will focus the transportation engineer’s attention on ethical behavior without belaboring ethical codes or canons, and it will examine the potential for ethical dilemmas in the practice of transportation engineering.

Background

According to the dictionary, *ethics* is:

1. *The study of standards of conduct and moral judgment; moral philosophy*
2. *The system or code of morals of a particular person, religion, group, profession, etc.*

A simple internet search leads a practical observer to several important conclusions related to ethics:

- There is a distinction between personal ethics and business/professional ethics.
- Just because an action is legal doesn’t mean it’s ethical.

All (well, perhaps *most*) persons embrace a personal code of values that proscribes how they will behave in a general sense. In fact, most rational individuals believe some form of the general credo *treat others as we would like to be treated*. According to *Religion for Dummies*, most major religions adopt this theme. For example:

> “Not one of you is a believer until he desires for his brother what he desires for himself.” (Islam)
> “Do not do to others what you would not like yourself.” (Confucianism)
> “If you do not wish to be mistreated by others, do not mistreat anyone yourself.” (Zoroastrianism)
> “Thou shalt love thy neighbor as thyself.” (Judaism)
> “Do to others whatever you would have them do to you.” (Christianity)

The foregoing in no way implies that atheists don't have a code of ethical behavior. Indeed, ethical theory identifies two important nonreligious ethical policies:

- *Utilitarianism*, which holds that one can know what is good by deciding in a rational manner what action will produce the greatest happiness or good for the most people. Engineers apply this strategy when they select projects based on their benefit/cost ratios.
- *Deontology*, which holds that decisions must be made by considering one's duties and the rights of others. This requires adherence to a moral code: don't lie, steal, or intentionally kill or injure.

Informal Codes of Ethics

It is extremely important that engineers maintain a very high level of personal ethics, because their behavior at this level will strongly influence how they conduct their professional duties. An individual who maintains a high level of ethics at home and within society is unlikely to change that behavior at the workplace.

Before discussing the formal codes, it is worthwhile to consider some shorter, simpler guides to making ethical decisions or actions. One of the more frequently cited comes from Dr. William Brown, in his book *The Right Thing: Ethics Inaction/Ethics in Action*. Brown's guide, presented in the following table, consists of questions rather than rules or principles that a decision maker can apply to a wide range of issues.

Table from Dr. William Brown

- Does your chosen course of action seem logical and reasonable? Forget what others might say. Does it make sense to you? If so, it is probably right.
- Does the solution you choose pass the test of sportsmanship? If everyone followed the same course of action, would the results be beneficial for all?
- Where do you think your plan of action will lead? What effect will it have on others? What effect will it have on you?
- How well will you think of yourself when you look back on what you have done?
- Separate yourself from the problem. Imagine it is a problem affecting the person you most admire. How would that person respond to the problem?
- What difference would it make if everyone knew about your decision, especially your family members and friends? Chances are that decisions made in hopes that no one will find out are not ethical.

Codes of Ethics

Many professional associations, boards, and societies have established codes of ethics that help guide their members in making decisions. Most codes have two parts—a preamble outlining the society's aspirations, and the canons that specify rules or principles that should guide the actions of the society's members. Some engineering codes take a single page, while others stretch to six or eight.

A web site at the Illinois Institute of Technology (IIT) provides links to 32 domestic and foreign engineering codes of ethics (http://ethics.iit.edu/codes/engineer.html). The codes provide an outline of ethical behavior, recognizing that it is not feasible to address every possible situation. As a result, they provide a framework for engineers to make ethical decisions. At the same time, most professional societies are not organized or operated in ways that would permit them to provide real-time guidance to an engineer faced with a critical decision. However, there have been several notable cases where professional societies have rallied after the fact around individual engineers who were censured or fired for making ethical decisions. IEEE's 1973 effort to assist three BART engineers who were fired for raising safety concerns and ASME's support for Roger Boisjoly, the O-ring engineer for the space shuttle Challenger, are two prominent examples.

The National Society of Professional Engineers (NSPE) publishes a very detailed code of ethics. NSPE's Fundamental Canons are mimicked by many other professional engineering codes.

I. Fundamental Canons

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

The fundamental canons of the American Society of Civil Engineers (ASCE) are similar to NSPE's, but incorporate two more provisos:

- Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
- Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.

A transportation engineer can seek ethical guidance from ITE's Canons of Ethics, which is grouped into three categories:

- Relations with the Public
- Relations with Employers and Clients
- Relations with Other Professionals

Interestingly, the ITE canons do not put the same level of emphasis on safety as do other engineering professions. In contrast to the "Hold paramount. . . ." statement in the canons from NSPE and ASCE (as well as ASME and ABET), ITE's canon states "The member will have due regard for the safety, health and welfare of the public in the performance of professional duties." The authors of this paper believe that the only appropriate *due regard* for the safety, health and welfare of the public is that it be paramount.

Violating Ethical Principles

A transportation engineer might encounter ethical challenges in several ways. One situation that can clearly create problems involves the engineer as an expert witness. A second scenario where ethical challenges can occur is the interaction of a transportation engineer with clients, colleagues, elected officials, employers/employees, media, motorists, the public, and suppliers/vendors. But perhaps the most pervasive, yet generally overlooked, ethical issue involves the transportation engineering profession's failure to truly *hold paramount the safety, health, and welfare of the public*. This paper will comment briefly on the first two scenarios and consider the third issue in more detail.

Ethics and the Expert Witness

Expert witnesses may be employed by both plaintiff and defense attorneys to provide technical background, details, analysis, and explanations to a jury that is typically composed of non-technical citizens in tort liability cases. In some, but certainly not all, cases, transportation engineering experts can properly view the same data and come to differing conclusions. In other cases, experts may strain the limits of credibility by stretching the meaning of standards, guidelines, and policies engineers commonly use in their profession. Every expert has his/her favorite example of witnessing such a stretch. One of the authors remembers distinctly a plaintiff's expert who developed, *ex post facto*, a new traffic signal warrant for the intersection of a one-way street and a two-way street. The judge didn't buy it. In the sake of fairness, it should be noted that the roadway owner counted traffic volume for exactly eight hours to determine if the traffic volume warrants were satisfied; as a result, 10 percent of the financial responsibility was assigned to the owner for doing poor traffic studies.

Multiple technical papers could be devoted to the topic of ethics and the transportation expert witness. A May 2007 *ITE Journal* article by Honorary ITE members Bob Crommelin and Jim Pline offers some thoughtful comments on the Engineers' Creed, a framework for ethical decision making by expert witnesses.

Interactions with Others

Without a doubt, a transportation engineer's daily interaction with others affords many opportunities for ethical challenges. The ITE Canon of Ethics is primarily directed toward the issue of interactions with others. The transportation engineer must be completely honest in dealings with others. Employers may provide guidance regarding the acceptablility of certain actions—for example, whether a government employee can/should accept a $5 coffee cup with a supplier's logo, a $20 lunch from a consultant, or an expenses-paid trip to a vendor event.

One clear example of the failure of an engineer to act ethically (or even legally) involved Lester Matz, a consulting engineer in Baltimore County, Maryland. His firm, Matz, Childs and Associates, was founded in 1956 but had no success in getting government contracts. In 1963, Matz met with newly elected Baltimore County Executive Spiro T. Agnew to inquire about competing for county road contracts. Matz was told that he needed to pay a kickback, so he created an elaborate scheme where the firm's associates were awarded "bonuses." Those individuals kept enough money to pay the income tax on their "bonuses" and returned the rest in cash to Matz, who passed the money to Agnew. According to the firm's accounting books, these appeared to be proper transactions. The kickbacks continued when Agnew was elected Maryland governor in 1966 and even into the early 1970s, while Agnew was the Vice President of the United States. Following an investigation by the US Department of Justice, Agnew resigned and pleaded *nolo contendre* to a single charge of failing to report income; he was fined and placed on probation. Matz cooperated with the authorities and avoided criminal punishment.

As part of its member education focus, NSPE has developed a number of hypothetical ethics case studies, which are available online at http://www.niee.org/cases/. According to the web site, NSPE's Board of Ethical Review operates on an *ad hoc* educational basis and does not engage in resolving disputes of fact between parties in actual cases. Being solely educational, the Board's function is to take the submission of "facts" as the basis for analysis and opinion without attempting to obtain rebuttal or comment from other parties. The following is a representative example of the cases considered by the NSPE's BER.

NSPEBER Case 94-9

Conflict of Interest – Accident Reconstruction Services

Facts:
Engineer A, a principal in a private practice firm, is retained orally by the attorney for a litigant involved in a legal action to provide accident reconstruction consultation. The litigant, a plaintiff, is suing a defendant allegedly responsible for a traffic accident. Although Engineer A sends a letter of agreement to plaintiff's attorney, it is never returned signed by plaintiff or his attorney. No additional information is exchanged between Engineer A and plaintiff's attorney. Approximately two years later, the law firm representing the defendant contacts Engineer A and seeks to retain his services in connection with the same legal action. Engineer A, assuming the plaintiff and his attorney have decided to retain the services of another expert, agrees to provide his services to the law firm representing defendant. Later plaintiff's attorney contacts Engineer A with the expectation that Engineer A would provide accident reconstruction consultation per earlier agreement.

Question:
Was it ethical for Engineer to agree to provide his services to the law firm representing the defendant?

References from the NSPE Code of Ethics:
Section II.4.a . - Engineers shall act in professional matters for each employer or client as faithful agents or trustees.
Section III.4.b. - Engineers shall not, without the consent of all interested parties, participate in or represent an adversary interest in connection with a specific project or proceeding in which the Engineer has gained particular specialized knowledge on behalf of a former client or employer.

In its discussion of this case, the Board of Ethical Review paid particular attention to similar cases it had decided earlier and on the most relevant parts of the Code of Ethics. The interested reader is referred to the discussion and conclusion available at the web site.

Safety as an Ethical Issue

According to the IIT web site (http://ethics.iit.edu/codes/codes_index.html), certain professions, including engineering, some sciences, medical providers, and airline pilots, incorporate the concept of providing safety in their codes of ethics. By contrast, ethics codes from the arts, business, finance, and law do not include the concept of safety. This is not unexpected because the former professions provide service in areas that could lead to adverse safety consequences. So the question arises, how can one assess the degree to which transportation engineers are meeting their ethical responsibility with respect to safety?

Analysis of case studies—actual or hypothetical—can be useful in assessing ethical behavior. Real-world cases are, obviously, examined after the situation has developed, a decision was made, and the consequences (but usually not the intimate details of the case) are known to everyone. The cases are inherently realistic, and especially if the consequences are dire, the blame has been established. In contrast with a hypothetical example that can be presented in a page or less, many serious real-world cases (e.g., airline crashes, Ford Pinto, Firestone tires, train/school bus collisions) generate volumes documenting the case. The primary shortcoming of these cases is that the after-the-fact analyst has the advantage of hindsight.

The alternative is hypothetical situations. Several web sites provide hypothetical case studies in engineering ethics. In general, hypothetical case studies can be stated simply while avoiding complex interacting factors. They can be examined directly, or by considering a set of *what if. . .* alternatives. Distinguishing between *good* and *bad* is generally not too difficult. The shortcoming of hypothetical ethics case studies is that they are, well, *hypothetical*. Furthermore, they may be constructed and discussed by ethicists with little or no engineering background.

The National Science Foundation sponsored work by the Center for the Study of Ethics in Society at Western Michigan University to develop 32 hypothetical case studies. The case most relevant to transportation involves roadside safety. This case, which is presented online at http://www.onlineethics.org/cases/pritchard/trees.html, is cited below:

> Cutting Roadside Trees
>
> Kevin Clearing is the engineering manager for the Verdant County Road Commission (VCRC). VCRC has primary responsibility for maintaining the safety of county roads. Verdant County's population has increased by 30% in the past 10 years. This has resulted in increased traffic flow on many secondary roads in the area. Forest Drive, still a two lane road, has more than doubled its traffic flow during this period. It is now one of the main arteries leading into Verdant City, an industrial and commercial center of more than 60,000 people.

For each of the past 7 years at least one person has suffered a fatal automobile accident by crashing into trees closely aligned along a 3 mile stretch of Forest Drive. Many other accidents have also occurred, causing serious injuries, wrecked cars, and damaged trees. Some of the trees are quite close to the pavement. Two law suits have been filed against the road commission for not maintaining sufficient road safety along this 3 three mile stretch. Both were dismissed because the drivers were going well in excess of the 45 mph speed limit.

Other members of VCRC have been pressing Kevin Clearing to come up with a solution to the traffic problem on Forest Drive. They are concerned about safety, as well as lawsuits that may some day go against VCRC. Clearing now has a plan -- widen the road. Unfortunately, this will require cutting down about 30 healthy, longstanding trees along the road.

Clearing's plan is accepted by VCRC and announced to the public. Immediately a citizen environmental group forms and registers a protest. Tom Richards, spokesperson for the group, complains, "These accidents are the fault of careless drivers. Cutting down trees to protect drivers from their own carelessness symbolizes the destruction of our natural environment for the sake of human 'progress.' It's time to turn things around. Sue the drivers if they don't drive sensibly. Let's preserve the natural beauty and ecological integrity around us while we can."

Many letters on both sides of the issue appear in the Verdant Press, the issue is heatedly discussed on local TV, and Tom Richards presents VCRC with a petition to save the trees signed by 150 local citizens.

Discuss how Kevin Clearing should proceed at this point.

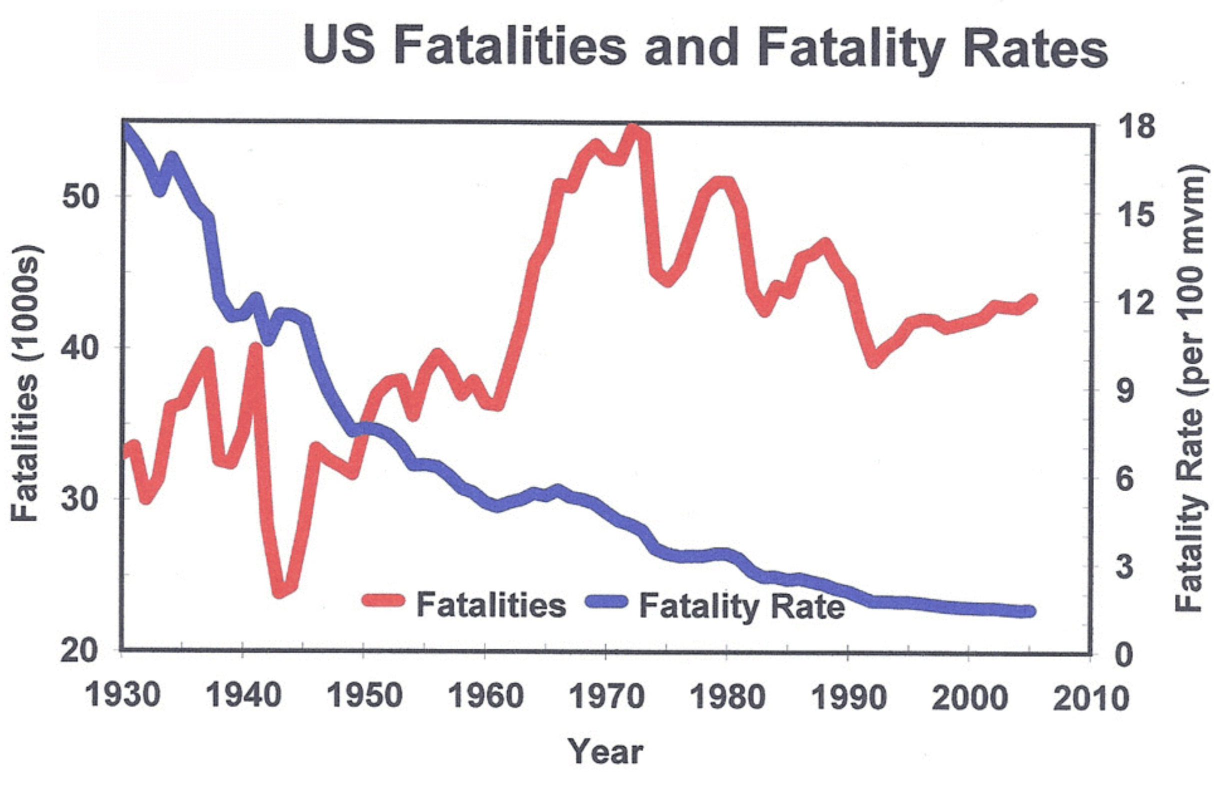
An experienced transportation engineer’s reaction to this location’s record of one fatality per year for seven years would be “Get out the chain saw!” However, the opinions on the web site were written by four philosophers and an architect whose expertise is structural failures. Their commentaries, which exclude any reference to clear roadsides, the AASHTO Roadside Design Guide, or similar technical references, include the following observations:

- Fatalities have been limited to speeding drivers.
- The field of environmental ethics suggests that trees may also have intrinsic value.
- Special-interest groups frequently polarize situations. [Really?!]
- Options include installing speed bumps or guardrails, and increasing police patrols. [Speed bumps on a 45 mph road?!]
- The risks to motorists should be balanced against the benefits provided by the trees.
- In the opinion of Verdant County lawyers, the trees do not represent an unreasonable hazard. [Who are the lawyers to judge this?!]
- One expedient might be to wait until the next accident and lawsuit, and let the courts decide about the trees.
- Clearing should find out if the drivers are willing to assume some risk in order to avoid destroying the trees. [What about drivers who do not participate in the survey?!]

This example is so hypothetical and so removed from the reality of transportation engineering as to render it either useless or dangerously misleading.

The Big Picture

Transportation engineers can try to evaluate their profession's ethical record with respect to safety by examining initiatives in light of the highway safety record over time. One of the authors joined ITE in 1966, the same year that the US Congress passed two landmark pieces of legislation: the Highway Safety Act and the Motor Vehicle Safety Act. The former applied to such highway safety elements as enforcement, driver education, uniform traffic regulations, engineering design and operations, alcohol, and emergency medical services; the latter resulted in safety performance standards for motor vehicles. In 1966, nearly 51,000 road users were fatally injured on this nation's highways, and the travel-based highway fatality rate was 5.5 fatalities per 100 million vehicle-miles (100 mvm) of travel. The federal goal at that time was to reduce the fatality rate to 4.0 by 1980; the author doubted that this goal was not achievable in 14 years. Indeed, the number of fatalities peaked in 1972 at nearly 54,600, but due to increased travel the rate had dropped to 4.33. After minor changes in 1973, the results improved dramatically in 1974, when fatalities dropped to 45,200 (the greatest numerical drop since this country's entry into WWII) while the rate dropped to 3.53 fatalities/100 mvm. Although debate continues, much of these decreases are attributed to the National Maximum Speed Limit of 55 mph and to reduced travel, both of which happened in response to fuel shortages.



As shown in the figure, highway fatality counts and rates generally trended downward from 1980 to the present, with some of the variation due to economic conditions and many other factors. One significant factor was the introduction of safety restraint legislation by New York in 1984; within a decade, all but two New England states had adopted similar legislation. The national focus on alcohol impairment, the continued improvements in vehicle-occupant protection and roadway design/operation, and concentrated enforcement activities have helped. In 2005, highway fatalities followed an increasing trend but were still 11,200 below the 1972 peak; and for the first time in over 20 years, the fatality rate increased (by an insignificant 0.01, to 1.45).

Doesn’t the figure demonstrate that the transportation engineering profession has been working toward improved highway safety? Yes and no. It is not clear, for instance, how much of the reduction is due to highway and traffic engineering. Nor is it clear how much the transportation engineers of 50 years ago understood their responsibility for providing safety to the motorist. In congressional hearings in the late 1960s, several engineers made comments to the effect that *we design the roads, not the roadsides*. They were strongly rebuked by committee chairman Rep. John Blatnik (D-MN), who told them:

> It is the height of cynicism to contend that the drivers should never have left the roadway or that many of them must have been drunk, or that somehow the driver was at fault. Why or how he left the road is not the issue. Whether he left because he was drunk, or stealing a kiss, or because he suffered a bee sting, dozed, had a blowout, was sideswiped, or forced off the road is irrelevant to roadbuilders.
>
> What is relevant is that those who are responsible for road construction recognize that the roadside is as vital to the safe operation of a vehicle as the pavement itself, and that the duty to make that roadside safe is a very real one.

In today’s world, the engineers’ comments are hard to believe. AASHO published its Yellow Book in 1967, addressing the issue of roadside safety and calling for, among other things, 30-foot clear roadsides on freeways. One of the authors vividly recalls accompanying an FHWA highway safety expert on a pre-ribbon cutting visit to a new, eight-lane suburban freeway in 1971. They measured the location of the rigid fixed objects—every one was 30 feet, 0 inches from the edge of the travel lane. If highway engineers actually appreciated the weak rationale for a “30 foot clear roadside,” they would have provided an even wider clear roadside, when feasible, where there was no additional cost.

But has engineers’ sense of responsibility to motorists really changed? Over the past forty years, the authors have talked to highway and traffic engineers about locations with unusually high numbers of traffic accidents. Before discussing the engineering issues, several of those engineers first asked *how many of the drivers were drunk?* Do transportation engineers somehow think they have no responsibility to a motorist whose BAC is greater than 0.08 percent? Which highway or traffic engineering improvements help only sober drivers? Doesn’t it make sense that strategies such as flatter curves, more delineation, better signing, and clearer roadsides will help all motorists? These comments do not imply tolerance of impaired driving; however, almost any expert can relate an example where an impaired driver won a tort liability lawsuit against a governmental agency. Engineers have a responsibility to design and operate the highway system for the prudent (a legal term) motorist, not the perfect motorist.

Many engineers have heard their colleagues refer to traffic signal warrant **P**, the political warrant. This warrant is used when an intersection does not meet one of the MUTCD’s accepted criteria. There are other **P** criteria as well. For example, in some CBDs, efficient, safe, energy-efficient one-way grids established in the 1950s are reverted to two-way streets that degrade safety and waste fuel, simply because it is politically desirable. Considering the numerous examples that document the benefits of one-way streets in a central business district, how can an engineer, in good conscience, endorse the reversion to a two-way system for the expressed purpose of improving safety and efficiency?

Making It Personal

The key dilemma of many transportation engineers is this: *If I don't do what the mayor/city council/county commission wants me to do, contrary to my best informed engineering judgment, I'll be fired or lined out of the budget.* That is a valid concern that can't be dismissed lightly. But how does it compare with the ethical responsibility to *hold paramount* the safety, health and welfare of the public—or at least have *due regard* for it? Recent engineering history recounts examples of engineers who have stood up and said *that's not safe—don't do it*. Roger Boisjoly advised against launching the space shuttle Challenger in cold weather, and lost his job after testifying before Congress. Three engineers raised valid complaints about the safety of the BART control system, and they lost their jobs due to poor whistleblowing. Individuals such as these, who took seriously their obligation to public safety, are truly role models of ethical engineering.

The current stipulation by some state PE Boards for an ethics component in their continuing education requirements for professional registration makes this discussion particularly relevant. It is imperative for engineers to remind themselves of the seriousness of their ethical responsibilities and to develop viable mechanisms for meaningful engineering ethics education.

A search of the *ITE Journal* reveals that since 1950 there have been only seven articles that mention ethics. In addition to the aforementioned May 2007 article by Crommelin and Pline, Hibbett Neel's article in March 2004 reminds transportation engineers of their ethical challenges as public sector employees, consultants, and expert witnesses. Walter Kraft, in his acceptance of ITE's Burton Marsh Award (November 1992), stresses the importance of ethics and integrity in this profession. In a May 1977 article, Roy Anderson addresses the issue of ethical practices in providing improved work zone safety. The authors of this paper recommend all of these *ITE Journal* articles to the interested reader.

The authors believe that ITE, at regional and national levels, should encourage and facilitate a substantive discussion of appropriate manifestations of sound ethical principles in this discipline. Perhaps ITE District 6 might be aggressive enough to solicit Annual Meeting papers on the topic of ethics. The national organization should reconsider the wording of its canon to elevate the importance of providing for the public safety from its standard of *due regard* to a mandate for *holding paramount*. Each member of this profession should take seriously the obligation to identify, interpret, and apply ethical principles to their daily activities. If you find available resources to be shallow or inappropriate, request better ones. If you face or envision daunting ethical challenges, pose them as inquiries that will stimulate professional examination and dialogue.

Further Study on Ethics

In addition to numerous books on the topic of engineering ethics, which can readily be found in an internet search, ethics centers at a number of universities provide references and case studies suitable for independent studies. The following universities, whose URLs are give in the References section, are among the most comprehensive:

1. Online Ethics Center for Engineering and Science, Case Western Reserve University
2. Center for the Study of Ethics in the Professions at IIT
3. Engineering Ethics, Texas A&M University
4. National Institute for Engineering Ethics, Texas Tech University

A number of ethics case studies involve failures such as the space shuttle Challenger, the Kansas City Hyatt, the Bopal/Union Carbide, the Exxon Valdez, and the Ford Pinto.

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Case Western Reserve University, Online Ethics Center for Engineering and Science, http://onlineethics.org/ .

Cases from the National Society of Professional Engineers Board of Ethical Review, available at http://www.niee.org/cases/ .

Center for the Study of Ethics in the Professions at IIT, http://ethics.iit.edu/csep/aboutcsep.html .

Engineering Ethics, Texas A&M University, http://ethics.tamu.edu/ .

Ethics test exercise, http://www.businessballs.com/ethics.htm .

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ITE, Canon of Ethics. http://www.ite.org/aboutite/index.asp

National Institute for Engineering Ethics, Texas Tech University, http://www.murdough.ttu.edu/FP.cfm .

NSPE, *Code of Ethics for Engineers,* http://www.nspe.org/ethics/eh1-code.asp

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