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Ethics and Standard of Care

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Perhaps no greater “soft skills” are necessary for the Engineer to acquire than the ability to deal capably with ethical issues and to behave in a professional manner, for these skills lie at the heart of the engineer’s primary obligation—to hold paramount the public safety, health, and welfare. As Engineers seek to enhance their image in the 21st century by achieving a better grasp of globalization and improving their ability to communicate effectively, they must also strive to enhance their image with the public whom they are obligated to protect by performing their work in accordance with ethical standards and by giving back to their profession through participation in professional activities and licensure. The Engineer’s role and responsibility today extends beyond protecting today’s public to protecting future generations and the environment that these generations will inherit.

While ethics have always been an important component of engineering practice, the ethical considerations of the 21st century place a heavier burden on engineers today. Engineers today must also work to devise ethical means of addressing such problems as climate change, an increase in natural disasters, and the pressing need to incorporate the principles of sustainable design into a wide array of projects. And as Engineers move forward in the 21st century, they must also formulate a vision that focuses on how best to determine future societal needs and approaches the management process accordingly, an ethical consideration not typically considered in the past.

The public “takes for granted” that the infrastructure for which the public relies will not fail. The public also puts their trust into engineers and believes that Engineers will be truthful and honest. The standard of truthfulness in engineering is very high, much higher than in everyday life. It imposes an absolute prohibition on deception. An engineering practicing professional must possess a service motive and share advances in knowledge, safeguard professional integrity and ideals, and render gratuitous public service in addition to service rendered to clients; must recognize one’s obligations to society and to other practitioners by living up to established codes of conduct; must assume relations of confidence and

accept individual responsibility; and should carry one's part of professional groups as well as one's part of the responsibility of advancing professional knowledge, ideals, and practice.

Given the failing infrastructure of today, in today's environment, the client is looking to the engineer to provide solutions that will not only be in the best interest of "today" but will serve as a solution for "tomorrow" and the "future". Sustainability considerations, life-cycle costing and asset management considerations are all areas that an engineer should be addressing along with the risks that may arise based on decisions to be made in these considerations which in turn may fall to an expected standard of care. The design process must consider the knowledge of a particular product performance or design process as is easily obtained in the public domain-especially given the internet and the availability of knowledge and engineering journals. Assumptions made in the design process will be used in standard of care allegations.

Sustainable design is now requisite. While environmental impact assessments are now common, clients will begin to require that both social-economic and human impact assessments be performed before projects can proceed. For instance, with respect to economic considerations, what is the project cost that represents the best values from the perspective of achieving the project objectives? Have the life-cycle costs been analyzed to determine the total cost of project delivery over its expected life? Have environmental factors been included in the valuation of assets and services? With respect to environmental questions, how will the project interact with the natural environment? Are there any concerns regarding the materials or products proposed that may exert potential future negative impacts on the project depending on the use application?

When considering social impacts, the engineer should begin by asking how the person living next door is going to view the project. How can the project best be integrated into the community? Will the health, diversity, and values of the community be maintained or enhanced for the benefit of future generations? This in time will require the engineer to examine specific aspects of the project relative to its materials and products. Is the life expectancy of the selected materials and/or products the same relative to the social expectation of how long the project will function as designed? Is there a need for future inspections of any aspect of the project regarding its structural integrity to assure its sustainability over the expected design life?

We should be proud we are engineers. However, just having a degree in engineering is not enough. It is what we do and what we give back that makes us a profession. It is more than a job. The profession calls for high standards as it should. We have an ethical responsibility to the population of this world to act responsibly in everything we do, whether it is designing, constructing, or making managerial decisions. The professional engineering license examination is a necessary requirement to ensure that we can

safely design and teach others how to design. Continuing education should be required to maintain a professional engineering license and to better ourselves as first managers and then leaders of the engineered project. We must actively participate in our professional organizations and as part of these professional organizations move as a coalition to ensure that we maintain our stronghold in leadership and decision-making positions, whether that is in City or State government, a particular project, or within our own universities or corporations. We must endure a long battle, but it is our civic duty and obligation as part of our ethical and professional responsibilities.

1 THE IMPORTANCE OF ETHICS IN THE 21ST CENTURY

Engineering is considered one of society's activities that has the highest of ethical standards. Opinion polls show that engineering has rated near the top in public esteem and judgment of ethical standards. A written code of ethics declares before the public the high standards which are professed and provides the public with an understanding of what to expect in their relations with members of the profession. The public then "takes for granted" that the infrastructure for which the public relies will not fail. The public also puts their trust into engineers and believes that Engineers will be truthful and honest. The standard of truthfulness in engineering is very high, much higher than in everyday life. It imposes an absolute prohibition on deception.

The Calling of the Engineer (in Canada) and the Order of the Engineer (in the United States) and Professional Society Codes of Ethics and Province/US State Licensing Boards define the Engineer's role and responsibility. The Canadian Society of Civil Engineers as well as the American Society of Civil Engineers (ASCE) makes known the importance of the Engineer's role. For example, the first canon in the ASCE Code of Ethics notes:

- Fundamental Canon 1.0
 - "Engineers shall hold paramount the safety, health and welfare of the public....
 - a. Engineers shall recognize that the lives, safety, health and welfare of the general public are dependent upon engineering judgment, decisions and practices incorporated into structures, machines, products, processes and duties.
 - b. Engineers shall approve or seal only those design documents reviewed or prepared by them, which are determined to be safe for public health and welfare in conformity with accepted engineering standard."

An engineering practicing professional must possess a service motive and share advances in knowledge, safeguard professional integrity and ideals, and render gratuitous public service in addition to service rendered to clients; must recognize one's obligations to society and to other practitioners by living up to established codes of conduct; must assume relations of confidence and accept individual responsibility;

and should carry one's part of professional groups as well as one's part of the responsibility of advancing professional knowledge, ideals, and practice.

Of course the root of the term "professional" is the word "profession," which may be defined variously as a calling requiring specialized knowledge and often long and intensive academic preparation; a principal calling, vocation, or employment; an occupation that requires advanced expertise, self-regulation, and concerted service to the public good; an occupation in which one is skilled; or a vocation in which professional knowledge of some level of learning is applied to serve others. But what distinguishes a profession—or more precisely, the engineering profession—from a job or an occupation? A job is a task for which one is paid, so clearly engineering is a job. An occupation is employment through which a person earns a living, and so clearly engineering is an occupation. Engineering, however, is certainly much more than a job or an occupation. While the necessity of education and training is implied in the definition of the term "profession," an individual does not become a professional simply by acquiring a broad education.

The role is to design a project that meets the desired purpose, is constructible, and designed so that the user and public health safety and welfare are protected. However, today the role and responsibility goes beyond protecting today's public, but also to the protection of future generations and the environment. Public works projects are constructed for public welfare; thus consideration as to project long term impact to society and ultimate client objectives play an important part. Ignoring your role including sustainability issues could lead to being found not to have followed a Standard of Care. The Engineer can be held liable and even negligent. Despite the dire consequences of not meeting a standard of care, few Engineers are aware of the meeting a standard of care means or that not meeting it can be construed as being negligent. While professional liability insurance policies cover errors and omissions, policies seldom cover negligence.

2 MEETING A STANDARD OF CARE

The standard jury instructions for professional malpractice actions contain the traditional definition of the Standard of Care:

In performing professional services for a client, defendant has the duty to have that degree of learning and skill ordinarily possessed by reputable engineers practicing in the same or a similar locality and under similar circumstances. It is his or her further duty to use care and skill ordinarily used in like cases by reputable members of his or her profession practicing in the same or similar locality under similar circumstances, and to use reasonable diligence and his or her best judgment in the exercise of his or her professional skills and in the application of his or her learning in an effort to accomplish

the purpose for which he or she was employed. A failure to fulfill any such duty is negligence (Ashcroft 2002).

The Standard of Care is based upon the context of the place and time when the work was executed. Standards of Care arguments use the following types of documents to argue that an Engineer may not have followed a Standard of Care that would have reasonably been expected (Ashcroft 2002):

- Text, papers, and treatises
- Written standards and regulations
- Firm guidelines and manuals
- QA/QC reports
- Contract agreements and conditions (i.e. warranties and expressed limitations)

In the end, the basis of whether the Engineer performed to a reasonable Standard of Care will be based on the following questions:

- (1) What was known about the technology and/or systems at the point in time when the Project was executed?
- (2) Who had that knowledge?
- (3) Was it reasonable for the Engineer to have that knowledge at that time?
- (4) Did the Engineer have that knowledge?

According to a 2007 book published by the American Bar Association, the licensing and registration laws of the various states applicable to contractors, engineers and architects may include performance functions closely associated with even those performing construction management (Hess, et. al, 2007). For instance, the Construction Management Association of America (CMAA) promulgated its Construction Management Standards of Practice in 1987. Seven primary areas of construction management are covered including (CMAA 2003):

- (1) Project Management
- (2) Time Management
- (3) Cost Management
- (4) Quality Management
- (5) Contract Management
- (6) Safety Management
- (7) Program Management

CMAA also began its Construction Manager Certification Program, which when completed provides the individual with a certificate as a Certified Construction Manager (CCM), meaning that individual is a practitioner who meets all the certification requirements.

Accordingly, as an agent of the Owner, a professional construction program manager is expected to represent the interest of the Owner above those of other construction professionals involved in a Program in order to attain and maintain:

- *Optimum use of available funds*
- *Control of the scope of work*
- *Project scheduling*
- *Optimum use of design and construction firm's skills and talents*
- *Avoidance of delays, changes and disputes*
- *Enhancing project design and construction quality*
- *Optimum flexibility in contracting and procurement*

Comprehensive management of every stage of the project, beginning with the original concept and project definition, yields the greatest possible benefit to owners from Construction Management. (CMAA 2008)

As with other relationships, both in and outside the construction industry, the construction manager's performance will be measured by reference to a legal Standard of Care. As further noted in the ABA construction law book (Hess, et. all. 2007):

The Construction Manager will be held to a standard of care normally applied to persons and professions or trades requiring special skills. As a general rule, when a person holds himself out to the public as a member of a particular profession or trade, there is an implied agreement with those who employ him that he 1) posses that degree of knowledge and skill ordinarily possessed by others in the profession or trade, and 2) will perform the services for which he was engaged with that degree of prudence and care ordinarily possessed and observed by others engaged in the same or like employment.

Even if a contract is silent concerning the Standard of Care, according to *Construction Insurance, Bonding and Risk Management*, an Engineer or Construction Manager will still be expected to exercise a Standard of Care and will be held to the ordinary negligence standard. However, when the contract contains a specific clause setting forth a Standard of Care, the Engineer or Contractor needs to be sure to closely follow the language of the clause. For example, a clause may state:

Consultant/Contractor represents that the services will be performed in a manner consistent with the highest standard of care, diligence and skill exercised by nationally recognized consulting firms for similar services. (Palmer, W. et. al., 1996)

Warranty to perform in accordance with this higher standard could subject the consultant or contractor to liability even though all work has been performed in accordance with generally accepted standards in the industry. Furthermore, this failure to meet the required Standard of Care could constitute a contractual liability that may not be covered by insurance policies (Palmer, W. et. al., 1996).

It is again stressed that design professionals may be insured for professional negligence, i.e. conduct that falls below the "Standard of Care" for architects or engineers. But with Design-Build/EPC contracting, there is a risk of contract standards replacing common law standards for design professionals. As noted in *Return of the Master Builder*, the Design-Build Institute of America (DBIA)'s standard form of subcontract between the Design-Builder and the designer includes insurable "Standard of Care" clause in paragraph 2.2.1 consistent with state law in most jurisdictions holding the designer to that level of care and skill "...ordinarily used by members of the design profession practicing under similar conditions at the same time and locality of the Project." (Quatman; Sell 2005) The clause goes on to incorporate any performance standards in the prime contract and states that the, "Designer agrees that all Services shall be performed to achieve such standards", i.e. regardless of the Standard of Care (DBIA 1999). As *Return of the Master Builder* notes, this may create a warranty or guarantee not covered by professional liability insurance, if the performance standards mandate a specific outcome. Thus, Design-Build/EPC contractors must be cautious of such "flow through" risks that may be uninsured (Quatman; Sell 2005),

The Standard of Care in a Design-Build/EPC situation will infer an implied "check and balances" where the Design-Build/EPC contractor assures the Owner that it is watching for errors and omission and, in theory, Design-Build/EPC contracting should result in cost savings from design errors and omissions being caught long before they manifest in the construction. In a Design-Build/EPC team, however, there may be more exposure to claims that the design firm was to help protect the Contractor from mistakes in both bidding and in construction. As discussed in the *The Master Builder* article, in the case of *C. L. Maddox, Inc. v. The Benham Group, Inc*, which involved a Design-Build contract on a power plant in Joppa, Illinois, the Design-Builder defaulted on the prime contract and the Owner called on the performance bond surety, USF&G, who paid \$2.8 million to complete the work. The project did not end well and the Design-Builder sued its Engineer-subcontractor for breach of contract, fraudulent and negligent misrepresentation seeking \$5.1 million in damages. After a five-week trial, the jury awarded the Design-Builder \$5 million in damages against its Engineer, including a finding of implied warranty on the part of the Engineer (Quatman; Sell 2005)

When change occurs and the actual deviates from the plan, the Owner will always be there to ask how, when, why, where and how. Whether it is the Engineer, the Design-Build/EPC Contractor or the Construction Manager, their actions in how these questions are answered will be judged against whether the Owner believes the Engineer/Contractor acted in a Standard of Care expected in the industry, and to

a higher Standard of Care if so required under its contract. That Standard of Care of today and the future will not only address issues of project management, design and construction, but whether the considerations in all those areas were consistent with the expectation of sustainability.

3 SUSTAINABILITY

The role of the Engineer is vastly different than may have been perceived in previous generations. Designing and constructing a project in the 21st Century involves new considerations often overlooked or not thought of in the past. As Engineers and Constructors, we have chosen a profession that enhances the quality of life. The role and responsibility of the Engineer has always been to protect the public, health, safety and welfare. Thus, the main objective of Engineers is to develop proper infrastructure for supporting the effort in achieving its welfare. However, today the Engineer's role and responsibility goes beyond protecting today's public, but to the protection of future generations and the environment.

There is perhaps no greater need on earth at this moment than sustainability. Distilled into its simplest form, sustainability is the practice of adequately meeting current needs while ensuring that future needs will be adequately met. Fleshed out a bit more, sustainability is the practice of ensuring that all of the world's inhabitants—from those living in the most developed nations to those living in the most underdeveloped nations—are ensured adequate food, shelter, and sanitation, now and in the future. A major factor influencing the major shifts in the global engineering and construction landscape stems from the global nature of many societal challenges. These challenges include building more secure national infrastructures in the wake of terrorist threats and actions; decaying infrastructure; increasing food shortages, lack of sanitation and clean drinking water; energy resources; increasing national capacity and disseminating technology to underdeveloped and developing countries; preventing environmental changes and degradation; improving weather forecasting to improve response to catastrophic national disasters; and diminishing the threat of widespread health epidemics - all which have global consequences and require a global team to resolve. The next generation of engineers and constructors will need to lead the world in combating these global problems.

The UN Commission highlighted these fundamental components to sustainable development: environmental protection, economic growth, and social equity. These components led to a concept of the triple bottom line, developed by John Elkington, the founder of the firm SustainAbility in the UK. The triple bottom line concept requires a balanced approach to economic development, environmental protection and social well being, or EES for short.

The biggest impact of the triple bottom line concept is on how engineers, planners, designers, and managers continue to deliver a best practice solution to our clients. Over the coming years, social impact

is going to be a major consideration for all projects. While environmental impact assessments are now common, we will begin to see social, economic and human impact assessments performed before projects can proceed.

When to apply best practice is different when looking at the perspectives of both the client and the Engineer/Contractor. Simple questions that Engineer should now be asking in this triple bottom line concept include questions from economic, environmental and social perspectives. The Engineer should be providing the best value and longevity to the public taxpayer, in public project considerations.

Relative to economic considerations, what is the project cost that represents the best values from the perspective of achieving the project objectives? Have the life-cycle costs been analyzed to determine the total cost of project delivery over its expected life? Economic analysis is critical in the material selection process. Have environmental factors been included in the valuation of assets and services? According to the US Army Corp of Engineers, selection of all components, systems and materials for civil works projects should be based on their long-term performance. Before making final recommendations to a client, the Engineer has a responsibility to analyze life-cycle costs and to inform the client about the short-term and long-term cost considerations. Engineers must recognize that materials and their service life differ greatly, especially between different types of projects.

With respect to environmental questions, how does the project interact with the natural environment? Are there any concerns relative to the material or product proposed which may have potential future negative impacts on the project depending on the use application? Has the Engineer looked at the impact of carbon emission that the project will produce once operating or the carbon levels that will be introduced into the atmosphere with the construction means and methods during the construction. How much energy will be required to construct the project and how much energy will be required to keep the project operating? What will the costs be there from and what will be the potential penalties from potential future carbon disallowances?

Looking at social impacts, the Engineer should ask how the person living next door is going to view the project. How can the project be best integrated into the community? Will the health, diversity and values of the community be maintained or enhanced for the benefit of future generations? This in time will require the Engineer look at specific aspects of the project relative to its materials and products. Is the life expectancy of the selected materials and/or products the same relative to the social expectation of how long the project will function as designed? Is there a need for future inspections of any aspect of the project regarding its structural integrity to assure its sustainability over the expected design life? The Engineer has a legal responsibility to determine whether or not the product being specified will perform its intended function for the specific project in which the design is performed. Hence, before specifying a

particular project, the Engineer must be aware of the characteristics, applications, potential deficiencies and limitations of the product.

Sustainability then represents the best engineering approach and the recognition that no project exists in a vacuum, but in a social and natural context that affects the project and is affected by it in turn. As Sir Mark Moody Stuart observed at the 2002 United Nations World Summit on Sustainable Development in Johannesburg, “even those companies at the forefront of sustainable development are closest to the start of the journey. We are very much on the first rung of the ladder” (Moody Stuart 2002).

4 SUMMARY OBSERVATIONS

The new construction environment is dictating that the Engineer re-evaluate how it does business. In a world economy where both governments and shareholders are looking to Owners for transparency and accountability, Owners are in turn looking towards its Engineer to “prove up” whether its costs - whether in the original contract scope or in changes - were reasonably incurred. While the past has allowed a Contractor to manage a Lump Sum contract any way it desired as long as it was completed within the contract time and price. In today’s environment, Owners are requiring the Design-Build/EPC contractor to prove that the costs expended were reasonable and prudently spent-including both original scope and any changes to that scope. Owners are now holding Design-Build/EPC contractors to a Standard of Care that compares what the Contractor did based on what it knew or should have known to what other Contractors would have done based on the similar projects in the same locale. The same is true for Engineers on Design-Bid-Build projects. Finally, Owners are looking toward the Engineer to incorporate the concepts of sustainability into the entire design, procurement and construction process. The failure to consider these new emerging risks and document the decision-making process for any of these factors could result in an Engineer being faced with potential losses and/or disputes with the Owner that could further lead to being held to have been deemed to be negligent or even gross negligent.

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