

Key Concepts in Engineering Ethics: Protecting the Public Health and Safety & Demonstrating Professional Competence

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Engineering Ethics

- *“Among the universal ethical values are honesty, integrity, promise-keeping, fidelity, fairness, respect for others, responsible citizenship, pursuit of excellence and accountability.”*
 - Michael Josephson

Engineering Ethics

- **Black and White Areas – Easy**
 - Right vs. Wrong
- **Gray Areas – Tougher**
 - Right vs. Right
 - Lesser of the Evils/Dilemma
- **Other Factors**
 - Time/Money
 - Family
 - Career
 - Reputation

Engineering Ethics

- **Why Study Engineering Ethics?**
 - To Understand the Standards Governing What is Acceptable Behavior in the Practice of Engineering
- **Why Practice Engineering Ethically?**
 - Personal Injury/Property Damage
 - Disciplinary Action
 - Impact on Reputation, Employer, Clients, Profession
 - Possible Loss of Job, Business, etc.

Engineering Ethics

- *“All products of technology present some potential dangers, and thus engineering is an inherently risky activity...Engineering should be viewed as an experimental process. It is not, of course, an experiment conducted solely in a laboratory under controlled conditions. Rather, it is an experiment on a social scale involving human subjects”*
 - Martin and Schinziger, Ethics in Engineering

Engineering Ethics

■ Professional Codes of Ethics

- A code of professional ethics results when a field organizes itself into a profession. The resulting code is central to advising those professionals how to conduct themselves, to judge their conduct and to understand the profession.

Engineering Ethics

- Hierarchy of Ethical Obligations
- Primary: Ethical Obligations to the Public
- Secondary: Ethical Obligations to Employer or Client
- Tertiary: Ethical Obligations to Other Professionals and Other Parties

Engineering Ethics

- Three Basic Ethical Obligations – (1) Public, (2) Employer/Client and (3) Other Professionals...
 - Never Mutually Exclusive - Reciprocal
 - Not A “Zero Sum Game”
 - All Need To Be Considered At All Times
 - Should Be Complementary to Integrated With One Another To The Fullest Extent Possible
 - Ethical Integration = Professional Integrity

Engineering Ethics

- Seven Principles Impacting Each Obligation
 1. Protecting The Public Health, Safety and Welfare
 2. Demonstrating Professional Competence
 3. Maintaining Objectivity/Truthfulness
 4. Addressing Conflict of Interest
 5. Preserving Confidentiality
 6. Receiving and Providing Valuable Consideration
 7. Emerging Areas/Emerging Challenges

Engineering Ethics

1. Protecting The Public Health, Safety and Welfare

- Conformance with Applicable Standards
- Approval/Signing and Sealing of Engineering Drawings
- Responsible Charge/Responsible Control
- Judgment Overruled
- Awareness of Safety Violations
- Awareness of Illegal Practice

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2. Demonstrating Professional Competence

- Education, Experience, Qualifications
- Acceptance of Assignment
- Signing and Sealing of Work
- Coordination of Work
- Scope of Practice

Engineering Ethics

- This session will focus on the obligations of a professional engineer who learns of a significant bridge safety issue that may not be adequately addressed, obligation of a professional engineer to follow the most current technical standards and a professional engineer's obligation to take action in connection with a company's use of a potentially hazardous material.

Engineering Ethics

PUBLIC WELFARE – BRIDGE **STRUCTURE**

Case No. 00-5

Engineering Ethics

- **Facts:** Engineer A was an engineer with a local government. Engineer A learned about a critical situation involving a bridge 280 feet long, 30 feet above the stream. This bridge was a concrete deck on wood piles built in the 1950's by the state. It was part of the secondary roadway system given to the counties many years ago.

Engineering Ethics

- In June 2000, Engineer A received a telephone call from the bridge inspector stating this bridge needed to be closed due to the large number of rotten piling. Engineer A had barricades and signs erected within the hour on a Friday afternoon. Residents in the area were required to take a 10-mile detour.

Engineering Ethics

- On the following Monday, the barricades were in the river and the “Bridge Closed” sign was in the trees by the roadway. More permanent barricades and signs were installed. The press published photos of some of the piles that did not reach the ground and the myriad of patch work over the years.

Engineering Ethics

- Within a few days, a detailed inspection report prepared by a consulting engineering firm, signed and sealed, indicated seven pilings required replacement. Within three weeks, Engineer A had obtained authorization for the bridge to be replaced. Several departments in the state and federal transportation departments needed to complete their reviews and tasks before the funds could be used.

Engineering Ethics

- A rally was held, and a petition with approximately 200 signatures asking that the bridge be reopened to limited traffic was presented to the County Commission. Engineer A explained the extent of the damages and the efforts under way to replace the bridge. The County Commission decided not to reopen the bridge.

Engineering Ethics

- Preliminary site investigation studies were begun. Environmental, geological, right-of-way, and other studies were also performed. A decision was made to use a design build contract to avoid a lengthy scour analysis for the pile design.

Engineering Ethics

- A non-engineer public works director decided to have a retired bridge inspector, who was not an engineer, examine the bridge, and a decision was made to install two crutch piles under the bridge and to open the bridge with a 5-ton limit. No follow-up inspection was undertaken.

Engineering Ethics

- Engineer A observes that traffic is flowing and the movement of the bridge is frightening. Log trucks and tankers cross it on a regular basis. School buses go around it.

Engineering Ethics

- **Question:** What is Engineer A's ethical obligation under these circumstances?

Engineering Ethics

- Section II.1.- Code of Ethics:
Engineers shall hold paramount the safety,
health and welfare of the public.

Engineering Ethics

- Section II.1.a. - Code of Ethics:

If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.

Engineering Ethics

- Section II.1.f.-Code of Ethics:

Engineers having knowledge of any alleged violation of this Code shall report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required.

Engineering Ethics

- Section III.8.a. - Code of Ethics:

Engineers shall conform with state registration laws in the practice of engineering.

Engineering Ethics

- **Conclusion:** Engineer A should take immediate steps to go to Engineer A's supervisor to press for strict enforcement of the five-ton limit, and if this is ineffective, contact state and/or federal transportation/highway officials, the state engineering licensure board the director of public works, county commissioners, state officials, and such other authorities as appropriate. Engineer A should also work with the consulting engineering firm to determine if the two crutch pile with five-ton limit design solution would be effective and report this information to his supervisor. In addition, Engineer A should determine whether a basis exists for reporting the activities of the retired bridge inspector to the state board as the unlicensed practice of engineering.

Engineering Ethics

- Polling Question:
 - Under no circumstances would it have been ethical for Engineer A to go directly to the media to report his personal and professional concerns regarding the potential collapse of the bridge.
 - 1. Yes
 - 2. No
 - 3. Not Sure

Engineering Ethics

PROFESSIONAL COMPETENCE IN CURRENT STRUCTURAL DESIGN

Case No. 02-5

Engineering Ethics

- **Facts:** Engineer A is involved in the design of the structural system on a building project in an area of the country that experiences severe weather conditions. Engineer A, who has experience with structural designs in this area of the country, designs the structural system based upon what Engineer A believes constitutes sound structural engineering principles. Although Engineer A has knowledge and experience in structural design, new and improved design methods have recently been developed to address the severe weather conditions in the location in which Engineer A practices.

Engineering Ethics

- These new and improved severe weather design standards have been published in the most recent technical literature. While Engineer A generally attempts to stay current on changing structural design trends, Engineer A was not familiar with this recent technical literature.

Engineering Ethics

- Engineer A completes his design which is later incorporated in the plans and specifications for the building and the building is built. Within one year following construction, severe weather conditions cause significant structural damage to the building. It is determined that had Engineer A followed the severe weather design parameters, the structural failure would not have occurred.

Engineering Ethics

- **Question:** Was it ethical for Engineer A to fail to follow the most recent design parameters for structural design in severe weather areas published in the most recent technical literature?

Engineering Ethics

- Section II.1. - Code of Ethics:

Engineers shall hold paramount the safety, health, and welfare of the public.

Engineering Ethics

- Section II.1.b. - Code of Ethics:

Engineers shall approve only those engineering documents that are in conformity with applicable standards.

Engineering Ethics

- Section II.2. - Code of Ethics:

Engineers shall perform services only in the areas of their competence.

Engineering Ethics

- Section II.2.a. - Code of Ethics:

Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved.

Engineering Ethics

- Section III.8. - Code of Ethics:

Engineers shall accept personal responsibility for their professional activities, provided, however, that Engineers may seek indemnification for services arising out of their practice for other than gross negligence, where the Engineer's interests cannot otherwise be protected.

Engineering Ethics

- **Conclusion:** It was not unethical for Engineer A to fail to follow the most recent design parameters for structural design in severe weather areas published in the most recent technical literature.

Engineering Ethics

■ Polling Question

- Engineers should have the authority to determine whether to follow established codes and standards in the design of facilities even when those codes and standards impact the public health and safety.
- 1. Yes
- 2. No
- 3. Not Sure

Engineering Ethics

- **USE OF ALLEGED HAZARDOUS MATERIAL IN A PROCESSING FACILITY**

Case No. 99-11

Engineering Ethics

- **Facts:** Engineer A is a graduate engineer in a company's manufacturing facility that uses toxic chemicals in its processing operations. Engineer A's job has nothing to do with the use and control of these materials.

Engineering Ethics

- A chemical called "Mega X" is used at the site. Recent stories in the news have reported alleged immediate and long-term human genetic hazards from inhalation of or other contact with Mega X. The news items are based on findings from laboratory experiments, which were done on mice, by a graduate student at a well-respected university's physiology department. Other scientists have neither confirmed nor refuted the experimental findings. Federal and local governments have not made official pronouncements on the subject.

Engineering Ethics

- Several colleagues outside of the company have approached Engineer A on the subject and ask Engineer A to "do something" to eliminate the use of Mega X at the processing facility. Engineer A mentions this concern to her manager who tells Engineer A, "Don't worry, we have an Industrial Safety Specialist who handles that."

Engineering Ethics

- Two months elapse and Mega X is still used in the factory. The controversy in the press continues, but since there is no further scientific evidence pro or con in the matter, the issues remain unresolved. The use of the chemical in the processing facility has increased and now more workers are exposed daily to the substance than was the case two months ago.

Engineering Ethics

- **Question:** Does Engineer A have an obligation to take further action under the facts and circumstances?

Engineering Ethics

- Section II.1.- Code of Ethics:

Engineers shall hold paramount the safety,
health and welfare of the public.

Engineering Ethics

- Section II.1.a. - Code of Ethics:

If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.

Engineering Ethics

- **Conclusion:** Engineer A has no obligation to take further action under the facts and circumstances.

Engineering Ethics

- While engineers have an ethical obligation to hold paramount the public health and safety, if their judgment is overruled by a management superior, the engineer must yield to the decision and not pursue the matter further.
 - 1. Agree
 - 2. Disagree
 - 3. Not Sure

Engineering Ethics

Review of Key Issues

Engineering Ethics

- It is important to study engineering ethics because it is critical to understand the standards governing what is acceptable behavior in the practice of engineering.
- It is important to practice engineering ethically because if you do not, the following could occur - personal injury, property damage, disciplinary action, impact on the reputation of the employer, clients, profession and possible loss of job or business.
- Engineers having knowledge of any alleged violation of this Code should report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required.

Engineering Ethics

- Engineers should accept personal responsibility for their professional activities, provided, however, that Engineers may seek indemnification for services arising out of their practice for other than gross negligence, where the Engineer's interests cannot otherwise be protected. – True
- Engineers should undertake assignments when qualified by education or experience in the specific technical fields involved.

Engineering Ethics

- Among the universal ethical values are honesty, integrity, promise-keeping, fidelity, fairness, respect for others, responsible citizenship, pursuit of excellence and accountability.
- Black and white areas –right vs. wrong issues are easiest to resolve.
- Other factors such as time, money, family, career, reputation affect ethical decision-making.

Engineering Ethics

- Discussion
- Questions and Answers

Engineering Ethics

- *“The reputation of a thousand years may be determined by the conduct of one hour”*
 - Japanese proverb

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Questions & Answers

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