

ENGINEERING ETHICS

Professionalism & Engineering Ethics

- Professionalism: Acting in a professional manner when carrying out your duties of employment
- Engineering Ethics: The systematic study of the rules and ideals of the engineering profession



David B. Steinman, P.E. • Chief Engineer of the Mackinac Bridge • Founder of the National Society of Professional Engineers

Professionalism

- Professionalism is the high standard that we expect from a professional who is well trained in a particular job which requires great skill.
- Engineers have always been looked upon to provide professional conduct.
 - Organization
 - Thoroughness
 - Dedication
 - Attentiveness to details
 - Promptness
 - Taking pride in their profession.
- Clients expect these traits of the person they contract for their project.

Responsibilities of Engineers and Safety

- Safety is the most important ethical issue in the career of an engineering professional.
- Engineering products and services must be safe for the consumer which is the demand of the society.
- When a product is made, there are uncertainties and risk in its design and implementation.
- The product may not perform as expected and may result in harm.
- Besides economic damage, it affects the reputation and future business of the company.
- So, safety is a very important aspects of the engineering profession.
- Terms «Safety», «Risk» and «Hazard» are defined here.

i. Safety:

- An action is considered safe when the risks associated with it are known and are considered acceptable.
- The condition of being protected from harm or other non-desirable outcomes



ii. Risk:

- The probability of getting into a dangerous situation or achieving an unfavourable result is considered as risk.
- Thus, risk is something which is expected to happen in future.
- An element of probability and uncertainty is associated with risk.



iii. Hazard:

- Anything that can cause damage is hazard.
- Something is hazardous if it has the potential to cause harm.
- An exposed electric wire is hazardous because it has the potential to give an electric shock.
- Anybody may not get a shock, but potentiality and probability exist.



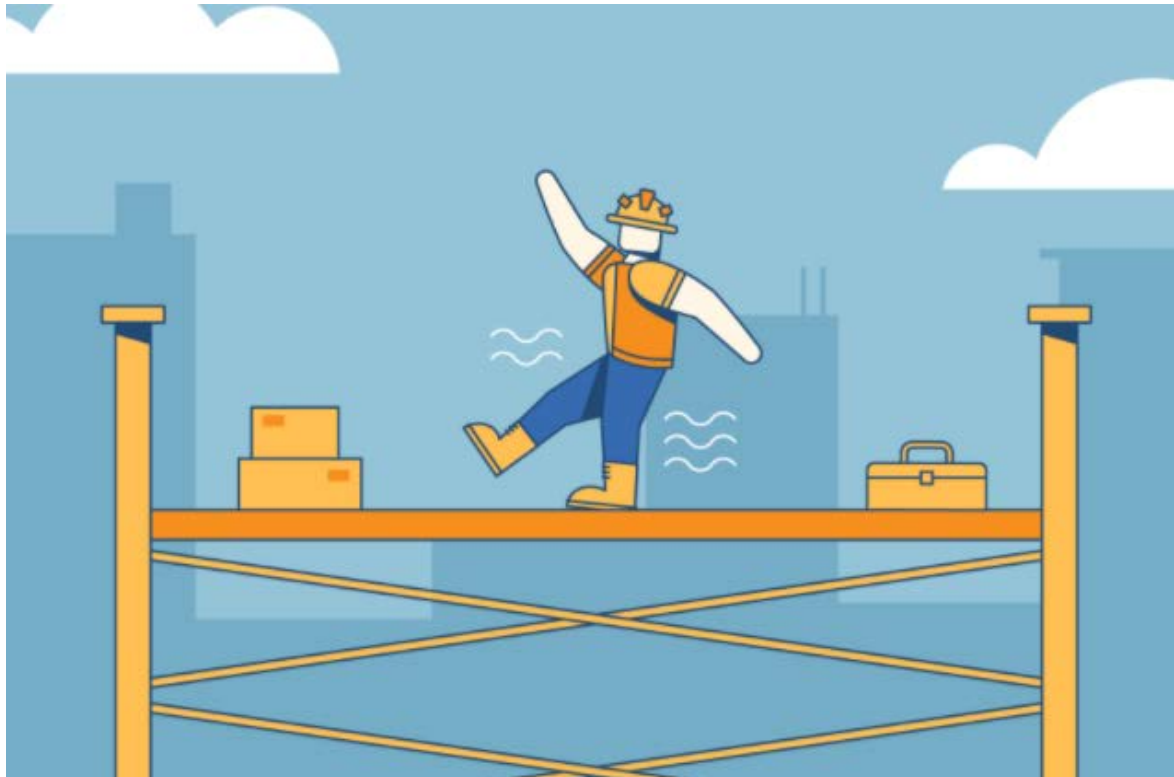
Safety&Risk:

- Both safety and risk are probabilistic.
- Probabilistic actions, methods, or arguments are based on the idea that you cannot be certain about results or future events but you can judge whether or not they are likely, and act on the basis of this judgment.
- Safety and risk can be considered in following three ways.



i. Underestimating the Risk:

- In construction site, temporary structures are generally made of wooden planks.
- Workers work in these structures.
- If poorly designed/constructed, these create very hazardous conditions and workers could be injured or killed.
- It happens because we underestimate the risks.



ii. Overestimating the Risk:

- The concept of overestimating the risk will be clear from the following incident.
- A man was driving his car and he noticed fire coming from its bonnet.
- Such incidents do not happen everyday as modern cars have in-built safety features.
- If someone decides that he will not drive a car because of such incidents, he is overestimating the risks.

iii. Indifference to the Risk:

- Indifference to risk means when people do not think of the risk factors at all.
- For them, being safe and unsafe does not matter. They do not make any judgment of risks.
- For example, a group of people crossing a stream in ankle deep water may not be aware of any dangers involved.
- A flash flood may come and sweep away many of them, who later die.
- According to the them, this activity is neither safe nor unsafe.
- Risk manifests itself only in the future.
- Safety of a product can only be known when it is used by customers.
- Past experience with products is a good guide while designing something for safety.

Threshold Risk Level

- Certain types of risk have threshold levels.
- For example, the harmful effect due to noise pollution has a threshold level and exposure to nuclear radiation is harmful beyond a certain level.
- While designing, the designer has to ensure that the risk is below the threshold level.
- It is impossible to guarantee one hundred per cent safety in product.
- However, the design for safety is mandatory in engineering products.

Safety and Engineering Design

- The main duty of engineers is to protect the safety and well-being of the public. Indeed, the codes of ethics of the professional engineering societies make it clear that safety is paramount importance to the engineer.
- The engineering codes of ethics will show that engineers should have a responsibility to society to produce products, structures, and processes that are safe. There is an implied warranty that products are safe to use.
- Engineers are required to make their designs as safe as reasonably possible. Thus, safety must be an integral part of any engineering design.

Preventive Measures for Risk

- Following three preventive measures for risk management can be applied.
 - Avoiding Risks
 - Risk Reduction
 - " Transfer of Risks "or " Outsourcing of Risks "

i. Avoiding Risks

- Risk avoidance is the elimination of hazards, activities and exposures that can negatively affect
- Risk avoidance is not performing any activity that may carry risk.
- This step can be taken if the probability of the risk is very high and economic losses are huge.
- A risk avoidance methodology attempts to minimize vulnerabilities which can pose a threat.

ii. Risk Reduction

- Risk reduction measures are taken to reduce the severity or probability of risk.
- For example, fire control measures such as smoke/fire alarms, water sprinkler systems, and sand buckets, can be put in place.
- This will reduce the severity of the risk.
- The probability can be reduced by proper maintenance of electrical systems through frequent inspections.
- All this will cost money but will reduce the severity of risk.

iii. " Transfer of Risks "or " Outsourcing of Risks "

- This method can be adopted if an external agency takes up a part of the job of the company.
- Transferring the risk to an insurance company is an example.
- The insurer will take care of the loss in case of accident.

Case Studies

- Some major accidents have created greater awareness about safety.
- Most of the accidents could have been avoided.
- Many lives were lost and there were heavy economic losses because ethical decisions and appropriate precautions were not taken
- The following cases highlight the need for great concern for safety, better engineering practices, and also the need to be more careful when a small risk factor is identified.
 - Chernobyl nuclear power plant accident (1986)
 - Space Shuttle Challenger disaster (1986)
 - Soma mine disaster (2014)
 - Accidents in Tuzla (İstanbul) Shipyards
 - Ankara-Konya high-speed train collision (Marşandiz train collision, 2018)
 - Hyatt Regency walkway collapse (Kansas City, US)

Space Shuttle Challenger Disaster (1986)

- Poor Engineering Judgment
- Entire crew lost
- Space program set back years
- Lost public confidence



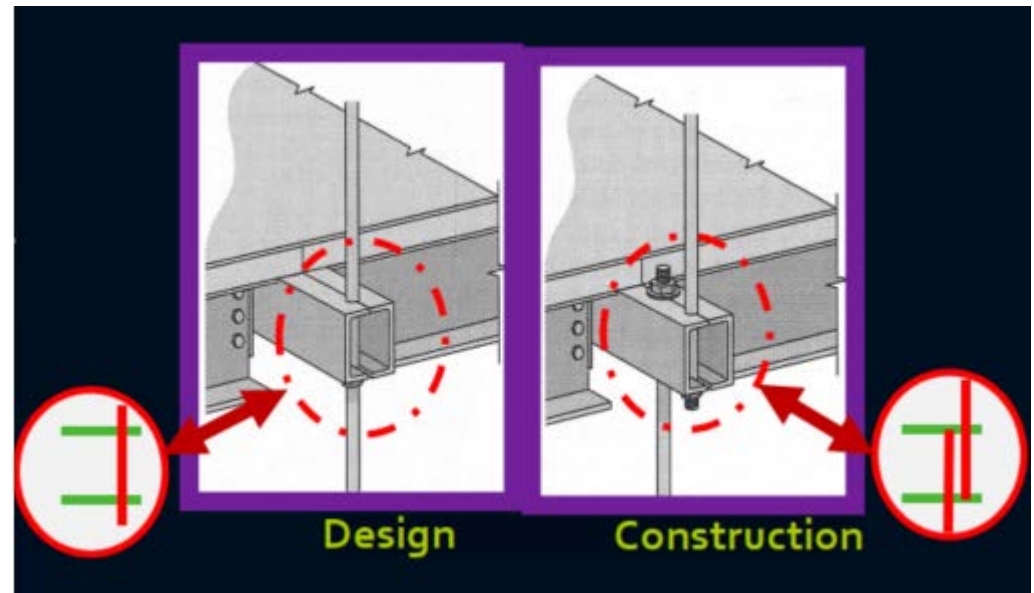
Ankara-Konya high-speed train collision (2018)

- The locomotive was on its assigned track. The high-speed train was wrongly directed to the same track, causing the head-on collision.
- The accident occurred due to lack of communication between railway personnels.
- The switchman did not receive any training in handling of the board, which went in use four days prior to control the electric railroad switch.
- 9 deaths, 47 injuries



Hyatt Regency walkway collapse (Kansas City, 1981)

- Support system was changed in the shop drawings by the steel fabricator
- Engineer failed to review the shop drawings and therefore did not discover the change
- The change doubled the load on the supports
- 32 ton walkways collapsed
- 114 deaths, 200 injuries
- Engineers prosecuted



Herbert Hoover (on Engineering)

“The great liability of the engineer compared to men of other professions is that his works are out in the open where all can see them. His acts, step by step, are in hard substance. He cannot bury his mistakes in the grave like the doctors. He cannot argue them into thin air or blame the judge like the lawyers....He cannot, like the politician, screen his shortcomings by blaming his opponents and hope that the people will forget. The engineer simply cannot deny that he did it. If his works do not work, he is damned forever.”



31st President 1929-1933 Mining Engineer

Who does the public think is ethical?

Honesty/Ethics in Professions

Please tell me how you would rate the honesty and ethical standards of people in these different fields -- very high, high, average, low or very low?
How about -- [RANDOM ORDER]?



	Very High	High	Average	Low	Very Low
	%	%	%	%	%
Nurses	29	55	13	2	1
Pharmacists	15	52	26	6	2
Medical doctors	15	50	29	5	2
Engineers	13	52	29	4	1
Dentists	10	49	34	5	2
Police officers	16	42	29	10	3
College teachers	10	37	32	12	6
Clergy	12	32	39	9	4
Psychiatrists	6	32	45	9	3
Chiropractors	5	33	45	10	3
Bankers	2	22	46	22	8
Journalists	4	19	34	23	18
Lawyers	3	15	45	26	11
State governors	2	16	45	27	8
Business executives	2	15	50	23	9
Stockbrokers	2	10	46	28	11
HMO managers	1	11	48	23	8
Senators	1	11	37	36	14
Advertising practitioners	1	10	46	29	11
Insurance salespeople	1	10	51	28	10
Car salespeople	1	8	45	31	15
Members of Congress	1	7	31	39	20

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GALLUP

Why follow a code of Ethics

- Engineers should follow a code of ethics because it provides a clear definition of what the public expects from responsible engineers.
- It builds your reputation and the reputation of your profession
- Always ask yourself, “Would you be proud to read about the actions and decisions you made today in tomorrow’s newspaper.



Significance of Ethical Codes

- The guidelines ,which are followed by the professionals and such guidelines inform them about their rights and responsibilities, are known as ethical codes.
- The significance/needs/objectives of ethical codes are described as follows:

1) Ethical codes act as guides for ethical functioning

- The ethical codes of professional societies act as guides for a professional to perform his professional duties.
- The decisions and actions of professionals can be guided by these codes.

2) Ethical codes enhance the image of the profession

- Ethical code is not only necessary to regulate conduct of the member professionals, but also to enhance the image of the profession and the group forming the society.

3) Ethical codes support professionals to fight against unethical acts

- When a professional enters the profession, it is likely that he may face a moral dilemma, something he feels is not right.
- If the professional has to raise his voice against such ethical deviations, he needs some support to justify why he chooses to do so.
- The professional gets necessary support from ethical codes to fight against unethical acts.

4) Ethical codes provide prevention to unethical acts

- Ethical codes provide preventive actions and punishment for unethical product.
- Preventions are a necessary part of the codes.

5) Ethical codes can create an unethical climate

- Ethical codes are the rules of conduct based on ethical principles.
- Ethical code is a type of self-regulatory mechanism.
- Ethical codes are dynamic and undergo changes from time to time.

Engineering Codes of Ethics

- The following professional bodies have their own ethical codes:
 - Accreditation Board for Engineering and Technology (ABET)
 - National Society of Professional Engineers (NSPE)**
 - Institute of Electrical and Electronic Engineers (IEEE)
 - American Society of Mechanical Engineers (ASME)
 - American Society of Civil Engineers (ASCE)**

* A code of ethics is not the only thing guiding our conduct as engineers, we also have laws, company or department policies, international treaties and regulations.

American Society of Civil Engineers (ASCE) – Code of Ethics

- First adopted in 1914,
- The ASCE Code of Ethics is the model for professional conduct for ASCE members.
- In April 1975, the ASCE Board of Direction adopted the fundamental principles of the Code of Ethics of Engineers as accepted by the Accreditation Board for Engineering and Technology, Inc. (ABET).

In October 2009, the ASCE Board of Direction adopted the following definition of Sustainable Development: “Sustainable Development is the process of applying natural, human, and economic resources to enhance the safety, welfare, and quality of life for all of the society while maintaining the availability of the remaining natural resources.”

- The Code of Ethics was recently updated on July 29, 2017.

American Society of Civil Engineers (ASCE) – Code of Ethics

Fundamental Principles

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

1. using their knowledge and skill for the enhancement of human welfare and the environment;
2. being honest and impartial and serving with fidelity the public, their employers and clients;
3. striving to increase the competence and prestige of the engineering profession; and
4. supporting the professional and technical societies of their disciplines.

American Society of Civil Engineers (ASCE) – Code of Ethics

Fundamental Canons

1. Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties.
2. Engineers shall perform services only in areas of their competence.
3. Engineers shall issue public statements only in an objective and truthful manner.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.

American Society of Civil Engineers (ASCE) – Code of Ethics

Fundamental Canons

7. Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.

8. Engineers shall, in all matters related to their profession, treat all persons fairly and encourage equitable participation without regard to gender or gender identity, race, national origin, ethnicity, religion, age, sexual orientation, disability, political affiliation, or family, marital, or economic status.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

Canon 1. Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties.

a. Engineers shall recognize that the lives, safety, health and welfare of the general public are dependent upon engineering judgments, decisions and practices incorporated into structures, machines, products, processes and devices.

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 standards.

c. Engineers whose professional judgment is overruled under circumstances where the safety, health and welfare of the public are endangered, or the principles of sustainable development ignored, shall inform their clients or employers of the possible consequences.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

- d.** Engineers who have knowledge or reason to believe that another person or firm may be in violation of any of the provisions of Canon 1 shall present such information to the proper authority in writing and shall cooperate with the proper authority in furnishing such further information or assistance as may be required.
- e.** Engineers should seek opportunities to be of constructive service in civic affairs and work for the advancement of the safety, health and well-being of their communities, and the protection of the environment through the practice of sustainable development.
- f.** Engineers should be committed to improving the environment by adherence to the principles of sustainable development so as to enhance the quality of life of the general public.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

Canon 2. Engineers shall perform services only in areas of their competence.

- a. Engineers shall undertake to perform engineering assignments only when qualified by education or experience in the technical field of engineering involved.
- b. Engineers may accept an assignment requiring education or experience outside of their own fields of competence, provided their services are restricted to those phases of the project in which they are qualified. All other phases of such project shall be performed by qualified associates, consultants, or employees.
- c. Engineers shall not affix their signatures or seals to any engineering plan or document dealing with subject matter in which they lack competence by virtue of education or experience or to any such plan or document not reviewed or prepared under their supervisory control.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

Canon 3. Engineers shall issue public statements only in an objective and truthful manner.

a. Engineers should endeavor to extend the public knowledge of engineering and sustainable development, and shall not participate in the dissemination of untrue, unfair or exaggerated statements regarding engineering.

b. Engineers shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony.

c. Engineers, when serving as expert witnesses, shall express an engineering opinion only when it is founded upon adequate knowledge of the facts, upon a background of technical competence, and upon honest conviction.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

- d. Engineers shall issue no statements, criticisms, or arguments on engineering matters which are inspired or paid for by interested parties, unless they indicate on whose behalf the statements are made.
- e. Engineers shall be dignified and modest in explaining their work and merit, and will avoid any act tending to promote their own interests at the expense of the integrity, honor and dignity of the profession.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

Canon 4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.

a. Engineers shall avoid all known or potential conflicts of interest with their employers or clients and shall promptly inform their employers or clients of any business association, interests, or circumstances which could influence their judgment or the quality of their services.

b. Engineers shall not accept compensation from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed to and agreed to, by all interested parties.

c. Engineers shall not solicit or accept gratuities, directly or indirectly, from contractors, their agents, or other parties dealing with their clients or employers in connection with work for which they are responsible.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

- d. Engineers in public service as members, advisors, or employees of a governmental body or department shall not participate in considerations or actions with respect to services solicited or provided by them or their organization in private or public engineering practice.
- e. Engineers shall advise their employers or clients when, as a result of their studies, they believe a project will not be successful.
- f. Engineers shall not use confidential information coming to them in the course of their assignments as a means of making personal profit if such action is adverse to the interests of their clients, employers or the public.
- g. Engineers shall not accept professional employment outside of their regular work or interest without the knowledge of their employers.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

Canon 5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.

a. Engineers shall not give, solicit or receive either directly or indirectly, any political contribution, gratuity, or unlawful consideration in order to secure work, exclusive of securing salaried positions through employment agencies.

b. Engineers should negotiate contracts for professional services fairly and on the basis of demonstrated competence and qualifications for the type of professional service required.

c. Engineers may request, propose or accept professional commissions on a contingent basis only under circumstances in which their professional judgments would not be compromised.

d. Engineers shall not falsify or permit misrepresentation of their academic or professional qualifications or experience.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

e. Engineers shall give proper credit for engineering work to those to whom credit is due, and shall recognize the proprietary interests of others. Whenever possible, they shall name the person or persons who may be responsible for designs, inventions, writings or other accomplishments.

f. Engineers may advertise professional services in a way that does not contain misleading language or is in any other manner derogatory to the dignity of the profession. Examples of permissible advertising are as follows:

- Professional cards in recognized, dignified publications, and listings in rosters or directories published by responsible organizations, provided that the cards or listings are consistent in size and content and are in a section of the publication regularly devoted to such professional cards.
- Brochures which factually describe experience, facilities, personnel and capacity to render service, providing they are not misleading with respect to the engineer's participation in projects described.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

- Display advertising in recognized dignified business and professional publications, providing it is factual and is not misleading with respect to the engineer's extent of participation in projects described.
- A statement of the engineers' names or the name of the firm and statement of the type of service posted on projects for which they render services.
- Preparation or authorization of descriptive articles for the lay or technical press, which are factual and dignified. Such articles shall not imply anything more than direct participation in the project described.
- Permission by engineers for their names to be used in commercial advertisements, such as may be published by contractors, material suppliers, etc., only by means of a modest, dignified notation acknowledging the engineers' participation in the project described. Such permission shall not include public endorsement of proprietary products.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

g. Engineers shall not maliciously or falsely, directly or indirectly, injure the professional reputation, prospects, practice or employment of another engineer or indiscriminately criticize another's work.

h. Engineers shall not use equipment, supplies, laboratory or office facilities of their employers to carry on outside private practice without the consent of their employers.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

Canon 6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero-tolerance for bribery, fraud, and corruption.

a. Engineers shall not knowingly engage in business or professional practices of a fraudulent, dishonest or unethical nature.

b. Engineers shall be scrupulously honest in their control and spending of monies, and promote effective use of resources through open, honest and impartial service with fidelity to the public, employers, associates and clients.

c. Engineers shall act with zero-tolerance for bribery, fraud, and corruption in all engineering or construction activities in which they are engaged.

d. Engineers should be especially vigilant to maintain appropriate ethical behavior where payments of gratuities or bribes are institutionalized practices.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

- e. Engineers should strive for transparency in the procurement and execution of projects. Transparency includes disclosure of names, addresses, purposes, and fees or commissions paid for all agents facilitating projects.
- f. Engineers should encourage the use of certifications specifying zero-tolerance for bribery, fraud, and corruption in all contracts.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

Canon 7. Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.

a. Engineers should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminars.

b. Engineers should encourage their engineering employees to become registered at the earliest possible date.

c. Engineers should encourage engineering employees to attend and present papers at professional and technical society meetings.

d. Engineers shall uphold the principle of mutually satisfying relationships between employers and employees with respect to terms of employment including professional grade descriptions, salary ranges, and fringe benefits, practices.

American Society of Civil Engineers (ASCE) – Code of Ethics

Guidelines to Practice Under the Fundamental Canons of Ethics

Canon 8. Engineers shall, in all matters related to their profession, treat all persons fairly and encourage equitable participation without regard to gender or gender identity, race, national origin, ethnicity, religion, age, sexual orientation, disability, political affiliation, or family, marital, or economic status.

- a. Engineers shall conduct themselves in a manner in which all persons are treated with dignity, respect, and fairness.
- b. Engineers shall not engage in discrimination or harassment in connection with their professional activities.
- c. Engineers shall consider the diversity of the community, and shall endeavor in good faith to include diverse perspectives, in the planning and performance of their professional services.

Mühendis Yemini (Engineer's Oath)



MÜHENDİSİN YEMİNİ

Bana verilen mühendislik unvanına daima layık olmaya; onun bana sağladığı yetki ve yüklediği sorumluluğu bilerek, hangi şartlar altında olursa olsun onları ancak iyiye kullanmaya; yurduma ve insanlara yararlı olmaya kendimi ve mesleğimi maddi ve manevi alanlarda yükseltmeğe çalışacağıma, namusum ve şerefim üzerine yemin ederim.



Class Discussion #1

You are the engineer of record on a building project which is behind schedule and urgently needed by your clients. Your boss wants you to certify some roofing construction as properly completed even though you know some questionable installation techniques were used. What should you do??



Choices??

- A) Certify it and negotiate a raise from your boss for doing so.
- B) Refuse to certify it even though there may be repercussions.
- C) Tell the client about the problems, saying that you'll certify it if they want you to.
- D) Certify it but keep a close watch in the future for problems associated with the roofing installation

Class Discussion #2

Your company has used a certain supplier for steel rebars for years. In an attempt to get your company's business, a rival supplier buys you dinner at a fancy restaurant and sends you backstage passes for an Imagine Dragons concert. What do you should you do?



Choices??

- A) Accept the gifts but don't tell your company because you know you can still be unbiased.
- B) Report the gifts to your company and let them decide whether you should keep them.
- C) Don't accept any of the gifts that go beyond legitimate business expenses.
- D) Tell your normal supplier about the gifts and ask them to provide some too so that you won't be biased by the new suppliers gifts.

References

- «Notes For Professional Ethics» - by Dr. Janmejy Senapati
- CODE OF ETHICS THE AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
- <https://www.wikipedia.org/>