Engineering Ethics

January 2025

Andrew McFadden

Our Agenda

1. Overview of engineering ethics

2. How do we influence others, and why is influence sometimes ethically problematic for engineers?

3. Three cases to discuss

4. Takeaways -- and strategies for speaking up

Test Poll Question

- **Please indicate answer C.**

A. Not this one

B. Not this one either

C. **Yes, please pick this one**

D. Not this one, go back to C

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Where do you work

- **Please share what type of organization you work for**

A. State DOT
B. Private contractor
C. Municipality or town
D. County
E. Consultant
F. Vendor
G. Other

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What are engineering ethics?

Engineering ethics
- Standards of behavior and moral principles that describe how an engineer should act to ensure their decision-making is aligned with their obligations to the public, their clients, and the industry

https://www.engineering.pitt.edu/subsites/projects/engineering-ethics/what-is-ethics/
https://online.hbs.edu/blog/post/ethics-in-engineering

Engineering Code of Ethics - NSPE

I. Fundamental Canons:

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.

II. Rules of Practice

III. Professional Obligations

https://www.nspe.org/resources/ethics/code-ethics

Engineering Code of Ethics - ASCE

PREAMBLE

Members of The American Society of Civil Engineers conduct themselves with integrity and professionalism, and above all else protect and advance the health, safety, and welfare of the public through the practice of Civil Engineering.

Engineers govern their professional careers on the following fundamental principles:

- create safe, resilient, and sustainable infrastructure;
- treat all persons with respect, dignity, and fairness in a manner that fosters equitable participation without regard to personal identity;
- consider the current and anticipated needs of society; and
- utilize their knowledge and skills to enhance the quality of life for humanity.

All members of The American Society of Civil Engineers, regardless of their membership grade or job description, commit to all of the following ethical responsibilities. In the case of a conflict between ethical responsibilities, the five stakeholders are listed in the order of priority. There is no priority of responsibilities within a given stakeholder group with the exception that 1a. takes precedence over all other responsibilities. [1]

CODE OF ETHICS

1. SOCIETY

Engineers:

a. first and foremost, protect the health, safety, and welfare of the public;

b. enhance the quality of life for humanity;

c. express professional opinions truthfully and only when founded on adequate knowledge and honest conviction;

d. have zero tolerance for bribery, fraud, and corruption in all forms, and report violations to the proper authorities;

e. endeavor to be of service in civic affairs;

f. treat all persons with respect, dignity, and fairness, and reject all forms of discrimination and harassment;

g. acknowledge the diverse historical, social, and cultural needs of the community, and incorporate these considerations in their work;

h. consider the capabilities, limitations, and implications of current and emerging technologies when part of their work; and

i. report misconduct to the appropriate authorities where necessary to protect the health, safety, and welfare of the public.

2. NATURAL AND BUILT ENVIRONMENT

Engineers:

a. adhere to the principles of sustainable development;

b. consider and balance societal, environmental, and economic impacts, along with opportunities for improvement, in their work;

c. mitigate adverse societal, environmental, and economic effects; and

d. use resources wisely while minimizing resource depletion.

3. PROFESSION

Engineers:

a. uphold the honor, integrity, and dignity of the profession;

b. practice engineering in compliance with all legal requirements in the jurisdiction of practice;

c. represent their professional qualifications and experience truthfully;

d. reject practices of unfair competition;

e. promote mentorship and knowledge-sharing equitably with current and future engineers;

f. educate the public on the role of civil engineering in society; and

g. continue professional development to enhance their technical and non-technical competencies.

4. CLIENTS AND EMPLOYERS

Engineers:

a. act as faithful agents of their clients and employers with integrity and professionalism;

b. make clear to clients and employers any real, potential, or perceived conflicts of interest;

c. communicate in a timely manner to clients and employers any risks and limitations related to their work;

d. present clearly and promptly the consequences to clients and employers if their engineering judgment is overruled where health, safety, and welfare of the public may be endangered;

e. keep clients' and employers' identified proprietary information confidential;

f. perform services only in areas of their competence; and

g. approve, sign, or seal only work products that have been prepared or reviewed by them or under their responsible charge.

5. PEERS

Engineers:

a. only take credit for professional work they have personally completed;

b. provide attribution for the work of others;

c. foster health and safety in the workplace;

d. promote and exhibit inclusive, equitable, and ethical behavior in all engagements with colleagues;

e. act with honesty and fairness on collaborative work efforts;

f. encourage and enable the education and development of other engineers and prospective members of the profession;

g. supervise equitably and respectfully;

h. comment only in a professional manner on the work, professional reputation, and personal character of other engineers; and

i. report violations of the Code of Ethics to the American Society of Civil Engineers.

Wisconsin Administrative Code Chapter A-E 8

A-E 8.04 Offers to perform services shall be truthful. When offering to perform professional services, an architect, landscape architect, professional engineer, designer, professional land surveyor, or registered interior designer:

(1) Shall accurately and truthfully represent to a prospective client or employer the capabilities and qualifications which the registrant or licensee has to perform the services to be rendered.

(2) Shall represent the costs and completion times of a proposed project to a client or prospective client as accurately and truthfully as is reasonably possible.

(3) May not offer to perform, nor perform, services which the registrant or licensee is not qualified to perform by education or experience without retaining the services of another who is qualified.

(4) May not use advertising or publicity which is fraudulent or deceptive.

(5) May not misrepresent the extent to which the performance of services will involve a partnership or association with another registrant or licensee or misrepresent the identity of a registrant or licensee with whom a partnership or association will be engaged in for the performance of services.

(6) May not collect a fee for recommending the services of another unless written notice is first given to all parties concerned.

(7) May not practice under a firm name that misrepresents the identity of those practicing in the firm or misrepresents the type of services which the individuals, firm or partnership is authorized and qualified to perform.

A-E 8.05 Conflicts of interest. **(1)** An architect, landscape architect, professional engineer, designer, professional land surveyor, or registered interior designer:

(a) Shall avoid conflicts of interest. If an unavoidable conflict of interest arises, the registrant or licensee shall immediately inform the client or employer of all the circumstances which may interfere with or impair the registrant's or licensee's obligation to provide professional services. Under these circumstances a registrant or licensee may not proceed to provide professional services without the full approval and consent of the client or employer.

(b) Shall notify the employer or client and withdraw from employment at any time if it becomes apparent that it is not possible to faithfully discharge the responsibilities and duties owed to the client or employer.

(c) May not agree to perform professional services for a client or employer if the registrant or licensee has a significant financial or other interest which would impair or interfere with the registrant's or licensee's responsibility to faithfully discharge professional services on behalf of the client or employer.

(d) May not accept payment from any party other than a client or employer for a particular project or may not have any direct or indirect financial interest in a service or phase of a service to be provided as part of a project unless the employer or client approves.

(e) May not solicit or accept anything of value from material or equipment suppliers in return for specifying or endorsing a product.

(f) May not violate the confidences of a client or employer, except as otherwise required by rules in this chapter.

(g) May not perform services for a client or employer while a full-time employee of another employer without notifying all parties concerned.

https://docs.legis.wisconsin.gov/code/admin_code/a_e/8.pdf

Let's briefly revisit this old Venn diagram – you may feel you live with plenty of trivial conflicts of interest in your personal lives: *how does it differ when we have those in our professional lives?*

Many of the social ties in our personal lives may rely somewhat on favors we do for others and the obligations those may entail.

- Paying for dinner
- Buying tickets
- Giving a ride

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What are some other examples of

common personal favors?

A study published by Nesse and Mace (2007) explored how the exchange of resources in humans, such as favors or assistance, can trigger feelings of indebtedness, which in turn influence future social behavior.

They argue that *reciprocal altruism—where individuals help others with the expectation of future reciprocation*—has deep evolutionary roots, shaped by both cognitive mechanisms and social dynamics. Their research claims that humans are not just motivated by direct reciprocity but also by a general sense of social equity and the desire to "settle debts" with others. The more obligated someone feels, the more likely they are to be influenced or to influence others in return.

Nesse, R. M., & Mace, M. L. (2007). Cognitive and social foundations of reciprocal altruism. *Trends in Cognitive Sciences, 11*(9), 381–388. https://doi.org/10.1016/j.tics.2007.06.006

Some of these social ties may also be seen in our business context.

- Letter of reference
- Paying for dinner
- Gift baskets

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What are some other examples of common business favors?

Let's consider an extreme example of drug reps in the medical industry

Let's consider an extreme example of drug reps in the medical industry

- A review[1] of 36 studies in 2021 showed that **30 studies found *only* positive associations between payments and prescribing** and the remaining 6 had mixed results
  - Meals and beverage payments were most common favors

- Generally resulted in **lower prescribing quality and/or increased prescription costs**[2]

- *"Physicians are susceptible to corporate influence because they are overworked, overwhelmed with information and paperwork, and feel underappreciated."*[3]

- "It's my job to figure out what a physician's price is. For some it's dinner at the finest restaurants, for others it's enough convincing data to let them prescribe confidently and for others it's my attention and friendship…but at the most basic level, everything is for sale and everything is an exchange." [3]

1 Aaron P. Mitchell, Niti U. Trivedi, Renee L. Gennarelli, et al. Are Financial Payments From the Pharmaceutical Industry Associated With Physician Prescribing?: A Systematic Review. Ann Intern Med.2021;174:353-361. [Epub 24 November 2020]. doi:10.7326/M20-5665
2 Brax H, Fadlallah R, Al-Khaled L, Kahale LA, Nas H, El-Jardali F, et al. (2017) Association between physicians' interaction with pharmaceutical companies and their clinical practices: A systematic review and meta-analysis. PLoS ONE 12(4): e0175493. https://doi.org/10.1371/journal.pone.0175493
3 Fugh-Berman A, Ahari S. Following the script: how drug reps make friends and influence doctors. PLoS Med. 2007 Apr;4(4):e150. doi: 10.1371/journal.pmed.0040150. PMID: 17455991; PMCID: PMC1876413.

A Conflict of Interest (CoI) typically occurs when an engineer's decision-making or actions might be biased or influenced by competing interests.

The NSPE and ASCE codes typically emphasize the need to avoid conflicts of interest, disclose any potential conflicts, and uphold integrity to prevent any form of bribery or corruption in professional work

Recognizing and avoiding a conflict of interest is a part of acting with integrity and professionalism. COI's can diminish our fairness and ability to foster equitable participation . . .

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THE AMERICAN SOCIETY OF CIVIL ENGINEERS

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Both the ASCE and the NSPE Codes specifically require engineers to make clear to clients and employers any real, potential, or perceived conflicts of interest.

ASCE:

4. **CLIENTS AND EMPLOYERS**

Engineers:
   a. act as faithful agents of their clients and employers with integrity and professionalism;
   b. make clear to clients and employers any real, potential, or perceived conflicts of interest;

NSPE:

4. Engineers shall act for each employer or client as faithful agents or trustees.
   a. Engineers shall disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services.

You've heard a load of ethics "rules" – but are all of our bases covered?

- The challenge with ethics is that specific situations can create ambiguities

- Often -- even with Conflicts of Interest -- our choices may be on a continuum from ethically praiseworthy, to legal but not truly ethical -- to totally unacceptable.

- Some cases are black and white – others are not, so discussion with other engineers is key.

While considering our case studies today, remember that sometimes these questions from moral theory can help, too:

- **Publicity test:** How would I feel if everything I'm about to do in response to this dilemma were to become public knowledge?

- **Respect for persons test:** How well does my decision respect the rights and the dignity of others?

- **Reversibility test:** How would I feel about my decision if I or someone I care about stood to be negatively impacted by this decision?

- **Universality test:** What if other engineers in exactly this same position were to start making similar decisions? Would that lead to a just, fair society?

- **Harms test:** Do the short- and long-term benefits for all stakeholders outweigh the possible harms? (Or am I planning to do a "greater good" only for myself, at someone else's expense?)

Case 1 – consider the foundational context for this case.

Case 1: Samira is a DOT Project Manager who maintains long-term friendships with several consulting engineers who went through the Civil Engineering program with her at the local state university. She reconnects with them at the homecoming football game every year, and she reaches out ahead of conferences, so that they can enjoy the golf tournaments and social gatherings together. These gatherings are sponsored by the conference and costs are built into the registration. Samira values these opportunities in part because she learns from some of the experiences these friends have had in the industry. Often the consultants alert her to emerging techniques or materials that help her stay at the cutting edge in her own work.

https://www.uwplatt.edu/department/music/marching-pioneers

https://www.golfdigest.com/courses/wi/glenway-golf-course-glenway

Consider Q1 and provide a response in Mentimeter:

Q1: If Samira always recuses herself from any proposal decisions that involve any of the consulting firms of these friends, is her effort to maintain these friendships in itself something you would define as "*potentially* creating a conflict of interest"?   Or would that be, in your opinion, "over-interpreting the conflict of interest"?

Mentimeter:

a. Definitely a concern and could be seen *as potentially creating a conflict of interest*

b. Could raise some concerns – the situation warrants careful attention by Samira

c. Not a concern – seems to over-interpret the potential conflict of interest

Consider Q1 and provide a response in Mentimeter:

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Mentimeter:

a. Definitely a concern and could be seen *as potentially creating a conflict of interest*

b. Could raise some concerns – the situation warrants careful attention by Samira

c. Not a concern – seems to over-interpret the potential conflict of interest

-- What would you suggest that she do in this situation, if anything?

Q2: Let's say Samira only recuses herself from a proposal decision if she knows that one of her friends is directly involved in writing the proposal. She does not bother to recuse herself if the bid proposal seems to be written by others within the firm where her friend works. **Is that acceptable, and would you see that as a reasonable mitigation of the potential conflict of interest?**

Mentimeter:
    a. Completely unacceptable
    b. Might be acceptable
    c. Perfectly acceptable

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Mentimeter:
- a. Completely unacceptable
- b. Might be acceptable
- c. Perfectly acceptable

- **Explain your response – why might it be acceptable or unacceptable?**
- **Is there any chance of backfire in this approach?**

Case 2. An NSPE BER case

Engineer A, serves as a construction inspector on a bridge that is being extensively renovated. Engineer A's employer, ABC Engineering, holds the construction inspection services contract with the Town of Bridgeton, where the bridge is located. The general contractor on the bridge project is Engineer A's former employer, XYZ Construction Company. After leaving XYZ as a full-time employee, Engineer A continued to perform occasional jobs for the company on a part-time basis. One such task was the preparation of shop drawings for the bridge renovation project. Engineer A did not disclose his relationship with XYZ Construction to ABC Engineering or to the Town of Bridgeton.

What are Engineer A's ethical obligations under the circumstances?

a. **Immediately cease performing work for XYZ Construction**

b. **Work with his supervisor to terminate their contract with the Town of Bridgeton**

c. **Disclose the work he has performed for XYZ Construction to ABC Engineering with notice and agreement from the Town of Bridgeton**

d. **Both a and c**

e. **Both b and c**

The NSPE Board of Ethical Review discussed this Case 18-4 (from year 2018):

It is the BER's view that **Engineer A's actions** were inconsistent with the NSPE Code of Ethics because, at a minimum, they **raise the appearance of a conflict of interest.** Although Engineer A is currently a full-time employee of ABC Engineering, his role as a part-time contract employee of XYZ Construction could **raise questions of dual loyalty**—the very essence of a conflict of interest. Moreover, the very nature of the work Engineer A is performing for XYZ Construction and for ABC Engineering—shop drawing preparation and construction inspection—raises the issue that Engineer A, as an employee of ABC Engineering, **may be reviewing work he prepared for XYZ Construction**. Under the facts, there is no indication that Engineer A discussed performing services for XYZ Construction with ABC Engineering or that ABC Engineering has any company policy regarding the performance of services outside of normal business hours or the scope of employment.

The NSPE Board of Ethical Review discussed this Case 18-4 (from year 2018):

For these reasons, in order to fulfill the ethical obligations outlined in the NSPE Code of Ethics for Engineers, **Engineer A must immediately cease performing work for XYZ Construction and fully disclose the shop drawing preparation work as well as any other services he has performed on behalf of XYZ Construction to ABC Engineering with notice and agreement from the Town of Bridgeton.**

https://www.nspe.org/resources/ethics/ethics-resources/board-ethical-review-cases/conflict-interest-bridge-construction

Case 3

Engineer B, serves as construction supervisor on a bridge project for the general contractor. During installation of a decorative wooden archway above the bridge, the construction crew hears popping and observes cracking on the wooden structure. The subcontracted engineer who designed the archway inspects the structure and recommends reinforcements. After changes are made and the structure is installed, if Engineer B has concerns about the structural integrity of the arches what is Engineer B's ethical obligations under the circumstances?

What are Engineer B's ethical obligations under the circumstances?

a. **Inform the subcontracted engineer of the potential issue**

b. **Inform their supervisor of the potential issue**

d. **Both a and b**

e. **Something else**

Case 3

Engineer B, serves as construction supervisor on a bridge project for the general contractor. During installation of a decorative wooden archway above the bridge, the construction crew hears popping and observes cracking on the wooden structure. The subcontracted engineer who designed the archway inspects the structure and recommends reinforcements. After changes are made and the structure is installed, if Engineer B has concerns about the structural integrity of the arches what is Engineer B's ethical obligations under the circumstances?

What are Engineer B's ethical obligations if the response from the subcontracted engineer and his supervisor is that nothing is wrong?

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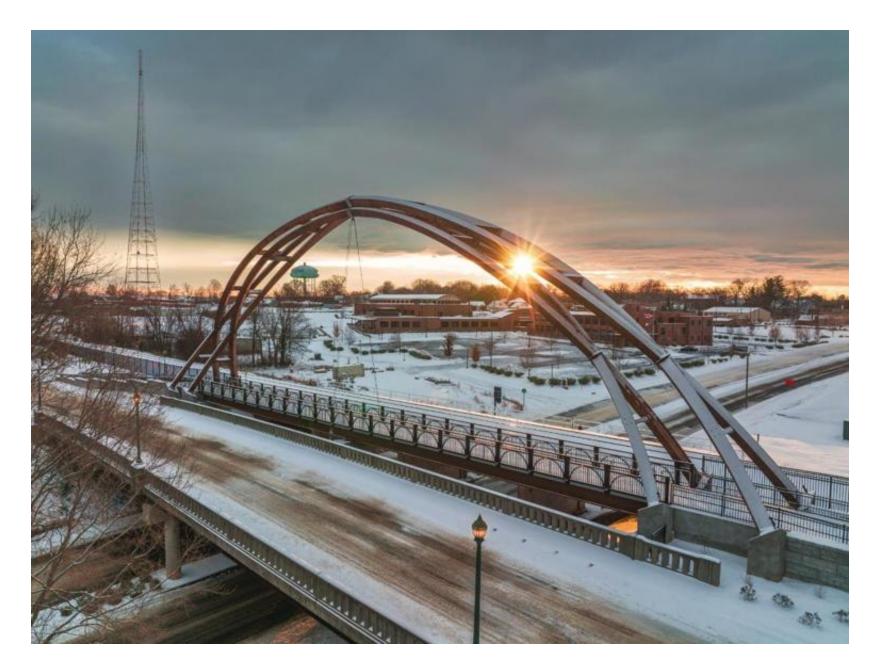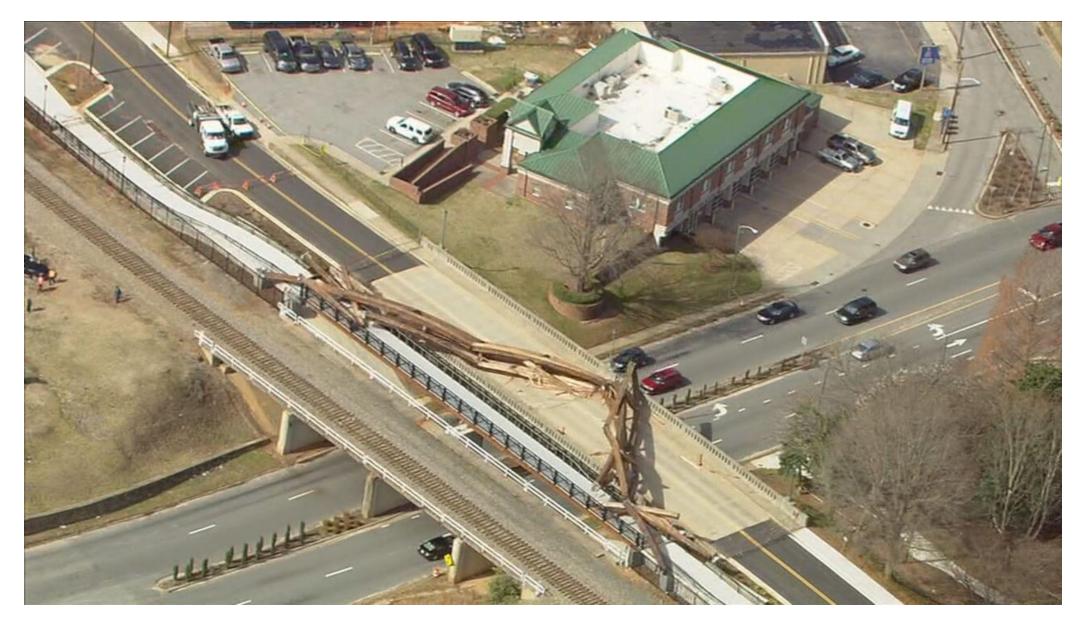Enter the code
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Photo obtained from https://www.thestructuralengineer.info/news/north-carolina-a-pedestrian-bridge-collapses-video-reveals-the-arches-collapsing Source: Nelson Aerial Productions

https://www.youtube.com/watch?v=c_D6RfCLZA0

- Forensic report indicated the collapse was partially or fully due to design flaws made by subcontracted engineer
- Settlement agreement provided city $1.325M
- It is not known at this time if anyone had concerns about the arches structural integrity or inability to withstand wind

What can you do to remain ethical in your practice?

- Be aware, curious, honest, and respectful
- Identify potential bias in your work
- Identify potential conflicts of interest in your work
- Take steps to reduce bias and conflicts of interest
- Know what to do when you see a potential issue

What can you do to remain ethical in your practice?

- Be aware, curious, honest, and respectful

- Identify potential bias in your work

- Identify potential conflicts of interest in your work

- Take steps to reduce bias and conflicts of interest

- Know what to do when you see a potential issue

- **What else could you do?**

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Some Potential Bias in Engineering

- Confirmation bias
  - Only looking for or accepting insights that you already think are true
- Availability bias
  - Focusing on problems or solutions that are top of mind
- Anchoring bias
  - Anchored to first result or context
- Selection bias (Errors of non-observation)
  - Data is not truly representative
- Outlier and Aggregation Error
  - Focusing on averages might hide patterns in subgroups and distributions
- Funder bias
  - Who is funding or commissioning the study may affect the analysis
- Historic bias
  - Patterns in historic data may perpetuate patterns in the analysis
- Optimism bias
  - Thinking things will work out better than likely
- Groupthink
  - Group only validates aligned thinking
- Omitted variable bias
  - Missing or omitted variables may shift the affect of included data on outcomes

Some Mitigations of Bias

- Reconsider old problems with a fresh perspective
- Use multidisciplinary and diverse teams
  - Empower stakeholders to participate in project meetings
- Conduct premortem analysis to identify risks before they occur
- Assess your data collection process
  - Evaluate your sampling frame and how representative it is
- Assess your analysis methods
  - Divide your data into calibration and validation data sets
- Assess your results
  - Analyze your results across sub-groups, sub-areas, and sub-time periods
  - Double check whether your process or results would be different with a different sponsor
- Acknowledge bias that cannot be removed
- Share your results and data

If you decide you are facing a problem that has an ethical dimension, prepare before you speak up:

Document the problem and your ethical decision-making process – for yourself.

Consider whether you need to have a (friendly) fact-gathering conversation with key stakeholders.

Work through the code of ethics and questions from moral theory to gain *the courage* to speak up: know that many people try to avoid difficult conversations.

Try to voice your own values without judging what appear to be the motivations of others: that only puts people on the defensive.

How to start a clarifying conversation, without putting people on the defensive:

- Use "I feel" statements rather than judgements
  - "I feel uncomfortable about X and would like to talk about it."
  - Instead of saying "This data was removed unethically by someone" -- say, "I feel (or I'm concerned that) there has been an unexplained deletion of data – can you help me understand?"

- Assume the people you are working with mean well. It is likely that they do, and it is possible you've misunderstood something.

A crucial conversation requires humility:

- Remember that humans are adept at fooling ourselves: our perspective may be biased. Sometimes seeing and admitting that to ourselves or others can help during a difficult conversation.

- Did you play any role in the problem? Admitting that early can help.

- Counter-intuitively, the harder you push and the more you insist on certainties and absolutes, the more resistance you will find in a conversation. You can gain ground by admitting uncertainty– SAY "Can you help me understand this? I may be missing some important information."

Seek input from trusted sources:

- If you can talk about the issue with a trusted supervisor or colleague, do that first!

- Consider calling a designated ethics/compliance and safety officer in your company, or call your Professional Society's ethics hotline for advice (for anonymity).

- Check the National Institute for Engineering Ethics website, which catalogs a number of cases with options and analysis from practicing engineers.
http://www.depts.ttu.edu/murdoughcenter/products/cases.php

- Check the NSPE Board of Ethical Review to see what options other experienced engineers have recommended for cases similar to yours.
http://www.nspe.org/Ethics/EthicsResources/BER/index.html

- Check the ASCE's Civil Engineering Magazine – "A Question of Ethics" columns are included six times a year – or search their cases at https://www.asce.org/career-growth/ethics/question-of-ethics