

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

“One test of character and virtue is what a person does when no one else is watching. A society that rests on expertise needs more people who can pass this test.”

Responsibility in Engineering



LECTURE # 03

Hoover's View of Engineering as Profession

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- A great profession transforming ideas into useful products.
- Brings jobs and elevates standards of living.
- Engineer's work- out in the open, mistakes cannot be hidden.
- In fact, Hoover's view focuses on engineers as independent consultants.

Corporate Trend in Engineering

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- Engineers are invisible/ less visible to general public.
- Corporate head, a typical manager, is blamed for any technological failures.
- Invisibility reduces the sense of accountability and responsibility among engineers.

Saving Citicorp Tower

A Case Study

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- Structural engineer Bill LeMessurier faced a big design problem while working on the Citicorp Tower, NY 5th highest skyscraper.
- The 900 feet high bank would rise from 9 storey high stilts. The stilts were positioned in the manner:
 - One stilt in the center
 - Others at the center of each side of the tower, and not at the corners.
- Wind braces were installed.
- Mass damper installed.
- Designed to withstand perpendicular wind loads.





Saving Citicorp Tower

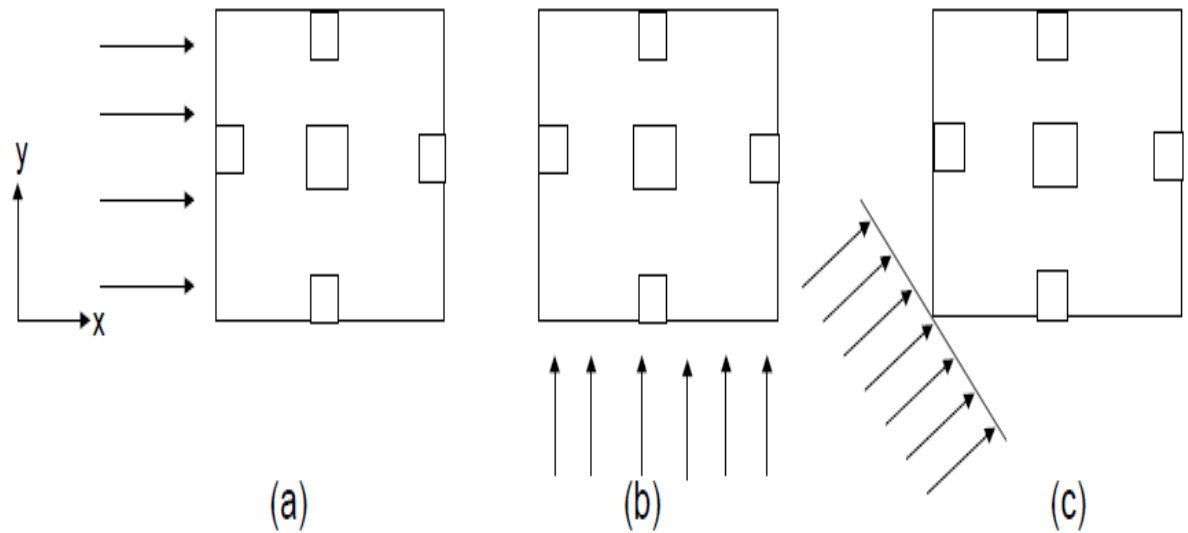
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- Question asked by an engineering student raised several different questions in LeMessurier's mind.
- **Can the building withstand oblique wind loads?**

Saving Citicorp Tower

In case (c), the resultant force becomes 40% larger than the safe tolerance for wind loads.

LeMessurier however thought that high quality welded joints will provide enough safety to tolerate the wind loads.



Saving Citicorp Tower

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- LeMessurier called on the engineer in charge at NY to ask about how the welded joints had worked out?
- Was shocked to hear that instead of being welded, joints were bolted.
- Wind tunnel tests had already proved that diagonal wind loads would result in the failure of bolted joints and hence the building can collapse.

What was the negligence?

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- Instead of being welded, joints were bolted and NO RECALCULATION WAS DONE to determine any design or structural change.

Ethical Dilemma

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- LeMessurier faced an ethical dilemma in the form of conflict between:
 - Responsibility for public safety.
 - Responsibility to various financial constituencies.
 - Self interest.

What to do now?

LeMessurier's Reaction

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- He convinced himself:
 - I have the information that nobody else in the world have.
 - I should take action to prevent a big disaster.
- The problem was shared with the client.
- 2 inch thick steel plates were welded over more than 200 bolted joints for strengthening the building.
- The cost of project raised much more than the insurance claimed for it, but LeMessurier behaved ethically.

Saving Citicorp Tower

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- With only half of the bolted joints were welded, when hurricane Ella was threatening to strike the building.
- Necessary evacuation plan had been made.
- Luckily, direction of the hurricane changed, and no damages occurred.

Criticism on LeMessurier

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- Insufficient oversight leading to bolted rather than welded joints.
- For misleading the public about the extent of danger during reinforcement process.
- *Facing temporary difficulties made LeMessurier to set a very good example of ethical behavior by saving hundreds of thousands of lives.*

What is Responsibility?

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- Obligations.
- Accountable.
- Conscientious.
- Blameworthy/Praiseworthy.

Obligations

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- Also called “*Obligation Responsibility*”.
- Morally mandatory actions incumbent on everyone.
- Role responsibility.
- Safety engineer responsible for regular inspections at building sites.

Accountable

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- Answerable to positions of authority for meeting obligations.
- Self-accountability.

Blameworthy/ Praiseworthy

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- Blameworthy.
 - Being held accountable for wrongdoing.
- Praiseworthy.
 - When right conduct is at issue.

Conscientious

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- Accepting the responsibilities.
- Carefully fulfilling the assigned responsibilities.
- Do the right thing even under difficult circumstances.

Types of Responsibility

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- Moral.
- Causal.
- Job.
- Legal.

Causal Responsibility

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- Being a cause of some event.

A young child playing with the match box caused a house to burn down.

But

The individual who left the child with the matches is morally responsible.

Job Responsibility

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- To fulfill assigned tasks at the place of employment.

To design a 900 feet high tower on the top of 9 storey high pillars so that the wind loads could be effectively tolerable was the job responsibility of LeMessurier

But

Implementation of reinforcement plan made to strengthen the building was the moral responsibility.

Legal Responsibility

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- It is whatever law requires.
- Strict liability:
 - Legal responsibility to provide compensation, make repairs, or the like.
 - Imposed on corporations rather than individual engineers.

Ways in which Harm is caused



- Intentionally – this is often criminal
- Recklessly – acting in a way that we recognize might cause harm
- Negligently – by failing to exercise due care

Three models of responsibility



- Minimalist or Malpractice model
- Reasonable Care model
- Good Works or Supererogation model

Minimalist or Malpractice model of Responsibility:



- Engineers have a duty *only* to conform to accepted practice and fulfill only basic duties prescribed by terms of employment.
- Those who would follow this model might be most concerned with not doing anything “wrong”.
 - “That’s not my responsibility, someone else will take care of that.”

Reasonable Care Model of Responsibility:



- Adhere to accepted standards of practice, and...
- Take reasonable care to ensure that mistakes are prevented and the public welfare is protected
- Recognize when minimal standards of practice might not be sufficient to prevent a harm, and take additional actions to prevent such a harm in those cases
- Attitude of concern or caring

Good Works (Supererogation) Model of Responsibility:



- “...above and beyond the call of duty.”
- Example: A local consulting engineer offers to design a parking lot for a church at her cost, with no charge for her own time.

Where do Professional Responsibilities lie?



- The reasonable care model is the best model for engineers.
- Codes demand it (...accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment...IEEE Code of Ethics)
- Public expects it
 - Principle of Proportional Care: When people have a greater ability to harm, they have a greater obligation to prevent harm.

ACM/IEEE Code of Ethics



- The professional societies in the US have cooperated to produce a code of ethical practice.
- Members of these organisations sign up to the code of practice when they join.
- The Code contains eight Principles related to the behaviour of and decisions made by professional software engineers, including practitioners, educators, managers, supervisors and policy makers, as well as trainees and students of the profession.

The ACM/IEEE Code of Ethics



In accordance with their commitment to the health, safety and welfare of the public, software engineers shall adhere to the following Eight Principles:

Ethical Principles



- 1. *Public*** - Software engineers shall act consistently with the public interest.
- 2. *Client and Employer*** - Software engineers shall act in a manner that is in the best interests of their client and employer consistent with the public interest.
- 3. *Product*** - Software engineers shall ensure that their products and related modifications meet the highest professional standards possible.
- 4. *Judgment*** - Software engineers shall maintain integrity and independence in their professional judgment.

Ethical Principles



5. *Management* - Software engineering managers and leaders shall promote an ethical approach to the management of software development and maintenance.

6. *Profession* - Software engineers shall advance the integrity and reputation of the profession consistent with the public interest.

7. *Colleagues* - Software engineers shall be fair to and supportive of their colleagues.

8. *Self* - Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

Practicing Ethics as an Engineering Student

Students Have a Code of Ethics Too

The San José State University Academic Integrity Policy requires that each student:

1. Know the rules that preserve academic integrity and abide by them at all times. This includes learning and abiding by rules associated with specific classes, exams and course assignments.
2. Know the consequences of violating the Academic Integrity Policy.
3. Know the appeal rights, and the procedures to be followed in the event of an appeal.
4. Foster academic integrity among peers.

Plagiarism & Cheating



- Many components go into being a good engineering student.
- One of the most important, as reflected by the codes of ethics for engineers, is to be **competent** in your field of engineering.
- To be competent, it is *necessary* that one actually knows what they claim to know.
- Proving to others that you know what you are supposed to know requires certification through a degree.

What students Say...



- 70% of American high school seniors admit to cheating on at least one test
- 95% of the students who said they cheated were never caught.
- An average of 75% of college students report cheating sometime during their college career

Academic Dishonesty



Cheating

At SJSU, cheating is the act of obtaining or attempting to obtain credit for academic work through the use of any dishonest, deceptive, or fraudulent means.

SJSU defines 5 basic types of cheating

1. Copying



One obvious type of cheating that we all recognize is copying someone's work on a homework assignment, exam, or paper.

Submitting someone's work as your own is a kind of cheating.

2. Unauthorized Sources



Using sources that one is not allowed to use as deemed by the instructor or the university as a whole is a kind of cheating, such as solution manuals.

Also, a text message from your friend with the answer to a question on the exam is a form of cheating.

3. Altering Grades



Altering your grade in any way is a form of cheating.

If you are given a C on your homework, paper, or exam and then you change your grade to a B+, you have cheated.

4. Surrogate



Surrogate cheating occurs when someone else either does your homework, takes an exam for you, or writes your paper.

Doing someone's work for them is a kind of cheating.

5. Multiple Submissions



Submitting your own work from one class to another class or submitting one piece of work to two distinct classes is a kind of cheating.

A paper for one class is not a paper for another class.

Why is Cheating Wrong?



Cheating undermines the credibility of the university and the degrees it awards.

If too many people cheat at SJSU, then the degrees awarded by SJSU won't certify that its students are competent. So, by cheating you not only hurt yourself, you also hurt others.

Why Cheating is Wrong?



Cheating also undermines the work of fellow students who are honest.

When you cheat, all the other students who didn't cheat are penalized. They end up getting lower grades. Consequently, of lower grades they lose out on scholarships and recommendations.

Cheating vs. Teamwork



- Working on a team for an assigned project is *not* cheating.
- However, failing to do your assigned task on a team project is a form of cheating. It is called *free-riding*, which is benefiting from the work of others without doing any work of your own.
- Teamwork is important in engineering, but free-riding is wrong, since if everyone did it nothing would get done.

Ethics – Courage & Integrity

- As we will be seeing more and more being ethical requires:

- Courage to do the right thing the situation calls for.

&

- The integrity to withstand the pressures that push you in the wrong direction.

The “Problem of Many Hands”

A Barrier to Accountability



- Because so many people contribute in so many different ways, it is very difficult to determine who is accountable for organizational behavior.
- It can often be extremely difficult to determine an individual's contribution to failures in large organizations or large engineering projects where many people participate and add their particular skills or expertise (in fact, the same goes for “successes”).

The Doctrine of “Many Eyes”



- “Many eyes” as a solution to the problem of many hands
- Given enough morally responsible individuals (“many eyes”) the network of accountability can be managed
- In a responsible organization, the many eyes that watch the many hands are a watchdog that could prevent risk and harm
- A culture of responsibility can develop if only one can fix the errors of another
- Engineers have a responsibility to address the errors of their co-worker engineers working on the same project

THE END