

Engineering Failures/Ethics/Citicorp Case Study

Primary Causes of Engineering Failures

The primary causes of engineering failures are usually considered to be

- human factors (including both 'ethical' failure and accidents)
- design flaws (many of which are also the result of unethical practices)
- materials failures
- extreme conditions or environments, and, most commonly and importantly
- combinations of these reasons

A recent study conducted at the Swiss federal Institute of technology in Zurich analyzed 800 cases of structural failure in which 504 people were killed, 592 people injured, and millions of dollars of damage incurred. When engineers were at fault, the researchers classified the causes of failure as follows:

Insufficient knowledge	36%
Underestimation of degree of influence of engineering (e.g. design/construction) factors	16%
Ignorance, carelessness, negligence	14%
Forgetfulness, error	13%
Relying upon others without sufficient control	9%
Objectively unknown situation	7%
Imprecise definition of responsibilities	1%
Choice of bad quality	1%
Other .	3%

M. Matousek and Schneider, J., (1976) Untersuchungen Zur Struktur des Zicherheitproblems bei Bauwerken, Institut für Baustatik und Konstruktion der ETH Zürich, Bericht No. 59, ETH.
(<http://www.matscieng.sunysb.edu/disaster/>)

Engineering Ethics

Often, a deficiency in engineering ethics is found to be one of the root causes of an engineering failure. An engineer, as a professional, has a responsibility to their client or employer, to their profession, and to the general public, to perform their duties in as conscientious a manner as possible. Usually this entails far more than just acting within the bounds of law. An ethical engineer is one who avoids conflicts of interest, does not attempt to misrepresent their knowledge so as to accept jobs outside their area of expertise, acts in the best interests of society and the environment, fulfills the terms of their contracts or agreements in a thorough and professional manner, and promotes the education of young engineers within their field.

Code of Ethics for Engineers

(National Society of Professional Engineers)

Preamble

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

I. Fundamental Canons

Engineers, in the fulfillment of their professional duties, shall:

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.

Assignment

Read the article about the Citicorp Building.

Respond to the following two questions (2 typed pages):

As you know from your own experience in this course, the design cannot always be fully implemented in the construction phase. In the article such a field construction change was made which had significant unforeseen consequences.

1. What was the motivation for the construction change?
2. Were the changes reasonable from an engineering perspective?
3. Were the changes lawful?
4. Based on your answers to the above questions, would you have approved this construction change?
5. Based on the list of causes of engineering failures, what were the source(s) of this near failure?
6. Based on the summary of the code of ethics above, which may have been violated in this episode?