

Part 2: Long Reading

Time Remaining: 19 minutes

NEXT

Very often, the discipline of engineering surprises the world with marvelous feats such as the longest bridges, tallest buildings, and most sophisticated space exploration technologies. Occasionally, it sinks people's heart with unexpected failures and tragedies, like the explosion of *Space Shuttle Challenger*. In today's media-rich society, this type of sad story travels faster than ever as engineering accidents may be more eye-catching than celebrity news. Like other applied fields, engineering continues to build upon previous errors and mistakes. Taking the proverb "To err is human; to forgive, divine," Professor Henry Petroski titled his book *To Engineer is Human: The Role of Failure in Successful Designs* to highlight the truth that engineering failures happen; what matters most is to learn from them. The attention around engineering failures and disasters has brought new courses and professionals to the field, such as failure analysis and forensic engineers.

What are the common causes of engineering failures? A number of factors, including violation of codes of practice, miscommunication, extreme weather conditions during construction, or questionable engineering ethics, can come into play. Based on an analysis of 800 cases of structural failure before 1976, Miroslav Matousek and Jörg Schneider, two researchers at the Swiss Federal Institute of Technology, found that human factors constituted the main causes of failure. These included carelessness, negligence, or unpreparedness. In a more recent study, George Sowers (an honorable member of the American Society of Civil Engineering), evaluated 500 failure cases in civil engineering to identify the stages the failures stemmed from and the causes that led to the failures. About 58% of the cases had issues in the design stage, 38% in the construction stage, and 4% in the operation stage. In terms of causes, 88%

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1. Professor Henry Petroski is likely to be teaching which one of the following engineering courses?

- ☐ Integrated Engineering
- ☐ Material Engineering
- ☐ Engineering Ethics
- ☐ Environmental Engineering

2. What does the book title *To Engineer is Human* suggest?

- ☐ the wisdom of the idiom
- ☐ the tendency of making errors
- ☐ the nature of engineering
- ☐ the consequences of failures