

# Chapter 1

## Introduction

Failure can be defined as an unacceptable difference between an actual condition or performance and the intended or reasonably anticipated condition or performance. Failure need not involve a complete or even partial collapse; failure may involve a less catastrophic deficiency or performance problem, such as unacceptable deformation, cracking, water- or weather-resistance, or other such phenomena. The role of the forensic engineer may be that of an investigator of the causes of the failure, or it may extend into litigation support and testimony in legal proceedings. Forensic engineers are also involved in devising repairs or mitigating consequences of failures, however, the *Guidelines* do not intend to address issues of failure mitigation or repair.

Etymologically, the word “forensics” comes from the Latin *forensis* (of the forum)\* and applies to the public forums of discussion, debate, or the administration of justice. College and high school debate teams are often referred to as “forensic societies.” Although rooted in argument, the term has also become commonly associated with applying scientific or engineering knowledge or expertise to investigation. Here too, however, the term is generally associated with criminal investigation, or with some other domain related to our legal system. Formally then, forensic engineering can be defined as applying engineering principles, education, and knowledge to problems where legal liability is to be decided in a legal forum. However, much of the work of forensic engineers leads to the resolution of a problem without formal legal proceedings, and the term “forensic engineering” more generally and most often applies to studying problems that *may* be decided in a legal forum. The possibility that a forensic engineer will be retained as a consultant or expert in a legal proceeding distinguishes forensic engineering from other engineering disciplines, and the context of this naturally adversarial environment affects how forensic engineering is practiced.

For forensic engineers to intelligently investigate the cause of a failure, to help identify parties responsible for the failure, and to assist in mitigating the effects of the failure, they have to understand technical issues, and the professional, ethical, legal, contractual, and business practices that may have played a part in the failure. When forensic engineers possess that understanding, they can be of significant help in the effort to know what in fact failed, where, when, how, and why a failure has originated, and who may have contributed to responsibility for the failure. Because deficiencies and failures of the built environment can lead to claims, disputes, and legal proceedings, forensic engineers need to have some familiarity with relevant legal processes, and need to know how to work effectively with attorneys. One feature of the

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\* Retrieved from [www.perseus.tufts.edu](http://www.perseus.tufts.edu)

*Guidelines* is its coverage of a range of subjects, the understanding of which is necessary for the effective and successful practice of forensic engineering.

Engineering outside of the forensic arena is, at its best, an exercise in addressing the concerns and accommodating the positions of many diverse parties involved in conceptualizing, planning, designing, constructing, operating, maintaining, renovating, reconfiguring, and decommissioning an engineered facility. The goal of the engineering effort can be seen as satisfying as many of those diverse parties in each of their areas of concern, or at least dissatisfying them as little as possible. The forensic arena, however, often involves an adversarial process concerned with a particular aspect of the facility or with a specific occurrence, where there can be “winners” and “losers.” Because of that, some practicing design engineers may be of the opinion that a forensic engineer’s role in helping identify responsible parties may itself border on unethical behavior, because it may merely be seen as a venal participation in the “blame and shame game.” The Committee does not hold that opinion. In a well-ordered, just and caring society, identifying sources of failures, and holding responsible those who contribute to causing damage are worthwhile endeavors. Forensic engineers can aid in the processes of correctly characterizing the failure and of allocating responsibility.

The purpose of this publication is to document current practice and to provide guidance for the effective and ethical practice of forensic civil engineering. It is intended as a primer for the novice and as a reference for the seasoned practitioner.

No single author would have the details and the credibility to write on all the topics that were necessary for the *Guidelines*; therefore, many of the members of the Forensic Practices Committee were involved in the preparation of the individual chapters. The *Guidelines* chapters each deal with an important aspect of forensic engineering practice, such as competencies of a forensic engineer; the standard of care of engineers, including forensic engineers; the investigation and reporting processes; ethics; the legal forum; and business considerations.

Chapter 2: “Competencies and Qualifications of Forensic Engineers,” describes the attributes and competencies that the Committee sees as appropriate for forensic engineers. The chapter brings up the problematic subjects of advocacy, objectivity, and bias, which are also addressed in subsequent chapters.

Chapter 3: “The Standard of Care,” discusses that concept and explains that it is best understood as the boundary between negligent error and non-negligent error. The chapter shows that the standard of care is not a “Standard” in the typical engineering sense of the word, but that it is a duty of every engineer, including forensic engineers, to exercise care. The concept of care is

discussed, as well as the necessary components of a valid and reliable method an expert can use to support testimony concerning the standard of care.

Chapter 4: “Investigations and Reports,” describes typical steps in a forensic investigation and what the Forensic Practices Committee sees as constituting appropriate investigation procedures. The chapter addresses the collection and handling of evidence in legal procedures, describes proper use of Codes and Standards in investigation and analysis, and outlines the process of investigation, from initial client contact and conflict check through production of a report of the forensic engineer’s opinion.

The sections in Chapter 4 dealing with **Reports** describe reasonable content and organization of written reports of forensic investigations and touch on some of the requirements of a report in the legal forum.

Chapter 5: “Ethics” is an important focus of the *Guidelines*. A primary objective of ASCE, TCFE, and the Forensic Practices Committee is the promotion of ethical behavior on the part of forensic engineers. The chapter cites the ASCE Code of Ethics as it applies to forensic engineers. The chapter also continues the discussion of advocacy, objectivity, and conflicts of interest, along with other ethics topics such as those related to expert opinions, fees, time constraints, reporting unethical practices, and other sanctioning processes.

Chapter 6: “The Legal Forum” gives a brief overview of the US court system as it relates to the design and construction industry. The chapter defines the role of the forensic engineer as an expert witness, and discusses the interactions of the forensic engineer with plaintiffs, defendants, attorneys for each side, and other witnesses. It discusses the role of the forensic engineer in non-adjudication forums and describes rules of evidence and case law that affect the qualification of expert witnesses and admissibility of expert testimony.

Chapter 7, “The Business of Forensic Engineering,” describes the non-technical management and business sides of forensic engineering practice. The chapter discusses marketing of forensic engineering services within acceptable ethical limits and addresses the topics of contracts, insurance, and compensation for services.

The members of the Forensic Practices Committee believe that this Second Edition of the *Guidelines of Forensic Engineering Practice* will be used as much as, or more than, the first edition was, and that it will contribute to the improvement of the effective, ethical, and rewarding practice of forensic engineering.