

Chapter

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Safety and Sustainability— the Structural Engineer's Role

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1.1 Introduction

The mission of structural engineering is to design and construct safe structures by making appropriate decisions. At the same time, society also has a strong demand for sustainability, to which structural engineers can contribute through their decisions. Such decisions are necessary at every step of the design, construction, maintenance, and demolition process. The appropriateness depends on people's expectancy for a structure, which varies according to their cultural background and economic well-being, as well as technological development. Historically, when quantitative information of a design variable was not available, the structural safety was determined by engineers, based mainly on their own experiences. Materials and construction systems simply followed what had been successful in the past.

Due to the scientific developments, structural analysis is now available to examine if structural materials are strong enough to withstand the likely forces on a structure, and these forces can be calculated for postulated unfavourable situations. Safety is one of the essential requirements for a structure, but the purpose of construction is to create comfortable spaces for human activities, with serviceability requirements being equally important. Economic efficiencies are also important in addition to safety and serviceability. Sustainability is now another important aspect for buildings and structures. Quantitative discussions on the balance between safety and sustainability has thus become possible.

The availability of quantitative information to assess structural safety (e.g., probabilistic models for the physical characteristics of structural materials, environmental actions, and the physical dimensions of structural members) has enabled the reliability of a structure to be evaluated for required safety and serviceability limits. The reliability concept for structures is now commonly; the standard ISO 2394 becoming first available in 1986 [1]. Safety and structural requirements can be discussed at the design stage for new construction or at the maintenance stage for existing structures.