

Life-Cycle Performance, Safety, Reliability and Risk of Structural Systems

A Framework for New Challenges

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In recent years, life-cycle performance, safety, reliability and risk have become emergent and key issues of civil infrastructure systems due to recurring natural and man-made disasters, the infrastructure crisis, sustainability issues and global warming. In dealing with these problems, uncertainties are unavoidable. Modern society can no longer afford to ignore congested roads, deficient bridges, aging dams, broken levees and water mains, among others. Management of aging civil infrastructure involves significant expenditures and, at a time of constrained public resources, requires difficult decisions to establish priorities for maintenance, rehabilitation and replacement. Decisions regarding requirements for design, continued service, rehabilitation or replacement should be based on multi-criteria optimization under uncertainty, in order to balance conflicting requirements such as cost and performance. This can only be achieved through proper integrated risk management planning in a life-cycle comprehensive framework. Such a framework is shown in *Figure 1*.

The development of practical methods for modeling, analyzing, designing, maintaining, monitoring, managing, predicting and optimizing the life-cycle performance of civil infrastructure systems under uncertainty has become one of the most fertile and important areas in structural engineering research. At the same time, a recent ASCE report, *Civil Engineering Body of Knowledge for the 21st Century: Preparing the Civil Engineer for the Future*, has identified *risk and uncertainty* as one of the desired technical educational outcomes for the future practice of civil engineering.

In recognition of the need for such methods and models, the SEI-ASCE Technical Activities Division approved, on October 1, 2008, the creation of the Technical Council on Life-Cycle Performance, Safety, Reliability and Risk of Structural Systems (<http://content.seinstitute.org/committees/strucsafety.html>). This is the only Technical Council within SEI.

The Technical Council provides a forum for reviewing, developing, and promoting the principles and methods of life-cycle performance, safety, reliability, and risk of structural systems in the analysis, design, construction, assessment, inspection, maintenance, operation, monitoring, repair, rehabilitation, and optimal management of civil infrastructure systems under uncertainty. To achieve these objectives, three Task Groups have been formed within the Technical Council, with the following purposes:

Task Group 1: *Life-Cycle Performance of Structural Systems Under Uncertainty*; to promote the study, research, and applications of scientific principles of safety and reliability in the assessment, prediction, and optimal management of life-cycle performance of structural systems under uncertainty.

Task Group 2: *Reliability-Based Structural System Performance Indicators*; to promote the study, research, and applications of reliability-based system performance indicators including structural system reliability, robustness, and redundancy.

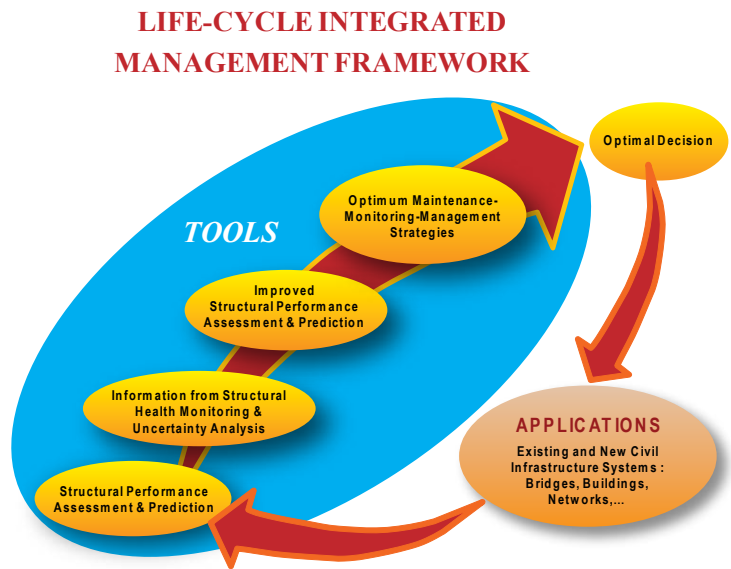


Figure 1: Life-cycle integrated management framework.

Task Group 3: *Assessment of Structural Infrastructure Facilities and Risk-Based Decision Making*; to promote the study, research and applications of scientific principles of risk assessment and risk-based decision making in structural engineering.

The newly created Technical Council on Life-Cycle Performance, Safety, Reliability and Risk of Structural Systems will be the central forum within the Structural Engineering Institute to highlight the challenges and promote some of the important directions for research and applications of scientific principles related to this important and highly significant area of structural engineering. The success of this forum depends much on the cooperation between industry and academia.

We encourage you to actively participate in this Technical Council by joining one of its Task Groups and contributing to its success. ■

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