LIFE CYCLE PERFORMANCE OF CIVIL STRUCTURE AND INFRASTRUCTURE SYSTEMS

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To fulfill the continuously increasing demand from societal, political, economic and environmental needs, structural engineering is undergoing a profound change towards a life-cycle oriented design philosophy where the classical point-in-time design criteria are extended to account for more comprehensive time-variant performance indicators over the entire service life. Considering this need, ASCE proposed the use of Life Cycle Cost Analysis in conjunction with the Grand Challenge of reducing life-cycle costs of civil infrastructure projects by 50% by 2025. The recent relevant advances accomplished in the fields of modeling, analysis, design, maintenance and rehabilitation of deteriorating civil structure and infrastructure systems are hence perceived to be at the heart of a modern approach to structural engineering. However, despite such advances, a gap has still to be filled between theory and practice before life-cycle concepts can actually be implemented in design of structures and civil infrastructure.

The research and applications in the field of life-cycle assessment, prediction, and optimal management of structures and infrastructure systems under uncertainty is promoted within SEI/ASCE by the Technical Council (TC) on Life-Cycle Performance, Safety, Reliability and Risk of Structural Systems, Task Group 1 (TG1) on Life-Cycle Performance of Structural Systems under Uncertainty. The Technical Council and its three Task Groups provide 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. In particular, the purpose of Task Group 1 is to promote the study, research, and application of scientific principles of safety and reliability in the assessment, prediction, and optimal management of life-cycle performance of structural systems under uncertainty.

The ongoing activities of SEI/ASCE TC TG1 include a Special Project approved by the SEI Technical Activities Division Executive Committee for the development of a state of the art report outlining the current status and research needs in the fields of life-cycle of civil structure and infrastructure systems. The task of the Special Project was to conduct a Survey and organize an International Workshop on Life-Cycle Performance of Civil Structure and Infrastructure Systems. The objectives were to overview the advances accomplished in the field of life-cycle civil engineering, to promote a better understanding of life-cycle concepts in the structural engineering community, and to discuss methodologies and tools to incorporate life-cycle concepts into structural design codes and standards.

The International Workshop, organized and chaired by the writers of this article, was held on November 10th, 2015, at ASCE Headquarters in Reston, VA, USA (Figure 1). The Workshop program included invited plenary lectures addressing the current state of research and practice, as well as breakout working sessions and group reports. Over 30 invited participants from several countries attended the Workshop (Figure 2). This was very successful and fruitful to assemble information on the development and implementation of criteria, methods and tools for life-cycle design and assessment of civil structure and infrastructure systems. The final results of the survey will complement information on the state-of-research and -practice.

Civil infrastructure systems are the backbone of modern society and among the major drivers of the economic growth and sustainable development of countries. It is hence a strategic priority to consolidate and enhance criteria, methods and procedures to protect, maintain and improve the safety, durability, efficiency and resilience of critical structure and

infrastructure systems under uncertainty. We sincerely hope that the effort ongoing within the SEI/ASCE TC and TG1 will contribute to promote the application of life-cycle concepts in design practice, influence the development of structural design codes and standards, and enhance the state of the civil structures and infrastructures to protect the public safety and improve the quality of life.

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