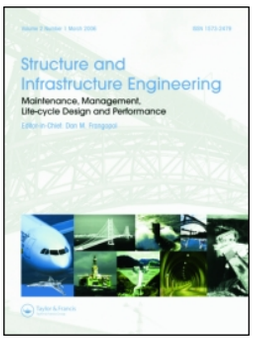

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Life-cycle of engineering systems: emphasis on sustainable civil infrastructure

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GUEST EDITORIAL

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Life-cycle of engineering systems: emphasis on sustainable civil infrastructure

The International Association for Life-Cycle Civil Engineering (IALCCE) was founded in 2006 to support this challenge and to create a fertile ground for promoting the study, research, and applications in the design, assessment, prediction, and optimal management of life-cycle performance, safety, reliability and risk of civil structures and infrastructure systems (http://www.ialcce.org). To accomplish this mission and following a series of International Workshops on Life-Cycle Cost Analysis and Design of Civil Infrastructure Systems held in Honolulu, Hawaii, USA (LCC1, 2000), Ube, Yamaguchi, Japan (LCC2, 2001), Lausanne, Switzerland (LCC3, 2003), Cocoa Beach, Florida, USA (LCC4, 2005), and Seoul, Korea (LCC5, 2006), it was decided to bring together the main advances on life-cycle civil engineering and related topics at the First International Symposium on Life-Cycle Civil Engineering (IALCCE'08), held in Varenna, Lake Como, Italy, 10–14 June 2008 (http://www.ialcce08.org), and afterwards at the Second International Symposium on Life-Cycle Civil Engineering (IALCCE 2010), held in Taipei, Taiwan, 27–31 October 2010 (http://www.ialcce2010.ntust.edu.tw), the Third International Symposium on Life-Cycle Civil Engineering (IALCCE 2012), held at the Hofburg Palace in Vienna, Austria, 3–6 October 2012 (http://www.ialcce2012.org), the Fourth International Symposium on Life-Cycle Civil Engineering (IALCCE 2014), held in Tokyo, Japan, 16–19 November 2014 (http://www.ialcce2014.org), and the Fifth International Symposium on Life-Cycle Civil Engineering (IALCCE 2016), held in Delft, The Netherlands, 16–19 October 2016 (http://www.ialcce2016.org).

IALCCE 2016 has been organised onbehalf of the IALCCE under the auspices of InfraQuest, which is a collaboration between the Delft University of Technology, TNO (the Netherlands Organization for Applied Scientific Research) and Rijkswaterstaat (government agency within the Dutch Ministry of Infrastructure and the Environment). The interest of the international civil engineering community in areas covered by the IALCCE has been confirmed by the significant response to the IALCCE2016 call for papers. In fact, 475 abstracts from 48 countries were received by the Symposium Secretariat, and approximately 70% of them were selected for publication. Contributions presented at IALCCE2016 included state-of-the-art as well as emerging applications related to key aspects of the life-cycle civil engineering from a life-cycle perspective.

The extended versions of selected papers presented at IALCCE 2016 and invited contributions are included in this special issue of *Structure and Infrastructure Engineering*. *Lollini, Gastaldi and Bertolini* study performance parameters related to durability design of reinforced concrete structures exposed to aggressive chloride bearing environments using stainless steel reinforcement. *Melchers* presents the state-of-the-art in realistic corrosion models, including longer-term corrosion of actual structures and short-term field or laboratory corrosion tests. The main aim of the article by *Ferreira, Santos, Flintsch and Cerezo* is to develop a multi-objective optimisation framework for sustainable pavement management that is based on a comprehensive and integrated pavement life-cycle costs assessment model that covers the pavement's whole life-cycle. *Papakonstantinou, Andriotis and Shinozuka* develop efficient decision-making techniques, based on Partially Observable Markov Decision Processes and Mixed Observability Markov Decision Processes, for the optimal scheduling of inspection and maintenance policies as well as efficient allocation of resources for infrastructure utilizing informative but uncertain data that become available during their structural life-cycle. *Kim, Zhang, Wang, Oshima and Morita* following a Bayesian approach present a damage detection methodology for the long-term health monitoring of bridges that is applied to detect the structural changes in an in-service steel bridge considering the environmental (temperature) and operational (vehicle weight) effects.

The study by *Jonkman, Voortman, Klerk and van Vuren* highlights recent developments in flood risk management in the Netherlands and presents efficient approaches for reliability analysis and asset management for flood defences and hydraulic infrastructure. An overview of structural integrity management of offshore structures in the oil and gas energy sector is presented by Moan, while the current status of risk and reliability methodologies to aid decisions in the safety management of offshore structures is briefly reviewed. The paper by *Abspoel, Courage, Dabekaussen, de Bruijn, Kruse, Wiersma, Hijma, van den Heuvel and van den Broeck* describes the development of a fully computerised and automated tool to calculate the probability of failure of pipe networks in the Netherlands, assisting thus the decision-making process regarding preventive measures, such as timely replacement.

Shekhar, Ghosh and Padgett develop an efficient framework for seismic loss assessment of highway bridges considering also environmental deterioration that can estimate the extent of structural degradation and aid prompt decisions on rehabilitation of ageing bridges under different chloride exposure conditions. *Barrias, Rodriguez, Casas and Villalba* present examples of structural health monitoring of two real world structures in Barcelona, utilizing distributed optical fibre sensors based on an optical backscattered reflectometry technique, emphasising on

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the influence of strain transfer between the sensors and the bonding surface. *Titi, Bianchi, Biondini and Frangopol* investigate the probabilistic life-cycle seismic performance of reinforced concrete frames under chloride-induced corrosion, considering the influence of the environmental aggressiveness and exposure scenario and the role of spatial correlation of the random variables.

Leyder, Dertimanis, Frangi, Chatzi and Lombaert work aims at determining optimal sensor configurations for the modal identification of a post-tensioned timber frame structure by maximising the information gained from the structural testing, while keeping the number of necessary sensors to a minimum. The paper by *Yanweerasak, Pansuk, Akiyama and Frangopol* proposes a novel probabilistic methodology for estimating the life-cycle reliability of existing reinforced concrete bridges under multiple hazards that most threaten their structural safety by identifying the structural components with the lowest reliability. The objective of the work of *Van Erp and Orcesi* is the prediction of infrastructure degradation under uncertainty, which is achieved by combining nested sampling with a Markov-based estimation of the condition rating of the infrastructure elements and the corresponding maintenance costs.

The guest editors wish to thank the authors and the reviewers for contributing to this special issue and hope that this collection of papers will represent a useful reference for researchers, students, and practitioners to promote and advance research and applications in the field of life-cycle civil engineering.

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