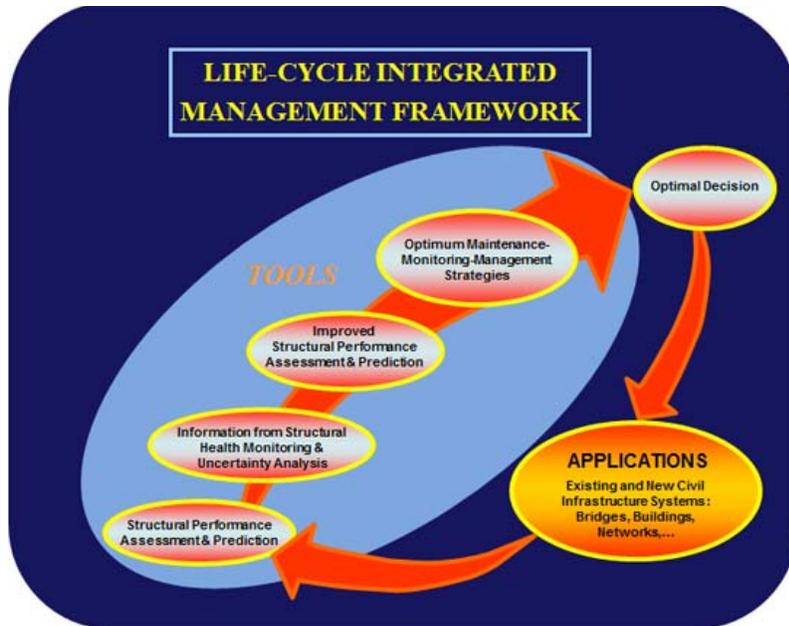


Frangopol Awarded Contract to Help Solve the ASCE Grand Challenge



Frangopol's life-cycle integrated management model for civil infrastructure systems

"How do ASCE members encourage policy makers and the engineering community to take the long view rather than focus on the upfront sticker price?"

That's a question [Dr. Dan M. Frangopol](#), the Fazlur R. Khan Endowed Chair of Structural Engineering and Architecture, posed to fellow educators and industry leaders in civil engineering at the [American Society of Civil Engineers \(ASCE\)](#) annual convention in New York City this fall. It's also a question that's propelled him to the forefront of a critically important area of study and practice within the civil engineering community.

The philosophy behind life-cycle engineering holds that the best decisions are the ones that maximize the benefits of investments over the life-cycle of a structure or infrastructure system to serve the needs of our society. This is accomplished by selecting the optimum balance among multiple requirements including safety, serviceability, economy, resiliency and sustainability despite imperfect information and knowledge. The risk-informed multiple-objective decision-making process requires the consideration of both technical and nontechnical factors, such as risk acceptance, environmental impact, and social/political implications. Through probabilistic modeling and analysis, uncertainties are assessed, and through optimization and computer simulation, a robust decision can be obtained. When successfully carried out, optimum solutions can save money, time, and even lives.

Life-cycle engineering is a broad area of research that Frangopol started studying while writing the paper "[Life-cycle cost design of deteriorating structures.](#)" Published in 1997 in the ASCE's Journal of Structural Engineering, and co-authored by two of his former Ph.D. advisees, Kai-Yung Lin and [Allen C. Estes](#), the paper has been cited more than 330 times in subsequent publications (Google Scholar, 2015).

Although it remained a niche topic within the broader discipline of civil engineering for many years, Frangopol continued developing and promoting life-cycle assessment, prediction, and optimization procedures. He edited (with Professor Hitoshi Furuta of Kansai University) the first book on life-cycle structural engineering – *Life-Cycle Cost Analysis and Design of Civil Infrastructure Systems* – published by the ASCE in 2001. He is also the Founding President of the [International Association for Bridge Maintenance and Safety \(IABMAS\)](#), founded in 1999, and of the [International Association for Life-Cycle Civil Engineering \(IALCCE\)](#), founded in 2006. Additionally, he is the founder and editor-in-chief of the international peer-reviewed journal *Structure and*

Civil and Environmental Engineering



Lehigh Professor Dan Frangopol and two of his Ph.D. advisees have contributed to solve the Grand Challenge of the American Society of Civil Engineers, the nation's oldest engineering society, which represents 146,000 civil engineers.



Infrastructure Engineering - Maintenance, Management, Life-cycle Design and Performance.

Furthermore, he is the founding chair of the ASCE-SEI Technical Council on Life-Cycle Performance, Safety, Reliability and Risk of Structural Systems, and the IASSAR Technical Committee on Life-Cycle Performance, Cost and Optimization.

For all of these efforts and many more, the ASCE will award Frangopol with its prestigious OPAL Award in March 2016 for a lifetime achievement in education and for being a pioneer in the field of life-cycle civil engineering.

Now, the Industry Council Leaders of the ASCE has turned to him to help solve the ASCE Grand Challenge: significantly enhance the performance and value of infrastructure projects over their life cycles, reducing the life-cycle cost of infrastructure by 50 percent by 2025, and fostering the optimization of infrastructure investments for society. Therefore, over the next ten years, the leading civil engineering professional organization hopes that by encouraging its members to adopt life-cycle engineering principles into their everyday practice, they can collectively reduce life-cycle costs of civil infrastructure investments by 50 percent. As a preliminary investigation, the ASCE and Eno Center for Transportation released a report, Maximizing the Value of Investments Using Life Cycle Cost Analysis, that reviews the current use of life-cycle cost analysis and how it might be used to make informed decisions about future projects and costs.

To kick off the effort, Frangopol, Mohamed Soliman '15 Ph.D., and Ph.D. candidate Samantha Sabatino created a survey, called "Utilization of Life-Cycle Cost Analysis (LCCA) and Performance Based Design (PBD) for New and Existing Infrastructure," that was shared with 18,000 civil engineers in the weeks leading up to the 2015 ASCE National Convention.

"We have reached out to Lehigh University, and in particular, Dr. Frangopol because of his expertise on the subject matter and his knowledge of ASCE and its mission," indicated Carol Vargas, ASCE Director of Industry Relations. "As we work together to improve how our nation approaches issues related to infrastructure, this initial research will serve as a milestone marker in our continued effort of serving our nation. Future output of this research will provide the foundation for developing tools and information about best practices that will help guide our industry towards more efficient use of resources, improved management of projects and assets, and innovation."

"It was a very large effort that the ASCE Industry Leaders Council approached us with," Frangopol said. "When all the results were compiled, we presented our initial findings at both the ASCE National Convention in New York City (October 11-14, 2015) and at the ASCE International Workshop on Life-Cycle Performance of Civil Structure and Infrastructure Systems at the ASCE headquarters in Reston, VA (November 10, 2015)." The latter event was co-chaired by Frangopol and Fabio Biondini, associate professor of structural engineering at the Politecnico di Milano, Italy. It was attended by 32 participants including industry leaders and prominent educators from North America, South America, Asia, and Europe.

Going forward, the ASCE plans to publish the findings of the survey and of the workshop in a special publication on life-cycle performance of civil infrastructure systems, which is anticipated to be available in 2017.

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