LEHIGH UNIVERSITY

News > News Article

A LIFETIME OF RESEARCH IN LIFE-CYCLE ENGINEERING

What do you get when you integrate the expertise of a bridge engineer with an economist's financial constraints over three decades of research and innovation?

A more effective and efficient approach to managing civil infrastructure that is rooted in practicality.

And an emerging area of structural research championed by Dan Frangopol, the Fazlur R. Khan Endowed Chair of Structural Engineering and Architecture at Lehigh.

The intended lifespan of a typical civil structure, says Frangopol, is decades, or even centuries, in length. Over time, structures can be exposed to abnormal loads of various origin—from natural hazards such as earthquakes, floods and hurricanes to manmade disasters like terrorist attacks, fire or vehicular collisions. At the same time, structures and infrastructures gradually deteriorate due to the aging of their materials, to harsh environmental conditions and to increased usage. The associated social, economic and political consequences can be enormous.

Wear and tear, and financial realities

Frangopol's life-cycle research started as a broad inquiry: How do wear, tear and time affect not only the durability and safety of highway bridges, but also the overall cost of building and maintaining these bridges? He spent years analyzing the impact of seasonal weather on construction materials, and how fluctuating traffic loads propagate cracks. Along the way, Frangopol began examining this collected evidence within the context of practical financial constraints.

His research approach now helps designers determine the duration a new bridge can stand before it will need to be replaced or repaired. It also integrates engineering and economics into the decisions made on behalf of older bridges, thus helping to prevent future bridge failure.

It becomes a question of which bridge needs to be fixed first, says Frangopol, a world-renowned expert in safety, reliability and risk in structural engineering and life-cycle civil engineering. Bridges can be deteriorating or structurally deficient, but we need more precise methods of deciding which ones present imminent danger of collapse.

Over time, Frangopol's research helped introduce a new concept in bridge design and maintenance—a combination of civil engineering and life-cycle engineering that balances fiscal responsibility and infrastructure sustainability.

A lifetime award, and select company

In recognition of his innovative research and career, Frangopol was recently awarded the lifetime title of Honorary Professor at Tongji University, an acclaimed Chinese educational institution renowned for its engineering research.

The award, an acknowledgment of Frangopol's scientific contributions and expertise, was announced in late September and presented by Professor Yongsheng Li, Vice President of Tongji University. Following the ceremony, Frangopol gave a lecture on Integrated Life-Cycle Optimization Framework for Maintenance, Monitoring, and Reliability of Structures and Infrastructures.

An honorary professorship is considered Tongji's highest academic honor for professors, and for this reason the selection process for the award is strict and rigorous.

According to Professor Airong Chen, vice dean of Tongji's College of Civil Engineering and former chair of its department of bridge engineering, Frangopol has joined a select group of five world-renowned bridge engineers who share this honor from Tongji, including Frangopol, Manabu Ito (Japan), T.Y. Lin (United States), Jorg Schlaich (Germany) and Man-Chung Tang (U.S.).

Frangopol is founder and chair of the Technical Council on Life-Cycle Performance, Safety, Reliability and Risk of Structural Systems of the American Society of Civil Engineers' Structural Engineering Institute (ASCE-SEI). He serves as president of the International Association for Bridge Maintenance and Safety (IABMAS) and of the International Association for Life-Cycle Civil Engineering (IALCCE).

He also serves as editor-in-chief of *Structure and Infrastructure Engineering*, an international peer-reviewed journal included in the Science Citation Index and dedicated to recent advances in maintenance, management, and life-cycle performance covering a wide range of issues related to structures and infrastructure.

Elaine Hardenstine
By:
Posted on: Monday, October 26, 2009