Industry Perspectives and Insights

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Don't Let Economic Pressures Limit Life-Cycle Assessments

With limited funds available to maintain public safety on our bridges, transportation agencies have to balance their new/rehabilitation/repair contract mix to effectively use those limited funds for the immediate future.

Unfortunately, short-term needs to keep the public moving may trump life-cycle analysis and recommendations for projects that may be more beneficial and cost effective for the long term. With continued constrained budgets, it is tempting to look at the upfront sticker price when choosing between project designs or even a list of projects.

At ASCE, we're focused on reducing the overall life-cycle cost of infrastructure projects. Our goal is to get engineers and our elected officials to look at these decisions more long-term.

There are a number of barriers, including lack of data, that limit the ability to predict future cost. A recent report we produced with the Eno Center for Transportation found that while most agencies and industry practitioners think that life-cycle cost analysis is important in the planning stages, only 59% currently employ some form of it. Less than half of respondents to the survey set up an operations plan as part of the project planning process. So clearly there is a desire to do more, but we need the tools and training.

For background on life-cycle cost analysis, visit www.asce.org/Infrastructure/Life-Cycle-Cost-Analysis-Report/. ■

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Prefab/Modular Gain Momentum

Bridge engineers, owners and industry are listening to the traveling public they serve, and they are changing their practices as a result.

In recent years, we've seen a number of examples of prefabricated superstructure (span or spans) rolled into place as a unit on self-propelled modular transporters or laterally slid into place using hydraulic jacks. While the application is still relatively infrequent, these moves are seeing greater interest and application due to the extremely short bridge closure times that are possible with these technologies.

While not quite as glamorous as overnight superstructure span installations, modular decked steel or concrete beam elements are also gaining exposure. The Federal Highway Administration's Highways for LIFE program showcased modular decked steel beams in the 2011 MassDOT I-93 Fast14 project. Modular decked beams are relatively simple to fabricate and construct. Work is under way to develop more streamlined steel beam shapes to improve efficiency.

FHWA and state DOTs have been focusing research and implementation efforts to ensure cast-in-place closure joints, common in modular beams, aren't a maintenance issue in subsequent years. Ultra high-performance concrete (UHPC) closure joints currently hold the most promise. In fact, the FHWA just kicked off a national Every Day Counts 3 (EDC-3) initiative that includes promotion of UHPC connections for prefabricated bridge elements.

The 2014 National Accelerated Bridge Construction Conference will be held Dec. 4 to 5, 2014 in Miami. Online registration ends November 21 (www.abc-utc.fiu.edu). ■

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Inside Emerging Probability-Based Redundancy Modeling Tools

The catastrophic structural failure of bridges such as the I-35 in Minnesota sparked a wave of change across the bridge research and engineering community. Where once reliability was the primary probabilistic performance indicator to evaluate the overall safety of structural systems, redundancy has taken on an equally important role.

Specifically, a bridge's structural system must be designed in such a way that it can continue carrying loads even after damage or failure to one or more of its members. Quantifying redundancy in component design allows researchers and engineers to consider the system effect in the design of individual components of structural systems.

However, there is little guidance in structural design codes on how to quantitatively incorporate redundancy in the design process. That's begun to change.

Under the sponsorship of the FHWA, a research group at Lehigh University under my leadership is working on a three-year project to develop a set of redundancy factors for bridge design based on the general modeling of the bridge's structural system, number of components, post-failure material behavior of bridge components, and uncertainties in loads and resistances. The goal is to propose a set of practical redundancy factor modifiers that can be applied to a wide range of systems with a different number of components and configurations—and thereby achieve a deeper understanding of the redundancy-based performance indicator for bridge systems.

Prof. Frangopol (www.lehigh.edu/~dmf206) is the founding chair of the ASCE-SEI Technical Council on *Life-Cycle Performance, Safety, Reliability and Risk of Structural Systems* and founding president of the International Association for Bridge Maintenance and Safety (IABMAS, www.iabmas.org). ■