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## Design it to last

R. Craig Finley, P.E.

A motto of mine is "design it to be built." This is because I've seen too many bridge designers focused on "making a statement" or taking the easy way out with their designs. It's frustrating that some bridge design professionals fail to consider adequately what it takes to build their designs, leaving a trail of frustrated contractors and disappointed owners in their wake.

That opinion holds as true today as the day I formed it many years ago. However, a project that our firm currently is doing overseas reminds me of an additional perspective that needs to be considered—"design it to last."

The project is a \$600-million (U.S. dollars) reconstruction of several kilometers of urban roadway, including nine, precast segmental interchange bridges that we're designing. This tollway project is notable in that the contractor is responsible for design and construction, as well as for financing, operating, and maintaining the entire stretch of highway for more than 30 years.

This project is a classic example of a contractor having to put its money where its mouth is. As is customary with contractors, this company wants the project built as quickly and economically as possible. But it also knows that it needs to build it so it can be maintained and operated as efficiently as possible for the next 30-plus years. Quick fixes and questionable shortcuts are out of the question.

The technical design requirements and construction quality of this project are fascinating. I also believe there are three important lessons that we, as an industry, can take away from this venture:

### 1) Good engineering lives throughout a project

When factors such as operation and maintenance are considered from the outset, there is even more pressure on the designer to focus on constructability, to know how the project is going to be built and maintained before he or she completes the design. It's impossible for a bridge designer to consider how a structure will be operated and maintained for three decades without first considering how it will be built.

### 2) Many experts are better than one

This project also illustrates another one of my core beliefs about the business of bridge design and construction—when the owner, engineers, and contractor work together early in the process, good things happen. By having the entire team together, focused on the same goal from the outset, we were able to devise an innovative approach to reduce construction costs and increase speed of construction.

Good engineering also minimizes quick fixes and changes in the field. In this case, we developed a precast segmental bridge design that incorporated external continuity tendons, utilizing details that incorporate recent innovations in durability and constructability. This allowed for a reduction in the number of segments and quantities of material required, and it increased standardization of precasting equipment.

Not that this is a radical approach to designing and building bridges—this technique is being used successfully in other parts of the world. But with input from the various professions and specialties required on the project, the team was able to devise an innovative, new twist on an old idea.

### 3) The project is paramount

In other words, nothing should stand in the way of completing a project in the most efficient, cost-effective, and highest-quality way. In this case, the governing body's existing codes did not allow the innovative approach our team proposed—even though it was best for the project's short- and long-term welfare.

Having each other's support and the conviction that we were right, our team was able to confirm and articulate the benefits of the approach in a successful effort to convince the governing body to accept our design. In persuading them to accept a proven, yet out-of-the-mainstream approach, the team simply and convincingly demonstrated how the sound engineering judgment of this approach would benefit the project. The governing body would have been crazy to let the codes stand in the way of what was best for the project. We would have been crazier still to let the limitations of an existing code stop us in our tracks. Yet, this reluctance to question the status quo is not uncommon on bridge projects in the United States and elsewhere.

So on your next bridge project—even in the likely event that it's not a design/build/finance/operate/maintain situation—consider how the structure will be operated and maintained 30 years down the line, solicit input from every expert on the project, and put what's best for the project first. Keeping these points in mind could help you and your team turn out a better product.

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