Material decisions

R. Craig Finley, P.E.

Someone once asked me whether I prefer bridges made from steel or concrete. I'm sure my answer disappointed this person—he was a member of one of the industry organizations promoting one or the other—but I felt about it then the way I feel about it now: I prefer bridges made from the best material for that particular bridge, using the best construction scheme for the site and owner requirements.

This is on my mind because we've recently received some notoriety for our value engineering (VE) redesign of the Estero Parkway Flyover in Florida. For that project, we took a post-tensioned concrete box design and converted it to steel, saving the county nearly $2 million.

The people on the steel side, including the National Steel Bridge Alliance and the steel fabricator, were understandably ecstatic. For them, it was validation of their argument that steel bridges are more economical and efficient than their concrete counterparts. And on that project, they were right.

As you might expect, our friends in the concrete industry reacted quite differently. I can sum up their reaction in three words: "How could you?" What they'd forgotten was that several times in the past our redesigns worked in their favor. In these cases, the project site, contractor, or economics led us to convert a steel bridge design into a concrete concept during value engineering.

So when you ask which material is better for bridges, the answer could be steel or it could be concrete. (In fact, the answer can be "both"; internationally, we've been involved with some composite designs, with concrete top and bottom slabs and steel webs.)

Industry advocates and lobbyists aren't the only ones promoting one material over the other. Many owners and engineers have tunnel vision when it comes to choosing the primary material in their bridge design. To these folks, I offer the following suggestions:

Make sure it's not overkill. Owners and engineers who prefer steel will often design a substructure that far exceeds what is required by the deck. Instead, they should be looking to save time and money in the substructure. Jean Muller once told me, "If we're winning coming out of the ground or water, we'll be hard to beat in the deck." I think this is very true and applicable to both steel and concrete.

Know how to build it before you design it. Some owners and engineers design a bridge for the basic service conditions. They never seem to look at what it's actually going to take to build it. You can't choose the correct material for a bridge if you can't envision how the contractor is actually going to build it.

Keep it simple, stupid. Deciding which material to use is not complex. These are typically simple questions with simple answers. You just have to ask them. For steel, intricate details that require special fabrication are much more expensive than plate. In concrete, the variations in forming or steel details can add a lot of cost. A good rule of thumb is "simple equals cost effective."

Know the market. This requires doing more than a simple square-foot unit/cost estimate. You need to have an idea of the current and projected cost of materials, equipment, and labor if you hope to have any chance of estimating the overall cost. Too often, owners and engineers are surprised when they learn that the actual cost

Material decisions

of material or labor costs is what is driving the VE scheme.

Don't reinvent the wheel; use proven specifications and realistic schedules. Too many owners and designers choose wishful thinking over reality when planning their project schedule. When they start missing milestones, the domino effect hurts the entire project. We're helping fix one project whose schedule went bad when the design team failed to build in adequate time for substructure construction, even though the issues causing the delays were not even central to the bridge design.

Market the project. The "good, old days," when it seemed as if contractors would do just about anything to get a sniff of a job, are over. These days, contractors will not bid on a job if there isn't enough incentive to do so. They've been burned too many times. Transportation departments and their representatives need to understand this and start working hard to entice contractors and suppliers to bid in their state. They can do this simply by being fair to the contractor (including using materials that best reflect the needs of the job). Competition leads to better pricing and better quality projects, but contractors won't compete unless they have an incentive to do so. Re-bidding the job because the price was too high the first time is not a good option. Determine why the project was expensive and see if changes will make it more cost competitive.

Curb the ego. It's self-defeating to think that your design cannot be improved. Value engineering provides the opportunity for a fresh set of eyes that can consider whether there might be a better way to build a bridge. The changes may be minor or, as in the case of the Estero Parkway Flyover, they may entail a change from one material to another. By embracing value engineering, design firms show that they're more interested in satisfying their client's needs than they are in getting credit for their design.

The question you need to ask isn't, "Is steel or concrete better for building bridges?" Every time out, we all need to ask, "What's best for this particular bridge?"

R. Craig Finley, P.E., is the president of Finley Engineering Group in Tallahassee, Fla.