



Photo: PCI

AI Bridge Design and Construction?

William N. Nickas, *Editor-in-Chief*

Today, it seems like everyone is focused on this promising or menacing thing called artificial intelligence (AI). Are we ready for an AI-designed bridge? It's coming, or maybe it's already here.

So, how does AI-driven bridge design work? Do we just feed the environmental conditions, restrictions, constraints, materials, and performance requirements into a specialized bridge design AI tool and—"booyah!"—out comes a complete set of plans, covering everything from earthwork to environmental requirements, structural calculations, final design, and construction plans? Imagine that instead of taking years to develop, a project could be ready to be permitted and constructed in a matter of weeks.

In this accelerated scenario, what happens to the process of seeking public input about infrastructure projects? And what happens to our bridge design profession? Will AI push designers out to pasture by automatically adapting established solutions to fit the conditions of a selected site? Today, design and project engineers are a critical component of the concrete bridge industry. Are they (we) quickly becoming a thing of the past? If human engineers become obsolete, how do we ensure quality control, quality project delivery, and safety to bridge owners and the traveling public?


We've heard from some pundits that AI won't displace anyone. "You need humans to program the bots," they say. "Human experts are necessary to make AI work." Until when?

It is clear that contractors and construction equipment manufacturers in the concrete bridge industry are going to use AI tools to enhance jobsite construction. Personally, I thought it would take a little while longer for AI to play a central role in the preparation of engineering plans, but that time appears to be here. Designers are being asked by contractors to adjust details to facilitate unmanned assembly. This type of jobsite feedback is just the beginning. In the next few issues of *ASIPRE*®, let's start a discussion about the various strategies to consider while designing that hypothetical AI bridge, and how we can remain integral to the process.

In October, I attended a University of Texas Concrete Bridge Engineering Institute (CBEI) class on bridge deck construction, which involved going from classroom lecture to visiting the three-span bridge located at CBEI. On the third trip to the bridge site, I noticed that a motorized screed was running. It moved along the rails, over the partial-depth concrete deck panels with a single mat of reinforcement, to verify the adequacy of the concrete cover. We were instructed to begin taking deck and elevation measurements, move forward to take additional measurements, and then calculate the adjustments needed to finish the deck at the proper elevation as we neared the quarter point of the span.

This type of immersive training is an exceptional feature of the new CBEI curriculum. It emphasizes for participants how many things need to go right to achieve a smooth riding deck, the myriad of steps involved in this activity, and the distinctive types of tasks that can go wrong. Working through the logic of the beam deflecting from a transient screed load, and incorporating the newly added dead load from the partial cast-in-place slab, made the engineering estimate for camber and deflection real.

No one designs or desires the bump that can occur at the expansion joints or near the pier. Our instructor explained that concrete finishers commonly tend to deviate from the global screed rail alignment to finish the concrete at the expansion joint. It makes sense to use the joint as a bulkhead to control the top surface, but that action may create a bad ride. Today, humans have to verify the deck elevations. In the future, there may be an AI-driven solution to such challenges, and I have no doubt someone is already working on finding a way.

The global pace of AI is dizzying. The motivational force behind its use is tied to capitalizing along economic lines, and I get it. I'm still committed to innovation, but I caution against becoming a business of catalogued and ready-made solutions. Let's stay with human-centered technologies that feature tools that make sense. We have never been a one-size-fits-all profession. 

Editor-in-Chief

William N. Nickas • wnickas@pci.org

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Cover

Located in a region susceptible to hurricanes, the new Harbor Bridge in Corpus Christi, Texas, challenged the limits of precast concrete segmental design and construction. Photo: Harbor Bridge Project.

Ad Sales

Scott Cunningham • scunningham7@aol.com
(678) 576-1487 (mobile)
(770) 913-0115 (office)

Reprints

lisa scacco • lscacco@pci.org

Publisher

Precast/Prestressed Concrete Institute

Bob Risser, President

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ASIPRE (Vol. 20, No. 1), ISSN 1935-2093, is published quarterly by the Precast/Prestressed Concrete Institute.

<https://doi.org/10.15554/asp20.1>

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