Bridge Deck Construction Inspection Program at the Concrete Bridge Engineering Institute

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A series of articles in previous issues of *ASPIRE*® introduced the Concrete Bridge Engineering Institute (CBEI) and presented two of its "pillars of learning," the Concrete Materials for Bridges Program and the Post-Tensioning Laboratory (PT Laboratory). Those articles also presented CBEI's collaborative efforts with the National Concrete Bridge Council. This article describes the Bridge Deck Construction Inspection Program along with an update on the Transportation Pooled Fund (TPF).

Program Scope

The Bridge Deck Construction Inspection Program is projected to open in the first half of 2024 and will offer training and certification programs. Support services for the program will also be offered through the concrete solutions center at CBEI, which will engage CBEI staff and other subject matter experts to provide direct technical support, webinars, and custom workshops. Like other CBEI programs, the Bridge Deck Construction Inspection Program will serve as a hub for sharing information, standardizing procedures, and facilitating the implementation of new bridge deck technologies.

Program Goal

According to studies through the National Cooperative Highway Research Program,[1] concrete bridge deck deterioration is one of the leading causes of bridges being rated in poor condition. The deterioration of a bridge deck—for example, delamination, spalling, ponding, cracking, or corrosion—hinders the performance of the bridge and its components. Therefore, the manner in which a bridge deck is constructed is important to the bridge's efficiency, serviceability, and long-term performance. While the causes of bridge deck deterioration have been well researched and identified, individuals working in our industry require resources that provide field guidance on the construction and inspection deficiencies that lead to deterioration so they can recognize and prevent problems. The goal of the Bridge Deck Construction Inspection Program is to serve as a center for prevalent and emerging bridge deck construction techniques to the bridge industry, specifically for students, engineers, construction crews, bridge owners, and inspectors. The program will use full-scale bridge components to train participants on the proper construction of concrete bridge decks (**Fig. 1**).

Training Specimen Setup

One of the priorities of the Bridge Deck Construction Inspection Program is to provide hands-on training. To meet this goal, a three-span concrete bridge consisting of four girder lines will be constructed at the Ferguson Structural Engineering Laboratory in Austin, Texas. Each span will detail different phases of construction, specifically, prepour activities such as elevation control, forming, reinforcement placement, and dry-run setup. In addition, the concrete bridge deck training specimen will have built-in examples of deficiencies alongside best-practice installations. These deficiencies will include typical issues that engineers, contractors, and inspectors should be aware of, such as inadequate formwork placement, lack of reinforcement details, insufficient concrete consolidation, and more. **Figure 2** shows a preliminary rendering of the bridge deck training specimen.

Curriculum Development

The Bridge Deck Construction Inspection Program is intended to be a four-day program consisting of a series of modules focused on the design and construction of concrete bridge decks. The modules will address critical details from an inspector's perspective in the construction of a bridge deck, such as adequately placing reinforcement; setting up and operating a screed; performing a screed dry run; placing, curing, and finishing concrete; and other crucial details such as formwork, joints, and precast concrete deck components. The course and training specimen will include information on various forming methods, including partial-depth precast concrete deck panels, stay-in-place metal deck forms, and wood forms (**Fig. 3**). Like the PT Laboratory, the modules are designed to be either taken individually or grouped together in custom blocks; the modules will also complement existing

Figure 1. Rendering of the full-scale bridge deck construction mock-up to be used in the Concrete Bridge Engineering Institute's Bridge Deck Construction Inspection Program. All Figures and Photos: Concrete Bridge Engineering Institute.

Figure 2. Participants in the Bridge Deck Construction Inspection Program will learn about deficiencies and results of deficiencies through a full-scale specimen of a bridge deck under construction similar to the one shown in this rendering.

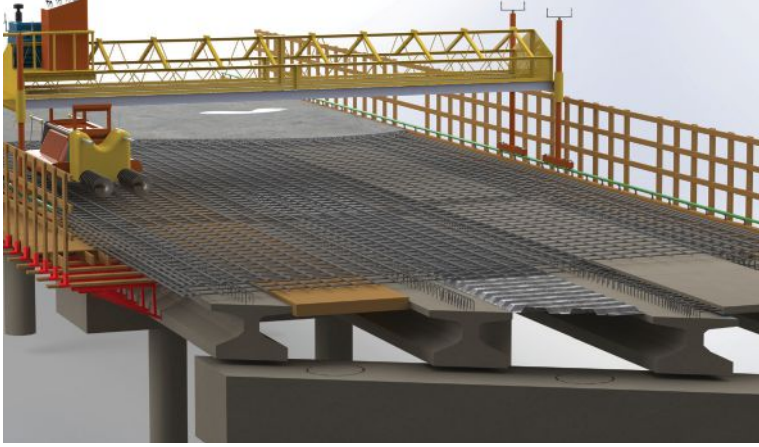

Figure 3. The full-scale training specimen at the Concrete Bridge Engineering Institute will incorporate various forming methods, including partial-depth precast concrete deck panels, stay-in-place metal deck forms, and wood forms.

courses and avoid redundancy. As new procedures, materials, and technologies are introduced to the industry, modules will be updated or new modules will be created as needed. For example, the course intends to incorporate different reinforcement types including both bare and epoxy-coated reinforcing steel. Procedures for inspection and proper repair of epoxy coating are some of the topics to be included.

A sampling of the training modules includes:

- Overview/Introduction/Detailing
- Materials and Components
- Reinforcement
- Geometry Control, Elevations, and Tolerances
- Concrete Placement
- Post-Deck Placement

Research and New Technologies

As previously mentioned, the Bridge Deck Construction Inspection Program aims to incorporate new procedures, materials, and technologies into its training modules as they are introduced to the industry. To do so, the program curriculum will closely follow the development of industry best practices and research in deck construction. One example of an industry best practice that the program intends to incorporate is the Federal Highway Administration's *State-of-the-Practice Report: Partial-Depth Precast Concrete Deck Panels*,[2] published in June 2022. The report discusses design, fabrication, and installation practices of partial-depth precast concrete deck panels, which provide advantages in the design and construction of bridge decks. The NextGen Texas Bridge Deck research project underway at the University of Texas at Austin is an example of current research on bridge decks that will also be incorporated into the Bridge Deck Construction Inspection Program. This research project includes the testing of full-scale specimens and aims to develop design guidelines for full-bridge-width, partial-depth precast concrete deck panels (**Fig. 4**). The program also aims to incorporate nondestructive evaluation techniques and draw from the best and most current state-of-the-art methods.

Transportation Pooled Fund Update

TPF 1580, the Concrete Bridge Engineering Institute, recently reached and exceeded its commitment requirements and has been officially launched. Information on the initiation of the solicitation was presented in the Fall 2022 issue of *ASPIRE*. Many thanks and much appreciation go to the members of the CBEI TPF: the Texas Department of Transportation (Lead Agency), Federal Highway Administration, Colorado Department of Transportation, Georgia Department of Transportation, Iowa Department of Transportation, Michigan Department of Transportation, Minnesota Department of Transportation, Pennsylvania Department of Transportation, and Utah Department of Transportation. Initial groundwork is already underway and additional site preparation and specimen installation are anticipated to commence in the near future. The CBEI staff looks forward to an upcoming kickoff meeting among the representatives of the TPF at an initial Technical Advisory Committee meeting.

Figure 4. The NextGen bridge deck research project, which is being conducted at University of Texas at Austin, is studying partial-depth precast concrete deck panels. Results of this research project, as well as other projects involving bridge deck construction, will be incorporated into the Bridge Deck Construction Inspection Program.

Conclusion

This article is the fifth in a series of articles about CBEI and its impact on the construction industry. For more information about CBEI, please visit www.cbei.engr.utexas.edu.

References

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2. McDonagh, M., A. Foden, and A. Beyer. 2022. *State-of-the-Practice Report: Partial-Depth Precast Concrete Deck Panels*. FHWA-HIF-22-031. Washington, DC: Federal Highway Administration. https://www.fhwa.dot.gov/bridge/concrete/hif22031.pdf.