The Latest from the Concrete Bridge Engineering Institute

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There has been a lot going on at the Concrete Bridge Engineering Institute (CBEI) in Austin, Tex., since the last report on the institute's activities (see the Summer 2024 issue of *ASPIRE*®). New components have been added to the concrete bridge component collection; the substructure for the bridge deck construction inspection training specimen has been constructed; CBEI has welcomed new team members; and new states have become members of the CBEI Transportation Pooled Fund. Additionally, the Concrete Materials for Bridges course, which was delivered four times in 2024, has been a big success and is now open to members of the public as well as the overall bridge community.

New Beams in the Concrete Bridge Component Collection

The Florida Department of Transportation (FDOT) recently donated three bridge beams to the CBEI concrete bridge component collection. Each of these beams is a unique addition to the collection, and FDOT has also shared valuable technical information based on their research as well as information about the components' historical significance. CBEI recognizes and is grateful for FDOT's extensive efforts to retain these specimens and relocate them to CBEI. CBEI is also thankful for the tremendous industry support from PCI, PCI's members, and the National Concrete Bridge Council (NCBC) that facilitated the effort to relocate the pieces. Brief descriptions of the specimens follow.

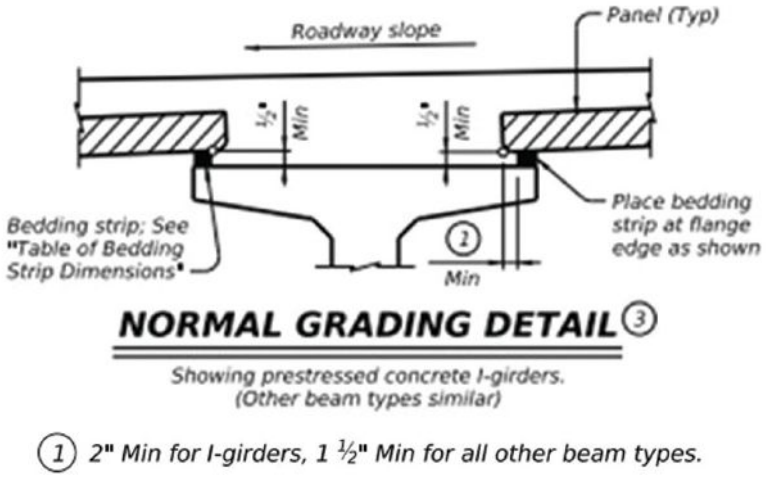
Early Florida Pretensioned Girder

One of the components donated by FDOT to CBEI is a bridge girder from State Road 72 (SR 72); it is an example of the earliest pretensioned concrete bridge girders used in the state. The SR 72 bridge was constructed in 1954 and was in service for nearly 55 years before being replaced. The bridge's original pretensioned girders with thin webs and limited vertical reinforcement provided an important opportunity to investigate shear capacity. In total, six girders were originally salvaged and tested. The results from load testing helped engineers determine the strength of similar existing girders in use on other structures. The FDOT project also evaluated the contribution to the shear capacity from the cast-in-place concrete bridge decks.[1] Results showed that despite the thin webs and minimal shear reinforcement, shear capacity exceeded the calculated nominal capacity.

Early Post-Tensioned Girder Replica

The second component donated by FDOT is a replica of an early (circa 1950s) post-tensioned concrete girder that was tested in an FDOT laboratory during research investigating shear

Bridge component specimens donated by the Florida Department of Transportation to the Concrete Bridge Engineering Institute component collection. Photos: Concrete Bridge Engineering Institute.



Current Texas Department of Transportation standard detail for a precast concrete deck panel.[5] Note the requirements for the bedding (bearing) strip.

capacity of different types of bridge girders.[2] The replica girders were constructed using the existing bridge plans and were tested in a three-point bending load setup. The I-girders were constructed with both parabolic and straight post-tensioning bars and minimal mild steel reinforcement in the end blocks. A three-point loading scheme was used to evaluate the girder shear behavior with a short shear span and no shear reinforcement.

Early Precast Concrete Deck Panel Application

The third FDOT specimen, which is the one most recently delivered to the CBEI component collection, was salvaged from the Interstate 75 overpass bridge on State Road 93 in Sarasota County, Fla. The component is an AASHTO Type III girder with a 3.5-in.-thick, partial-depth precast concrete deck panel and 3.5-in.-thick cast-in-place topping. The prestressed concrete beam and deck elements illustrate differences between the early use of precast concrete deck panels and current practices as specified by agencies such as the Texas Department of Transportation (TxDOT). The specimen will also be useful to help CBEI participants understand the importance of minimum requirements for bedding strip (the polystyrene between the deck panel and top flange of the girder) as discussed in the Bridge Deck Construction Inspection Program.

Bridge Deck Construction Inspection Program

The Bridge Deck Construction Inspection Program continues to make progress. Task group meetings have been conducted, and a final set of bridge construction plans has been completed. The drilled shafts have been constructed for the substructure, and CBEI is bringing a contractor on board to complete the remaining construction. Texas precast concrete fabricators organized through the Precast Concrete Manufacturers Association have agreed to donate the prefabricated elements for the structure, including the precast concrete panels, bent caps, and bridge girders. Valley Prestress, Bexar Concrete, Heldenfels Enterprises, Jobe Materials, Flexicore of Texas, and Legacy Precast have committed to supplying CBEI with the needed precast concrete elements, and CBEI is grateful for their contributions.

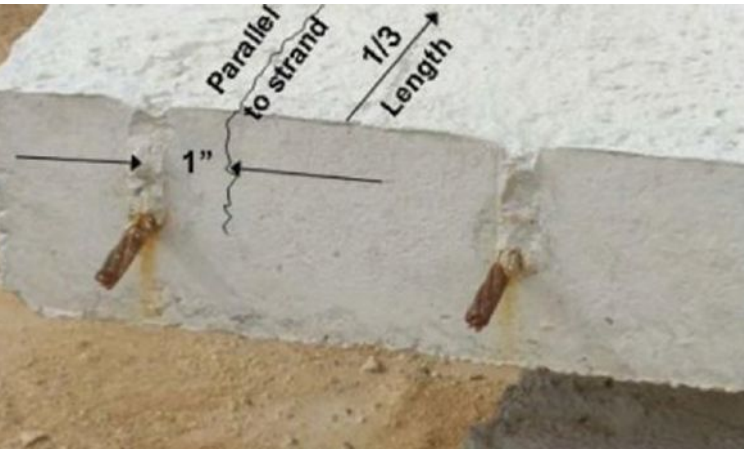
The first Bridge Deck Construction Inspection Program course is scheduled for March 2025. It will directly address training for bridge deck inspectors. Additionally, the course content will be of interest to engineers, inspectors, and contractors involved in bridge deck construction and inspection. The three days of training will include the following topics:

- Module 1: Minimum Bracing and Forming
- Module 2: Setting Forms and Grading
- Module 3: Reinforcement
- Module 4: Preplacement
- Module 5: Concrete Placement
- Module 6: Finish and Cure
- Module 7: Special Cases

Another anticipated topic in the Bridge Deck Construction Inspection course curriculum is on-site inspection of precast concrete deck panels for rejection or acceptance in accordance with TxDOT *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges*[3] Item 424 Section 4.3.1, "Defects and Breakage," which states that prestressed concrete deck panels will be rejected for any of the following conditions:

- Cracks extending to the reinforcing plane and running parallel and within 1 in. of a strand for at least one-third of the embedded strand length
- Transverse or diagonal cracks, including corner cracks and breaks, intersecting at least two adjacent strands and extending to the reinforcing plane

Drilled shafts have been installed to support a full-sized specimen for the bridge deck construction inspection training course. Photo: Concrete Bridge Engineering Institute.



One of the anticipated topics in the CBEI Bridge Deck Construction Inspection course is the on-site inspection of precast concrete deck panels. Shown here are illustrations of types of cracks that may appear after the initial fabrication inspection. Photos: Texas Department of Transportation.

Initial inspection of precast concrete panels typically occurs at the precast concrete producer's facility through the use of industry guidance with the owner's quality assurance program. However, it is also important for inspectors and others on site to understand the criteria for acceptance with respect to the condition of a precast concrete panel and some of the defects that can occur during transport, storage, and erection.

The long-awaited training program for bridge deck construction inspection will enhance previous training classes with the CBEI full-scale bridge deck specimen. Training in both classroom and field environments will facilitate learning for field staff. In the past, inspectors and engineers were trained by a mentor in both the office and on site at multiple projects to gain the required knowledge and experience to perform their job duties. This traditional form of training can be efficient and can effectively achieve learning outcomes, but limited resources and volume of work have made it challenging to deliver. To address these challenges, TxDOT had a vision to construct a training facility displaying multiple phases of bridge construction, which would serve as the statewide training facility. Graham Bettis, former TxDOT Bridge Division director, and Reggie Holt of the Federal Highway Administration (FHWA) worked together to bring that vision to life. This training facility will allow learning in the classroom and from CBEI site visits. This combination will enhance the value of training in a controlled environment away from traffic hazards. When fully launched, the training program will be offered to pooled-fund members, departments of transportation (Texas, Georgia, Florida, Colorado, Tennessee, and Wisconsin), consultants, and contractors.

Concrete Materials for Bridges Course

The Concrete Materials for Bridges Course held its third and fourth training courses of its inaugural year on July 30–31 and October 29–30, 2024. Among the attendees were employees of the Texas, Georgia, Florida, Colorado, Tennessee, Michigan, Wisconsin, Minnesota, Iowa, Pennsylvania, Utah, and Nebraska departments of transportation. The course was recently opened to the public, and the participants in the October session included general contractors' employees. Many of the topics in the course are of value to individuals in a wide variety of professional roles and with varying types of experience. For example, materials engineers, inspectors, engineering consultants, and contractors may benefit from attending. Some of the topics such as mass concrete placement and use of ConcreteWorks software are important topics for contractors who need to develop and administer thermal control plans. The course content on the constituent materials currently available in the marketplace—such as ASTM C595, Standard *Specification for Blended Hydraulic Cements,*[4] Type IL, and other types of blended cements—is relevant and important to professionals who seek to understand current industry practices. The next training sessions are scheduled for the following dates:

- January 8–9, 2025
- April 29–30, 2025
- August 19–20, 2025

Feedback from course attendees has been tremendous, with participants sharing the following comments: "A full semester of a concrete materials course in just two days," "Concepts were clearly articulated," and "Very easy to understand, very relevant to the problems we see."

Research and New Technologies

TxDOT's NextGen Texas Bridge Deck research project (Project 0-7041) has been completed, and the final project report will be published soon. Project 0-7041 represents a significant endeavor aimed at developing the NextGen Texas Bridge Deck system. It is expected that the use of partial-depth panel pairs reinforced with wire trusses will eliminate the need for bracket-supported deck overhangs, an outcome that will reduce construction time and effort. Through a comprehensive research approach encompassing experimental testing and advanced analysis techniques, the project sought to evaluate the feasibility and performance of this innovative bridge construction method. Experimental tests conducted on wire truss–reinforced, partial-depth panels provided valuable insights into the components' structural behavior under various loading conditions, revealing a ductile load response and highlighting the influence of wire truss span on overhang deflections. Full-scale bridge deck tests demonstrated the feasibility of implementing the system and provided confidence about strength and serviceability. Furthermore, fatigue testing elucidated the system's endurance under cyclic loading, informing recommendations for reinforcement strategies and material selection. The culmination of these efforts resulted in a set of design recommendations and guidelines offering practical

The Concrete Bridge Deck Inspection Site will have a location for new bridge technologies, including the NextGen Deck Panels. Photo: Concrete Bridge Engineering Institute.

insights for implementing the NextGen Texas Bridge Deck system in accordance with TxDOT standards. These recommendations cover wire truss spacing, reinforcement details, panel dimensions, and construction considerations, and they provide engineers with valuable tools to streamline bridge construction processes and enhance overall project efficiency. Moving forward, the findings and recommendations from Project 0-7041 have the potential to transform bridge construction practices in Texas and beyond, offering a viable alternative to traditional methods and paving the way for safer, more efficient, and more resilient transportation networks.

The Concrete Bridge Deck Inspection Site will have a location for new bridge technologies that will include the NextGen Deck Panels. CBEI looks forward to featuring other research and innovative technologies to enhance the continuation of learning at the facility.

New CBEI Team Members

CBEI is excited to announce that Doug Beer, PE, recently joined the CBEI team. Beer retired from TxDOT in 2024 and brings tremendous experience to the CBEI team. In his most recent role as the Bridge Division Construction and Maintenance Branch manager, he oversaw the team of engineers and construction inspectors that provides support for the 25 TxDOT districts on matters related to bridge construction and maintenance. In his new CBEI role, Beer will continue to share his knowledge and passion for bridges with the bridge community in the upcoming courses. We expect Beer will be one of several key staff members in the deployment of the Bridge Deck Construction Inspection Training, which is set to launch in March 2025, and the Post-Tensioning Academy, which will be next held in the spring of 2026.

Thanks to all the current members for their participation, and welcome to the California Department of Transportation, which recently joined the CBEI Transportation Pooled Fund. Current members are the Iowa, Michigan, Minnesota, Georgia, Florida, Wisconsin, Nebraska, Pennsylvania, Utah, Colorado, Tennessee, California, and Texas departments of transportation, and FHWA. Many thanks to CBEI's industry partners American Segmental Bridge Institute, PCI, NCBC, and Post-Tensioning Institute for their continued support. Please visit www.cbei.engr.utexas.edu for more information about CBEI.

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