

# CBEI: Vision and Progress

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During the conceptualization of the Concrete Bridge Engineering Institute (CBEI), there were several recurring themes: continuity of concrete bridge expertise and sustained development of new subject matter experts, continuous improvement of the quality of construction, minimizing potential for construction issues, and bolstering expertise, especially in highly technical and specialized operations. Training was identified as a significant component of CBEI; however, serving as a hub for dialogue and discussion on the design and construction of concrete bridges was seen as paramount to the institute's mission. Recognition by many industry stakeholders of these and other needs led to the genesis of CBEI.

In 2015, the American Association of State Highway and Transportation Officials (AASHTO) Technical Committee T-10, Concrete Design, identified the following characteristics of concrete bridges as part of its vision for these structures:

- Resilient, durable, sustainable, and uniformly safe over their life cycles
- Easily maintainable
- Cost-effective
- Constructed with minimal disruption to the traveling public
- Adaptable to functionality and climate change
- Proportioned and detailed for multihazards, as appropriate
- Designed, proportioned, detailed, constructed, inspected, and maintained by a knowledgeable workforce

Some of the strategies that were identified to realize this vision included items that ultimately spawned the idea for a concrete bridge center. For example, one of the strategies recognized the benefits of having a repository of information for concrete bridges.

A few years later, these concepts went from ideas to the first steps of implementation at an AASHTO Committee on Bridges and Structures meeting in Montgomery, Ala., where the theory of a national center serving concrete bridges was discussed. The AASHTO Technical Committees on Concrete Design, Construction, and Bridge Preservation played important roles in bringing the concept to fruition. Their support and collaboration remain invaluable and integral to the program.

Soon after the initial discussions, a portion of the Interstate 35/U.S. Route 183 segmental bridge connector in Austin, Tex., was decommissioned due to a change in alignment. Recognizing that the bridge was an excellent concrete sample, the Texas Department of Transportation salvaged portions of the structure and transported them to the CBEI site (**Fig. 1**). These specimens are among the first components in the Concrete Bridge Component Collection.

## Development of the Three Pillars

One of the first goals identified for CBEI was the creation of a post-tensioning (PT) laboratory. Initial work in this area started through a Broad Agency Announcement. Further discussions led to the concept of the PT Laboratory, followed by the development of the three pillars. Many potential topics were discussed and may be added in the future, but three topics rose to the top of the list as important areas of focus: post-tensioning, bridge deck construction inspection, and concrete materials for bridges. (See the Fall 2022 issue of *ASPIRE*®.)

Much of the initial work for CBEI was in the area of post-tensioning. An international benchmarking study on PT technology, in particular electrically isolated tendons (EIT), led to further



Figure 1. A component from a trapezoidal box-girder segment salvaged from the decommissioned Interstate 35/U.S. Route 183 direct connector is one of the first specimens in the Concrete Bridge Component Collection at the Concrete Bridge Engineering Institute. Photo: Concrete Bridge Engineering Institute.

brainstorming and discussion.<sup>1</sup> As part of a Federal Highway Administration (FHWA) Global Benchmarking Program study, a group from the United States visited projects in Switzerland and Italy and met with international experts to share best practices and discuss the challenges they faced. (See the FHWA article in the Spring 2021 issue of *ASPIRE*.) During the exchange, Dr. Max Meyer shared the hands-on approach his company had taken to help develop and train personnel using full-scale components at the VSL PT Academy in Thailand. Incorporating aspects of that program seemed like a natural next step for developing a PT laboratory in the United States, as well as the other pillars of CBEI's program, concrete materials and bridge deck construction inspection. (See the CBEI article in the Summer 2022 issue of *ASPIRE*.) Participants in the benchmarking

program study from the United States included Graham Bettis, Dr. Michael Brown, Gregg Freeby, Dr. Zachary Haber, Reggie Holt, Miroslav Vejvoda, and Kevin Western (Fig. 2).

As a result of the study, international collaboration continues and brings value by advancing the state of practice in post-tensioning as well as other concrete bridge-related concerns. Since that study, there have been several meetings and initiatives. A PT Technology Exchange meeting was held in conjunction with the American Segmental Bridge Institute (ASBI) Convention in Austin, Tex., in 2022. Participants included stakeholders from around the world, such as bridge owners and transportation agency representatives, who shared their experiences with post-tensioning and advancements in the industry. FHWA and CBEI staff have also been actively engaged, along with U.S. industry partners, in international efforts with *fib* (International Federation for Structural Concrete), including participation in *fib* Task Group 5.14, Durability of Post-Tensioning Tendons. This task group, which includes CBEI staff member Gregory Hunsicker, is updating the widely referenced 2005 *fib* Bulletin 33<sup>2</sup> and merging it with the FHWA technical report *Methodology for Risk Assessment of Post-Tensioning Tendons*.<sup>3</sup>

The focus on best practices for bridge deck construction to ensure long-term performance was identified as one of the three pillars. The long-term performance of bridge decks is a function of proper initial construction, and this topic sparks a lot of interest, given the multitude of bridge decks in the United States. Nearly all departments of transportation are engaged with the construction and maintenance of bridge decks on a large scale. A focus on a training program for construction inspection of bridge decks was identified as one of the important initial programs.

The Concrete Materials for Bridges Program serves as the third pillar. The importance of proper concrete mixture proportions was recognized, as well as the need for broader understanding of the “whats” and “whys.” While structural engineers tend to focus on



Figure 2. Participants in the Global Benchmarking Program trip in Switzerland. Photo: Federal Highway Administration.

the structure, rather than materials, a broad understanding of concrete materials can be very helpful. Ongoing changes in the industry also present an opportunity and need to increase the knowledge base within the industry. When using concrete materials in the modern environment, stakeholders must consider principles of sustainability, challenges with material availability, and new advances in materials.

Much of the training in the industry has been solely web based or classroom based. However, the use of in-person training outside of the production environment represents a unique and valuable experience. The ability to illustrate concepts, defects, and best practices in a hands-on manner can accelerate and strengthen the learning process, especially for technically demanding operations such as post-tensioning. Whether the goal is to explore outdoor concrete durability exposure sites (see the Winter 2023 issue of *ASPIRE*) or gain knowledge about mixing, testing, and injecting grout, a hands-on component makes a huge difference in the educational experience. When learning about a concrete deck, working through a dry run and seeing issues like insufficient clear cover in person is a good exercise.

Given the national scope of CBEI, it is important that the three pillars incorporate regional perspectives about construction methods, detailing, defects, and the environment.

It is also critical that robust training and certification programs be available for specific applications. As seen in examples involving other types of structures, such as welding in steel bridges, detailed and stringent training and certification programs can be developed to align workmanship requirements with the importance of the application. Training and certification programs for the various roles are important not only for contractors but also for engineers and inspectors.

### Progress and Schedule

We are excited to see the progress at CBEI. The concrete bridge component collection already includes several impressive items and will continue to grow. The kickoff meeting for the Transportation Pooled Fund (TPF) for CBEI was held in mid-June 2023. Several participating state transportation agencies and the FHWA are shaping the future of CBEI. Since the June kickoff for the TPF, the Florida Department of Transportation and Tennessee Department of Transportation have joined, and the fund has exceeded its initial funding target. One of the most exciting developments is that the pilot presentation of the Concrete Materials for Bridges Program is ready and scheduled for January 3–4, 2024.


Meanwhile, progress continues with our other programs. Working with industry partners such as ASBI, PCI, the Post-Tensioning Institute (PTI), and the National Concrete Bridge Council

(NCBC) has been critical. The input and collaboration of these organizations and their members is key to establishing best practices and training personnel. We are all working toward the same goals and see value in the partnerships. The recent approval and adoption of the PTI/ASBI M50.3-19<sup>4</sup> and PTI M55.1-19<sup>5</sup> specifications in the next editions of the *AASHTO LRFD Bridge Design Specifications*<sup>6</sup> and *AASHTO LRFD Bridge Construction Specifications*<sup>7</sup> represent a collaborative effort among FHWA, AASHTO Concrete Technical Committee, AASHTO Construction Technical Committee, ASBI, and PTI, and supported by CBEI.

Through CBEI, a significant effort is being made to collect and reinforce best practices. However, there is also room to advance new and under-used technologies. In general, the items being considered are relatively advanced in their technology-readiness level, and we look forward to CBEI helping to shape the best practices and develop the next generation of concrete bridge experts. Thank you to our state

transportation agency partners and industry partners for their support.

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