Building the Concrete Bridge Engineering Institute

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Participants in the Concrete Bridge Engineering Institute (CBEI) courses will have opportunities to see concrete bridge elements up close. Post-tensioning anchorage details, pretensioned strands, duct placement, and a composite deck are visible in this precast, prestressed concrete post-tensioned spliced girder research specimen. Photo: CBEI.

The Summer 2022 issue of *ASPIRE*® introduced the Concrete Bridge Engineering Institute (CBEI) and provided an overview of the ongoing activities of the institute and the needs that inspired its creation. Interest has been tremendous, and work to get the institute's programs up and running is continuing. This article continues the introduction by discussing the request for funding for CBEI through the Transportation Pooled Fund (TPF) Program and exploring further the key components of CBEI.

Transportation Pooled Fund

The TPF Program was first established in 1977 as a program administered by the Federal Highway Administration (FHWA) in coordination with state departments of transportation (DOTs). It has been in its current format for more than 20 years and has produced many valuable deliverables through partnerships between state DOTs and other partner agencies, including the FHWA, colleges and universities, private companies, and other organizations and agencies.

CBEI was advertised as a TPF study in May 2022.[1] As noted in the TPF *Procedures Manual*, "A TPF study is intended to address a new area of planning, research or technology transfer or provide information that will complement or advance those areas."[2] CBEI seeks to address several of those goals. Some of the objectives established for this study are:

> *to implement specific programs within CBEI that address national workforce training needs through research, development, and technology transfer activities. The technology transfer through training programs will draw on the latest technologies and provide an innovative approach by utilizing a hands-on intensive curriculum. The training programs will draw from the best, and most current, state of the art methods. CBEI will serve to continually gather emerging or underutilized technologies … and provide research, development, and technology transfer activities in partnership with the originators of the technology. This will result in training curricula and technology transfer documents for the concrete bridge workforce.…*
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> *The objective of this pooled fund is for CBEI to become a national resource for innovative workforce development programs and implementation of new technologies in the field of concrete bridges.*[1]

The lead organization for this TPF study is the Texas Department of Transportation, and the initial effort is proposed as a four-year study. FHWA has committed to the study as a partner agency, and other agencies are expected to join.

Participating members in the study will serve a critical role in providing direction and feedback for the CBEI programs through the TPF study's technical advisory committee. Benefits to participating members include training for employees, the ability to call on institute experts for technical questions, custom workshops, involvement in research and development efforts, and opportunites to set the direction for those efforts. Training courses will be available not only to TPF members but also to participants throughout the concrete bridge community. The institute also serves as a hub for information sharing among its members and the concrete bridge industry.

Program Development

Three specific needs ("pillars of learning") will be addressed by the TPF study. A program will be developed for each of the three initial topics, all of which will include both classroom and hands-on training. The infrastructure for the programs, including the site development, hands-on specimens, and curricula, will be developed during the first three years, and the individual programs will be made available as the relevant infrastructure is completed.

Concrete Materials for Bridges Program

The first program scheduled to be made available is the Concrete Materials for

The Concrete Bridge Engineering Institute (CBEI) has a collection of concrete bridge components that will be used to help participants compare theoretical behavior to actual test results, and predict and evaluate cracks in concrete. Photo: CBEI.

Concrete blocks that will be used in the Concrete Materials for Bridges Program. The blocks have different confinement and reinforcement details and show the effects of alkali-silica reaction. Photo: Concrete Bridge Engineering Institute.

Bridges Program, which is designed to provide guidance on the proper selection and use of constituent materials to improve the service life of concrete bridges and the sustainability of concrete construction. This program will also provide hands-on examples of what happens when these issues are not considered. Topics covered will include considerations for constituent materials, avoiding issues such as alkali-silica reaction and delayed ettringite formation, evaluating cracks in concrete, understanding failure mechanisms, troubleshooting, and corrosion of reinforcement. The program will also cover sustainability and how evolving practices in the industry affect some of these considerations. Other topics such as mass concrete will also be introduced. While the focus will be on best practices and strategies to ensure proper initial construction, some of the program will be dedicated to evaluating and extending the life span of existing infrastructure. Many of these efforts will be led by Dr. Kevin Folliard and Dr. Anca Ferche of CBEI, in collaboration with a network of subject matter experts (SMEs) from around the United States.

Bridge Deck Construction Inspection Program

The second program scheduled to be made available is the Bridge Deck Construction Inspection Program, which will use full-scale, hands-on components to train participants on the proper initial construction of concrete bridge decks. The initial program is intended primarily for new construction inspectors and engineers; however, it is anticipated that the program will be expanded to train installation crews and supervisors. The Bridge Deck Construction Inspection Program will include techniques using technologies that are prevalent across the United States, as well as emerging technologies, where appropriate. The deck construction technologies that will be covered include partial- and full-depth precast concrete deck panels, stay-in-place metal forms, plywood forms, and prestressed decks, among others. The program will implement information from such sources as FHWA's recently published *State-of-the-Practice Report: Partial-Depth Precast Concrete Deck Panels*.[3]

The curriculum will look at problems alongside correct installations in full-scale bridge components. The goal is to illustrate the best methods and details, and to provide meaningful examples of things to watch out for and avoid, from the initial design through field installation. Topics to be addressed include placing reinforcement and ensuring proper cover; performing a dry run; screed setup and operation; concrete placement, curing, and finishing; joints; overhang brackets; prestressing details; precast concrete deck component evaluation; and other details. Ensuring the performance of bridge decks is important due to their critical role in the overall structure, their exposure to harsh environments (including deicing chemicals), and their large surface areas. Therefore, proper initial bridge deck construction, taking into account the best available technology and details, is crucial. Once again, this effort will be led by the network of SMEs participating in CBEI.

Post-Tensioning Academy

The third program will be the Post-Tensioning Academy, which will provide hands-on training for engineers, field installers, and inspectors, as well as perform tests to verify promising post-tensioning technologies with associated research and development efforts. This program seeks to build on the successful training already offered by both the Post-Tensioning Institute and the American Segmental Bridge Institute, and provide training on post-tensioning installation and inspection through stations dedicated to the different phases of construction. For example, participants will perform the field functions associated with duct and anchorage installation, strand installation, stressing, and grouting with interactive hands-on modules. Within those areas, trainees will focus on the functions they typically perform in the field. For example, inspectors will focus on inspection-related tasks, and installers will concentrate on installation-related tasks. Best practices, understanding specification requirements, and the potential repercussions when steps are not carried out properly will be emphasized through hands-on examples, such as reconciling a failed pre-grouting air test or recording tensioning elongations and reconciling discrepancies. Other stations will include grout testing, proper pourback installation for blockouts and grout vent recesses, and post-grout inspection. Another important aspect of the curriculum will be training on the initial approval of post-tensioning systems and subsequent verification that the approved systems are being used on the project.

While training in existing technologies is important, there is also a need to support the successful implementation of emerging and underused technologies. This includes working with stakeholders, developers, and SMEs for

Stressing strands in a post-tensioning tendon for a demonstration specimen at the Ferguson Structural Engineering Laboratory (FSEL). Concrete Bridge Engineering Institute (CBEI) courses will include full-scale specimens for hands-on demonstrations of post-tensioning operations, including stressing. Photo: CBEI/FSEL.

various technologies. As technologies addressing such topics as electrically isolated tendons, monitorable tendons, replaceable tendons, improved grout monitoring/testing, and others are introduced, CBEI plans to encourage their implementation by leveraging contributions of its national network of SMEs.

Conclusion

This is the second in a series of articles about CBEI and its impact on the concrete bridge industry. Articles in upcoming issues of *ASPIRE* will explore the technical programs in greater detail as well as CBEI's collaboration with the National Concrete Bridge Council and its members.

For more information about CBEI, please visit: https://www.cbei.engr.utexas.edu.

References

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