PROJECT SUMMARY

Texas Department of Transportation

0-6348: Bridge Deck Reinforcement and PCP Cracking

Background

Bridge decks composed of precast, pre-stressed panels (PCPs) overlain by cast-in-place (CIP) are popular in many states of the United States, including Texas. Figure 1 shows essential elements of their construction.

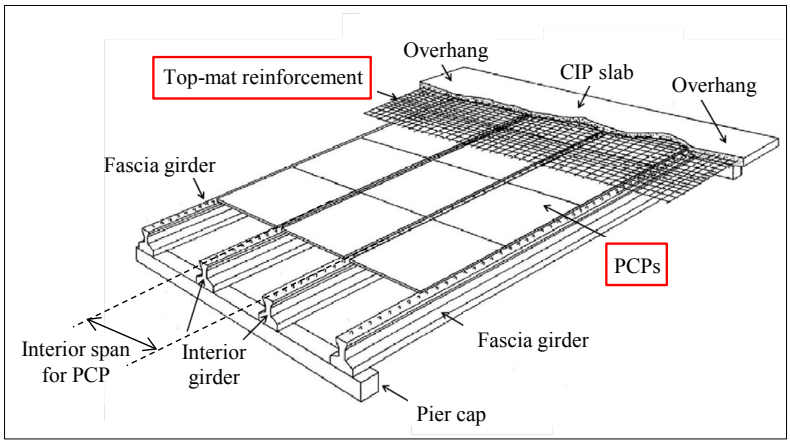

Figure 1. Essential Elements of Cast-in-Place Bridge Decks with Precast, Pre-stressed Panels.

What the Researchers Did

Optimization of top-mat reinforcement and reduction of collinear panel cracking were addressed in this project. Currently required top-mat reinforcement consists of No. 4 bars spaced 9 in. on centers in the longitudinal direction and No. 5 bars spaced 6 in. on centers in the transverse direction. Longitudinal top-mat reinforcement was found to be already optimized. Transverse top-mat reinforcement can be further optimized by using smaller bars (No. 4 @ 6 in.) or by using welded-wire reinforcement (D 20 @ 6 in.)

What They Found

Collinear panel cracking can be reduced by reducing the initial pre-stress or by placing additional transverse reinforcement at panel ends. Based on long-term monitoring of panels constructed at two different plants, measured pre-stress losses in PCPs were at most 25 ksi, much less than the 45 ksi currently assumed by TxDOT. Using this realistic value of pre-stress losses, initial pre-stress can be reduced from the current TxDOT-specified value of 189.4 ksi to 169.4 ksi. By reducing the level of initial pre-stress, the possibility of cracking in panels can be reduced, and the panels will still meet the serviceability criteria implied by current TxDOT specifications. As shown in Figure 2, additional transverse reinforcement consisting of one or two No. 3 bars placed 1 in. from the panel edge is also effective in controlling collinear cracking.

The comparative efficiency of different types of high-performance steel fibers was examined using double-punch testing, which involves the test setup and specimen shown in Figure 3.

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Using intra-laboratory and inter-laboratory testing, the double-punch test was standardized as a reliable and repeatable measure of the comparative efficiency of high-performance steel fibers, and is recommended to TxDOT for that purpose.

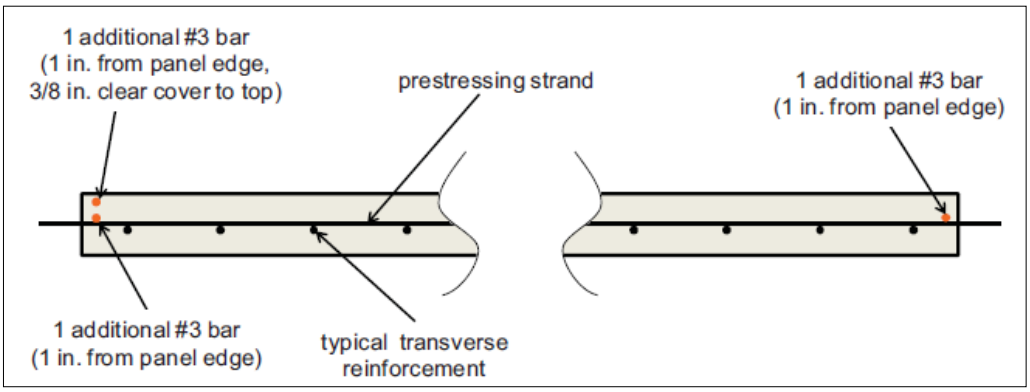

Figure 2. Section View of Reinforcement in Typical Panel, Showing Additional Transverse Reinforcement at Ends.

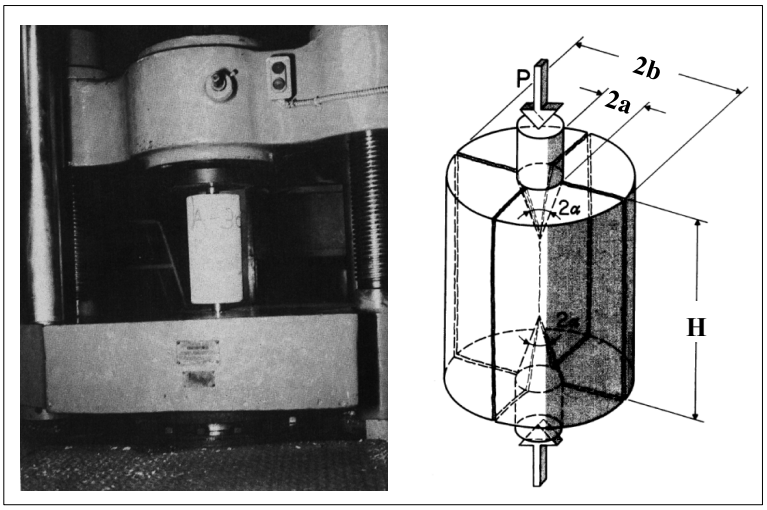

Figure 3. Setup and Specimen of Double-Punch Test.

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