Florida Department of Transportation Research

Temperature Effects in Match-cast Segmental Bridge Construction

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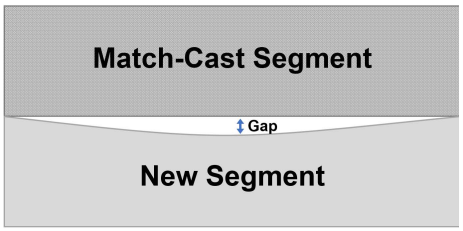
Current Situation

Match-cast segmental construction is a precast concrete fabrication method that creates geometrically matching interfaces by casting a segment against the previous one. Bowing happens when the heat (a temporary thermal gradient) from the match-cast segment meets the wet surface of the newly cast segment. The newly cast segment acquires and locks in the bowed shape on the exposed face as it hardens. This bowed shape begins to accumulate as the rest of the segments are cast in the same fashion, creating a gap that is difficult to close.



Bowing distortion caused by the heat of hydration in the new segment.

By reducing this thermal gradient and ensuring a good fit between match-cast segments, delays during bridge construction can be reduced as well as costly mitigation methods.

Research Objectives

The three main objectives of this research were to identify bridge segment geometries (width to length ratios) susceptible to this type of distortion, develop best practices to mitigate transverse bowing of match-cast bridge segments during production, and to determine which practical curing mitigation measures are most effective in reducing bowing distortion.

Project Activities

Following a literature review, the University of Florida research team developed a simulation matrix of 157 geometry, materials, and construction factor combinations. After analyzing the models, the team then created a concrete specimen to validate the modeling effort. The specimens, two solid slabs with dimensions 2-ft x 4-ft x 10-in, were cast a week apart and meant to simulate match cast construction. The second slab was match-cast to the first and a bond breaker material was applied between the sections.

The team then ran concrete temperature simulations on the matrix models and compared them against the measured results of the specimens. The results led to recommendations for best practices to reduce the distortion of precast segments during fabrication.

Project Conclusions and Benefits

By providing guidance on segment geometries, curing methods and using higher-quality concrete mixes for match-cast segments, FDOT will prevent construction delays and reduce long-term maintenance issues, ultimately reducing cost through the life of the bridge.

For more information, please see fdot.gov/research.