Summary of Final Report, BC 354-2
October 2002

POST-INSTALLED ADHESIVE-BONDED SPLICES IN BRIDGE DECKS

PROBLEM STATEMENT

FDOT bridge deck widening projects may require full tension splices between existing reinforcing bars and new reinforcing bars from the bridge addition. Currently, this process is accomplished by the demolition of a sufficient amount of the existing slab to expose the bars that require splicing. Post-installed adhesive bonded bars can also be used to splice with existing bars without the slab demolition currently required. This procedure involves drilling holes and installing adhesive-bonded bars. Although design procedures have been developed for adding post-installed dowel bars to existing concrete (Design Guidelines §7.15 Adhesive Anchor Systems), direct tension splicing with existing reinforcement is excluded unless special testing is performed. The primary difference between a post-installed dowel bar and a post-installed splice is that the load is transferred directly to the concrete in the dowel application while it is transferred to existing reinforcement in a splice application.

OBJECTIVES

The purpose of this project was to determine the feasibility of using post-installed adhesive-bonded splices for bridge deck additions, including both constructability concerns and structural requirements for the splices (i.e., what splice lengths are required when using post-installed adhesive-bonded bars in order to insure that the strength of existing bars can be relied upon at the splice). The objectives of this project included the following:

- Examine the methods used to install adhesive splices and determine if the methods are practical for use on a job site.
- Perform flexural tests to determine the splice length required to achieve full flexural strength when using an adhesive-bonded splice.
- Perform shear tests to determine the shear strength of adhesive-bonded dowel bars.
- Provide design recommendations for splice lengths for adhesive-bonded reinforcement in bridge deck additions.
- Provide design recommendations for determining the shear strength of adhesive- bonded dowel bars in bridge decks additions.

FINDINGS AND CONCLUSIONS

Four test series were performed to investigate constructability, moment capacity, and shear capacity of post-installed adhesive-bonded reinforcement. Each test series consisted of a control specimen with no spliced reinforcement and four test specimens using adhesive-bonded splices with varied locations and embedment lengths. For evaluation of flexure, the test specimens included cases in which the post-installed bars were located adjacent to the existing bars and cases in which the post-installed bars were placed mid-way between the existing bars. For evaluation of shear, the post-installed bars were placed at the centerline of the bridge deck.

Regarding overall constructability, researchers found that, based on time and efficiency of the installation, the specified embedment length should not exceed 15-18 inches whenever possible.

The results of the flexure tests indicated that the splice length provisions of the ACI 318 and AASHTO codes are adequate and that the FDOT specifications for anchorage of adhesive-bonded anchors could be used with some modifications to account for evaluating splice length. The location of the post-installed adhesive-bonded bars relative to the existing bars (i.e., the splice bars located in the same plane as the existing bars but either adjacent to or equally spaced between the exiting bars) did not affect the strength of the splice. Therefore, the post-installed adhesive-bonded bars can be located anywhere between the existing bars without affecting the strength of the splice.

The results of the shear tests indicated that for adhesive-bonded dowel bars, the shear-friction provisions of ACI 318 and AASHTO are appropriate. The shear strength determined when using shear friction provisions is dependent only on the yield strength of the reinforcement and the coefficient of friction associated with the cold joint between the existing bridge deck and the new bridge deck. For concrete placed against hardened concrete that has not been intentionally roughened, the coefficient of friction should be taken as 0.60.

BENEFITS

Currently, to add a lane to an existing bridge, a portion of the bridge is removed, bars are spliced to the existing bars, and then the new bridge deck is cast. This method requires a large amount of time to remove part of the existing bridge deck. The results of this study provide an alternative for the installation of reinforcement when widening bridge decks. The alternative is the use post-installed adhesive-bonded reinforcement. This method offers potential cost savings since the procedure is simply to drill holes into the side of the existing bridge deck and then install the reinforcing bars using a structural adhesive.

This research project was conducted by Ronald A. Cook, Ph.D., P.E., at the Department of Civil and Coastal Engineering, University of Florida. For more information, contact Marc Ansley, Project Manager, at (850) 414-4291, marc.ansley@dot.state.fl.us.