Florida Department of Transportation Research

Behavior of Standard Hook Anchorage Made with Corrosion Resistant Reinforcement
BD545-40

Hooked steel reinforcement bars typically are embedded in the nodal regions of strut-and-tie concrete structural systems. If the steel corrodes, the structure may be weakened and need to be repaired or replaced early in its service life. Methods to prevent corrosion include coating the steel with zinc or epoxy, or using corrosion-resistant steel to manufacture the bars.

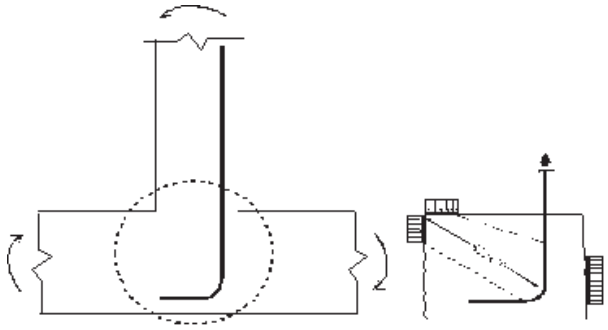
University of Florida researchers conducted laboratory tests on two types of steel: stainless steel strengthened with a nitrogen treatment (ASTM A955) and low-carbon steel with chromium added (ASTM A1035). The steel samples were formed into hooks and embedded in concrete to replicate the strut-and-tie system. The specimens were loaded until the reinforcement yielded and ruptured or split the concrete in the plane of the hook.

(a) (b)

Crushed concrete inside of bend radius (a) 90 deg. hook and (b) 180 deg. hook.

The tests provided sufficient data on the yield strengths of the steel samples to allow the researchers to analyze them in the context of the current standards. This study has provided valuable information that can be used to update FDOT structural design standards.

Current FDOT construction specifications call for the use of ASTM A615 steel, which is not corrosion resistant, and AASHTO design specifications do not address the use of corrosion-resistant steel materials. Furthermore, the equations FDOT uses to calculate hook lengths are based on ASTM A615 steel. The behavior, particularly the yield strength, of corrosion-resistant steel needed to be evaluated, and the design equations needed to be adapted for use with corrosion-resistant steels.



Line drawing showing a 90 degree hook

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