STRUT-AND-TIE MODELS FOR HEADED 1 BAR DEVELOPMENT IN C-C-T NODES

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Abstract

This study presents strut-and-tie models (STM) explaining the development of bond strength along bonded length together with anchorage by head bearing of headed bars. The anchorage at a head requires construction of a biaxial compressed nodal zone and bond resistance needs to use the concept of a smeared node. This model consists of a strut with the nodal zone at head for head bearing and fan-shaped stress field for bond stresses along the development length. This modeling clarifies interaction between head bearing and bond resistances where a bond transfers along the development length of headed bars is necessary for a smooth force flow. The experimental results For series of headed bars with relatively small area of plate heads are interpreted 1 by this proposed model.

Keywords: headed bar, strut-and-tie model (STM), bar anchorage, bar development, failure Mechanism, bond strength

1. INTRODUCTION

Successful bond behavior between concrete and reinforcing bars is essential for intended performance of reinforced concrete structures. The transfer of the forces between the reinforcement and the concrete is due primarily to bond strength along development length and/or end anchorage if appropriate mechanical anchorage devices are provided. Hooks are usually used to provide anchorage when there is insufficient length available to develop a bar. For last decade use of headed bars shown in **Fig. 1** has provided viable option for hooks.1, 2

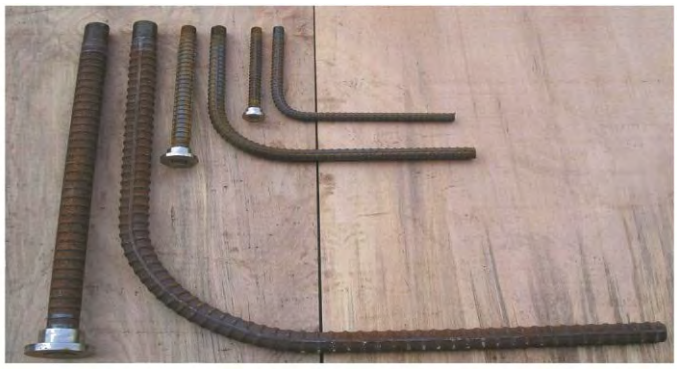

Fig. 1-Headed bars and hooked bars

Most of proposed design methods for headed bars have adopted those of anchored bolt embedded in concrete such as concrete capacity design (CCD) method in that their behavior shows similar failure modes.3 The CCD method basically relies on tensile strength of concrete with some modification factor to consider group of anchors, location of anchors, and other parameters. DeVries, et al.4 investigated additional anchorage strength provided by available bonded length of headed bars in case of side-blowout failure of deeply embedded headed bars. By varying bonded length in specimens with transverse reinforcement they studied interaction of development and head bearing.