Analytical and Experimental Behaviour of Blind Bolted Connections

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Abstract:
Although concrete-filled tubular columns have high load capacity with small cross-sectional area, favorable ductility and high energy absorption capacity, they are not popular in Australia due to the perceived difficulty of connecting them to beams. Due to the lack of access inside the tube in the beam-column connections, it is difficult to install standard bolts. Recently, innovative blind bolted connections, ranging from semi-rigid to rigid, have been developed to avoid welding at site. These innovative bolts can be fully installed from one side only. The objective of this research is to investigate the behavior of such blind bolts, analytically and experimentally. A full three dimensional finite element model is used to simulate the complex behavior of the connection. The result is compared to the actual behavior obtained from full scale experimental results

Introduction

Unlike with bolted connections to the flanges of I-shaped columns, in tubular columns access is not available on both sides of the column plate to which the bolts are being connected, making it impossible to tighten the standard type of structural bolts. In such cases welding is an alternative, but in Australia welding on site is not preferred since a higher degree of quality control can be achieved in the fabricating shop. In this project innovative blind bolted connections have been designed as an alternative to welded connections. The blind bolts can be installed from the outside of the tube.

Discussion and Results

The ultimate purpose of the finite element analyses is to understand the behaviour of different components of blind bolted connections. Later the same model will be used to do a parametric study.

Figure 1 shows a FE representation of the pull-out of a headed stud from unconfined concrete. The color contour in this figure is the damage of concrete in tension. Figure 2 shows FE results obtained for load vs. displacement in a concrete cylinder splitting test. The FE result is in good agreement with the experimental result.

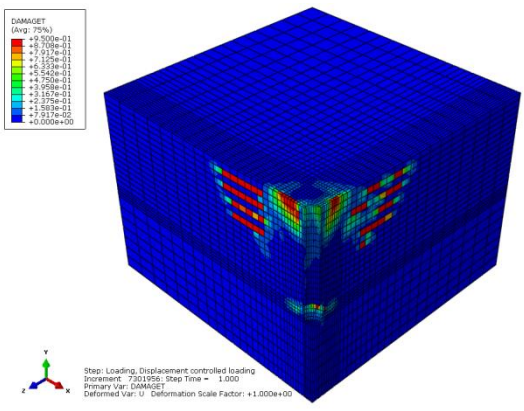

Figure 1: Pull-out of anchored headed stud (Tension Damage)

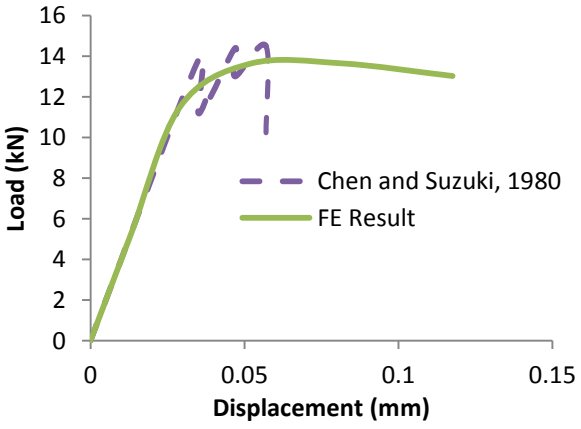

Figure 2: Splitting load vs. displacement of Tensile splitting test