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Tension-bend-shearing performance of bolted-flange connection for square steel tube structural column

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The connection between columns in high-rise structures, especially the connection at the top of the high-rise structure, may be subjected to the tension, bending moment and shear force under the combination of vertical and horizontal loads. The bolted-flange connection was used for square steel tube structural column in the high-rise structures. To study its mechanical properties, full-scale model tests and finite element analysis were performed on 10 column-to-column connections with different parameters. The mechanical properties of the specimen under the tension-bending-shear combination were obtained. The influence of the flange thickness, flange size, and bolt hole size on the connection performance was obtained. The flange thickness is the main factor affecting the bearing capacity of the connection. As the thickness increases, the yield mechanism of the connection converts from flange yield to bolt yield, and the bearing capacity gradually increases. The size of the bolt hole and the flange has little influence on the carrying capacity of the connection. The finite element models verified by the experiments were used to study the influence of the axial tension ratio of the column (i.e. the axial tension divided by the production of the sectional area and material design strength of the column) on the bearing capacity of the connection. The increase of the axial tension ratio leads to the increase of the bolt tension, which has an adverse effect on the bolt in the tension zone. Based on the yield line theory, the formula of bearing capacity under the combination of tension, bending moment and shear was deduced, which were verified by the tests and finite element analysis.

Biography

Xuechun Liu is a vice director of the Beijing Engineering Research Center of High-rise and Large-span Pre-stressed Steel Structures at the Beijing University of Technology. He received his PhD in Structural Engineering from the Beijing University of Technology. His research areas include steel structures, prefabricated steel structures, and pre-stressed steel structures. He has published more than 100 papers in reputed journals and gained more than 100 patents.

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