Finite Element Analysis on the Mechanical Behaviour of High Strength Bolted Friction Type Joint with Filler Plate

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Summary

Resent year, the filler plate should be used in high strength bolted frictional type joint. However, it is lack of enough technical information on influence of the thickness of the filler plate and the number of bolts in a line to the slip strength focused on extremely thick steel plate and high thickness change ratio. In this study, the tensile experiment for the high strength bolted joints with filler plates, using extremely thick plates, has been carried out to understand the mechanical behaviour of them. Also, complementing experiment results, and analysing the slipping behaviour of the joints with filler plates in detail, the finite element analysis (FEA) has been carried out. It is considered that FEA model is reasonable since comparing results of experiment and FEA. And based on FEA results by this model, the mechanical behaviour of such joints is explained.

Keywords: high strength bolted friction type joints, slip load, the number of bolts in a line, thickness of connected plate, thickness change ratio, filler plate

1. Introduction

Resent year, from the viewpoint of rational fabrication of the steel bridges, there are some applications using extremely thick plate which thickness is more than 75 mm in primary members of bridge structures. Since the thickness of the plate is kept constant through the member considering the fabrication cost, different thickness plates must be joined at the connection. That is, there is a thickness gap at the connection, and the filler plate should be installed in high strength bolted frictional joint. However, it is lack of enough technical information on influence of the thickness of the filler plate to the slip strength.

In this study, the tensile experiment [1] for the high strength bolted joints with filler plates has been carried out. Comparing mechanical behaviour of experiment, FEA [2] model has been discussed. Using reasonable FEA model, it has been carried out in order to complementing experiment results, and solving the slipping behaviour of the joints with filler plates in detail. Moreover, it is discussion that the influence of the thickness of the filler plate and the number of bolts in a line.

2. Tensile Experiment

2.1 Specimens

Structural dimensions of all specimens are tabulated in Table 1. The first characters of specimen name denote nominal diameter of bolt, the second characters denote the number of the bolts in a line, and the last characters denote the thickness of the connected plate 1. For example, M22-3-50 means; the bolts used in the specimen is M 22, the number of bolts in a line is 3, and the thickness of connected plate 1 is 50 mm. Connected plate 1 is at non-slip side. To prevent the slip at connected plate 1, bolt axial force is 20 % larger than design bolt axial force at connected plate 2.

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