

Thesis Title	Finite Element Analysis of Beam end Rotation on Single Plate Shear Connection
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Abstract

This research used finite element program ABAQUS to model single plate shear connections to investigate the beam end rotations. Every connection was modeled to fail by bolt shear rupture. Bolts ultimate strengths (F_u) used were 88 and 96 ksi. The bolt spacing of 3 inches was used in the models with the number of bolts of 3, 5, 7, and 9 with Gr.50 steel beams. Depths and lengths of the beams were modeled to maximize the beam end rotation resulting in 3-, 5-, 7- and 9-bolt connections being used with W18x55, W18x55, W24x62, and W30x90, respectively. The L/d beam ratios were 18, 11, 8, and 9, respectively. The analytical results showed that beams in models with 3, 5, 7, and 9 bolts beams reach M_p , with maximum rotation of 0.0279, 0.0148, 0.0108, and 0.015 radian, respectively. The results demonstrated that the beam end rotation tended to increase when L/d ratio increased; however, shear strength of the connections would decrease as a result. When the bolt ultimate strength of 88 ksi was used, it was found that the bolt would fail before the midspan moment reached M_p . On the other hand, if the bolt ultimate strength of 96 ksi was used, the beam would reach M_p before the bolt failed. When comparing the results with the Commentary of AISC 2005, single plate shear connections could be classified as a simple shear connection. The study on the effect of bolt position on the force acting on bolts showed that when the position of the farthest bolt with respect to the beam neutral axis increased to 6, 9 and 12 inches, the horizontal force acting on the farthest bolt tended to increase, resulting in the decrease of the total shear strength. When the connections with similar positions of the farthest bolt from the beam neutral axis were compared, the results showed that the connection with 3 bolts had more ductility because the decrease of the number of bolts improved bolt plowing and horizontal movement of the farthest bolt in the plate. In addition, the beam end rotation was better due to less horizontal force resisting in the horizontal movement of the bolts.

Keywords : ABAQUS / Beam Rotation / Finite Element / Single Plate Shear Connection