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DEVELOPMENT OF A FRICTION-SLIP JOINT FOR MOMENT FRAMES WITH CONTINUOUS BEAMS

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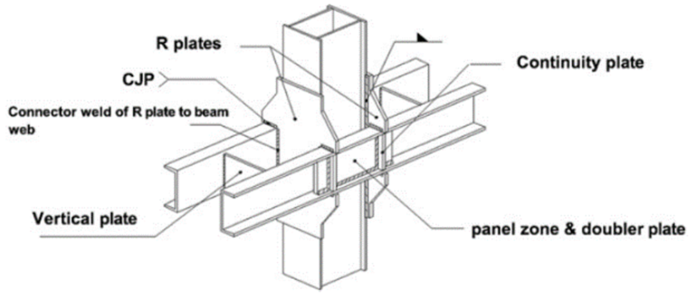
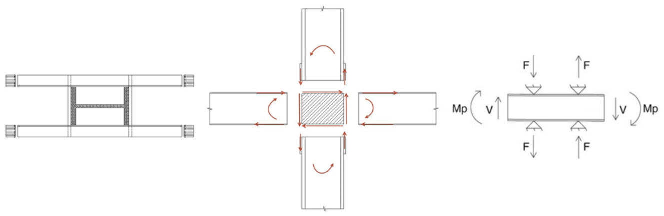
This paper introduces a new configuration for rigid connection in moment frames with continuous beams which is also capable of being developed as slip critical bolted connections.

In common moment frames, beams are placed between two adjacent columns connecting to the column flange surfaces, but in moment frames with continuous beams two beams are continuously passed through the column.

Mirghaderi and Renani proposed a detail for rigid connections in moment frames with continuous beams. Figure 1-a depicted the view of their proposed connection and the load pass which was determined for this connection is shown in Figure 1-b.



(a)



(b)

Figure 1. (a) Rigid connection detail in moment frames with continuous beams (Mirghaderi & Renani, 2008); (b) Load Pass (Renani & Mirghaderi, 2006).

In above-mentioned detail it was assumed that the load transfers with in-plane action between RPL and column; so the design force was pure shear and based on the design procedure it should have been able to be developed for slip critical bolted connections. However, the results showed that the out of plane action of RPLs can be significant. Although this action provides an extra capacity in rigid connections it is not pleasant in friction connections due to changing the pretension load of bolts.

As an alternative to this detail a new detail is proposed in this paper (Figure 2). In new detail by eliminating the effect of connection plate thickness the friction joint works as it was expected. Thus, instead of the plastic behavior of structural elements, these friction joints can be used as an energy dissipating system.

In this connection PL1 is welded to beams flanges (weld 1) and beams webs (weld 3) and PL2 is welded to column flanges (weld 2); the beams and column are connecting via the connection between PL1 and PL2 which can be performed by weld or bolt with standard holes for rigid connections and bolts with slotted holes for friction connections.

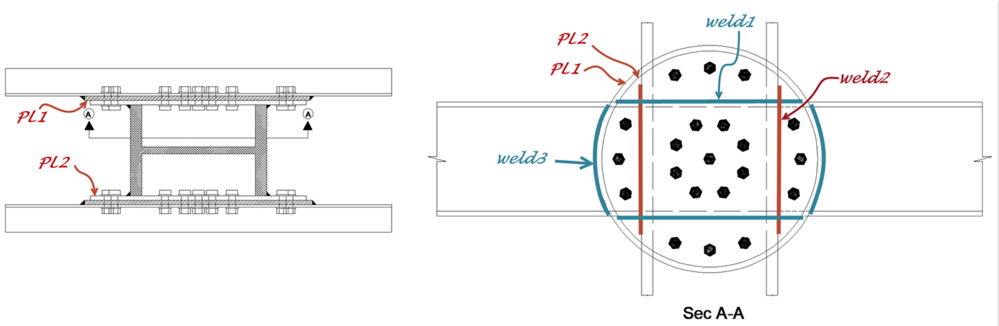


Figure 2. View of new proposed rigid bolted connection for moment frames with continuous beams.

Figure 3 shows the FEM hysteresis response for both old and new details with welded connections. The results are similar and even the new detail response has wider loops (more dissipated energy).

After ensuring the rigidity of connection, the bolted connection with slotted holes which correspond to the friction connection was assessed analytically and Figure 4 shows the comparison between its response and the response of the welded connection (both for new configuration).

The friction details of modeling are based on the model which is verified with (Wolski, 2006).

As it was expected, after reaching the threshold of slip force, no increase is observed in the base shear force; so the new configuration is completely able to be used as a friction detail.

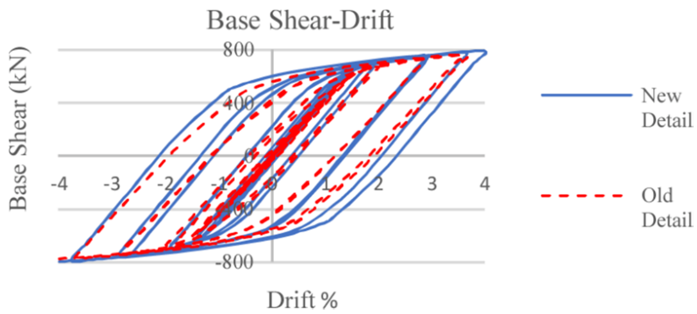


Figure 3. Comparison between the base shear- drift responses of old and new welded detail.

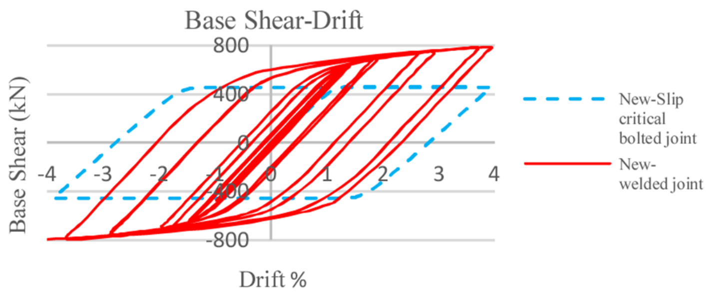


Figure 4. Comparison between base shear- drift responses of new detail, welded and friction connection.

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