

## ANALYTICAL INVESTIGATION OF A NEW THROUGH-COLUMN-TYPE JOINT FOR REINFORCED CONCRETE AND STEEL FRAMES

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### ABSTRACT

Composite structural systems, which consist of reinforced concrete columns and steel (RCS) beams, provide substantial savings in material cost, increase structural damping and lateral stiffness through RC columns, and increase energy dissipation capacity through steel beams. The load transfer mechanisms between RC column and steel beam may be very complicated, due to different material properties of columns and beams. In this study, a new Through-Column-Type Joint is proposed that uses different ways for developing a reliable load path. The joint is reinforced by cover plates and a vertical plate passing through the column, and beams are connected to the vertical plate named the Through Plate. This study employed finite-element analyses of the mentioned connection to investigate the structural performance and the stress transfer mechanisms. It was found that the initial stiffness and energy dissipation of the new details were increased and strength degradation was decreased under cyclic loading compared with previous details. The study further showed that the use of through plate is effective in enhancing the structural performance of the joints.

### INTRODUCTION

Composite structures, which consist of steel and reinforced concrete members, have been used for the last 30 years in various forms. One of these systems which resist seismic moments based on the moment connection between reinforced concrete columns and steel beams is called RCS system. Using RC instead of structural steel as columns can result in substantial savings in material cost and an increase in the structural damping and lateral stiffness of the building. Further energy dissipation capacity can accordingly be provided through steel beams. In fact, this system with the optimum combination of steel and concrete structural elements has the advantages of both concrete and steel systems.

To date, there have been recognized two main categories in RCS connections, namely the through-beam type and the through-column type. In the through-column type, beams are cut adjacent to the column, so compared with the through-beam type, there is less interruption in panel zone and longitudinal bars can be placed in appropriate arrangements in the column section. The details offered for such kind of connections that use diaphragms or cover plates (Nishiyama et al., 2004) to connect the steel beam and column are