

## Seismic Behaviour of RC Knee Joints in Closing and Opening Actions

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**Abstract :** Knee joints, the beam column connections found at the roof level of a moment resisting frame buildings, are inherently different from conventional interior and exterior beam column connections in the way that forces from adjoining members are transferred into joint and then resisted by the joint. A knee connection has two distinct load resisting mechanisms, each for closing and opening actions acting simultaneously under reversed cyclic loading. In spite of many distinct differences in the behaviour of shear resistance in knee joints, there are no special design provisions in the major design codes available across the world due to lack of in-depth research on the knee connections. To understand the relative importance of opening and closing actions in design, it is imperative to study knee joints under varying shear stresses, especially at higher opening-to-closing shear stress ratios. Three knee joint specimens, under different input shear stresses, were designed to produce a varying ratio of input opening to closing shear stresses. The design was carried out in such a way that the ratio of flexural strength of beams with consideration of axial forces in opening to closing actions are maintained at 0.5, 0.7, and 1.0, thereby resulting in the required variation of opening to closing joint shear stress ratios among the specimens. The behaviour of these specimens was then carefully studied in terms of closing and opening capacities, hysteretic behaviour, and envelope curves to understand the differences in joint performance based on which an attempt to suggest design guidelines for knee joints is made emphasizing the relative importance of opening and closing actions. Specimens with relatively higher opening stresses were observed to be more vulnerable under the action of seismic loading.

**Keywords :** Knee-joints, large-scale testing, opening and closing shear stresses, seismic performance

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