World Academy of Science, Engineering and Technology
International Journal of Geotechnical and Geological Engineering
Vol:10, No:01, 2016

Evaluation of Reinforced Concrete Beam-Column Knee Joints Performance: Numerical and Experimental Comparison

Authors : B. S. Abdelwahed, B. B. Belkassem

Abstract : Beam-column joints are a critical part in reinforced concrete RC frames designed for inelastic response to several external loads. Investigating the behaviour of the exterior RC beam-column joints has attracted many researchers in the past decades due to its critical influence on the overall behaviour of RC moment-resisting frames subjected to lateral loads. One of the most critical zones in moment-resistant frames is the knee joints because of restraints associated with providing limited anchorage length to the beam and column longitudinal reinforcement in it and consequentially causes a lot of damage in such building frames. Previous numerical simulations focussed mainly on the exterior and interior joints, for knee joint further work is still needed to investigate its behaviour and discuss its affecting parameters. Structural response for an RC knee beam-column joint is performed in this study using LS-DYNA. Three-dimensional finite element (FE) models of an RC knee beam-column joint are described and verified with experimental results available in literature; this is followed by a parametric study to investigate the influence of the concrete compressive strength, the presence of lateral beams and increasing beam reinforcement ratio. It is shown that the concrete compressive strength has a significant effect on shear capacity, load-deflection characteristics and failure modes of an RC knee beam-column joints but to a certain limit, the presence of lateral beams increased the joint confinement and reduced the rate of concrete degradation in the joint after reaching ultimate joint capacity, added to that an increase in the maximum load resistance. Increasing beam reinforcement ratio is found to improve the flexural resistance of the anchored beam bars and increase the joint maximum load resistance.

Keywords : beam reinforcement ratio, joint confinement, numerical simulation, reinforced concrete beam-column joints, structural performance
Conference Title : ICESE 2016 : International Conference on Earthquake and Structural Engineering
Conference Location : Jeddah, Saudi Arabia
Conference Dates : January 26-27, 2016