World Academy of Science, Engineering and Technology
International Journal of Structural and Construction Engineering
Vol:10, No:05, 2016

Finite Element Simulation of RC Exterior Beam-Column Joints Using Damage Plasticity Model

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Abstract : In the present study, 3D simulation of a typical exterior (RC) beam–column joint (BCJ) strengthened with carbon fiber-reinforced plastic (CFRP) sheet are carried out. Numerical investigations are performed using a nonlinear finite element (FE) analysis by incorporating damage plasticity model (CDP), for material behaviour the concrete response in compression, tension softening were used, linear plastic with isotropic hardening for reinforcing steel, and linear elastic lamina material model for CFRP sheets using the commercial FE software ABAQUS. The numerical models developed in the present study are validated with the results obtained from the experiment under monotonic loading using the hydraulic Jack in displacement control mode. The experimental program includes casting of deficient BCJ loaded to failure load for both un-strengthened and strengthened BCJ. The failure mode, and deformation response of CFRP strengthened and un-strengthened joints and propagation of damage in the components of BCJ are discussed. Finite element simulations are compared with the experimental result and are noted to yield reasonable comparisons. The damage plasticity model was able to capture with good accuracy of the ultimate load and the mode of failure in the beam column joint.

Keywords : reinforced concrete, exterior beam-column joints, concrete damage plasticity model, computational simulation, 3-D finite element model
Conference Title : ICSE 2016 : International Conference on Structural Engineering
Conference Location : Rome, Italy
Conference Dates : May 02-03, 2016