Finite element modeling of RC T-beams strengthened in the negative moment region by NSM-CFRP rods with various embedment depth subjected to low cyclic loading

Y Haryanto[1*], H-T Hu[2,3], F-P Hsiao[2,4], A L Han[5], F Salim[2], L Nugroho[2], C-C Lin[4]

[1]Department of Civil Engineering, Jenderal Soedirman University, Purwokerto, Indonesia
[2]Department of Civil Engineering, National Cheng Kung University, Tainan, Taiwan
[3]Department of Civil and Disaster Prevention Engineering, National United University, Miaoli, Taiwan
[4]National Center for Research on Earthquake Engineering, Taipei, Taiwan
[5]Department of Civil Engineering, Diponegoro University, Semarang, Indonesia

*Corresponding Author Email: yanuar.haryanto@unsoed.ac.id

Abstract. This research uses nonlinear finite element (FE) analysis to examine the seismic performance of reinforced concrete (RC) T-beams strengthened in the negative moment region by near-surface mounted (NSM) carbon fiber reinforced polymer (CFRP) rods under low cyclic loading. The studied variable was the rods' depth of embedment. The developed FE model considers the nonlinear constitutive material properties of concrete, yielding of steel reinforcement, CFRP rod, and the cohesive behavior to simulate contact interaction between two neighboring material. The numerical FE simulations were compared with experimental measurement comprising of two specimens strengthened with NSM-CFRP rods in addition to one un-strengthened control specimen. Overall, the predicted FE mid-span deflection responses agreed well with the corresponding measured experimental tested data. It is concluded that the developed FE model is quite suitable as a practical and economical tool for accurate modeling and analysis of negative moment region strengthening of RC members with NSM reinforcement under low cyclic loading.