Analyses for RC Beams Subjected to Blast Loadings Considering Bond-slip Effect

MinJoo Lee* and Hyo-Gyoung Kwak†

* Department of Civil and Environmental Engineering
Korea Advanced Institute of Science and Technology (KAIST)
291, Daehak-ro, Yuseong-gu, 34141 Daejeon, Republic of Korea
e-mail: ttl1114@kaist.ac.kr, web page: http://www.kaist.ac.kr

† Department of Civil and Environmental Engineering
Korea Advanced Institute of Science and Technology (KAIST)
291, Daehak-ro, Yuseong-gu, 34141 Daejeon, Republic of Korea
e-mail: kwakhg@kaist.ac.kr, web page: http://www.kaist.ac.kr

ABSTRACT

This paper presents an improved numerical model for nonlinear analysis of RC beams subjected to blast loadings. The strain rate effects on material behaviors of concrete and steel are expressed by using the dynamic increase factor (DIF) defined as a function of strain rate. The bond-slip causes nonlinear deformation after yielding of reinforcing steel and accompanies the fixed-end rotation. Based on the layered section method, the equivalent bending stiffness EI_{eq}, which represents the changed bending stiffness EI of elements placed within the plastic hinge length, is introduced to take into account the bond-slip effect in a numerical algorithm. In addition, cyclic stress-strain relations describing the hysteretic behavior of concrete and reinforcing steel are adopted to accurately simulate structural behavior even after reaching the maximum structural response. The proposed model is verified through correlation studies between numerical results and experiment data. The analytical results obtained by applying both bond-slip effect and unloading-reloading histories of constituent materials show good correlations with the experimental data in terms of the mid-span deflection and time histories.

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