Plastic Dilation Rate Characteristic of Concrete Confined with Steel Tube

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ABSTRACT

Recently, the use of external confining devices to confine the concrete material become widely used. One of the purposes is to gain additional strength and ductility. Although there are many types of external confining devices, in this paper, the attention is limited to understand the behaviour of concrete confined with the steel tube. One of the main objectives of this research is to study the plastic dilation rate behaviour of concrete confined with the steel tube. In the previous research, the authors proposed a plasticity constitutive model for concrete material where the plastic dilation rate formulation was calibrated with the experimental results from both actively and passively confined concrete. For the calibration with passively confined concrete, sets of FRP experimental results were used. However, the stress-strain behaviour of the FRP and the steel tube materials is different. FRP material has a linear elastic behaviour up to failure, while steel tube material has an elastic-perfectly plastic material behaviour and obeys J2 plasticity model. Although the proposed plastic dilation rate formulation is generalised to be able to model any type of confining devices, it would be interesting to investigate the performance of the proposed model for concrete confined with the steel tube. For that purposes, a series of experimental investigation to obtain the plastic dilation rate behaviour of concrete confined with the steel tube is carried out. A comparison of the proposed plastic dilation rate formulation with the experimental counterparts is presented. Furthermore, the overall response of concrete confined with the steel tube is evaluated by using an in-house three-dimensional non-linear finite element analysis.