

An Improved Tie Force Method for Progressive Collapse Resistance Design of Precast Concrete Cross Wall Structures

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Abstract : Progressive collapse of buildings typically occurs when abnormal loading conditions cause local damages, which leads to a chain reaction of failure and ultimately catastrophic collapse. The tie force (TF) method is one of the main design approaches for progressive collapse. As the TF method is a simplified method, further investigations on the reliability of the method is necessary. This study aims to develop an improved TF method to design the cross wall structures for progressive collapse. To this end, the pullout behavior of strands in grout was firstly analyzed; and then, by considering the tie force-slip relationship in the friction stage together with the catenary action mechanism, a comprehensive analytical method was developed. The reliability of this approach is verified by the experimental results of concrete block pullout tests and full scale floor-to-floor joints tests undertaken by Portland Cement Association (PCA). Discrepancies in the tie force between the analytical results and codified specifications have suggested the deficiency of TF method, hence an improved model based on the analytical results has been proposed to address this concern.

Keywords : cross wall, progressive collapse, ties force method, catenary, analytical

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