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Behavior of the RC Slab Subjected to Impact Loading According to the DIF

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Abstract : In the design of structural concrete for impact loading, design or model codes often employ a dynamic increase factor (DIF) to impose dynamic effect on static response. Dynamic increase factors that are obtained from laboratory material test results and that are commonly given as a function of strain rate only are quite different from each other depending on the design concept of design codes like ACI 349M-06, fib Model Code 2010 and ACI 370R-14. Because the dynamic increase factors currently adopted in the codes are too simple and limited to consider a variety of strength of materials, their application in practical design is questionable. In this study, the dynamic increase factors used in the three codes were validated through the finite element analysis of reinforced concrete slab elements which were tested and reported by other researcher. The test was intended to simulate a wall element of the containment building in nuclear power plants that is assumed to be subject to impact scenario that the Pentagon experienced on September 11, 2001. The finite element analysis was performed using the ABAQAUS 6.10 and the plasticity models were employed for the concrete, reinforcement. The dynamic increase factors given in the three codes were applied to the stress-strain curves of the materials. To estimate the dynamic increase factors, strain rate was adopted as a parameter. Comparison of the test and analysis was done with regard to perforation depth, maximum deflection, and surface crack area of the slab. Consequently, it was found that DIF has so great an effect on the behavior of the reinforced concrete structures that selection of DIF should be very careful. The result implies that DIF should be provided in design codes in more delicate format considering various influence factors.

Keywords : impact, strain rate, DIF, slab elements
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