Public Abstract

First Name:Joseph

Middle Name:Ernest

Last Name:Kirby

Adviser's First Name:Sarah

Adviser's Last Name:Orton

Co-Adviser's First Name:

Co-Adviser's Last Name:

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Title:Dynamic Increase Factor in Reinforced Concrete Frames Under Disproportionate Collapse

Under a disproportionate collapse, the sudden loss of a support causes a dynamic response that can amplify the internal forces in the surrounding members and lead to significant global damage. This study considered a two-dimensional, quarter scale, two bay, two story reinforced concrete frame with discontinuous reinforcement. In order to simulate an interior bay condition, the frame was axially restrained at the adjacent-bay beam locations. Dead weights were applied to simulate the dead and live loads expected to be present during a collapse event. To initiate the test, and to simulate the sudden loss of a load-bearing column, a kickstand was implemented. The results presented herein are from four dynamic tests under various levels of applied load. The fourth drop, with a load corresponding to 42% of the $1.2*DL + 0.5*LL$ typically specified in disproportionate collapse guidelines, resulted in a catenary action. The results show that there is a very fine tipping point at which the structure is pushed past the compressive arch and flexural range of resistance into the catenary action range (hereafter referred to as the snap-through effect). Furthermore, the results show that due to this snap-through effect, the dynamic increase factor can be as great as 2.4, significantly higher than the value specified by the aforementioned guidelines.