

EVALUATION OF ALTERNATIVE RESISTANCE
MECHANISMS FOR
PROGRESSIVE COLLAPSE

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ABSTRACT

The purpose of this research is to better understand the collapse resistance mechanisms of reinforced concrete buildings. Currently, resisting progressive collapse is generally outside the design considerations for ordinary buildings due to a lack of information on how to economically provide that resistance. Reinforced concrete frame structures, however, may possess inherent structural redundancy and ability to withstand collapse if the structure is properly detailed to provide alternative resistance mechanisms. A more accurate progressive analysis procedure that takes into account alternative collapse resisting mechanisms will lead to the identification of detailing requirements that could be implemented economically on new buildings or retrofit measures for existing buildings to ensure a limited ability to resist collapse and save lives.

Collapse resisting mechanisms studied in this research include catenary action, compressive arch action, and contributions from infill walls. This research tested a series of three quarter scale two bay by two story frames. The column between the two bays was removed to simulate a collapse scenario. The design of the three frames consisted of discontinuous reinforcement, continuous reinforcement, and infill walls placed in the bays. The discontinuous reinforcement frame reached a load of 2.34 kips under compressive arch action and 8.19 kips under catenary tension. The continuous reinforcement frame reached a load of 5.81 kips under the flexural action and 8.30 kips under catenary tension. The frame with the infill wall did not perform significantly different than the discontinuous reinforcement frame. The results show that both compressive arch and catenary action are viable resistance mechanisms in frames under a collapse loading and could reduce the required sizes and reinforcement of structural members.