

Limit analysis fast methods for assessment of progressive collapse potential in RC structures

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Abstract

This study presents a comparative analysis of results obtained by using the LSP adopted in the GSA (2003) Guidelines with respect to similar data furnished by two limit analysis based methods. The first method takes into consideration only the contribution of beams, and the second one considers the behavior under gravity forces of the entire two-way floor system. If the floors, spanning above to a column lost in the first floor are of identical strength, then they will all stand or they will all fall. For this reason, only an isolated bay should be considered in the analysis and not the whole structure. These new, fast and easy methods require plastic analysis of beams and slabs, and involve only hand calculations. Two models representing a three-story framed structure are seismically designed, and their progressive collapse potential is evaluated at lost corner column case. To assess the reliability of results, the classical DCR values (GSA) are compared to plastic analysis DCR values, named by authors DCR_p and obtained following this approach. The new DCR_p values are in good agreement with DCR values obtained from the Linear Static Procedure-GSA (2003) ($DCR_p = 1.96$ vs. $DCR = 2.37$), and lead to similar conclusions regarding the potential for progressive collapse. If the second method is applied and the contribution of slabs is considered, the magnitudes of inelastic demands and DCR_p values are obtained via the yield-line analysis by using the virtual work method. Preliminary results shown reductions of DCR_p values in the range of 55%, followed by a change of the verdict from HIGH to LOW potential for progressive collapse; the verdict is confirmed by advanced NS and ND analyses.

Keywords: progressive collapse, DCR, yield-line theory, limit analysis, RC structures.

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