



Recovery-Based Seismic Resilience Assessment of IS Code-Conforming RC Buildings

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Abstract

Earthquake-induced damage to various structural and non-structural building components results in direct and indirect losses and hinders achieving desired performance objectives such as immediate occupancy after the event. Modern code-compliant buildings prove adequate to meet collapse-prevention and life-safety performance requirements and reduce the risk of casualty. However, the buildings may experience long downtime and disruption. The conventional approaches traditionally focus on structural damage and loss immediately following an earthquake and do not consider post-event parameters to quantify recovery. The present study considers resilience by including repair time and cost under the performance-based earthquake engineering framework. The study also takes into account the collapse potential and damage beyond repairability. The study also examines likelihood of unsafe placard. The implementation of the framework is demonstrated on three archetypical special moment-resisting reinforced concrete (RC) frame buildings. It considers component-level fragility and consequence functions for structural and non-structural components. Monte Carlo simulations are used to account for uncertainties in structural response, damage, repair costs and repair time. The empirical and lognormal-fit performance curves for repair cost ratio and repair time are developed, and the range, mean, median, and 90th percentile values are reported. The contribution of structural and non-structural damage to different performance indicators has been investigated. The results indicate that the buildings in high seismic areas in India are likely to suffer extensive damage, resulting in unacceptably high economic loss and downtime, and thus trigger the need to revisit the current design provisions, and promote recovery-based design approaches.

Keywords: Seismic performance assessment, Repair cost, Repair time, Unsafe placards, Recovery-based design, Performance-based engineering