



Probabilistic Seismic Vulnerability Assessment of RC Frame Building Considering Time-Dependent Deterioration

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Abstract

The Earthquake though infrequent events, causes enormous structural, monetary, and human losses. To plan risk mitigation strategies, it is crucial to estimate the seismic vulnerability associated with the structural elements of building stock. In addition to intermittent seismic risk during their service life, reinforced concrete (RC) buildings are continuously exposed to multiple environmental stressors. In RC structures, corrosion deterioration can cause significant reduction in the reinforcing steel area along with several secondary effects including loss of core and cover concrete strength, reduction of yield or ultimate strength and ductility of steel reinforcement, and loss of bond strength, among others. Therefore, for realistic vulnerability assessment of aged building stock, it is crucial to consider the time-dependent effects of deterioration. There are very few such studies pertaining to the old stock buildings in India, hence the present study considers an older non-ductile RC frame to assess its seismic vulnerability under joint aging and seismic threats. A finite-element model of the frame is developed by considering the nonlinear behavior of different components and time-dependent aging effects. Nonlinear time-history analysis is carried out using a suite of ground motion representative of the seismic hazard. The fragility curves are obtained for both as-built conditions and at different times along the service life of the building. Results have shown an increase up to 44% in the failure probability of deteriorated RC frame when compared to its pristine or as-built condition, highlighting the need for due consideration of aging effect in seismic vulnerability assessment.

Keywords: Time dependent corrosion, Seismic vulnerability, Fragility analysis