

Multi-hazard vulnerability assessment of highway bridges

Civil infrastructure systems such as highway bridges play an essential role in the sustained economic growth and social development of any country. During their service life, highway bridges are continuously exposed to multiple chemical and physical stressors such as corrosion deterioration along with intermittent seismic threats. These deterioration effects, if not effectively monitored and managed, can cause significant reduction in structural functionality and safety especially during extreme event such as earthquakes. This research provide an enhanced understanding of the impact of realistic and commonly occurring critical deterioration mechanisms typically ignored in the past such as pitting corrosion of embedded rebars in bridge columns and deterioration of anchor bolts due to necking at interface in bridge bearings within the seismic vulnerability assessment framework for highway bridges (Fig. 1). Seismic fragility curves which gives conditional probabilistic statement of damage state exceedance given the intensity of the ground motion are developed for commonly occurring exposure condition and the results highlights the need to consider realistic deterioration within the seismic vulnerability and seismic life-cycle assessment framework (Fig. 2).



Fig. 1: Realistic deterioration mechanism affecting highway bridge components

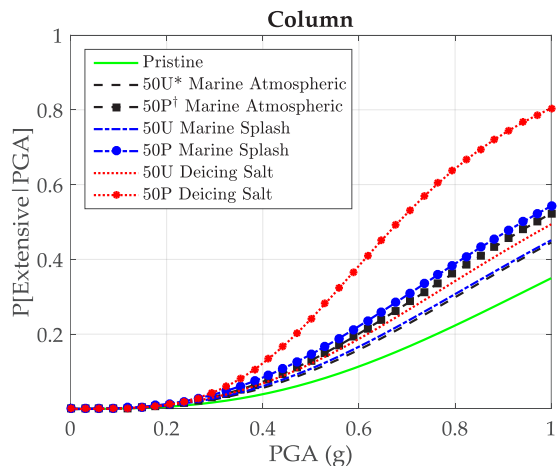


Fig. 2: Comparison of pristine column fragility curves for extensive damage states with fragility at 50 years for different exposure condition and deterioration modeling assumptions (uniform and pitting); U* is uniform corrosion and P† is pitting corrosion

Our other research focus is on developing framework for seismic vulnerability assessment of highway bridges in India. The Indian subcontinent lists among the high earthquake prone regions in the world and has witnessed significant earthquakes in the recent past. Geographical statistics of India show that more than 60% area in the country is considered to be prone to damaging earthquakes.