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# Findings

The probabilistic performance evaluation of steel box girder bridge under NF and FF earthquakes is investigated using incremental dynamic analysis to develop fragility curves and PSDM models. A steel box girder bridge with or without seismic isolation is being investigated for this purpose. The seismic isolation system comprises of lead rubber bearings and friction pendulum isolators. The vulnerability of the bridge is affected by the frequency content, and this is studied by varying the PGV/PGA in directivity pulses. The sensitivity of bridge response with variation in bearing design parameters has also been examined in order to suggest an optimal seismic isolation parameter for LRB. The numerical analysis is performed by varying the characteristic strength to weight sustained by LRB isolators (Q/W). Furthermore, the behaviour of non-isolated steel box girder bridges exposed to a sequence of mainshock-aftershock occurrences is then thoroughly investigated. The major conclusion drawn from the above studies are summarized as below:

- The bridge piers are more susceptible to damage from the NF ground motion than the FF ground motion. The ductility and displacement demand of bridge is significantly higher when exposed to the NFD-HF and NF-FS earthquakes.
- The frequency ratio (PGV: PGA) has a considerable impact on the POE when there are directivity-effect of near-field earthquakes.
- The PSDMs presented may be assumed to be a well-versed model which may address the variability in earthquake ground motion while performing the bridges seismic vulnerability evaluation.
- LRB isolated bridge subjected to NFD-HF and NF-FS ground motion are significantly vulnerable to larger deck and isolator displacement that can lead to post earthquake functionality disruption of the bridge. However, the FPS system showed promising performance in reducing the MDD as compared to LRB isolated bridge.
- The effectiveness of LRB and FPS isolation is presented by the positive change in the fragility median for the MPD, MDR and MRD as damage measures for various ground motion ensemble.
- There is negligible damage during the mainshock, but as the PGAs of the aftershocks rise, the intensity of the damage increases.