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# SEISMIC FRAGILITY ANALYSIS OF HIGHWAY CURVED BRIDGES

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The specific characteristics of near-field earthquake records can lead to different dynamic responses of bridges as compared to those of far-field ones. However, the effect of near-field strong ground motion has often been neglected in the seismic performance assessment of bridges. Most researches, have so far focused on the deterministic responses of bridges (Zakeri, 2013), while more precise vulnerability assessment can be made using probabilistic methods thru various levels of uncertainty.

On the other hand, no comprehensive inquiry in the world has yet been performed on the vulnerability of curved concrete box-girder bridges subjected to three-directional earthquake excitations, thus the probabilistic investigation of such bridges is of great importance. Nielson (2005), Padgett (2007), Ramanathan (2012) and Zakeri (2013) carried out widespread researches on the vulnerability and retrofitting of multi-span continuous and simply-supported concrete bridge classes in the central and western United States. However, their studies are dedicated to straight bridges, all asserting that the effect of deck curvature should be considered in subsequent inspections. Furthermore, damage to horizontally curved multi-frame RC box-girder bridges in the past earthquakes has reinforced the potential of the seismic vulnerability of these structures due to their distinctive dynamic behavior. Based on the nonlinear time history analyses in OpenSEES, this article assesses the effects of near-field versus far-field earthquakes on the seismic performance of horizontally curved multi-frame RC box-girder bridges by accounting the vertical component of earthquake records. Analytical seismic fragility curves have been derived by considering uncertainties in earthquake records, material and the geometric properties of bridges. 3D modeling view of bridge along with nonlinear behavior of elements is shown in Figure 1.

The findings indicate that for these bridge sub-classes, near-field effects are found to reasonably increase the seismic vulnerability. The results can guide future regional risk assessments regarding the importance of including or excluding near-field effects on the seismic performance of horizontally curved bridges.

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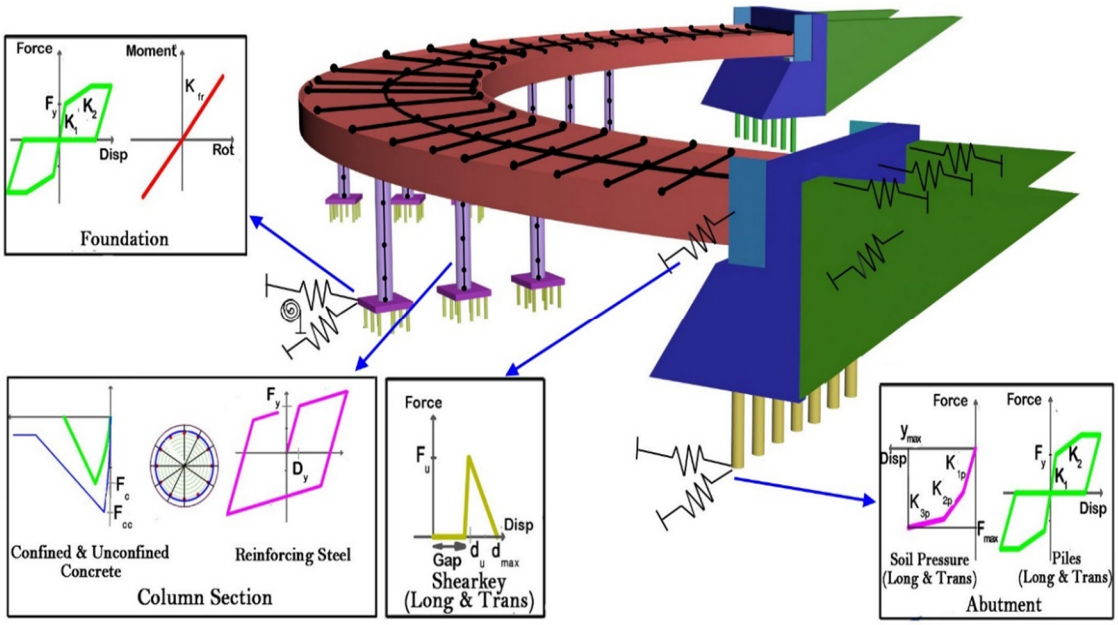


*Figure 1. 3D modeling view of bridge along with nonlinear behavior of elements.*