Study on seismic behaviour of integral concrete bridges with different skew angles through fragility curves

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ABSTRACT

Bridges are key elements in urban transportation system and should be designed to sustain earthquake induced damages to be utilized after earthquake. Extensive damages during last earthquakes highlighted the importance of seismic assessment and damage estimation of bridges. Skewness is one of the primary parameters effects on seismic behavior of bridges. Skew bridges are defined as bridges with skew angle piers and abutments. In these bridges, the piers have some degrees of skewness due to construction restrictions, such as those caused by crossing a waterway, railway line or road. This paper aims to investigate seismic behavior of skew concrete bridges using damage criteria and estimate probability of piers damage with fragility curves. To this end, three types of concrete bridges with two, three and four spans and varying skew angles of 0^0 ,10^0, 20^0 and 30^0 are modeled with finite element software. Seismic responses of bridge piers under 10 earthquake ground motion records are calculated using incremental dynamic analysis. Following, damage criteria proposed by Mackie and Stojadinovic are used to define damage limits of bridge piers in four damage states of slight, moderate, extensive and complete and bridge fragility curves are developed. The results show that increasing skew angles increases the probability of damage occurrence, particularly in extensive and complete damage states.

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