Influence of Viscous Dampers on Seismic Response of Isolated Bridges Including Soil Structure Interaction

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Abstract : Bridges represent critical structures in lifeline systems. They provide reliable modes of transportation, so their failure can seriously obstruct relief and rehabilitation work. Earthquake ground motions can cause significant damages in bridges, so during the strong earthquakes, they can easily collapse. The base isolation technique has been quite effective in seismic response mitigation of the bridges in reducing the piers base shear. The effect of soil structure interaction on the dynamic responses of seismically isolated three span girder bridge with viscous dampers is investigated. Viscous dampers are installed in the mid span of the bridge to control bearing displacement. The soil surrounding the foundation of piers has been analyzed by applying different soil densities in order to consider the soil stiffness. The soil medium has been assumed as a four layered infill as dense and loose medium. The boundaries in the soil medium are considered as infinite elements in order to absorb the radiating waves. The formulation of infinite elements is the same as for the finite elements in addition to the mapping of the domain. Based on the iso-parametric concept, the infinite element in global coordinate is mapped onto an element in local coordinate system. In the formulation of the infinite element, only the positive direction extends to infinity thus allowing the waves to propagate outside of the soil medium. Dynamic analyses for two levels of earthquake intensity are performed in time domain using direct integration method. In order to specify the effects of the SSI, the responses of the isolated and controlled isolated bridges are compared. It is observed that the soil surrounding the piers has significant effects on the bearing displacement of the isolated RC bridges. In addition, it is observed that the seismic responses of isolated RC bridge reduced significantly with the installation of the viscous dampers.

Keywords : viscous dampers, reinforced concrete girder bridges, seismic response, SSI
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