Aging of Fiber Reinforced Elastomeric Bridge Bearings

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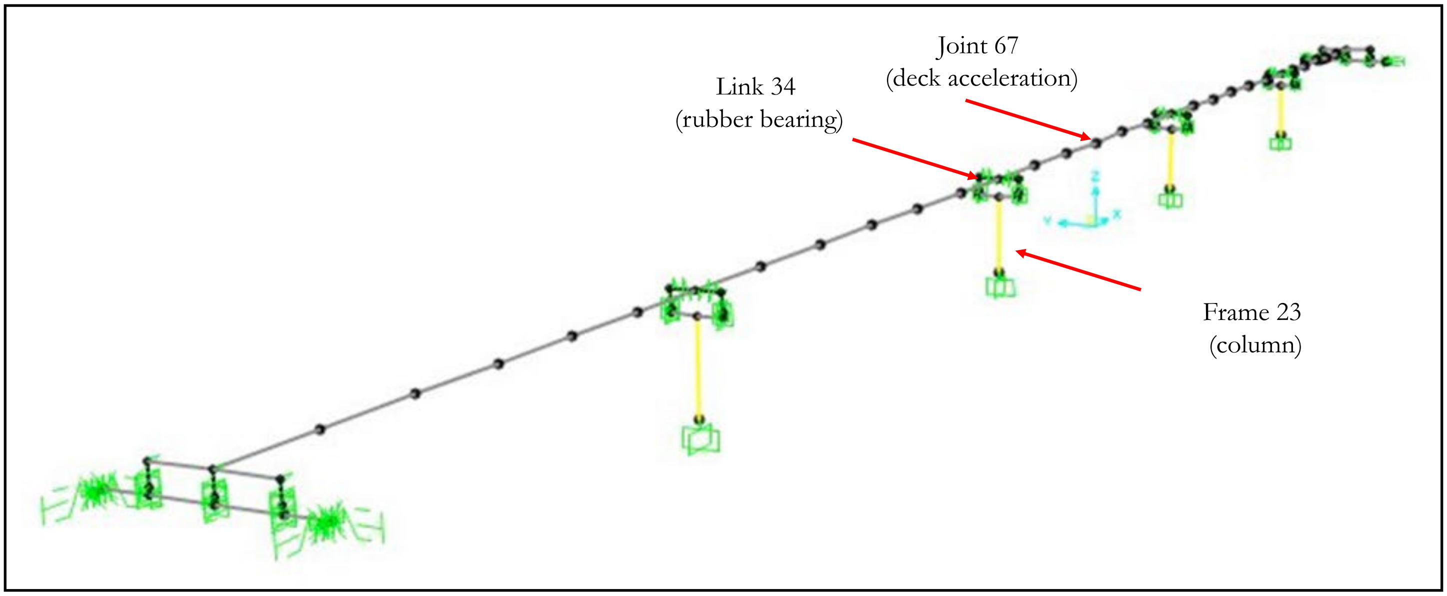
Study Methods

The aims of this research project include (i) the study of the long-term performance of bridge rubber bearings through testing and (ii) shedding some lights on the effects elastomeric bearing aging on the seismic response of a typical concrete overpass. The full range of available research techniques are embraced in this work, including experimental tests, numerical modelling of the devices and response history analyses of a typical bridge structure with aging of the rubber bearings explicitly modelled. Elastomeric bearings have been tested under axial and shear loads to verify the influence of aging on their mechanical response. Accelerated aging tests have been performed to determine the effects of thermal oxidation on the response of the bearings. The experimentally determined properties of FRBs have been compared to available results for conventional steel reinforced devices. Hysteresis models representative of new and aged fiber reinforced and steel reinforced bearings have been included in a structural model representative of an ordinary concrete bridge. Results of response history analyses of the prototype structure under tridirectional seismic excitation, including new and the aged devices, have been studied to verify the influence of aged elastomeric bearings on the global response of the structure. Multidirectional NRHAs were necessary for a complete understanding of the behavior of the prototype bridge under earthquake loads.

Findings

The effects of aging of FRBs of the seismic response of a typical overpass bridge were determined in this study. It was found that the aging of FRBs is more pronounced than that of LRBs, and additional research studies are required to understand the influence of manufacturing procedures and quality of materials on the degradation of the response of these bearings.



3D View of the SAP2000 Model of the Bridge

This study discusses the effects of aging on the axial and shear response of FRBs, and on the seismic response of a typical base isolated bridge in California.

About the Authors

Dr. Calabrese joined the CSULB CECEM Department as an Assistant Professor in Fall 2017. He gained a Ph.D. in Construction Engineering with an emphasis in Structural Engineering in 2013. He was a visiting research fellow at the Pacific Earthquake Engineering Research Center (PEER) from 2010–2012 along with having been a postdoctoral researcher of the ReLUIS Consortium at the Italian Network of University Laboratories in Earthquake Engineering, from 2013–2014. Dr. Calabrese has worked as a Structural Engineer at Foster & Partners, London and Italy for seven years. He has been a registered engineer in Italy since 2009 and a Chartered Engineer (CEng) and Full Member of the Institution of Civil Engineers (MICE) in the UK since 2017. Dr. Calabrese's current research interests are in the fields of experimental testing, structural dynamics, base isolation, vibration engineering, and in the development of novel low-cost devices for the seismic protection of buildings. He has carried out numerous large-scale experimental studies of base isolation systems and energy-absorbing devices on the shaking table at the Department of Structural Engineering at the University of Naples in Italy. This work has been instrumental in developing low-cost seismic isolation systems using recycled rubber and flexible reinforcements for the seismic protection of buildings in developing regions.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/1863

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