17th Symposium on Earthquake Engineering
November 14-17, 2022
IIT Roorkee, India
Paper No. 358

Understanding the Torsional Response of Unbonded Fiber Reinforced Elastomeric Isolators: A Finite Element Study

Ambili P[1], Mohan S C[1], Sistla Sai Teja[2]

[1]Dept. of Civil Engineering, BITS Pilani, Hyderabad
[2]Dept. of Civil and Natural Resources Engineering, University of Canterbury, Christchurch, New Zealand

Abstract

Conventional steel reinforced elastomeric isolators (SREI) have been widely used to improve the seismic performance of buildings; however, they are not economical for low-rise residential buildings in developing countries like India. Hence, Unbonded Fiber Reinforced Elastomeric Isolators (UFREI) have been developed as a cost-effective alternative to conventional isolators. Although studies have been conducted to understand the seismic behaviour of UFREIs, limited research related to their torsional behaviour was reported in the literature. Therefore, the primary aim of this study is to understand the torsional response of UFREIs by conducting finite element simulations on experimentally validated numerical models, using ABAQUS software. The rotational hysteresis behaviour of UFREI with respect to the torsional moment and rotation is obtained and a detailed comparison of torsional stiffness with the increasing rotation is presented. These results are used to develop a two-storeyed base isolated RC framed building model in SAP 2000 software. The global torsional response of the building model is studied by conducting linear time history analyses using bi-directional ground motions. A comparative analysis of the behaviour of the structure isolated by UFREI and the corresponding behaviour of the traditional fixed base structure are presented to understand how the rotational response of UFREI influences the performance of building under earthquakes in both horizontal directions. The results show that the torsional behaviour of isolator has negligible effect on the torsional response of the building under bi-directional ground motions.

Keywords: Unbonded fiber reinforced elastomeric isolators, Finite element simulations, Linear time history analyses, Bi-directional ground motions