**Grant Number**: NA

**Sponsor: NA**

**Project title**: Earthquake resistance of high-rise buildings using LRB isolators and VE dampers

**Abstract**: Seismic induced waves resulting in ground activity may at times cause significant damage to buildings, especially high-rise structures if not protected against. There are a number of solutions used to counter the effects of seismic activity to structures and buildings such as dampers and seismic isolators. This project investigates high-rise structures using FEA software and time-history analysis with seismic loads applied. A hybrid seismic prevention system composed of LRB isolators combined with VE dampers is numerically analysed using finite element software such as ETABS to allow for a comprehensive critical analysis.

Each seismic device is examined to see both its improvement on seismic activity reduction and percentage decrease in storey displacement and storey shear force. The improvement in storey displacement of each floor is investigated within the high-rise structure finding the effectiveness of each seismic system including the hybrid seismic system, as well as the viability of using such seismic devices within high-rise structure.

Seismic performance of the hybrid seismic system proved to be encouraging, significantly reducing storey displacement in comparison to a building with no seismic device. Storey displacement reduction was identified as 60-70%, demonstrating a system combining LRB isolators and VE dampers extremely beneficial. Storey shear force reduction likewise was revealed to reach a level of 66-78%, considerable in terms of seismic device performance.

**Dataset description:** The dataset archived relates to the seismic analysis of a constructed model on FEA software. ETABS 2018 was used to conduct seismic analysis on the modelled structure using a Windows 10 machine. Results were exported in PDF format directly from ETABS. Microsoft Excel was then used to further analyse the obtained results, seen within the excel documents within the archive.

The following files have been archived:

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| **Data Files** | |
| RSN5823\_Mex.zip | Earthquake data from the PEER Ground Motion Database, Berkeley for the El Mayor-Cucapah Earthquake, including displacement, velocity and acceleration files. |
| RSN4460\_Ita.zip | Earthquake data from the PEER Ground Motion Database, Berkeley for the L’Aquila Earthquake, including displacement, velocity and acceleration files. |
| ETABS Models.zip | Zipped files of all the high-rise structures modelled on ETABS. There are 4 particular models, one with no seismic device, one with a VE damper only, one with LRB base isolator and one with both seismic devices installed. Each model has a further 2 copies, for each earthquake analysed (El Mayor-Cucapah Earthquake & L’Aquila Earthquake) |
| Mexico\_VE Only.pdf | ETABS summary report of structural analysis of the high-rise building with VE damper installed using El Mayor-Cucapah Earthquake data |
| Mexico\_No Device.pdf | ETABS summary report of structural analysis of the high-rise building with no seismic devices installed using El Mayor-Cucapah Earthquake data |
| Mexico\_LRB Only.pdf | ETABS summary report of structural analysis of the high-rise building with LRB base isolator installed using El Mayor-Cucapah Earthquake data |
| Mexico\_Both.pdf | ETABS summary report of structural analysis of the high-rise building with both the VE damper and LRB base isolator installed using El Mayor-Cucapah Earthquake data |
| Italy\_VE Only.pdf | ETABS summary report of structural analysis of the high-rise building with VE damper installed using L’Aquila Earthquake data |
| Italy\_No Device.pdf | ETABS summary report of structural analysis of the high-rise building with no seismic devices installed using L’Aquila Earthquake data |
| Italy\_LRB Only.pdf | ETABS summary report of structural analysis of the high-rise building with LRB base isolator installed using L’Aquila Earthquake data |
| Italy\_Both.pdf | ETABS summary report of structural analysis of the high-rise building with both the VE damper and LRB base isolator installed using L’Aquila Earthquake data |
| Periods of Buildings.txt | Text file of period values of the different modelled structures obtained from ETABs |
| Storey Force Results.xlsx | Excel sheet of obtained storey force results from ETABS structural analysis |
| Building Parameters Edited Results Displacement.xlsx | Excel sheet of obtained storey displacement results from ETABS structural analysis |

**Publications**: Earthquake resistance of high-rise buildings using LRB isolators and VE dampers