ANALYTICAL STUDY ON THE SEISMIC RESPONSE OF BASE ISOLATION SYSTEM

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Base isolation is one of the most widely accepted seismic protection system used in building in earthquake prone areas. Seismic isolation is the separation of the building (or any other type of structure) from the harmful motions of the ground by providing flexibility and energy dissipation capability through the insertion of the so-called isolators between the foundation and the superstructure. The aim of this study is to reduce the base shear and story drifts due to earthquake ground excitation, applied to the structure of the building by installing base isolation devices at the foundation level and then to compare the different performance between the fixed base condition and base-isolated condition by using sap2000 software.

In this study 4 and 8 story symmetrical steel frame building is used as test model and simple concave friction bearing is used as isolation system. Nonlinear time history analysis is used on both of fixed base condition and base isolation (Fps) condition, and the comparative study of performance by three different time histories Northridge, mexico, chichi. Finally base shear, Relative drifts and Absolute acceleration are compare from 3 time histories analysis between fixed base condition and base isolated condition.

For the purpose of the present study two steel frame buildings,4 and 8 stories has been considered and modeled in SAP 2000 v14.2.4 software. The plan of the two buildings is symmetric about both X-axis and Y-axis. Buildings are having 4 bays and the distance of all bays is 4m. The overall plan dimensions are 16 m x 16 m measured from the central axis of the columns. The height of all floors is 3.2m and total height of 4-story building is 12.8 m and 8-story building is 25.6m. Stress ratio limit has been considered 1.05. and framing type and seismic zone have been considered ordinary MRF and zone4. Slab has been modeled as rigid floor diaphragm. Nonlinearity has been considered in each beam by providing M3 plastic hinges at both ends. Table 6-7 of FEMA 356 has been used for calculation of hinge properties. Nonlinearity has been considered in each column by providing P-M2-M3 plastic hinges at both ends of the column. To model the non-linear force-deformation behavior of the isolation system through the bilinear hysteresis loop, three parameters are very important namely (i) elastic stiffness, K1 (ii) post-yield stiffness, K2 (iii) characteristic strength, Q. (Naeim and Kelly, 1999). The characteristic strength, Q is related to the coefficient of friction of the sliding type of isolation system (Matsagar and Jangid, 2004).

Three earthquake far fault ground motion records are considered in the present analysis to study the dynamic behavior of the base-isolated building model. Acceleration are compatible to 0.35g. Base shear is shown in Figure 1 and Figure 2. Result shows base shear is reduced by 50% on average in 4-story and base shear is reduced by 70% on average in 8-story.

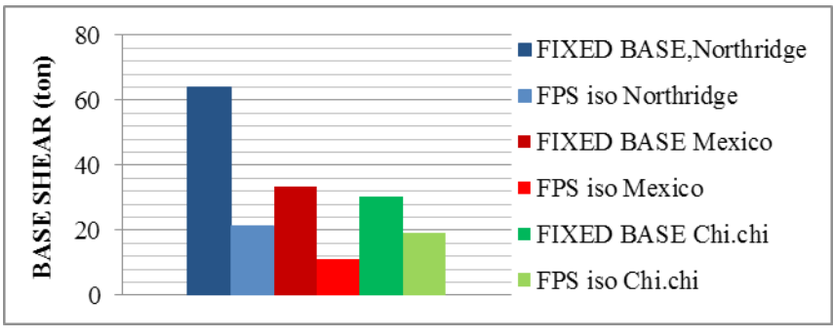

Figure 1. Base Shear in 4-story (ton)

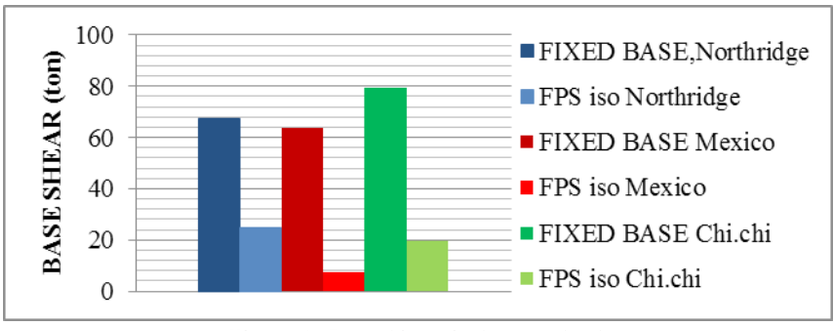

Figure 2. Base Shear in 8-story (ton)

REFERENCES

FEMA 273/274, NEHRP (1997) Guidelines for the seismic rehabilitation of buildings, Federal Emergency Management Agency

Matsagar VA and Jangid RS (2004) Influence of isolator characteristics on the response of base-isolated structures, *Engineering Structures,* 26, 1735-1749

Naeim F and Kelly JM (1999) Design of seismic isolated structures from theory to practice, John Willey and sons, Inc., NY