SEISMIC ASSESSMENT DEMAND OF ISOLATED BUILDINGS

Youcef MEHANI
Senior Researcher, CGS, Algiers, Algeria
Mehani_youcef@yahoo.com

Abdelkader BENYOUCEF
Assistant Researcher, CGS, Algiers, Algeria
abenyoucef@cgs-dz.org

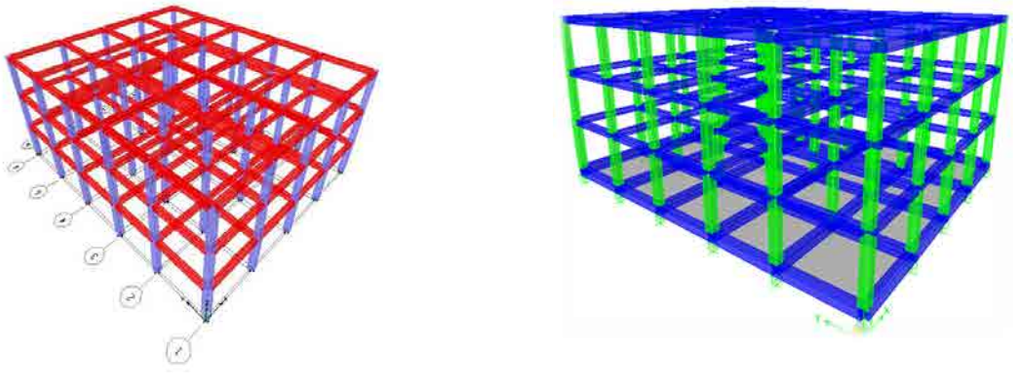
Keywords: Isolation, Seismic Demand, Capacity, Spectrum Method, Nonlinear Static Behavior

Nowadays, the seismic isolation system of structures is well known; it is possible that we can offer high security and protection from damage to the structure during the earthquake than an embedded system. The technology of the seismic isolation makes possible to convert weak and vulnerable buildings to resistant and insensitive buildings to earthquakes by reducing the transfer of the effect of the ground motion to the building without interruption of its functional operations.

This work aims to clarify the nonlinear static behavior of the structures with and without the seismic isolation system and the influence of these systems in the mitigation of seismic risk and seismic demands.

The objective of the first stage is to evaluate the seismic demands of reinforced concrete buildings with and without the isolation systems with the capacity spectrum method detailed in the Applied Technology Council "ATC40" (using the damping approach). In the second stage, a comparative study was made in order to quantify the influence of the isolators on the seismic demands.

A medium height building of three stories has been selected in order to understand the analysis and design of base isolators. Chosen building is regular in plan and elevation, to reduce computation efforts. Figure1 shows the 3D view of the same building with fixed and isolated base. The building is symmetric with respect to both horizontal directions. Transversal (Y-direction) is 19.6 m and longitudinal (X-direction) is 12.4 m. The story height is 3m and the thickness of the floor is 15cm for all stories.

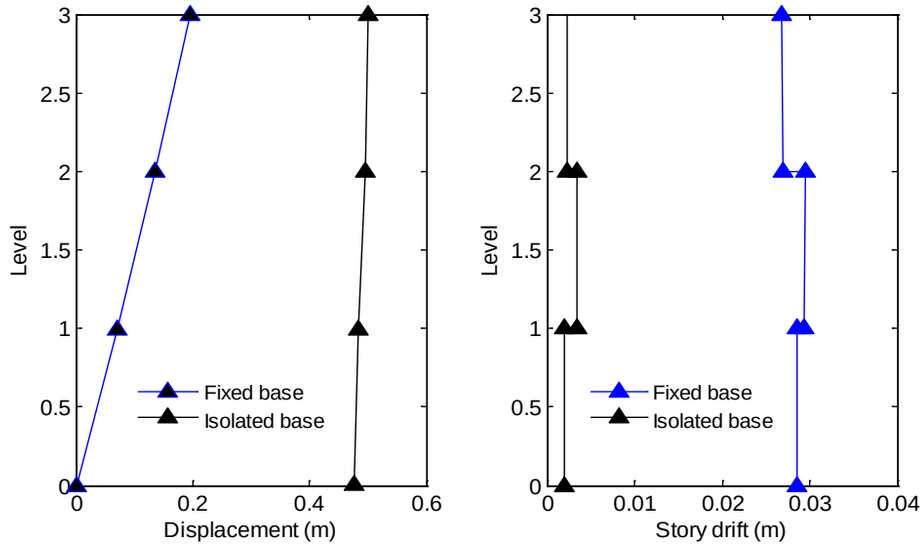


(a) Fixed base building (b) Isolated base building

Figure 1. General view of the analysed buildings (fixed and isolated base)

As mentioned earlier, the advantage of base isolation is lengthening time period for base isolated building compared to fixed base one. Therefore, initially fixed base building was modelled using the program ETABS 9.07. For fixed base building, the translations and rotations of all columns node at base were suppressed. A free vibration analysis was carried out for eigen-vectors solutions in order to get fundamental time period and mode shapes of the building. To provide more information about the performance of the structures, plastic hinge patterns were investigated. The nonlinear behavior of

beams and columns was modelled with plastic hinges at the elements ends (concentrated plasticity model) of M3 type and of PM2M3 type, respectively (ATC-40). The displacements and story drift for fixed and isolated base were obtained and compared. It has been observed that the displacement at roof of isolated base building was less compared to the fixed base building. However, because of flexibility at base the displacement at base is higher in isolated base building compared to the fixed base building. This can also be well understood by calculating the story drift for fixed base and isolated base building. It has been observed also that the story drift in isolated base building is less compared to the fixed base building. The figure 2 below shows displacements and the story drifts for isolated base building with LRB system compared with fixed base building. Figures 3 and 4 show the performance point of the two kinds of structures.



(a) Absolute displacement (b) Story drift.

Figure 2. Absolute displacement and storey drift of fixed base and base isolated buildings

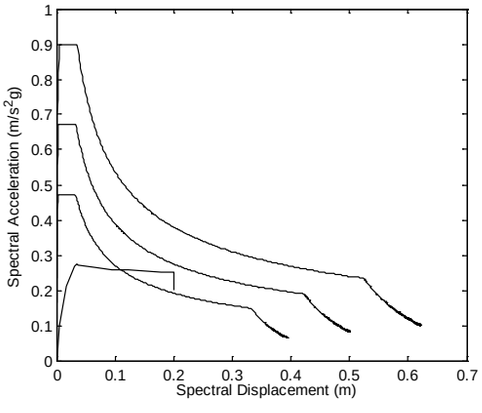


Figure 3. Evaluation of performance point of the fixed structure

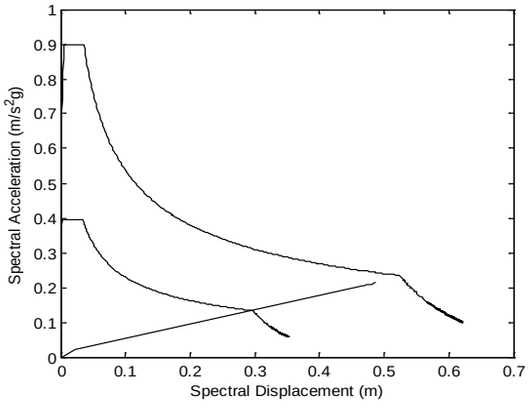


Figure 4. Evaluation of performance point of the base isolated structure

REFERENCES

Ibarra LF and Krawinkler H (2005) Global collapse of frame structures under seismic excitations, *Pacific Earthquake Engineering Research Center*

Lin YY and Chang KC (2003) An Improved Capacity Spectrum Method for ATC-40, *Earthquake Engineering & Structural Dynamics*, 32(13): 2013-2025

Naeim F (1999) Design of seismic isolated structures: from theory to practice, John Wiley & Sons

Torunbalci N and Ozpalanlar G (2008) Earthquake Response Analysis of Mid-story Buildings Isolated with Various Seismic Isolation Techniques, *14th World Conference on Earthquake Engineering*, Beijing, China (pp. 12-17)