COST/BENEFIT ANALYSIS OF BASE ISOLATED STRUCTURES: THE ROLE OF STRUCTURAL CONFIGURATION

Alberto DUSI
Director (M.Sc. Civ. Eng), Numeria Consulting Engineers Srl, Cremona, Italy
dusi@numeria-eng.it

Marco MEZZI
Professor, Dept. of Civil and Environmental Engineering, University of Perugia, Perugia, Italy
marco.mezzi@unipg.it

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Seismic (or base) isolation is a design technique that reduces the force demand on structures by isolating them from the damaging effect of the ground motion. It functions primarily by lengthening the period of the structure. This approach contrasts with conventional design schemes that rely on inelastic action of various structural elements to dissipate earthquake energy. The isolation alternative reduces the force demand on the structure and thereby limits inelastic deformation; it provides a level of performance well beyond the normal code requirements with potential for substantial life-cycle cost reduction (Naeim and Kelly, 1999).

There has been much emphasis on the suitability of base isolation for critically important structures such as hospitals or schools. For such buildings where protection of contents is critical, either because of their value or because of the need to maintain serviceability after an earthquake, seismic isolation has been proven to be an attractive option both technically and economically, (Dusi et al., 2007), (Castellano et al., 2007), (Gavin and Wilkinson, 2010).

However, in addition to the abovementioned benefits, and as far as the mere structural aspects are concerned, significant cost savings can be achieved in base isolated buildings thanks to a structural configuration that fully exploit the advantages offered by seismic isolation leading to either a new layout of the superstructure resisting elements with less ductile detailing and to a simpler and more economic foundation scheme with respect to the original fixed-based structure. This can easily be achieved provided that, starting from the conceptual design phase, the structural engineer experienced in base isolation works jointly with the team drafting the initial building layout.

The present paper, based on the authors' direct experience, reports on a comparative design of multi-storey reinforced concrete structures for hospital, schools and residential buildings and in their conventional and base isolated configurations.

The importance of the definition of conceptually new structural configuration and morphology in the design of the base isolated solution is presented and discussed; emphasis is placed on the structural configuration modifications that has been adopted, from the conventionally designed option, in the base isolated design in order to maximize the effectiveness of the base isolated solution from either the seismic performance enhancements and the economic points of view.

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