



Re-centring Capability Evaluation of Seismic Isolation Systems

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Summary

It was not until the most recent years that re-centring capability was identified as a fundamental function of an isolation system. The purpose of the re-centring capability requirement is not so much that of limiting residual displacement at the end of a seismic attack, as instead that of preventing cumulative displacements during the seismic event. During the last quarter of the past century energy dissipation has increasingly gained the favour of the design engineers to mitigate the disastrous effects of a seismic attack. However, energy dissipation and re-centring capability are two antithetic functions. Present Norms do not furnish an acceptable approach of general validity to evaluate the re-centring capability of seismic isolation systems. This author developed a theoretical approach to this problem, suggesting an energy-based criterion for its quantification. The scope of the presentation is precisely that of introducing the newly proposed criterion.

Keywords: Re-centring, self-centring, restoring force, seismic isolation systems.

1. Introduction

The idea of protecting structures through decoupling them from the disastrous ground motion generated during seismic attacks is certainly an old one. However, in order to witness the first practical applications of seismic isolation it was necessary to wait until the last quarter of the 20th century.

It goes without saying that, besides *transmitting vertical loads*, a seismic isolation system must *permit free relative movements* on the horizontal plane between foundation and superstructure, precisely to ensure decoupling between the soil and the predominant structural mass (e.g.: the bridge deck in cases concerning bridge structures).

Even though the principles of Physics that govern the effects of energy dissipation on the control of dynamic phenomena were studied more than two and a half centuries ago (*D'Alembert, Traité de dynamique, 1743*), it took some time before *energy dissipation* came to be identified as the most important instrument in the hands of the design engineer to adequately control seismic response in terms of forces and displacements between super- and sub-structure.

Furthermore, it was not until the most recent years that a fourth fundamental function, *re-centring capability*, was identified, as well as have it listed amongst the fundamental functions of a seismic isolation system. This tardy occurrence can perhaps be explained by the fact that, historically, the first seismic isolators were conventional laminated rubber bearings – which are endowed with a good re-centring capability owing to the elastic restoring force developed when the same undergo shear deformation.