

The damped cable system for seismic protection of frame structures - Part I: General concepts, testing and modeling

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Abstract

Research studies on the damped cable system (DCS) for seismic protection of frame structures are presented in this paper and the accompanying one. This technology includes prestressed steel cables linked to pressurized fluid viscous spring-dampers fixed to the foundation at their lower ends, and to the top floor, or one of the upper floors, at their upper ends. The cables have sliding contacts with the floor slabs, to which they are joined by steel deviators. The general characteristics of the system, as well as of the constituting spring-dampers and cables, are initially discussed. The results of a laboratory testing campaign developed on a DCS prototype are examined, and transferred into the formulation of the finite element model of the system, conceived to be easily generated by commercial structural analysis programs. A second dynamic experimental investigation follows, concerning a pilot installation of the system on a full-scale mock-up building. The benefits of the protective technology are evaluated in terms of maximum displacements and accelerations, as well as of equivalent viscous damping coefficient and MDOF transmissibility ratio. Further sections of the study, including a preliminary sizing criterion of DCS, additional numerical enquiries aimed at optimizing its geometrical layout, and the application to a real case study building, are offered in the companion paper. © 2011 John Wiley & Sons, Ltd.