VISCOUS DISSIPATIVE, DUCTILITY-BASED AND ELASTIC BRACING DESIGN SOLUTIONS FOR AN INDOOR SPORTS STEEL BUILDING

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ABSTRACT: Three bracing solutions are developed for an indoor sports facility representative of the most recent architectural design trends for recreational and commercial steel buildings. A viscous-dissipative bracing system incorporating pressurized fluid viscous spring-dampers is assumed as anti-seismic technology for the first solution. Thanks to the protective capacities of this technology, non-structural and structural operational performance levels are pursued for the building up to the maximum considered design earthquake level. A traditional concentric X-shaped configuration is selected for the second and third solution, which differ from each other in the design strategy adopted. In the first case, a ductility-based solution is chosen, by adopting a basic behaviour factor equal to 4, reduced by 20% to take into account the structural irregularity caused by the eccentric position of the intermediate floor of the building. In the second case, the same performance objectives as originally formulated for the viscous-dissipative design hypothesis are assumed, fixing the behaviour factor at 1. The resulting dimensions of the members, and the total weight and cost of the steel structure are compared for the three layouts. A substantially higher seismic performance at all normative design levels at a comparable cost; and a cut in the cost by about 50%, with an improved look of the structure due to the remarkably greater slenderness of the constituting members, come out for the viscous-dissipative bracing design as compared to the ductility-based and elastic X-bracing solutions, respectively.

Keywords: Steel structures, Seismic protection, Fluid viscous dissipative bracing, Damping, Concentric bracing, Ductility-based design, Elastic design