Development of divergent fluid wall damper for steel-framed structures subjected to dynamic load

ABSTRACT

This article presents the development of new adjustable and adaptive designs of divergent fluid wall dampers (DFWDs) that can diminish the effect of earthquakes on framed structures. The concept and mechanism of DFWDs is based on the bypass system, which is made by controlling the fluid flow inside the wall damper container using bypass pipes and by controlling the fluid pressure through a double-acting valve. The prototype of the DFWD device is fabricated based on a developed design, and the performance of the DFWD installed in steel frames is evaluated through experimental tests. For this purpose, three steel frames with the same geometric specifications are casted and tested in equal conditions, which include bare frame (BF), braced frame (BrF), and frame equipped with DFWD. All specimens are subjected to dynamic cyclic load and the response of the DFWD is evaluated when the valves are 100% open, 50% open, and 100% closed in comparison with the BF and BrF system to assess the performance of the DFWD in various conditions. The results indicate that the frame furnished with the DFWD in all conditions of fully open, half-open, and fully closed valves were able to absorb and dissipate more force than the BF by almost 28%, 53%, and 73%, respectively.

Keyword: Passive control; Damper device; Viscous wall damper; Earthquake