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Experimental Study on Two Full Scale Iranian Viscous Dampers

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Abstract

This study is devoted to investigate behavior of two 200 kN and 250 kN full-scale viscous dampers with a novel design manufactured by an Iranian company, Behsazan Larzeh Davam. Details of the damper differ with the currently available commercial viscous dampers such that it includes a cylinder with extremely smoothed inner face fully filled with a viscous fluid, a piston, a shaft and a flexible high pressure hose as an external orifice for viscous fluid passing through. Both dampers have been tested under seismic excitations and harmonic loads with different frequencies and amplitudes and both of them have shown very stable cyclic behaviors under all imposed dynamic loads. 8 months after the tests, the 250 kN damper was again tested using similar protocols to investigate its long-term behavior. Obtained results from the second phase test indicated no degradation in the behavior of the damper even after 8 months with no maintenance. Using both simplified link elements and sophisticated Computational Fluid Dynamics (CFD), behavior of the dampers are numerically evaluated and compared to the experimental results. Obtained results indicated that even the most advanced technologies in the field of earthquake resisting design can be successfully manufactured by domestic companies.

Keywords: viscous damper, passive control, energy dissipating device, damper, experimental study, structural dynamics

Introduction

Different passive energy dissipating devices have been experimentally and numerically investigated by different researchers during the last three decades and it is now well known that all of the above mentioned dampers are effective in mitigating seismic-induced vibrations. Comprehensive review of performance of different dampers can be found in Soong and Dargush (1997) and Constantinou et al. (1998). This paper focuses on viscous dampers which can significantly add viscous damping of the structures without altering its lateral stiffness. The pure velocity-dependent nature of the viscous damper is a unique characteristic which cannot be found in other supplemental energy dissipating devices. This feature makes the viscous damper a versatile option from architectural point of view. For example, there