

## **Experimental Verification and Analysis on Seismic Proof Performance of Velocity and Displacement Dependent Hydraulic Damper (VDHD)**

Wen-Pei Sung \*, Ming-Hsiang Shih \*\*, Darius Bacinskas \*\*\* and Gintaris Kaklauskas \*\*\*

\* Department of Landscape Architecture, National Chin-Yi University, Taichung, 411, Taiwan

\*\* Department of Civil Engineering, National Chi-Nan University, Nan-Tou, 545, Taiwan  
E-mail: [iloveaachen@gmail.com](mailto:iloveaachen@gmail.com)

\*\*\* Department of Bridges and Special Structures, Vilnius Gediminas Technical University, Sauletekio al. 11, LT-10223 Vilnius, LITHUANIA

### **Abstract**

VDHD (Velocity and Displacement Dependent Hydraulic Damper) is a passive energy-dissipating control system. To investigate the seismically proved performance of VDHD, a ten-floor steel structure installed with VDHD is subject to vibration that simulates the Kobe Earthquake excitation to generate a variety of PGA responses for bare building, building installed with VDHD, and building installed with BRB (buckling resistant bracing). Results confirms that energy-dissipating capabilities of VDHD of 1) performing excellent displacement and acceleration control with various ground magnitudes; 2) being an energy absorber to absorb mechanical energy in the structure and resist structural movement; 3) having the advantage of both BRB and viscous dampers.

**Key Words:** Velocity and Displacement Dependent Hydraulic Damper (VDHD), Damping Coefficient, Bare Building, Buckling Resistant Bracing (BRB), Seismic Reduction Performance.

### **1. Introduction**

According to the mechanical manufacturing processes, vibration problems in machinery and structures can be diminished by installing absorber or dampers. Mechanical and Civil engineers have developed various structural control technologies in past forty years to solve the safety and functional problems of structures subjected to external excitation. The structural control [1-3] that is based on the power requirement and control force generation can be classified as: active control, passive control, semi-active control and base-isolation, among the many others [4-5]. The technology utilizes additional external control component installed on the structure to change the dynamic characteristic of the structure, or to provide control force for achieving safety mechanisms under external excitation. The functions of these control systems are essentially producing viscous damping force in order to dissipate the input energy. There are various types of hydraulic dampers that uses oil viscosity to dissipate the dynamic energy for