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Estimation of Hysteretic Damping in Steel Dual Systems with Buckling Restrained Brace and Moment Resisting Frame

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Abstract : Nowadays, using energy dissipation devices has been commonly used in structures. A high rate of energy absorption during earthquakes is the benefit of using such devices, which results in damage reduction of structural elements specifically columns. The hysteretic damping capacity of energy dissipation devices is the key point that it may adversely complicate analysis and design of such structures. This effect may be generally represented by equivalent viscous damping. The equivalent viscous damping may be obtained from the expected hysteretic behavior under the design or maximum considered displacement of a structure. In this paper, the hysteretic damping coefficient of a steel moment resisting frame (MRF), which its performance is enhanced by a buckling restrained brace (BRB) system has been evaluated. Having the foresight of damping fraction between BRB and MRF is inevitable for seismic design procedures like Direct Displacement-Based Design (DDBD) method. This paper presents an approach to calculate the damping fraction for such systems by carrying out the dynamic nonlinear time history analysis (NTHA) under harmonic loading, which is tuned to the natural frequency of the system. Two steel moment frame structures, one equipped with BRB, and the other without BRB are simultaneously studied. The extensive analysis shows that proportion of each system damping fraction may be calculated by its shear story portion. In this way, the contribution of each BRB in the floors and their general contribution in the structural performance may be clearly recognized, in advance.

Keywords : buckling restrained brace, direct displacement based design, dual systems, hysteretic damping, moment resisting frames
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