

Best Combination of Design Parameters for Buildings with Buckling- Restrained Braces

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Abstract : Buildings vulnerability due to seismic activity has been highly studied since the middle of last century. As a solution to the structural and non-structural damage caused by intense ground motions, several seismic energy dissipating devices, such as buckling-restrained braces (BRB), have been proposed. BRB have shown to be effective in concentrating a large portion of the energy transmitted to the structure by the seismic ground motion. A design approach for buildings with BRB elements, which is based on a seismic Displacement-Based formulation, has recently been proposed by the coauthors in this paper. It is a practical and easy design method which simplifies the work of structural engineers. The method is used here for the design of the structure-BRB damper system. The objective of the present study is to extend and apply a methodology to find the best combination of design parameters on multiple-degree-of-freedom (MDOF) structural frame – BRB systems, taking into account simultaneously: 1) initial costs and 2) an adequate engineering demand parameter. The design parameters considered here are: the stiffness ratio ($\alpha = K_{\text{frame}}/K_{\text{total}}$), and the strength ratio ($\gamma = V_{\text{damper}}/V_{\text{total}}$); where K represents structural stiffness and V structural strength; and the subscripts "frame", "damper" and "total" represent: the structure without dampers, the BRB dampers and the total frame-damper system, respectively. The selection of the best combination of design parameters α and γ is based on an initial costs analysis and on the structural dynamic response of the structural frame-damper system. The methodology is applied to a 12-story 5-bay steel building with BRB, which is located on the intermediate soil of Mexico City. It is found the best combination of design parameters α and γ for the building with BRB under study.

Keywords : best combination of design parameters, BRB, buildings with energy dissipating devices, buckling-restrained braces, initial costs

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