Wellington Performance Comparison of Buckling-Restrained Braces and Friction Dampers Adopted for Retrofit of an Existing RC Frame Building Using Performance-Based Retrofit Procedure

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ABSTRACT

This paper presents a performance-based retrofit approach for designing and performance comparison of Buckling -Restrained Braces (BRBs) and Friction Dampers as retrofit strategies for RC frame buildings. An overview of BRBs, friction dampers and a displacement-based retrofit procedure is first presented. A Detailed Seismic Assessment (DSA) is performed on a pre-1970 eight-storey RC case study frame, using a SLaMA (Simple Lateral Mechanism Analysis) method as developed and presented in the NZSEE2016/017 Seismic Assessment Guidelines. The results indicate that the frame is classified as potentially earthquake-prone, showing joint shear failure mechanism with a seismic capacity of 41%NBS (New Building Standard). Last, a displacement-based retrofit of brace systems is implemented by targeting an adequate displacement, depending on the expected failure mechanisms of the existing frame.

BRBs and diagonal concentric braces with friction dampers are adopted as retrofit solutions. After the retrofit, the failure mechanism of the frame is changed and the seismic capacity of the building exceeds 100%NBS. Non-linear time history (NLTH) analyses of the as-built and retrofitted frames are performed using a lumped plasticity model implemented within the finite element software Rūaumoko. Moreover, the performance assessment of the retrofitted and the as-built frames are evaluated using FEMA P-58 procedure and the Expected Annual Losses (EAL) are derived. The results demonstrate the advantages and disadvantages of alternative bracing systems. Furthermore, the outcomes indicate the feasibility and efficiency of the performance-based retrofit design procedure for choosing and designing the appropriate retrofit interventions for concrete frame buildings.