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Performance of Non-Structural Components in Buildings with Controlled Rocking Steel Braced Frames and Buckling Restrained Braced Frames

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Abstract. Controlled rocking steel braced frames (CRSBFs) have shown promise for enhanced structural performance during earthquakes, but in order to assess the true resiliency of this seismic force resisting system, the performance of non-structural building components must also be considered. In this study, the performance of attached and sliding non-structural components in a three-storey CRSBF building is evaluated numerically and compared to the non-structural component performance in a buckling restrained braced frame (BRBF) building. The CRSBF and BRBF were designed to reach similar median peak drifts, allowing for the performance of acceleration-sensitive and sliding non-structural components to be compared between the two systems at a level where the response of drift-sensitive components is expected to be similar. The results show that in the relevant range of natural periods for attached non-structural components, larger peaks in the floor spectra suggest worse performance in the CRSBF building compared to the BRBF, while the analysis of sliding components shows similar performance between the two systems. One of the main structural advantages of using a CRSBF is avoiding plastic deformations in the brace members, but the results of this case study suggest that the trade-off for this structural benefit is larger acceleration demands on attached components when compared to a steel seismic force resisting system with distributed yielding.

Keywords: Controlled Rocking, Self-Centring, Buckling Restrained Braces, Floor Spectra, Attached Components, Sliding Components.

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