

## Improved Analytical Model for Special Concentrically Braced Frame.

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Special Concentrically Braced Frames (SCBFs) are commonly used as the seismic resisting system in buildings. Their inherent strength and stiffness assure serviceable performance during smaller, more frequent earthquakes. Inelastic tensile yield and post-buckling compressive deformations of the brace dominate performance during large seismic events. However, inelastic deformations of the brace place secondary yet significant inelastic deformation demands on beams, columns, and connections (Fig. 1), which significantly affect the seismic performance. These response modes must be included in an analytical model of the system to capture the response. However, conventional practice uses beam-column elements for the brace, to simulate brace buckling, with pin-ended or rigid end connections; these simple assumptions cannot capture the full range of SCBF behavior.

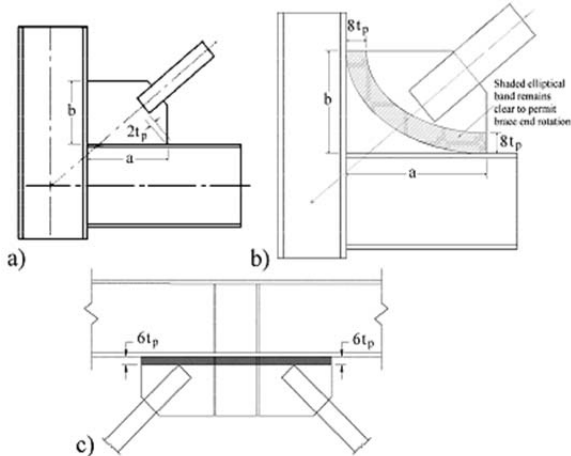


Figure 1. Variations in Gusset Plate Connections

The research was undertaken to develop a modeling approach for SCBFs to more accurately predict their seismic performance. Beam-column elements are used for the braces, beams and columns and these elements include nonlinear geometric effects to simulate brace buckling. A new connection model (Fig. 2) is proposed to simulate the behavior of the gusset plate. The model parameters are based upon the member sizes, properties and connection designs. Simulated results are compared with experimental results and

predictions from approaches more commonly used in practice (Fig. 3). Although the proposed model is a step beyond currently used in design practice, it remains simple in its implementation and is suitable for a wide range of practical applications. The proposed model provides accurate simulation of global behavior, while retaining simplicity and providing reasonable predictions for various local behaviors.

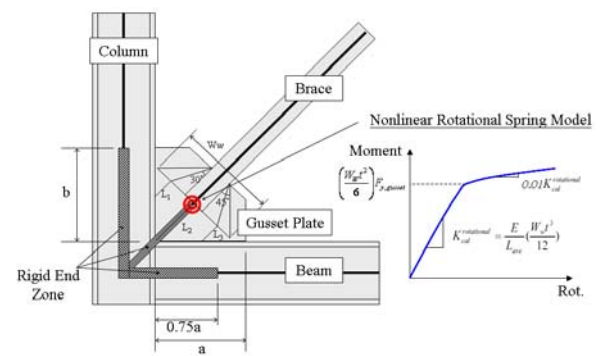


Figure 2. Illustration of the Proposed Connection Model

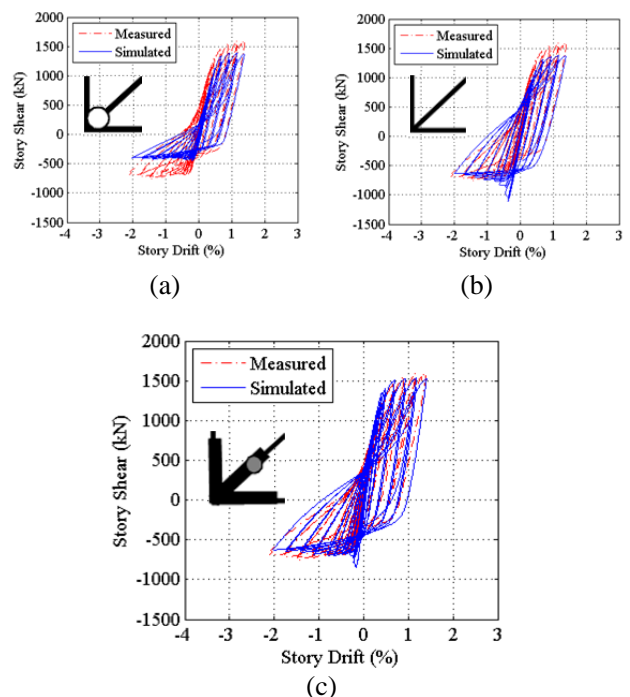


Figure 3. Simulated and Measured Responses of the Single-story Frames (HSS12)