

## Design of Seismically Resistant Tree-Branching Steel Frames Using Theory and Design Guides for Eccentrically Braced Frames

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**Abstract :** The International Building Code (IBC) and the California Building Code (CBC) both recognize four basic types of steel seismic resistant frames; moment frames, concentrically braced frames, shear walls and eccentrically braced frames. Based on specified geometries and detailing, the seismic performance of these steel frames is well understood. In 2011, the authors designed an innovative steel braced frame system with tapering members in the general shape of a branching tree as a seismic retrofit solution to an existing four story "lift-slab" building. Located in the seismically active San Francisco Bay Area of California, a frame of this configuration, not covered by the governing codes, would typically require model or full scale testing to obtain jurisdiction approval. This paper describes how the theories, protocols, and code requirements of eccentrically braced frames (EBFs) were employed to satisfy the 2009 International Building Code (IBC) and the 2010 California Building Code (CBC) for seismically resistant steel frames and permit construction of these nonconforming geometries.

**Keywords :** eccentrically braced frame, lift slab construction, seismic retrofit, shear link, steel design

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