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Design of special truss moment frames with energy Dissipating devices

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Abstract

Structural engineers must find ways to design structure that will survive earthquake ground motion. In this particular case, this research project looked at steel buildings. The Special Truss Moment Frame (STMF) is a relative new type of steel structure system that is implemented in building to help dissipate energy induced by earthquake ground motion. The frames dissipate earthquake energy through ductile special segments located near the mid-span of truss girders. The inelastic behavior of the special segment, limits forces on all element outside the special segment, to the ultimate capacity of the middle (special) segment, thus enabling them to remain elastic buildings. An innovative concept using energy dissipating devices, such as buckling restrained braces (BRB), is proposed for special truss moment frames (STMF). The configuration of the proposed system consists of pins introduced at the ends of the top and bottom chord elements of the special segments. Subsequently energy dissipating devices are used in the form of diagonal braces inside the special segments. The proposed system leads to more predictable seismic response and would potentially allow lighter construction and significant cost savings, due to significantly reduced member forces (up to 50% compared with conventional design). Furthermore, damage to structural elements is largely mitigated, hence allowing damage avoidance design of STMFs

Key words: BRB, Special Truss Moment Frame, Energy dissipating devices

1. Introduction

Structural steel is used extensively for medium and high rise buildings due to its excellent strength and ductility. Steel building structures can be either solid-web girder framing systems or open-web truss framing systems. Two of the most commonly used solid-web systems are concentrically braced frames (CBFs) and moment-resisting frames (MRFs).CBFs offer considerable strength and stiffness, but their energy dissipation and