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Non-Confidential Description - PSU No. 3848
"Improving Seismic Performance by Elastomeric Dampers"

Keywords:

Damping, viscoelastic, elastomeric, hysteresis, friction, seismic, pre-compressed, excitation frequency, temperature

Links:

Inventor Website

US Patent 8,844,205

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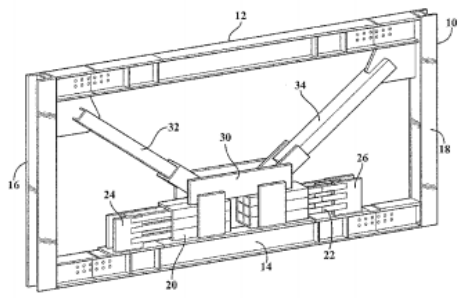

Fig 1: Damper placed in a steel frame

Background

Conventional seismic design of steel frames has resulted in excessive damage and residual drift. Passive damping systems have been shown to improve the seismic performance of buildings by reducing drift and inelastic deformation demands on the members of the primary lateral load resisting system. These dampers also have the ability to reduce the velocity and acceleration demands on non-structural components. However, these dampers have mechanical properties which are sensitive to frequency of loading and temperature that limit their effectiveness.

Invention Description

This invention introduces a second generation elastomeric damper that is constructed using a highly damped compressed butyl blend elastomer. The damper uses a high damping elastomer pre-compressed into steel tubes, called the Ultra High Damped Elastomer Tube (UHDET), consisting of an inner steel tube, outer steel tube, elastomeric material, and thin steel plates. The damper contains layers of elastomer with two different thicknesses that provide a slip and non-slip layer, energy dissipation, and stiffness. The slip in the thinner elastomeric layer causes energy dissipation to occur by friction, while also limiting the maximum force developed in the damper. The thicker layer provides stiffness to control drift of the structure and reduce residual deformation in the damper due to the slip. As the excitation frequency and ambient temperature increase, the damper becomes stiffer and dissipates more energy, making it more effective than traditional designs.

Advantages / Applications

- Uses a high damping elastomer pre-compressed into steel tubes
- Damper becomes stiffer and dissipates more energy with increasing temperature and excitation frequency
- Layers of elastomer provide slip and non-slip layers
- Thin elastomeric layer causes energy dissipation
- Thick elastomeric layer provides stiffness to control drift and residual deformation

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