Spectral evaluation of high force-volume lead dampers for structural response reduction

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Problem:

Existing extrusion based energy absorbers are designed for applications, such as base isolation, that do not allow placement into structural connections or other novel applications.

Solution:

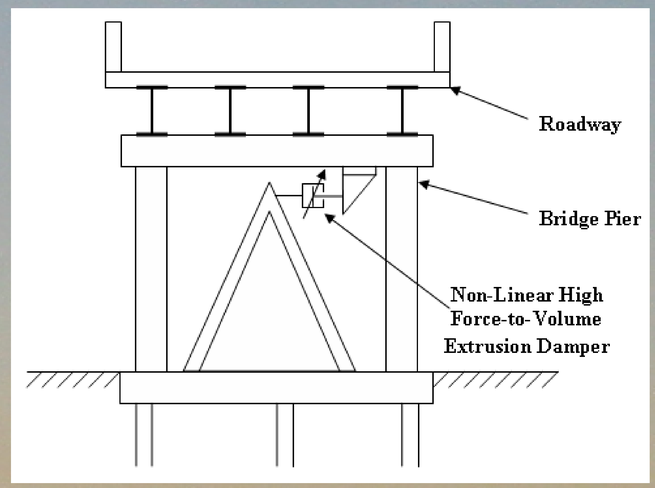
A compact, high force-to-volume lead extrusion damper with:

- **High force capacity - high energy dissipation**
- **Small device volume extends applications**
- **Optimal "Square" Hysteresis Loop**
  - **maximum energy dissipation per cycle**

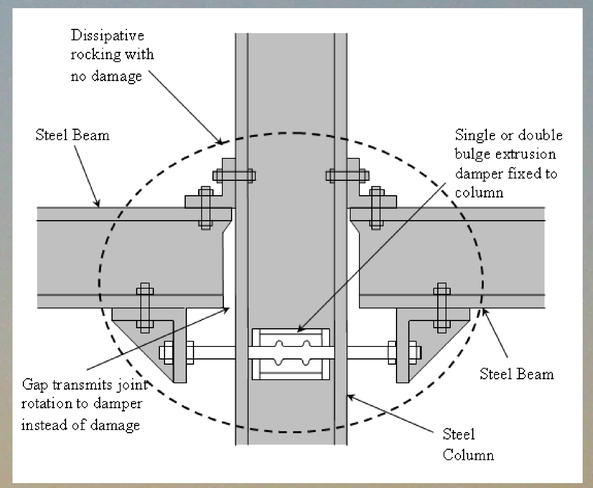
Main Features:

- **Up to 500kN resistive force (limited by shaft)**
- **"Square" Hysteresis Loop**
- **Compact – 100mm diameter, 300mm length**
- **High Force/Volume Ratio vs others**
- **Full Scale Prototypes**

Bridge Piers



Steel Joint

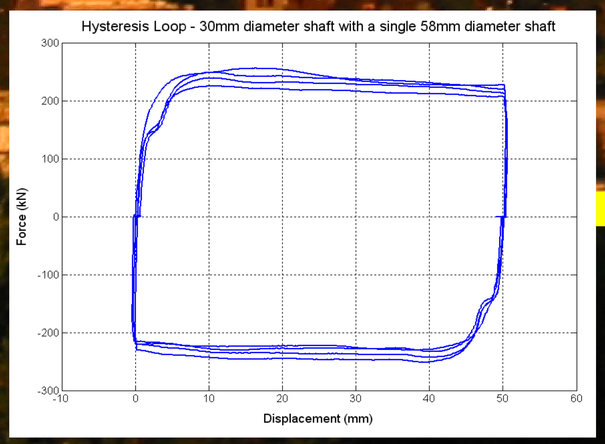


Design Equations:

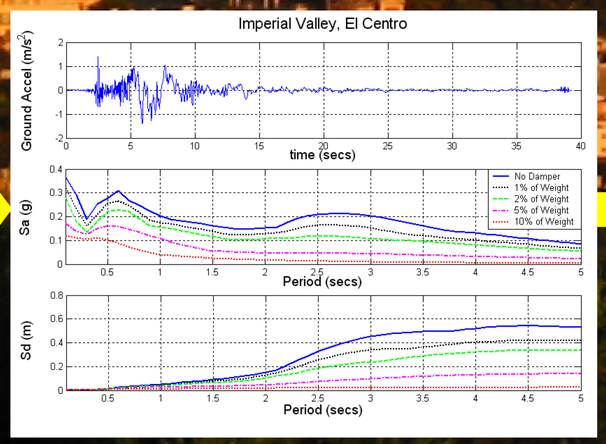
$B_a = 1 + 5.8\varepsilon \quad (T < 0.4 \text{ sec})$

$B_v = 1 + (8.72T + 1.44)\varepsilon \quad (0.4 \le T < 3.0)$

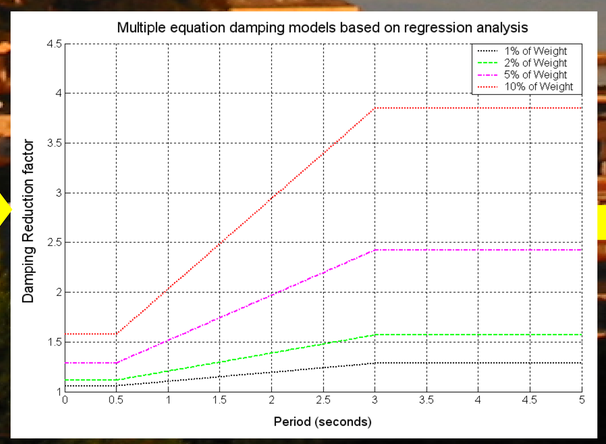
$B_d = 1 + 27.6\varepsilon \quad (T \ge 3.0 \text{ sec})$



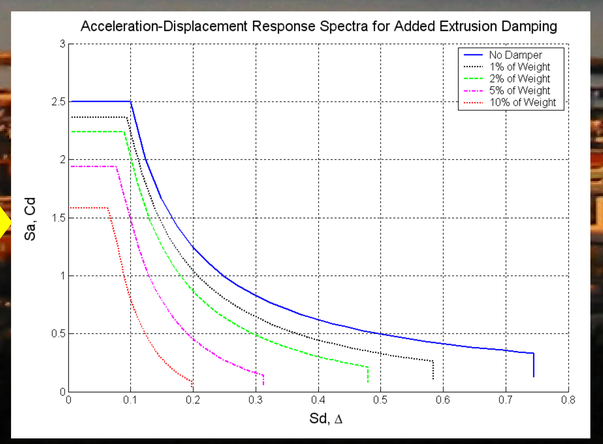
Prototype Hysteresis Loop



Response Spectra



Reduction Factors



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