Taylor Devices Incorporated

- Taylor Device is the leading producer of FVD devices in the world
- FVD (TMD, SI and LUD) provide the following **benefits**
- FVD reduce both **stress and deflection** in structures during a seismic event,
- Quality system is the same for **ALL** products weather military, aerospace or seismic
- **ALL** FVD are tested to capacity prior to shipment
- Relatively small size, self-contained **predictable** at all times compatible to commercially available modeling software
- Produced in forces of 10 mt to 800 mt, displacements to plus or minus 1.2 meters
- Stable, predictable performance at **any** temperature
- **Long life**, **No maintenance**, **35 year warranty**

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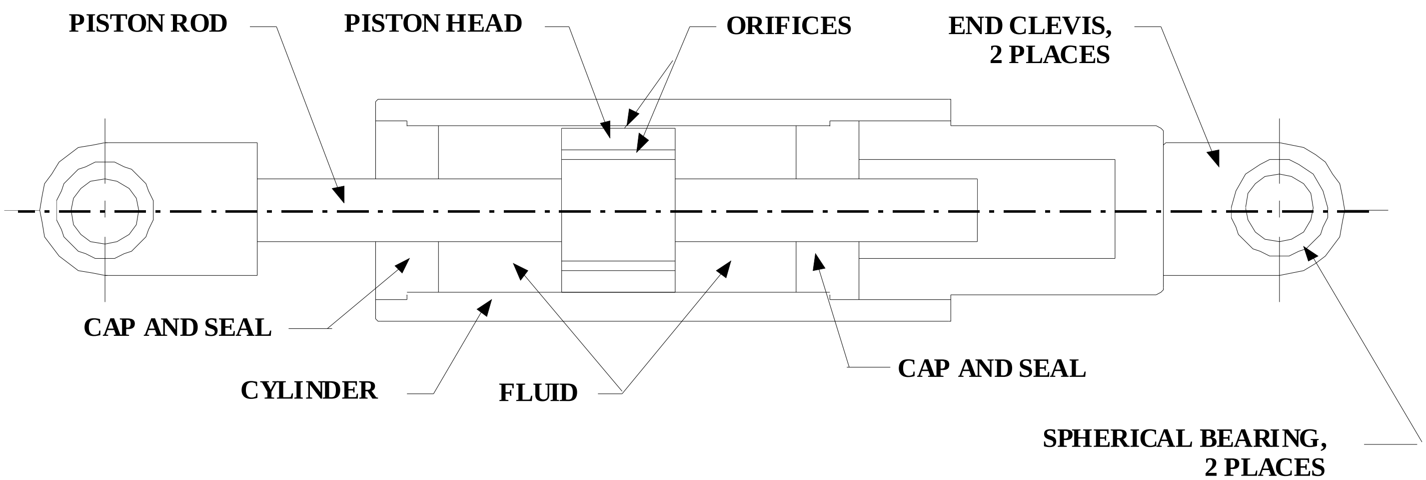
Cutaway Drawing – FVD, LUD, TMD, Shock Isolators



- Chambers with silicon fluid (wide range of temp according to specs) no fill plugs
- High Strength stainless Steel Piston Rod lapped proprietary design
- Patented seal constructed out of polymer /Teflon (not age sensitive) do not require lubrication and can sit for year without leaking
- Special proprietary piston using bi-metal components that allow expansion and contraction at different temperature than the cylinder and special machined orifices
- Typical can see internal pressures up too 20,000 psi or greater

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Recent Projects in Canada

Deh Cho Bridge in the Northwest Territories Lock Up Devices for Wind and Seismic

Port Mann Bridge in BC Fluid Viscous Dampers

BC Place Seismic Retrofit

Welland Canal Shock Isolation

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Recent Projects in Canada

Pedestrian Bridge over the QEW in Hamilton, Ontario
TMD used to reduce pedestrian induced vibrations.

Alexandra Bridge in Ottawa
TMD used to reduce pedestrian induced vibrations.

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Recent Bridge Projects for 2011

Tiangjin Qinghuangdao Bridge, CHINA, Beijing

New railway bridge use Lock-up Devices to control bridge deck movement during seismic events 50 LUD

Tonglou Interchange, TAIWAN, Taipei,

Retrofit of a Highway Interchange uses lock-up devices to control longitudinal movement in earthquake, while allowing free thermal movement 24 FVD

Nangang ditch 3rd Bridge, SOUTH KOREA, Hamyang

Seismic retrofit fo a 530 m multi-span PSC box girder bridge using 8 FVD.

Xiazhang Bridge CHINA, Xiamen

Cable-stayed bridge uses dampers between bridge deck and piers to control movements caused by earthquakes 16 FVD

Chung-An Pedestrian Bridge, Taiwan/Taipei

New Pedestrian bridge project uses dampers to reduce wind movement using 4 FVD

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Recent Bridge Projects for 2011

Beijing Fuchengmen Bridge, CHINA, Beijing

Retrofit of elevated highway bridge uses dampers to control vibration due to vehicle and earthquake using 20 FVD

Henley Street Bridge, USA, Knoxville, TN

Demolition and replacement of the 1,793 foot bridge deck and the vertical, concrete supports above the arches, addition of a sixth land to 79 year old span across Fort Loundoun Lake, Seismic protection provided using 8 FVD

Moonam Bridge, SOUTH KOREA, Goseong

Seismic retrofit for a 120 m multi-span PSC beam bridge using 4 FVD

New Janghowon Bridge, SOUTH KOREA, Eumseong,

Seismic retrofit of a 240 m multi-span PSC beam bridge using 8 FVD.

Fujian Wulongjiang Bridge, CHINA, Fujian,

Lock-up Devices used to control seismic movement while allowing free thermal movement 4 LUD

These bridge projects are part of the 41 Seismic, Wind, Vibration and Shock Isolation Projects presently in construction at Taylor Devices

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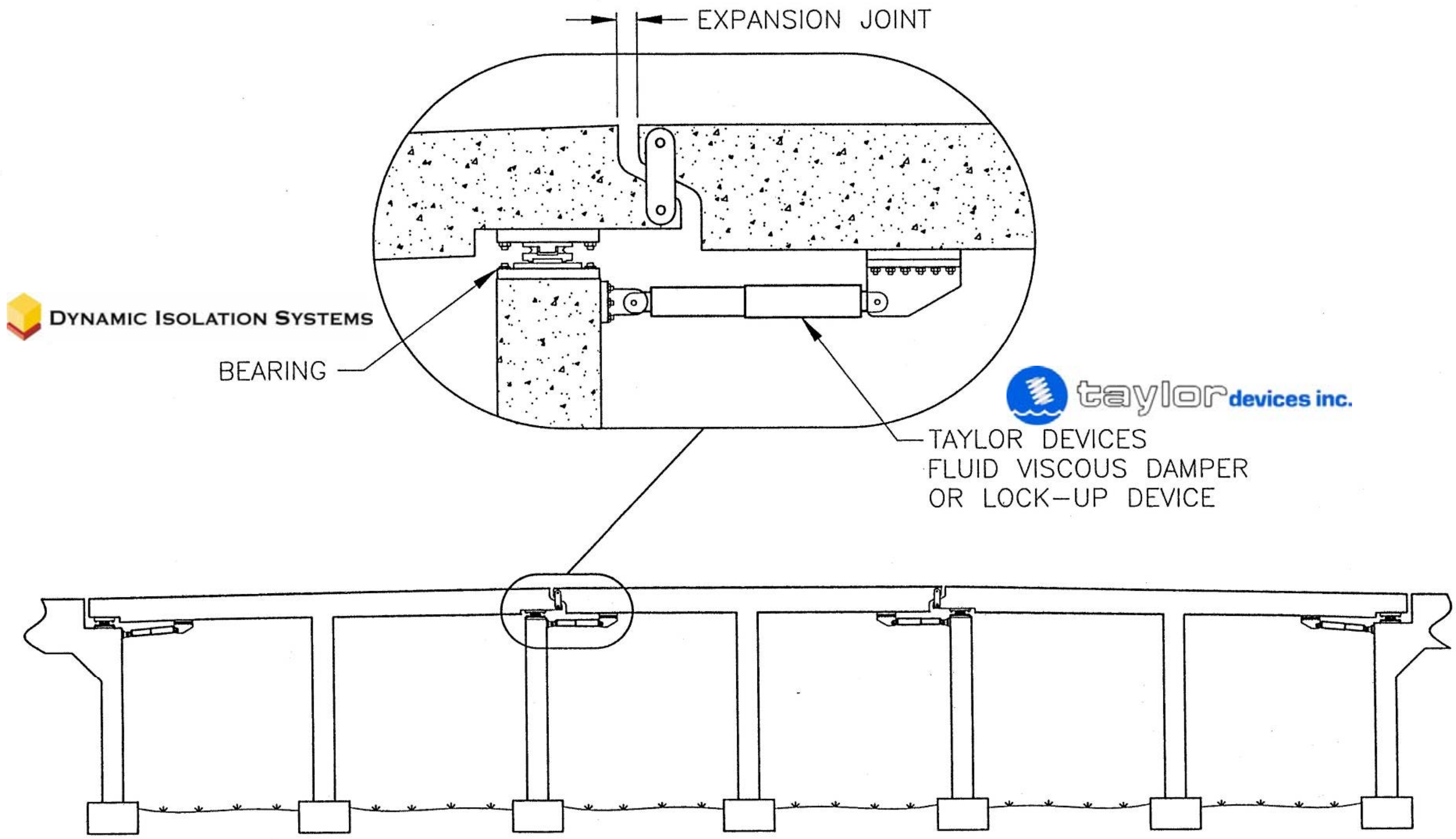
Typical Bridge Installation Detail



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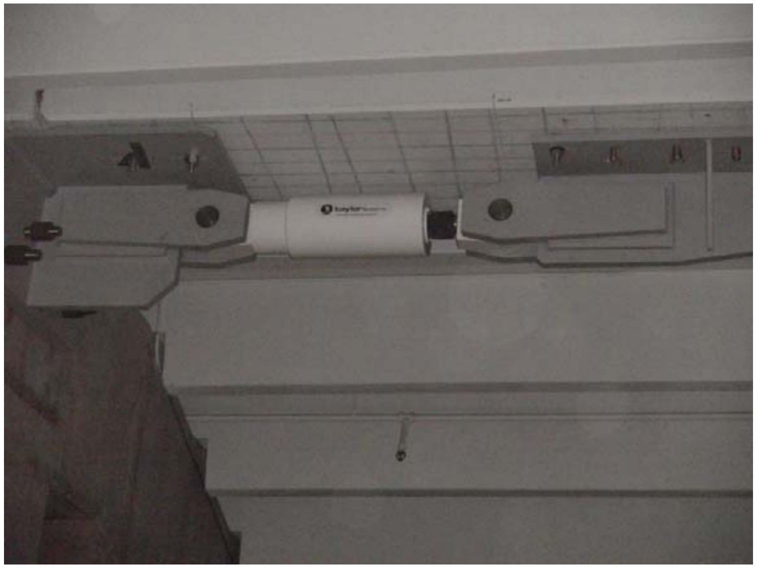
BC Place in Vancouver Canada



San Francisco East Bay

San Francisco, CA

Interim retrofit of East Bay 504 truss sections.

Seismic upgrade of West Suspension span

Dampers used to dissipate seismic energy

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San Francisco Bay Bridge

SAN FRANCISCO-OAKLAND
BAY BRIDGE – USA

FVD for Seismic Protection

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Richmond-San Rafael Bridge

San Francisco, CA

Retrofit of a 4.5 mile steel truss bridge designed in the 1950's. Special Fuse-Dampers used to dissipate seismic energy and allow bridge to withstand a maximum credible earthquake.

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Sutong Bridge

Sutong Bridge   Shanghai, China

World's longest cable-stayed bridge uses special spring dampers on the main span to control seismic/wind movements.

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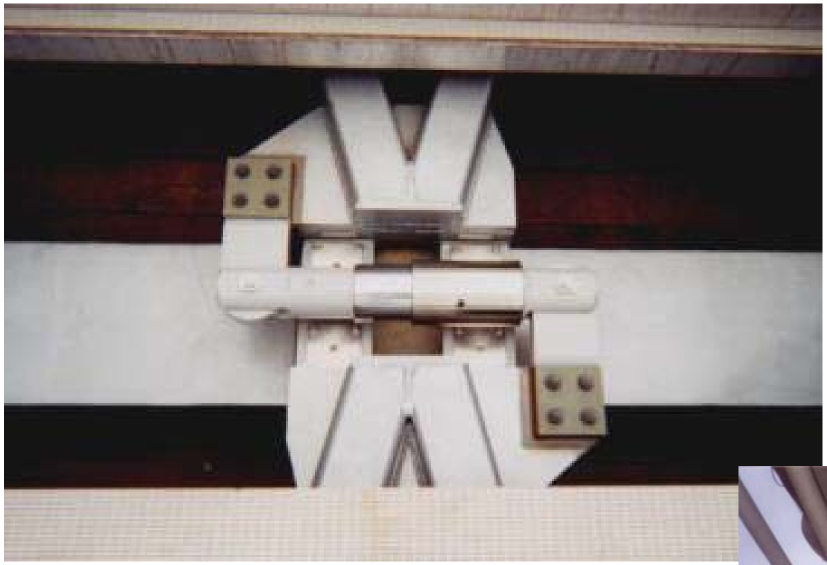
The Millennium Bridge



London, UK

Retrofit of pedestrian bridge to reduce lateral and vertical movements caused by large groups of people walking on the bridge.

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Port Mann Bridge, BC

Seismic Protection using 146 Taylor Device Seismic Dampers from 2200kn to 3500kn with strokes from 55 mm to 418 mm

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Port Mann Bridge, BC

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Typical Tuned Mass Damper
Las Vegas Bridges

CityCenter Project - Pedestrian Bridges

Group of three new pedestrian bridges utilize Taylor tuned mass dampers to reduce pedestrian-induced vibrations.

Spring Mountain Road - Pedestrian Bridges

Group of three new pedestrian bridges utilize Taylor tuned mass dampers to reduce pedestrian-induced vibrations

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Tune Mass Dampers TMD

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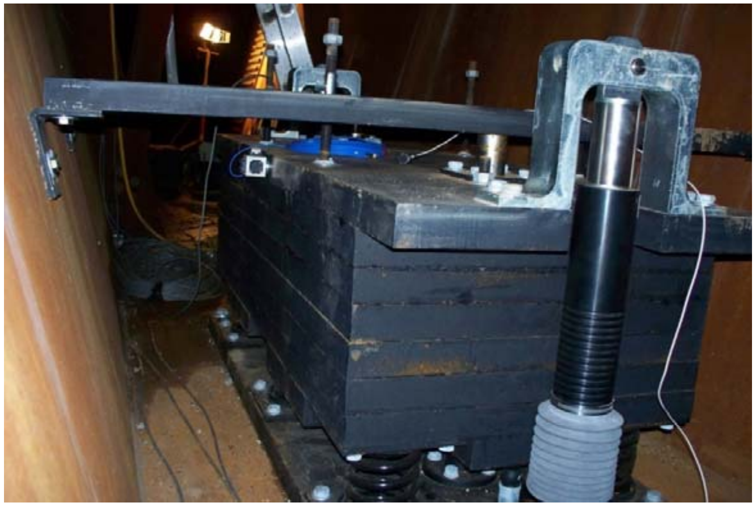
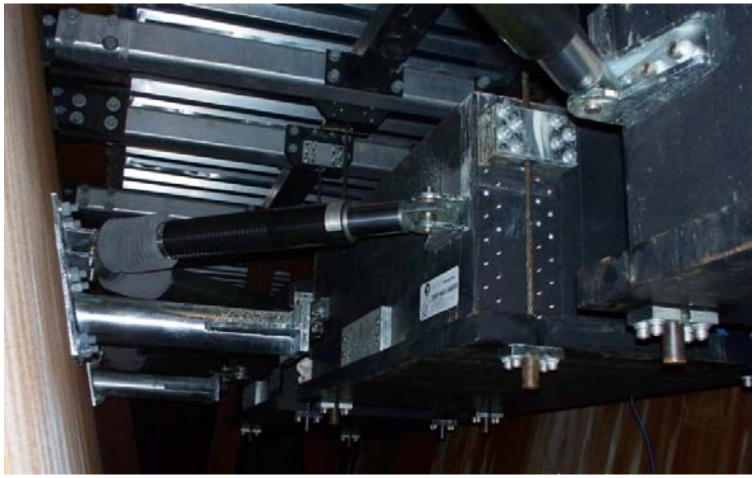
Typical Tuned Mass Damper - Cumberland River Bridge





2 vertical 5000 lb
3 horizontals 5000 lb

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Lock Up Devices - Taiwan High Speed Railway

Yun Lin, Taiwan

Lock-up Devices used on new high speed railway bridge sections to control movement at expansion joints during earthquake and train braking events.

Lock Up Devices - Deh Cho Bridge

Location: Northwest Territories

40 Lock Up Devices for Wind and Seismic specified to - 44 C
739 kn LUD with between 75 mm to 270 MM Stroke

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Shock Isolation Applications


St. Lawrence Seaway – Welland Canal Lift Bridge

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Shock Isolation Applications


St Lawrence Seaway-Welland Canal Bascule Bridge

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Testing in U of San Diego

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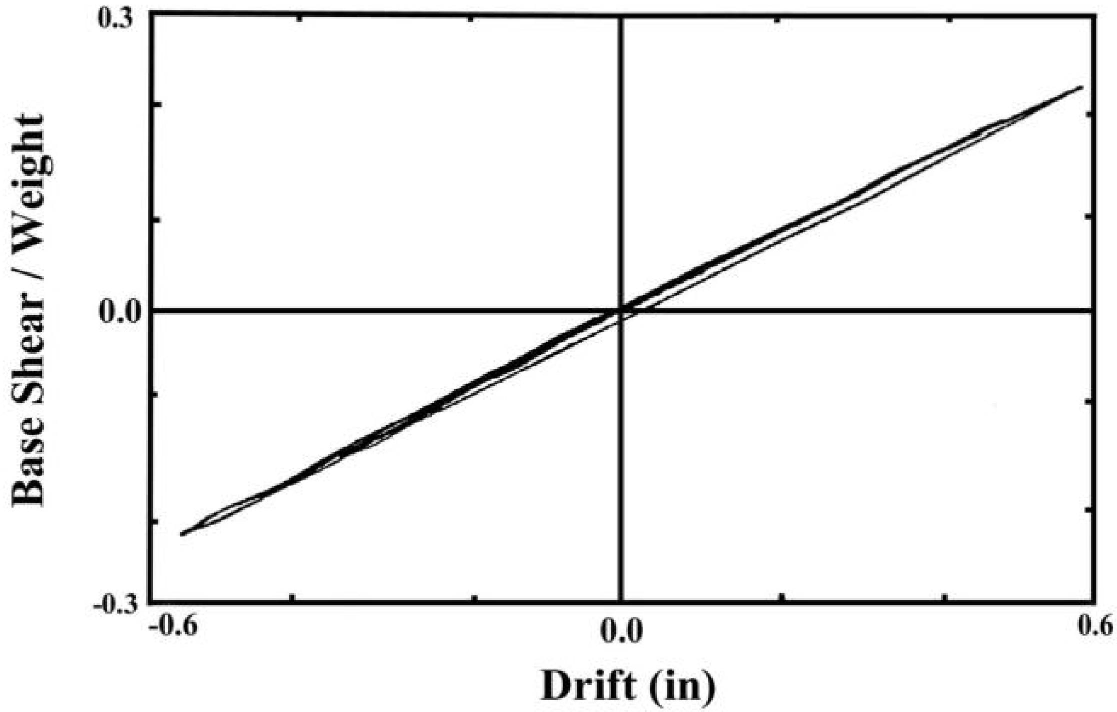
100% El Centro



1-Story, No Dampers, El Centro 33.33% Total Damping = 2%

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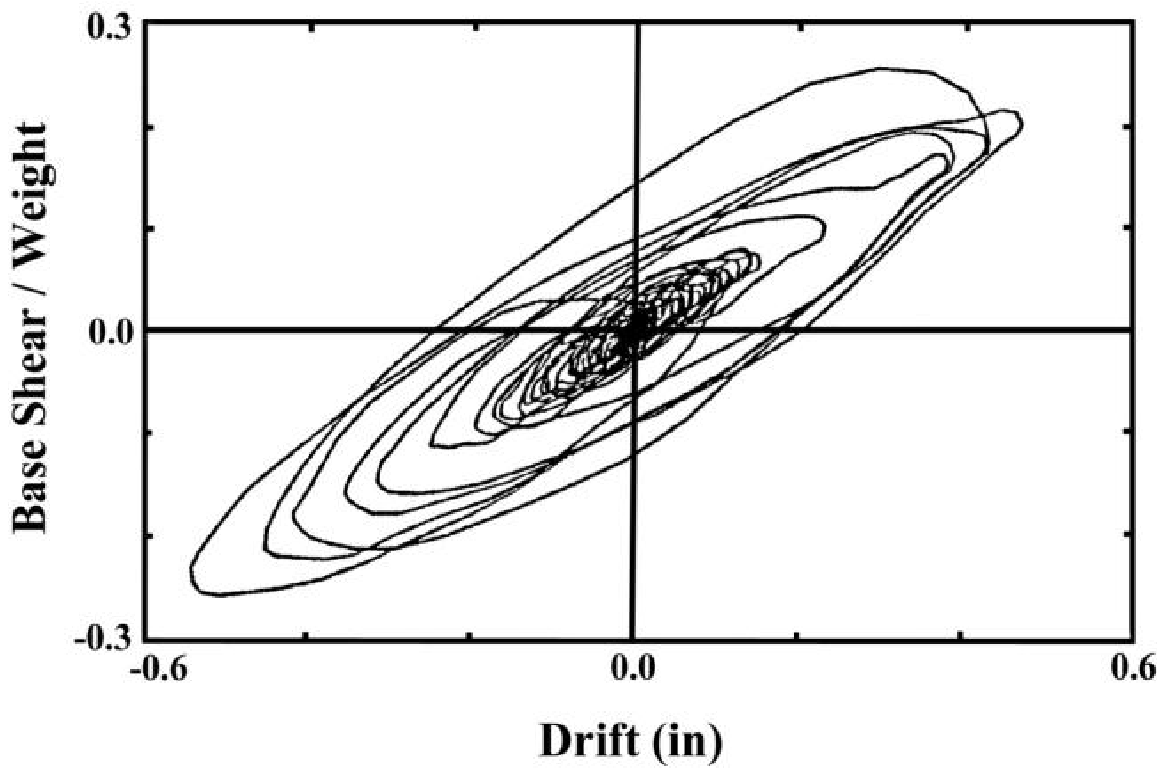
100% El Centro



1-Story, 2 Dampers, El Centro 100% Total Damping = 22%

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Conclusion

- By adding just two FVD the seismic capacity of this structure increased by three times. This may change depending on different modeling inputs (Northridge etc.).
- By adding damping to existing bridges as a retrofit it is possible to increase the bridges seismic capacity by adding FVD. There are many factors (type of EQ, Soil conditions, how far from fault) that determine how much improvement can be achieved by adding dampers and these need to be taken in to account.
- If the joints/bearings have movement designed in for seismic inputs, by adding Lock-up Devices you can reduce the size and displacement capacity of your bearings and expansion joints You will always need movement capacity to accommodate thermal expansion/contraction + creep and shrinkage of the bridge.
- Adding LUD on overpasses and exchanges can often provide a cost savings in pier size, bearings and expansion joints, LUDs can allow the earthquake force to be shared between all the piers rather than the fixed pier(s) taking all the load.
- In some lower seismic zones 5 M and below just adding LUD will might be enough to allow the bridge to withstand these seismic forces without further changes

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Thank-you