

The Highest Level of Resiliency. Guaranteed.

Rest assured, our products provide the highest level of protection for buildings and their occupants.



Building Resilience Together Through the USRC Industry Partner Committee

WELCOME

Taylor Devices is proud to be a founding member of the USRC, offering industry-leading solutions for better performing and resilient structures.









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ABOUT



Space Technology Protecting Structures Here On Earth

Originally developed for NASA in the 1960s, Fluid Viscous Dampers have successfully transitioned to the civil engineering community for use in protecting buildings, bridges and other structures worldwide. These dampers, much like the shock absorbers in your car, absorb earthquake energy as they stroke taking the energy out of the structure.

Today, leading structural engineers use Taylor Dampers as a cost-effective way to protect all types of buildings, their contents, and their occupants from damage caused by earthquakes. Since the early 90s, modern-day damping technology has been protecting buildings and saving lives in high-seismic areas throughout the world.

Designing for Resilience

Building codes only require that a building not collapse during a major earthquake, meaning heavy structural damage is acceptable under the current building codes. A building could still sustain a total loss after an earthquake and occupants could be forced to find another residence or workplace. Buildings designed with Taylor Dampers avoid this outcome, preventing major damage to structures altogether.

Taylor Devices Inc. is proud to be a founding member of the U.S. Resiliency Council (USRC). We are committed to creating more resilient communities by providing world-class products and solutions that lessen the impact our environment has on our structures.



Like Shock Absorbers on Your Car, Taylor Devices Protect Against Even the Largest Earthquakes in Your Region.

Added Value

Taylor Dampers provide better building performance – even to the point of allowing immediate occupancy after a major earthquake – for little or no extra cost. **Taylor Dampers are the only solution that reduces stress, deflection, and acceleration, protecting the structure and its' contents.**

Understanding Your Options

Conventional wisdom would indicate that it is better to add more steel and concrete to make a building more earthquake resistant. However, heavier buildings or buildings with yielding braces actually attract more earthquake load. Furthermore, these elements could result in a permanent offset of the building after an earthquake and need to be replaced.

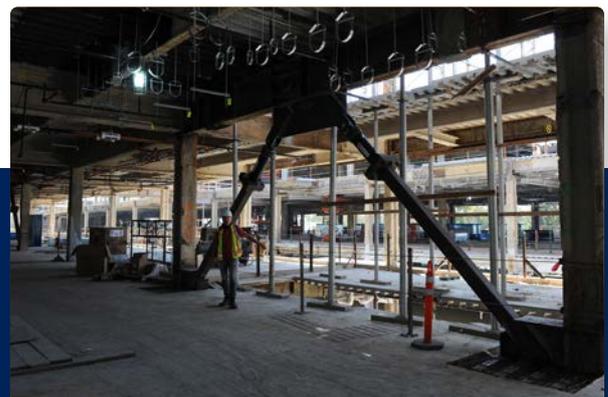
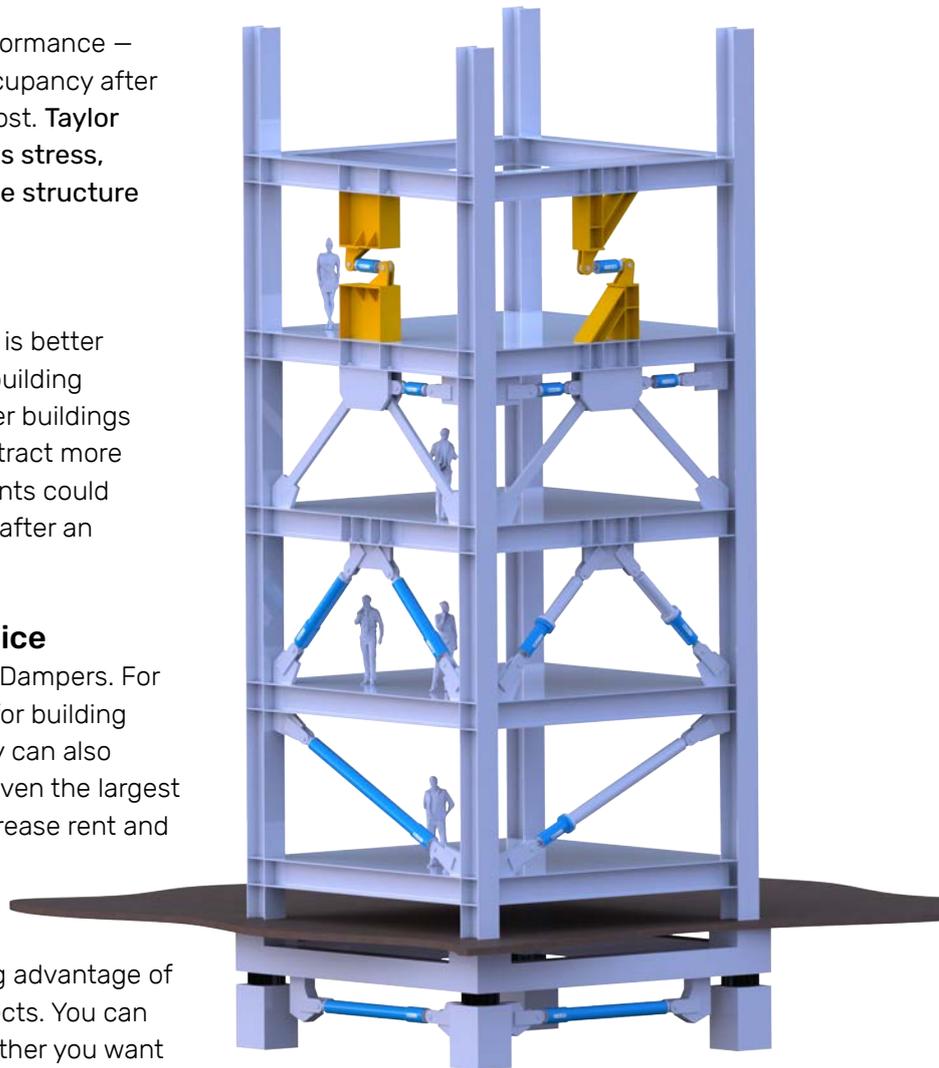
Taylor Dampers: The Resilient Choice

There are no disadvantages to using Taylor Dampers. For one, these dampers offer increased safety for building residents, businesses, and equipment. They can also enable immediate occupancy status after even the largest predicted earthquakes and allow you to increase rent and decrease insurance premiums.

Variety of Design Options

Leading engineers and architects are taking advantage of the benefits of Taylor Dampers in their projects. You can arrange Taylor Dampers in many ways, whether you want to display them for all to see or hide them inside the walls. To the right are some common configuration examples:

Additionally, we can supply dampers with any type of paint system, color, and a variety of architectural finishes.



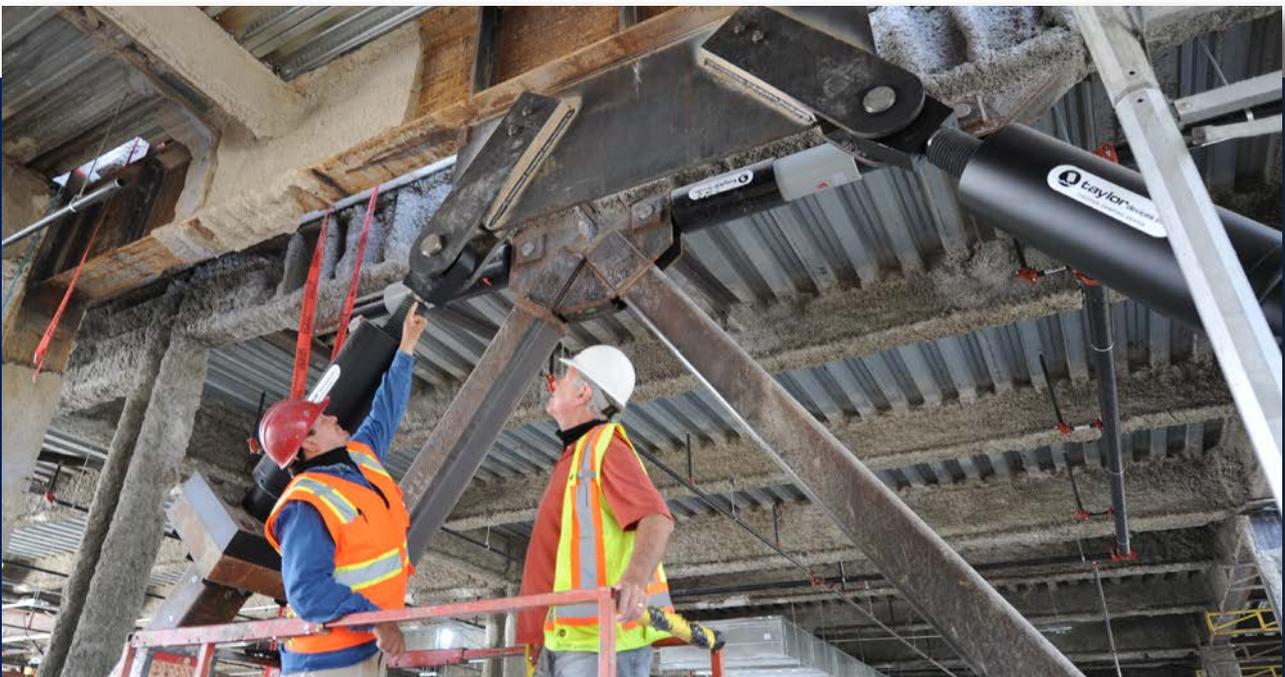


FLUID VISCOUS DAMPERS (FVDs)

BY: TAYLOR DEVICES

Fluid Viscous Dampers (FVDs) or seismic dampers as they are sometimes referred to, are hydraulic devices that, when stroked, dissipate the energy placed on a structure by seismic and wind events. Compact, yet powerful, these dampers increase structural damping levels to as much as 50% of critical, the result being a truly dramatic reduction in stress and deflection. Each damper is individually tested to customer specified maximum forces and velocities, ensuring the reliability and durability of our products.

Their use in seismic applications allows the structure to remain largely undamaged, improving functional recovery capacity and operability shortly after the event. When used in retrofits, FVDs can reduce seismic force and deformation demands below the existing structural capacity, reducing the need for costly widespread system strengthening.



30+

Years of
Experience

750

Global
Projects

35

Countries

30,000

Active Units
Worldwide



FVDs FOR BASE ISOLATION SYSTEMS

BY: TAYLOR DEVICES

A base isolation system is a method of seismic protection where the structure is separated from the seismic input. The isolation is obtained by putting the structure on base isolation bearings to minimize the effects of the ground motion on the building.

Fluid Viscous Dampers are included in a base isolation system to provide even greater protection to the superstructure. The addition of viscous dampers to the base isolation system increases the amount of energy dissipation during a seismic event, significantly reducing the movement of the superstructure. The improved performance of the base isolation system reduces the size of the base isolators which decreases the overall cost of the isolators, the moats around the building and services, as well as the utilities that are detailed to allow for the building movement.



UNRETROFITTED STRUCTURES

Buildings built before 2000 that have yet to be retrofitted.

CONVENTIONAL STRENGTHENING/DESIGN

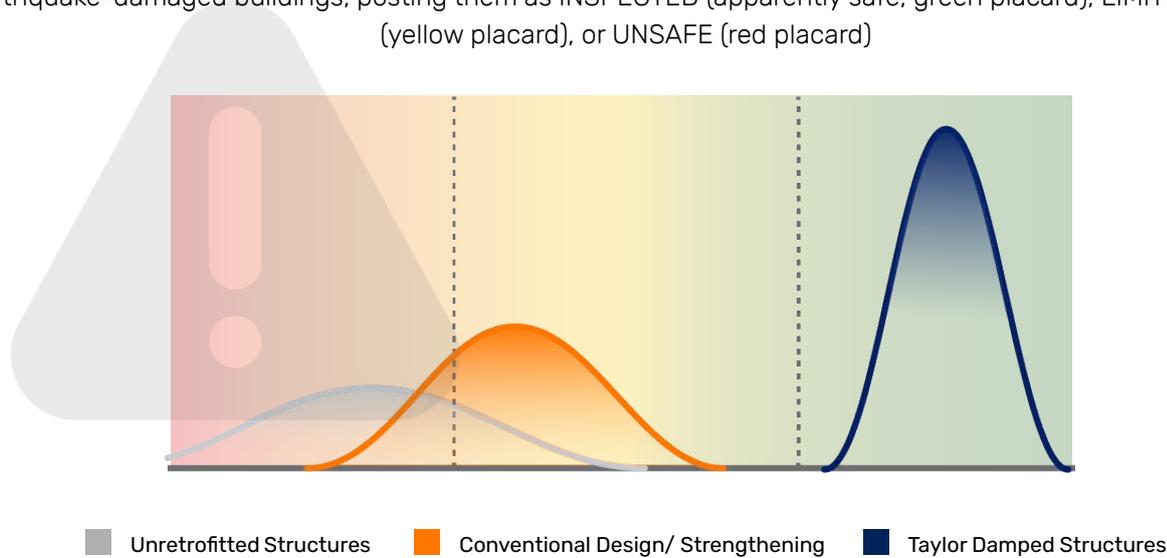
Buildings that are retrofitted or designed to only meet the basic standards.

STRUCTURES WITH TAYLOR DAMPERS

Buildings retrofitted or designed with Taylor Dampers

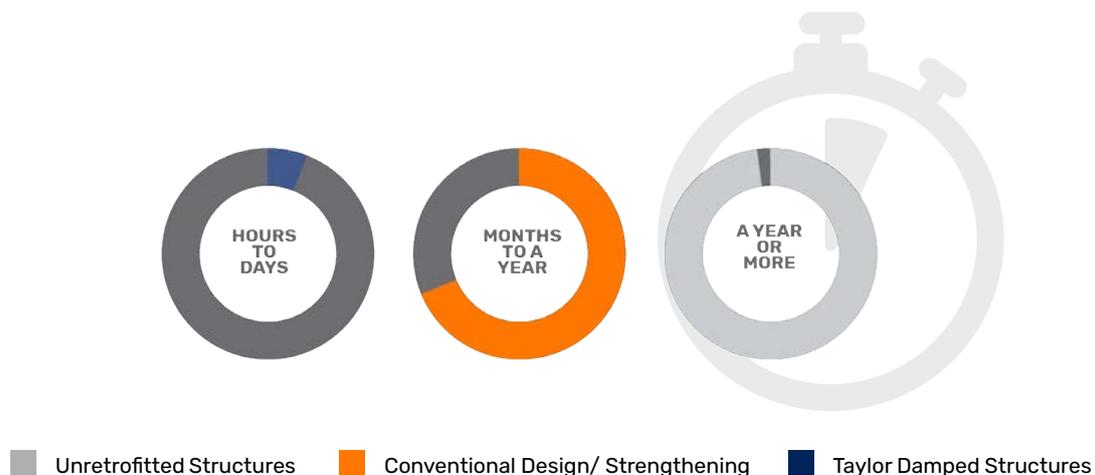
Chance of Post Earthquake Approval Placard

An earthquake placard consists of detailed evaluation procedures for evaluating earthquake-damaged buildings and reporting them as inspected. These reports include rapid and detailed evaluation procedures for evaluating earthquake-damaged buildings, posting them as INSPECTED (apparently safe, green placard), LIMITED ENTRY (yellow placard), or UNSAFE (red placard)

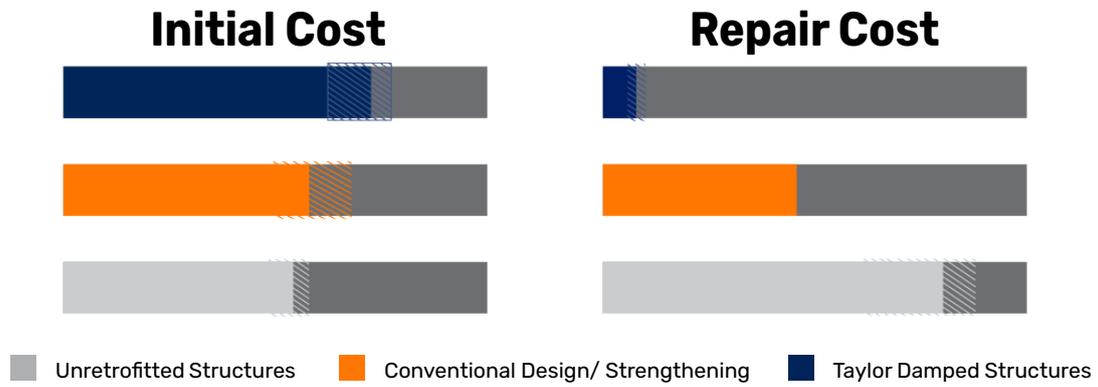


When designing a structure using Taylor Fluid Viscous Dampers, you can be confident that your building will perform consistently above base code-level requirements during and after an earthquake. When designing or retrofitting to the existing code your building runs the risk of being “red-tagged” preventing you or the occupants from re-entry.

Expected Building Downtime Post Event

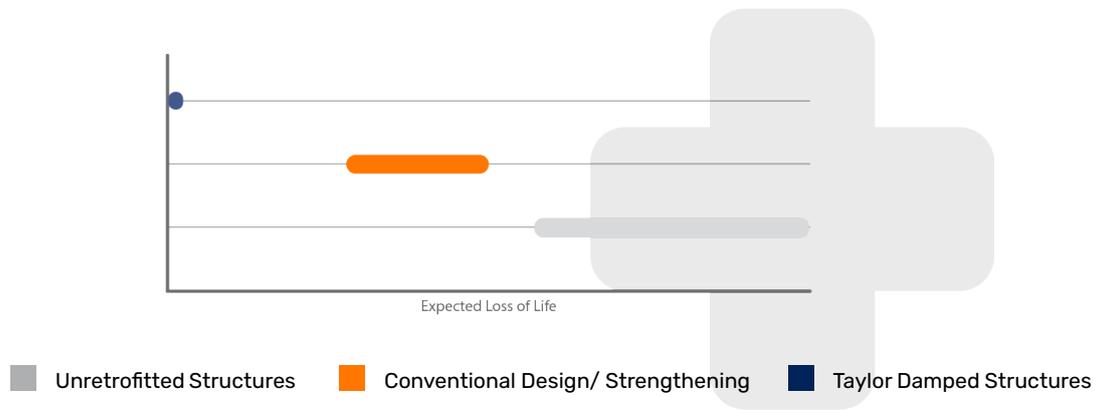


During the inspection, the structure is examined to determine whether or not it is safe for occupants to reenter. Buildings meeting only the minimum code requirements run the risk of experiencing greater damage and require repair. With Taylor Dampers, re-occupancy can range from immediate to a few days post-inspection.



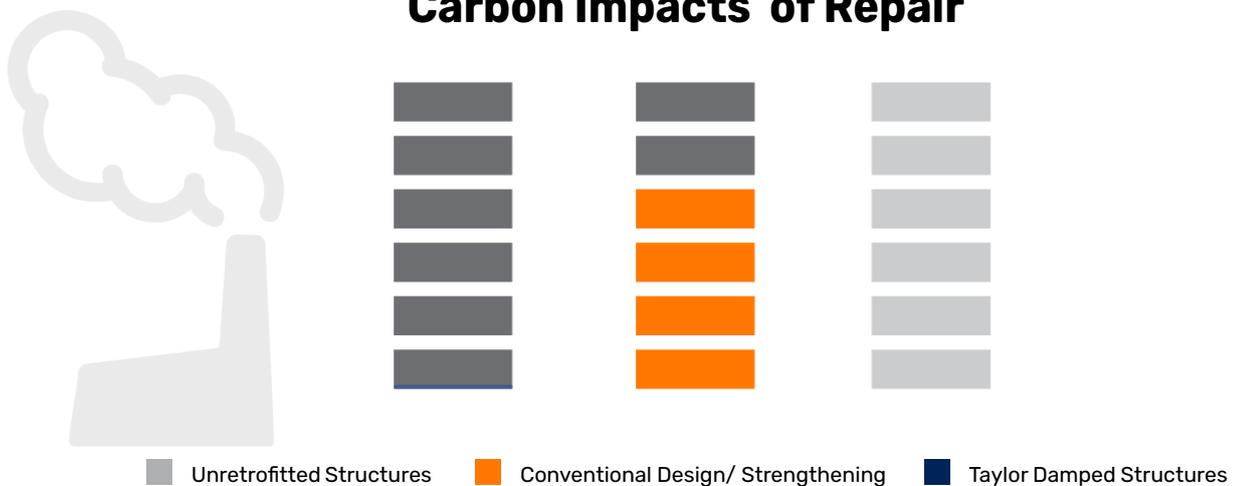
Although retrofitting or designing with Taylor Dampers may require additional costs, there would be minimal to no repair costs post-earthquake. Other buildings that are only designed to meet basic code requirements may need significant repairs or may even need to be demolished post-earthquake.

Casualty Risks for Each System



Older buildings simply aren't designed to the same standards that they are held to today. This is why retrofitting these structures is important to those that depend on the safety of these structures. A retrofit or new build that exceeds code requirements, such as one using Taylor Dampers, can lead to a significant reduction in loss of life after an earthquake.

Carbon Impacts of Repair



When it comes to building repairs, the environmental impact is an important factor to consider. Because buildings designed with Taylor Dampers experience virtually no damage, there is also next to no carbon impact on the environment.



BREMERTON NAVAL HOSPITAL

Bremerton, WA

BUILDING SPECIFICS:

Located in Bremerton, WA
 Built in the late 1970s
 9 Stories Tall
 250,000 sq/ft
 Engineering: Reid Middleton

The Naval Hospital at Bremerton (NHB) is a fully accredited, community-based hospital that serves over 60,000 military families in the Puget Sound region. Given its proximity to Seattle, in the event of a major earthquake, the medical campus could anticipate the need to serve over 250,000 people.

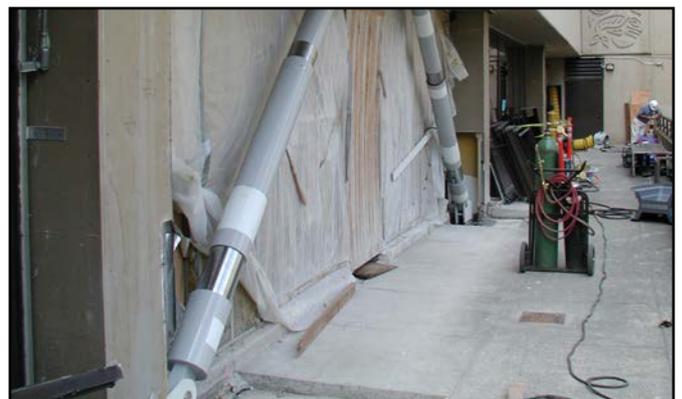
In 2001, the hospital shook for 45 seconds as the 6.8 magnitude Nisqually Earthquake struck the Pacific Northwest. Occupants on the upper floors recalled seeing the building sway as they watched the tree line below and feared for its collapse. The hospital structure experienced significant lateral drifts during the relatively small, "less than design level" earthquake, particularly on the upper floors of the tower of the main building where peak roof displacements from this modest earthquake were over 6".

Since the main building was constructed in the late 1960s with "Pre-Northridge Steel Moment Frames," a detailed inspection in accordance with FEMA 350 standards was performed and the building was evaluated. During the evaluation of the structure, it was determined that a conventional seismic retrofit by strengthening, or stiffening would have been too costly and disruptive to hospital operations, therefore alternative retrofit solutions had to be considered.

The use of Taylor Fluid Viscous Dampers proved to be the best design scheme to improve the seismic performance of the building while minimizing the disruption to hospital operations. In total, 88 Fluid Viscous Dampers were strategically installed in the existing structure. These dampers reduced the demands on the existing structure by reducing the lateral displacement of the structure and no retrofitting of the foundation was required.

RESULTS:

- Story drifts and floor accelerations reduced by over 40%.
- Diaphragm rotations reduced by 30-70% on all floors.
- FVD solution dramatically reduced the total project cost.
- Minimal impact on the day-to-day operations of the hospital.





555 CAPITOL MALL

Sacramento, CA

BUILDING SPECIFICS:

Located in Sacramento, CA
Built in the early 1970s
Two 14 Story RC Towers
Roughly 175,000 SF Each
Engineer: Miyamoto International

555 Capitol Mall in Sacramento California consists of two 14 story concrete office towers totaling over 380,000 square feet. It was constructed in the early 1970s to the 1967 version of the Universal Building Code. The facilities had several factors that enhanced its seismic performance such as its rectangular floor plan and its symmetrical design, however, there were concerns regarding several other structural deficiencies.

The biggest concern regarding the structure's seismic performance was due in part to the soft-story response of the first floor which was 50% taller than all of the other floors. These structures are more prone to collapse in the event of an earthquake. Additionally, the structure also experienced drift great than 2% in both orthogonal directions. These responses are deemed too high for non-ductile concrete buildings.

The buildings in their existing configuration had a Probable Maximum Loss (PML) value that exceeded 20% and it was determined that the structure was more than likely to experience moderate to significant damage in the event of a design level earthquake. This combination of concerns led building management to consider and ultimately pursue a seismic upgrade of the structure.

Eight Fluid Viscous Dampers were added to the first floor of each tower, totaling 16 dampers. These devices were aesthetically integrated into the existing building structure and presented minimal disturbance to facility operations during installation.

Additionally, building management opted to cancel their earthquake insurance, roughly \$145,000 a year, given the direct investment in seismic improvement technology to protect the structure. With a project cost of roughly \$800,000, building management was able to achieve a full return on investment in 6 years.

RESULTS:

- Soft-story response at the first floor significantly reduced.
- Drift ratio at the floor reduced from >2% to 1.2%, essentially limiting damage to minor yielding or none at all.
- Fluid viscous damper solution dramatically reduced the total project cost.
- Minimal impact on the day-to-day operations of the facilities.





NTT - SV1 DATA CENTER

Santa Clara, California

BUILDING SPECIFICS:

Located in Santa Clara CA

Completed in 2021

4-Story Tower

160,000 sq ft

Engineer: PARADIGM Structural Engineers

NTT Ltd. Is the third largest global data center provider, extending to more than 20 countries and regions, and boasts over 160 carrier-cloud and neural data centers with over 500,000 sqm of server space. In a recent expansion into California, company executives acknowledged that all providers in the Santa Clara region design data centers to withstand earthquakes but stated that their goal was to go a step further for their clients. This new facility utilizes a seismic isolation system consisting of triple friction pendulum pedestal and fluid viscous dampers to not only protect the four-story structure but also the critical IT equipment and people inside it.

This facility is a 4-story, 160,000 sf Data Center designed to achieve an Immediate Occupancy performance level in the event of a Maximum Considered Event (MCE). Immediate Occupancy Structural Performance Level (FEMA S-1) is defined as the post-earthquake damage state of a structure where it remains safe to occupy. These structures essentially retain their pre-earthquake design strength and stiffness with little to no damage to ceilings, facades, partitions, etc. These structures also maintain elevator functionality and fire protection systems are operable.

The isolation system itself consists of (50) Triple Friction Pendulum (TFP) bearings in parallel with (25) Fluid Viscous Dampers (FVD's) that are designed to accommodate 32" of horizontal displacement in each direction. The project site located in Santa Clara is a high seismic region subject to a local "basin effect" which increases long period seismic demands placed on a structure. This led the engineers at PARADIGM to incorporate the use of the FVD's to reduce the large building displacements to a level acceptable to both the client, design team, and local jurisdiction without sacrificing the project's stringent performance objectives.

RESULTS:

- Overall reduction in large building displacements
- Reduction in the seismic demand placed on the structure
- Reduction in floor accelerations





SAN DIEGO SUPERIOR COURTHOUSE

San Diego, California

BUILDING SPECIFICS:

Located in San Diego, CA

Completed in 2016

27-Story Tower

704,000 sq ft

Engineer: Skidmore, Owings & Merrill

The San Diego Central Courthouse is a 24-story federal building located in the heart of downtown San Diego. This 704,000 sq/ft building was designed to help consolidate over 70 departments across San Diego County's criminal trial, family, and civil courts. The building's dramatic aluminum-panel crown structure stands out in the San Diego skyline, making a bold architectural and engineering statement about the future of resilient-based design.

When designing the structure, the client and the engineers at SOM recognized that the site of the new San Diego Central Courthouse lies in a region of high seismicity. After evaluating many options, the team from SOM opted to move forward with a combined Steel Moment Frame-Fluid Viscous Damper design that would give architectural freedom and still deliver a high-performing structure.

In total, 106 FVDs were installed in the courthouse's superstructure. This system utilizes these damping devices to actively reduce earthquake-induced building story forces, drifts, and accelerations to provide enhanced seismic performance under peak demand of a Maximum Considered Earthquake (MCE). This system also resulted in a significant reduction in steel tonnage, offering the client cost savings on the total project cost.

Using FVDs on this project helped to reduce both story drifts and accelerations, resulting in reduced damage to nonstructural building components. Some examples of these include exterior wall elements, interior partition walls, courtroom finishes, as well as suspended ceilings, lighting fixtures, fire sprinklers, HVAC/MEP distribution and equipment, elevator guide rails, and egress stair elements. Potential damage to building contents including desktop electronics, office workstations, lateral filing cabinets, and shelving are also reduced.

RESULTS:

- Significant steel tonnage reduction and subsequent savings
- Reduction in building story drift, story shears, floor accelerations, and inelastic rotational demands on SMF beam-column joints
- Effective linear damping of 11% reduced low amplitude vibrations from wind loads





About the USRC Industry Partner Committee

The USRC established the Industry Partner Committee (IPC) in 2020 to leverage the knowledge and expertise of its vendor, trade, material, and commercial members to improve understanding of the performance of structures during seismic and other natural hazard events. USRC Industry Partners have committed to providing technical information, support, and options for improving expected building performance which can thereby help to improve a structure's resilience and USRC rating.



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