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# Synergizing Coupled Walls and Damping for Seismic Risk Reduction

**Anas Benali***

*Department of Civil Engineering, Mohammed V University in Rabat, Rabat, Morocco*

## Introduction

In seismic engineering, the need to develop structures that can absorb and redistribute earthquake forces effectively is critical. Over the years, coupled shear walls have proven to be vital elements in high-rise buildings, offering strength, stiffness and enhanced lateral resistance. Simultaneously, energy dissipation systems, such as U-shaped steel dampers and seesaw-arm mechanisms, have emerged as transformative technologies in reducing seismic impact. The integration of these two approaches coupled wall systems and advanced dampers marks a significant advancement in structural resilience. The concept focuses on improving deformation capacity, minimizing inter-story drift and reducing residual structural damage. This synergy creates a dual defense mechanism while the coupled walls provide strength and continuity across structural cores, the dampers dissipate energy during ground motion events. Such a hybrid system balances strength with flexibility, offering promising solutions for earthquake-prone regions [1].

## Description

Coupled shear walls consist of vertical wall elements connected by horizontal coupling beams, which collectively improve lateral load resistance. The interaction between these components ensures that forces are distributed across the structure rather than concentrated in a single element. Recent conceptual designs have emphasized optimizing coupling beam geometry and reinforcement detailing to enhance ductility without compromising stiffness. Research, including that by Bhunia et al., highlights the ability of coupled walls to reduce overturning moments and resist progressive collapse when subjected to lateral loading. When carefully designed, these systems exhibit a high level of redundancy, ensuring continued performance even after localized damage. The effectiveness of coupled walls lies in their inherent ability to act as integrated vertical cantilevers, contributing to both gravity and lateral load resistance during seismic events.

On the other hand, damping systems like the seesaw-arm configuration with U-shaped steel dampers provide a passive means to absorb and dissipate seismic energy. As presented by Tea et al., the seesaw-arm mechanism allows for cyclic motion under loading, enabling the dampers to deform plastically and absorb vibrational energy effectively. This approach minimizes stress concentrations and enhances post-event structural integrity. When incorporated into structural systems with coupled walls, dampers reduce the energy demand placed on primary structural elements, thereby prolonging the lifespan of buildings and reducing repair costs. The integration strategy involves strategically placing dampers within or adjacent to the coupling beams, ensuring that energy is effectively managed where it is most concentrated. This combined configuration not only improves seismic performance but also allows engineers to fine-tune the system's response to different magnitudes of ground shaking [2].

## Conclusion

The combined use of coupled shear walls and modern damping systems represents a powerful advancement in seismic design strategy. Together, they form a composite mechanism that blends stiffness, strength and energy dissipation into one unified system. While coupled walls enhance the structural framework's rigidity and load-sharing capabilities, dampers offer a reliable means to absorb shocks and limit damage. The result is a resilient, cost-effective solution for protecting high-rise and critical infrastructure from earthquake-induced stresses. As urban construction continues to grow in seismically active regions, such hybrid systems provide a forward-looking approach to structural safety and sustainability.

## Acknowledgement

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## Conflict of Interest

None.

## References

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2. Tea, Y. Sea, Hiroshi Tagawa and Xingchen Chen. "Seesaw-arm energy dissipation system with U-shaped steel dampers." *Structures* 57 (2023): 105143.

***Address for Correspondence:** Anas Benali, Department of Civil Engineering, Mohammed V University in Rabat, Rabat, Morocco; E-mail: anasbenali@um5.ac.ma*



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