



## Comparative Performance Analysis of Post Tensioned Hybrid Concrete Shear Wall with Openings Under Monotonic and Cyclic Loading

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### Abstract

Damage is more likely to occur with substantial residual lateral displacements and wide residual cracks in traditional RC shear wall structures. There has been a growing body of experimental research on self-centering structural systems in the recent past that can sustain severe earthquake motions with minimal residual damages. In the present study, to address the short-comings of traditional shear walls, post-tensioned (PT) tendons are utilized along with external energy dissipating reinforcement (EDR) in the form of mild steel bars to facilitate higher energy dissipation. This proposed system is expected to make it easier to repair the wall after an earthquake and to keep it ready for the next seismic shock. A numerical study has been carried out to fully understand the behaviour of the proposed hybrid shear wall. Effect of various parameters like post-tensioning force, aspect ratio and tendon profile has been taken into account. To study the performance of this resilient shear wall system further, openings has been provided and the shear wall has been analyzed for both monotonic and cyclic loading. The results of the study depict that aspect ratio plays an important role. It was observed that, the specimens with a lower aspect ratio (2-3), the yielding of EDR began early. The aspect ratio of 2.4-3.4 was found to exhibit desirable features and can be used in practice. Literatures suggest that effective prestressing force can improve a structure's resistance to lateral deformations. From the analysis, it was observed that to achieve the desired seismic performance and increase the lateral load carrying capacity, a minimum prestressing force of 0.4 times the ultimate stress in PT tendon ( $f_{pu}$ ) is required. A comparison between rectangular, square, circular and diamond opening with respect to its performance to full wall without opening under monotonic and cyclic loading has been performed. A suitable configuration is suggested based on the obtained results such as base shear, ultimate and yield stiffness and ductility.

**Keywords:** Resilient systems, Shear wall, Post-tensioned tendons, Energy dissipating reinforcements, Rocking behaviour