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Composite shear walls: An efficient seismic resistant system for multi-story buildings

Steel-concrete composite systems have seen widespread use in recent decades because of the benefits achieved by merging the two materials. Due to their high stiffness and lateral load resistance, reinforced-concrete shear walls (RCSW) and steel-plate shear walls (SPSW) are considered ideal for resisting earthquake lateral loads in moderate and high-rise buildings. Recently, various schemes of composite shear walls (CSW) have been the focus of recent research. The objective of this paper is to investigate analytically the behavior of composite shear walls as a lateral-load resisting system in comparison to RCSW. The investigation is performed on buildings with variable heights provided with either (RCSW) or (CSW). Three dimensional models for the case-study buildings are assembled using ETABS, computer software based on the finite element method. The buildings are analyzed for static lateral forces computed by the equivalent static load method (UBC-1997), response spectra dynamic analyses and dynamic time-history linear analyses using IZMIT earthquake record. Results are compared and interpreted so as the major findings include: First, to highlight on the structural characteristics and behavior of composite shear walls as a seismic resistant system. Secondly, to compare between the structural behavior of RCSW and CSW concerning their drifts, base shear and strength.

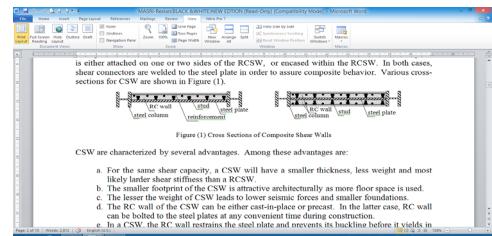
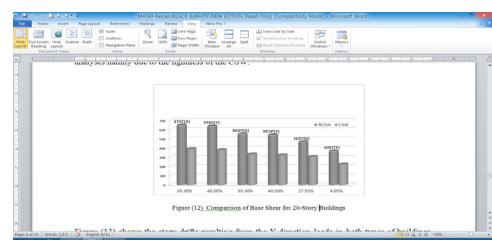


Figure 11: Cross Sections of Composite Shear Walls
CSW are characterized by several advantages. Among these advantages are:

- For the same shear capacity, a CSW will have a smaller thickness, less weight and most likely larger footprint than a RCSW.
- The footprint of the CSW is more effective architecturally as more floor space is used.
- The lesser weight of CSW leads to lower seismic forces and smaller foundations.
- The RC wall of the CSW can be either cast-in-place or precast. In the latter case, RC wall can be cast to the steel plates at any convenient time during the construction process.
- In a CSW, the RC wall restrains the steel plate and prevents its buckling before it yields in.



Recent Publications

- Meheddene M Machaka, Hisham S Basha, Adel M ElKordi (2014) The Effect of Using Fan Palm Natural Fibers on the Mechanical Properties and Durability of Concrete. *International Journal of Materials Science and Engineering*, 2(2): 76-80.
- Meheddene M Machaka, Hisham S Basha, Hadi Abou Shakra, Adel M ElKordi, (2014) Alkali Treatment Of Fan Palm Natural Fibers For Use In Fiber Reinforced Concrete. *European Scientific Journal*; 10(12).

References

- Hamad B, Masri A, Basha H and Baalbaki O (2011) Behavior of T-Shaped Reinforced Concrete Beams Partially Confined by Structural Steel. *Journal of Construction and Building Materials, Elsevier*; 25(2): 1037-1043.

Biography

Meheddene M Mashaka is an Adjunct Professor in the Department of Civil and Environmental Engineering at Beirut Arab University and Rafik Hariri University in the field of structural analysis and construction materials. He has received his Bachelor of Science in Civil Engineering in 1992 at BAU, MSc in Structural Engineering in 2005 and PhD degree in 2015 at Beirut Arab University, Lebanon. He is the Technical Manager for United Engineers Office at Beirut city from 1994 to till date and a Faculty Member in the Department of Civil Engineering.

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