World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:9, No:04, 2015

Seismic Response of Large-Scale Rectangular Steel-Plate Concrete Composite Shear Walls

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Abstract : An experimental program on steel-plate concrete (SC) composite shear walls was executed in the NEES laboratory at the University at Buffalo. Four large-size specimens were tested under displacement-controlled cyclic loading. The design variables considered in the testing program included wall thickness, reinforcement ratio, and faceplate slenderness ratio. The aspect ratio (height-to-length) of the four walls was 1.0. Each SC wall was installed on top of a re-usable foundation block. A bolted baseplate to RC foundation connection was used for all four walls. The walls were identified to be flexure-critical. This paper presents the damage to SC walls at different drift ratios, the cyclic force-displacement relationships, energy dissipation and equivalent viscous damping ratios, the strain and stress fields in the steel faceplates and the contribution of the steel faceplates to the total shear load, the variation of vertical strain in the steel faceplates along the length of the wall, near the base, at different drift ratios, the contributions of shear, flexure, and base rotation to the total lateral displacement, the displacement ductility of the SC walls, and the cyclic secant stiffness of the four SC walls.

Keywords : steel-plate composite shear wall, safety-related nuclear structure, flexure-critical wall, cyclic loading
Conference Title : ICCESE 2015 : International Conference on Civil, Environmental and Structural Engineering
Conference Location : Boston, United States
Conference Dates : April 20-21, 2015