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Structural performance of novel composite walling system with profiled steel and high performance concretes

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Composite walling system consisting of two skins of profiled steel sheeting and an infill of concrete is novel form of construction. Such walling system has great potential to be used as gravity and lateral load resisting elements in buildings. The strength, stiffness, ductility and energy absorbing capacity of composite walls subjected to axial, monotonic/cyclic shear and impact loadings will be described based on comprehensive experimental and theoretical investigations. The fire durability of the walls subjected to high temperatures will also be presented based on residual strength/stiffness/energy absorption capacity. The innovative feature of such walls is the use of new engineered high performance concretes (HPCs) with high strength, high ductility (strain hardening capacity) and micro-cracking characteristics developed at Ryerson University for the last few years. Such HPC composite walls have shown superior performance compared to those made with traditional concrete in terms of strength, ductility, energy absorbing capacity and durability as well as post-impact strength/stiffness/energy absorbing capacity. Analytical models/design equations for the load resistance of composite walls are developed and their performance validated through experimental and finite element modeling.

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Seismic behavior of steel plate shear walls with different configurations

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During the recent decades, many researches have been carried out on steel plate shear walls, SPSWs and accordingly, they have been classified as a reliable lateral load resisting system in the high seismic risk zones. This has given rise to increase of attentions to SPSWs as a new and economical system in structural design of buildings and even retrofitting of existing structures. Since different philosophies have been elaborated to explain and improve nonlinear behavior of SPSWs, various configurations are deemed in the design and construction of SPSWs as stiffened, un-stiffened, with holes, with simple or rigid frames, etc. Where, the stiffened approach employs stiffeners to prevent the infill steel plate fully or partially from elastic out-of-plane buckling. The un-stiffened approach relies mainly on post-buckling strength of infill steel plate ascribed to tension field action development in the plate. Also, application of holes in the infill plates is sometimes considered for passing utilities, architectural purposes, and/or special structural reasons. In addition, the type of peripheral frames affects nonlinear responses of the steel shear walls. This variety of the theories and applications might face structural designers with the difficulty of selection of an appropriate system in the design. Hence, in this study, seismic behaviors and structural characteristics of steel shear walls with different construction details are investigated based on the experimental and analytical results. Some aspects of advantages and areas of concerns of each type of steel plate shear walls are briefly reviewed and discussed, and some considerations are resulted and presented.

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