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Seismic performance of composite plate shear walls

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Abstract: Nonlinear seismic responses of a 4-storey and 6-storey composite plate shear wall (C-PSW) are studied. A nonlinear finite element model which includes both material and geometric nonlinearities is used for this study. Nonlinear seismic analysis shows that composite plate shear walls, in high seismic region, behave in a stable and ductile manner. It has been observed that the boundary members and the reinforced concrete panel of C-PSW carry significant amount of shear which is not considered in design of C-PSW in AISC 341-10. The study also shows that design axial forces and moments in the boundary columns designed according to capacity design concepts are in good agreement with those of the nonlinear seismic analyses. A series of C-PSWs with different geometry are designed and analysed to evaluate the current period formula in building codes. It is observed that the current code predicts periods that are generally shorter than the periods obtained from finite element analysis. An improved simple formula for estimating the fundamental period of C-PSW is developed by regression analysis of the period data obtained from analysis of the selected C-PSWs. Finally, two equations for determining shear stud spacing and thickness of reinforced concrete panel for the C-PSWs are proposed.

Keywords: Composite Plate Shear Wall; Seismic Analysis; Fundamental Period; Shear Stud Spacing