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# Numerical Modeling of Wall-Stud Shear Panels for Analyzing Seismic Performance

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**Abstract**

The cold formed steel frame sheathed with wood-based or gypsum-based panels named as shear wall panel is a main lateral load bearing component in light steel houses. Seismic performance of shear wall panels depends on racking strength and ductility of the shear wall. In this paper, a finite element model has been developed to study the seismic performance of shear wall panels based on pushover analysis of the wall. The finite element model has been validated with the experimental results of different experimental tests. Using the validated model, a parametric study has been performed to determine strength, ductility and force reduction factor of shear wall panels with different wall properties such as span width, type of sheathing material, thickness of frame members and screw spacing.

**Keywords: Light steel framing, Shear wall panel, Seismic performance, Lateral strength, R-factor**

## 1. INTRODUCTION

The use of cold-formed steel (CFS) as the main framing element in a structure is becoming more popular for the construction of low- to mid-rise buildings around the world, including areas with a high seismic hazard. The main components to resist earthquake forces and to provide seismic performance of a cold formed steel (light gauge steel) building are the shear walls. Shear walls in light steel structures are frames built by cold-formed steel profiles and braced by flat straps (plane or perforated steel straps) or sheathed with sheets (metal profiled or plan sheets, sandwich panels) or panels (wood-based panels, gypsum-based panels). The latest type (frame sheathed with panels) named as Shear Wall Panel (SWP) is widely used in light steel houses. Connections between sheathings and CFS profiles are generally made of self-piercing screws.

Understanding shear wall behavior is important in order to be able to assess structural performance in case of earthquake. As for any building structure expected to exceed its elastic behavior-range in case of earthquake, the interaction of load bearing capacity and structural ductility will influence the performance. In two recent decades, different experimental investigations have been carried out on various cold formed steel wall assemblies subjected to in-plane shear loading to determine ductility and strength of shear wall panels [1-8]. Nevertheless, developing the reliable numerical and theoretical models is necessary to assess lateral performance of various configurations shear wall panels in lack of experimental tests.

In this investigation, a finite element model of shear wall panel is developed. In order to achieve a higher level of reliability in the results, the results are verified using the results of experimental tests conducted on a range of shear wall panels. The model was then used in a parametric study to extract strength and ductility of shear wall panels with different span width, thickness of frame members and screw spacing. Finally, the Response modification factor (R-factor) of all frames is determined to investigate the effect of above-mentioned parameters on the seismic behavior of shear wall panels.

## 2. FINITE ELEMENT MODELING