

Shear Resistance Mechanisms on High-Panelized Steel Sheet Walls with Burring Holes

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Abstract

High-panelized shear walls containing 3.53–4.53 m long steel sheets with burring holes aligned vertically are applied to large space flat buildings in seismic regions. A configuration with burrs on the inside enables the construction of thinner walls and simplified attachment of finishing. Machining of equipment piping holes can be omitted. The wall that receives the in-plane shear force allows shear stress to concentrate in the intervals between the holes. Finite element analyses and in-plane shear experiments revealed that all intervals between the holes were simultaneously deformed, and buckling areas in the intervals were restricted by the use of ring-shaped ribs of the holes. Post-buckling behavior depended on the shapes of tension field on the intervals. The allowable design strength and indices of strength after buckling were developed.

Keywords: light-gauge steel structure; cold-formed steel; steel sheet; shear wall; burring hole; high-panel; prefabricated house; steel framed house; seismic design; design formula.

1 Design concept of steel shear walls

Shear walls are panels in which steel sheets with burring holes aligned vertically are fastened to studs and tracks (Fig. 1) [1]. The standard 2.73 m high walls are applied to low- to mid-rise buildings in places that require seismic resistances (Fig.2). Burring holes are made by cold-pressing a sheet with small-radius holes. A configuration with burrs on the inside and smooth walls on the outside enables the construction of thinner walls and simplified attachments of finishing. Machining of various holes for electric devices and equipment piping can be omitted (Fig.2) [1].

Steel shapes with burring holes for girders and joists have been developed using the results of previous studies [2]. The mechanisms for 2.73 m high walls with burring holes were investigated by analyses and cyclic loading experiments [1].

The purpose of this study is to clarify the effects of wall heights and cross-rails on the shear walls. Walls' heights of 3.53, 4.03, and 4.53 m applied to single-story buildings such as large area stores, offices, and ware houses are considered (Fig. 3). Cross-rails connected to studs placed parallel to each other at equal pitch are designed to strengthen the load bearing capacities (Figs. 4, 5).

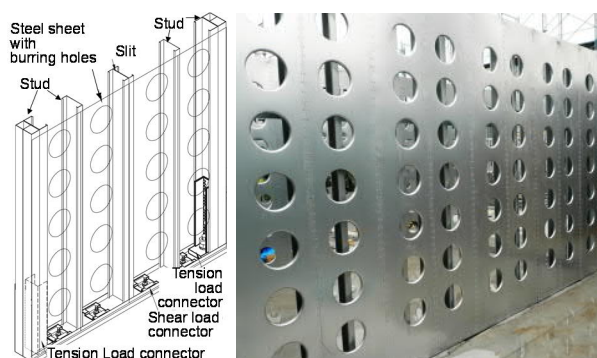


Figure 1. Steel sheet shear walls with burring holes