

Steel Sheet Shear Walls with Burring Holes for Low- to Mid-Rise Housings

Yoshimichi KAWAI, S.E, P.E

Manager

Nippon Steel Corporation

Tokyo, Japan

kawai.q9z.yoshimichi@jp.nipponsteel.com

Master of Engineering, Nagoya University



Shigeaki TOHNAI

Manager

Nippon Steel Corporation

Tokyo, Japan

tohnai.673.shigeaki@jp.nipponsteel.com

Master of Engineering, Kyushu University



Shinichiro HASHIMOTO

President

NS Hi-Parts Corporation

Tokyo, Japan

hashimoto@nshp.co.jp

Bachelor of Laws
Nagoya University

Atsushi SATO

Associate Professor

Nagoya Institute of Technology

Nagoya, Japan

sato.atsushi@nitech.ac.jp

Doctor of Engineering
Nagoya Institute of Technology

Tetsuro ONO

Professor emeritus

Nagoya Institute of Technology

Nagoya, Japan

t.ono@nitech.jp

Doctor of Engineering
Nagoya Institute of Technology

Contact: kawai.q9z.yoshimichi@jp.nipponsteel.com

1 Abstract

Steel sheet shear walls with cold formed edge stiffened burring holes are applied to low- to mid-rise housings in seismically active and typhoon- or hurricane-prone regions. A configuration with burrs on the inside and smooth on the outside enables the construction of omitting the machining of holes for equipments and thinner walls with simplified attachments of finishings. In-plane shear experiments and finite element analyses revealed that the walls allowed shear stress to concentrate in intervals between the burring holes. The walls maintained stable shear load and large deformation behavior, and the deformation areas were limited in the intervals and a large out-of-plane waveform in a sheet was effectively prevented owing to edge stiffened burring ribs. The design methods are developed for evaluating the shear load of the walls at story angle from zero to 1/100, using the idea of decreasing the band width of the inclined tension fields on the intervals with the effects of the thickness.

Keywords: light-gauge steel structure; cold-formed steel; steel sheet shear wall; burring hole; low- to mid-rise; prefabricated house; steel framed house; seismic design; design formula.

2 Design Concept of Shear Walls

Shear walls containing sheets with vertically aligned edge stiffened burring holes are employed in houses, stores and offices (Fig. 1). Standard walls in which 2.73m-long x 0.455m-wide sheets with holes are fastened to cold-formed steel studs and tracks. 200mm-diameter holes contain 10mm-radius curvature and 5mm-height cylinder, are created by cold pressing a sheet with small holes.

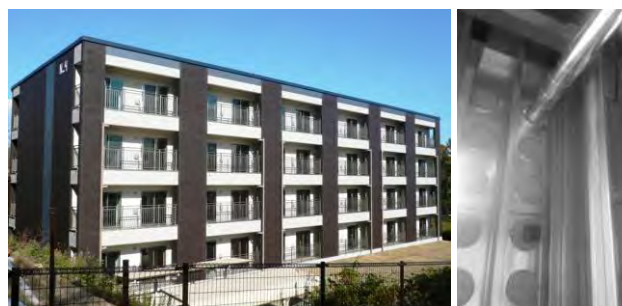


Figure 1. Shear wall w/ burring-holes in 4 story bldg.

<https://doi.org/10.2749/newyork.2019.2780>

Distributed by Structurae