Cold Formed Steel
Research Note
CANADIAN SHEET STEEL BUILDING INSTITUTE
652 Bishop St. N., Unit 2A, Cambridge, ON, Canada, N3H 4V6 Tel: (519) 650-1285 Fax: (519) 650-8081 Web Site: www.cssbi.ca

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Wall Deflection Limit For Steel Stud and Gypsum Board Walls

Introduction

Interior partition walls framed with steel stud and finished with gypsum board have been in use for over 30 years. There are many benefits to this type of construction. It is both lightweight and non-combustible. Many assemblies providing 1,2,3 or even 4-hour fire resistance ratings are available. This is the only system of stud-framed construction, when built with a single layer gypsum board on each side and cavity insulation, that will give a sound transmission classification (STC) of 50: an important design consideration in many building types.

The economics of steel stud construction, combined with its many other advantages, has made this the system of choice for interior partitions and party walls in hi-rise apartments, condominiums and office buildings. The majority of wall heights for these applications are 8' to 9', but occasionally can be up to 12'. The same economics and benefits of steel framing have also led designers and builders to use this type of construction in shopping malls, theatres, schools and industrial buildings, where wall heights can be as high as 20'. For some of these projects a lateral load of 10 psf may be a design requirement. These higher walls and larger loads can create conditions where the lateral deflection at mid-span could theoretically reach as high as $1/120^{th}$ of the wall height (i.e. L/120).

This deflection can be controlled and limited to a specific amount through the proper steel stud selection. The wide range of steel products now produced by CSSBI fabricator members will permit wall heights in excess of 30' for lateral loads of 10 psf, and with a limit of L/360 on the deflection of the wall (refer to CSSBI Technical Bulletin No8, Volume 1, *Maximum Height Tables for Non-loadbearing Steel Stud Partitions*). Stiffer walls can be achieved with deeper sections and/or thicker steel. The increase in material cost typically associated with higher walls could be reduced or eliminated if less stringent wall deflections of L/240, L/180 or L/120 were acceptable. A concern voiced in the industry for a wall designed to an L/120 deflection limit is the possibility of cracking the gypsum board at the taped joint.

In order to determine if the gypsum board joint will crack at a wall deflection of L/120, a series of tests were conducted. This testing was carried out under the direct supervision of Prof. R.M. Schuster P.Eng., professor of structural engineering and Director of the Canadian Cold Formed Steel Research Group at the University of Waterloo, Ontario.

Test Specimens

Wall panel specimens were constructed using 1-5/8" steel studs (0.018 in. thick) and ½ gypsum board attached to both sides of the panel, with a transverse taped joint at the mid-span of the panel. The panels were 32" wide and 60" long. There were two studs in each panel spaced 24" apart. A total of 8 tests were performed: six specimens used "paper tape" for the joint reinforcement and two specimens used "glass fibre tape". The wall panels were fabricated in accordance with common construction practices for the materials used.

The panels were mounted in a horizontal position and subjected to a uniformly distributed load along the length of both stud members. The deflection was measured at the mid-span along the centreline of both studs as the load was applied. The objective of the testing program was to subject the wall panel to an increasing uniform lateral load, record the resulting deflection, and determine at what deflection a visible crack would appear in the mid-span taped joint. The tests were not intended for the purposes of establishing the load carrying capabilities of the panel.

Panel Specimen Construction

All stud and track products were supplied by a CSSBI fabricator member and complied with the requirements of the CGSB Standard CAN/CGSB-7.1-98 *Lightweight Steel Wall Framing Components*. The steel members were 1-5/8" deep sections with a nominal base steel thickness of 0.018". All studs had standard pre-punched holes at 20" centre-to-centre. Stud-to-track connections were made with #6 - 7/16" sharp point pan head framing screws, 2 screws per connection.

The gypsum board was plain ½" thick board purchased from a local distributor. The gypsum board was fastened to the steel studs using 1-1/4" bugle head type drywall screws. The spacing of the screws conformed to the National Building Code of Canada section 9.29.5.9. The joint compound was a " ready-mixed" all purpose product that was purchased along with the tape from a local distributor. The taped joint and screw heads were finished (taped filled and sanded) following industry standard practices and the manufacturer's recommendations. The finished surface was left unpainted so that any cracks would be more visible.

Test Results and Conclusions

Shown in Figure 1 are the load versus deflection plots were for each test. All 8 specimens behaved in a similar manner during the test, and all deflected up to an L/120 limit without any visible sign of a crack at the taped joint. This test program demonstrates that cracking of the taped joint need not be a concern when selecting stud sizes based on a deflection limit of as much as L/120.

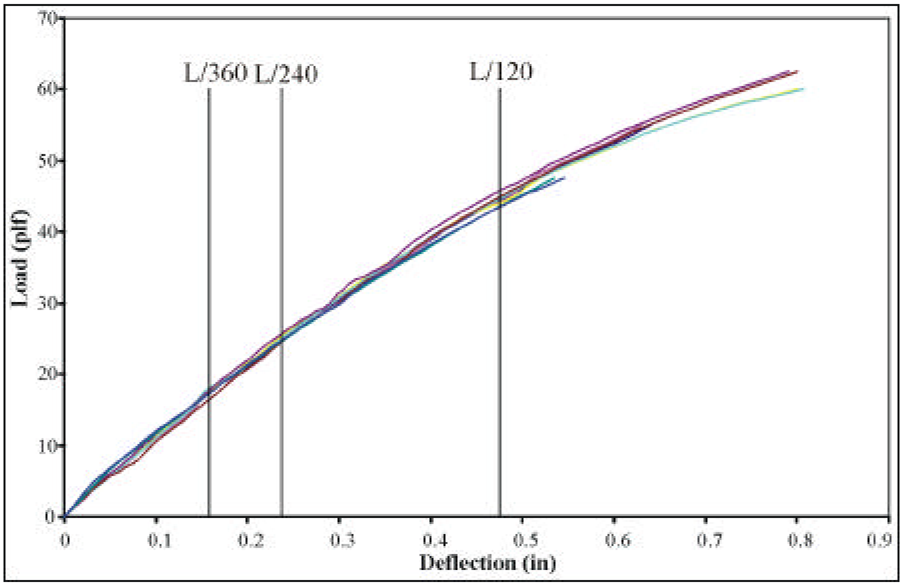

Figure 1: Load versus Deflection Curves