Newsletter for the *October 1997*

Light Gauge Steel Engineers Association

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Upcoming Events

AISI/LGSEA Meetings Oct 28-30
Atlanta, GA
Info: AISI - (202) 452-7202
LGSEA - (615) 386-7139

METALCON '97 Oct 28-30
Atlanta, GA
Info: (617) 965-0055

Building Industry Show Nov 13-14
Long Beach, CA
Info: (909) 396-9993

Standing Seam Metal Roofing Seminars
Montreal, CANADA Nov 13
Albany, NY Nov 14
Richmond, VA Dec 4
Providence, RI Dec 5

❖ **1998** ❖

NAHB Trade Show Jan 16-19
Dallas, TX
Info: (800) 368-5242

LGSEA Meetings Jan 16-17
Dallas, TX
Info: (615) 386-7139

New Shear Wall Test Data Gives Engineers Additional Design Flexibility

by Reynaud L. Serrette, Ph.D., Santa Clara University

Following completion of the AISI Shear Wall test program in 1996, new design data for the lateral resistance of steel stud wall systems (light gauge steel framed shear wall assemblies) was introduced in the 1997 UBC (Chapter 22, Division VIII. P.2-266). Tables 22-VIII-A and B of the UBC provide data for walls designed to resist wind loads and Table 22-VIII-C gives data for seismic design. These tables were based on experimental tests, and design loads are given in terms of nominal values. For allowable stress design (ASD), the allowable design load may be taken as the nominal value divided by a safety factor (3.0 for wind load conditions and 2.5 for seismic load conditions). Similarly, for limit state design (LSD), the factored resistance is recommended as the nominal value times the resistance factor (0.45 for wind load and 0.55 for seismic load conditions).

As noted in previous editions of the LGSEA Newsletter, another test program was undertaken at Santa Clara University to evaluate the performance of walls utilizing up to 0.054 in. (16 gauge) studs, X-braced assemblies, sheet metal assemblies, and high aspect ratio walls. Additionally,

Behaviour of Plywood and OSB Shear Wall Assemblies

Continued on page 2

(http://LGSEA.com)
LGSEA Merges Onto the Information Superhighway

Move over fax machine, there's a new technology in town.

As millions of new users go on-line every year, the World Wide Web is steadily growing into an important tool for sending and receiving information. Already, nearly 25 percent of engineers, architects and builders say that much of the information they used to get via fax or mail comes to them via Cyberspace. Recognizing the potential need and opportunity to increase the efficient delivery of information to the market, the LGSEA has set up shop in the fast lane of the Information Superhighway.

"One of the greatest advantages of the World Wide Web is that it gives the 'surfer' instant access to information and ideas," says Dean Peyton, partner at Anderson-Peyton Engineers and LGSEA president. "Our objective was to create a Web site where we can deliver almost anything you would otherwise get over the fax or phone, and do it 24 hours a day," Peyton says.

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Newsletter for the Light Gauge Steel Engineers Association

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Department Staff

Membership Information
To receive the LGSEA Newsletter, "Tech Notes", and other membership benefits of the ***LGSEA****, call* ***(615) 386-7139.***

New Shear Wall Test Data

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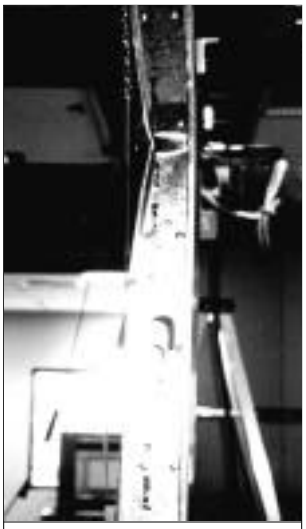
testing on plywood and OSB walls with perimeter screw schedules of 2 in./12 in. and 3 in./12 in. was conducted to re-evaluate the performance of these systems when chord stud buckling was not a governing mode of failure. An overview of the results from the recent test program are summarized below (along with photos) and a formal report will soon be available from AISI.

• When chord stud buckling is not the governing mode of failure, the capacities of plywood and OSB sheathed walls with 3 in./12 in. and 2 in./12 in. screw schedules were significantly higher than reported in the 1997 UBC.
• The UBC stud thickness limitation of 0.043 in. (18 gauge) for No. 8 sharp point screws in 15/32-in. plywood and 7/16-in. OSB wall assemblies is appropriate and justified. Tests showed that No. 8 sharp point screws fracture in applications with 0.054 in. (16 gauge) framing.
• In the design of X-braced walls with bracing on one side only, the designer must check that eccentricity of the strap force at the connection does not induce premature failure in the chord or top track due to combined bending and axial load. This is particularly important for heavily loaded walls and cases where actual yield strength of the strap is greater than the specified value.
• The steel sheathed wall assemblies exhibit a behavior similar to that of the plywood and OSB walls. As the thickness of the steel sheet was increased from 0.018 in. to 0.027 in. (25 gauge to 22 gauge), the mode of failure changed from rupture at the edges of the sheathing to screw pullout from the framing.
• The high aspect ratio walls (4:1) were found to exhibit high resistance at relatively large displacements. However, the initial stiffness of the wall on a reloaded path was very low.

This most recent data provides for an expansion in the use of light gauge steel framing construction and will give engineers more flexibility in the choice of a lateral support system.

Behaviour of Metal Sheet Shear Wall Assembly



X-Braced Wall Assembly Behaviour (high strap load)

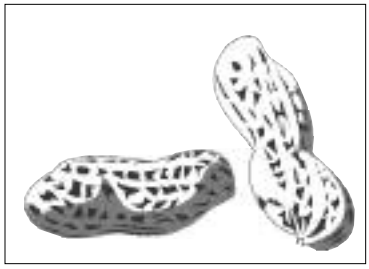
Please Pass the Peanuts

(Part 2)

By Don Moody, Western Metal Lath

In part 1, I used peanuts and the fact that they sell for more per pound than steel studs, to make a point about the commodity nature of the steel stud industry. In a nutshell (pardon the pun), my point was that existing steel stud markets are fully enabled and, as a consequence, the stud manufacturer, in an economic sense, is relegated to the role of producing and delivering quality products on time and at the lowest possible prices. All other services and functions attendant to the use of steel studs are provided by the market. This is why the commercial market is said to be fully enabled. It also explains why stud manufacturers can sell studs for peanuts and still survive.

Like the commercial construction market for steel studs, the residential construction market for wood studs is also fully enabled. Saw mills fill the same role in providing wood studs for residential construction as roll formers do in providing steel studs in commercial construction. Both convert their respective feed stocks into finished construction products in highly leveraged manufacturing environments, and both rely upon existing infrastructures for the specific application of their products in local markets.



The residential construction market for steel studs, on the other hand, is not fully enabled. There is no fully developed infrastructure that efficiently and economically provides all of the services and functions needed to enable the widespread use of steel studs. In the absence of such an infrastructure, many roll formers have attempted to provide those necessary services and functions themselves. The problem, in economic terms, is that as soon as a roll former begins adding value to his product, beyond simply converting feed stock into finished product, he is no longer selling a commodity. He is selling a value-added product. Why is that a problem? It's a problem because he still ends up selling at commodity prices. Why is that? Because wood prices are one determinant of the prices at which he can sell his studs, his competitors' products are another. Both are priced on a commodity basis. So what happens when you sell value-added products at commodity prices? You lose money and, eventually, you stop doing that.

This helps explain the early surge in the use of light gauge steel framing. As lumber prices began to rise dramatically, many stud manufacturers, seeing a huge new potential market for their products, rushed to develop the ability to provide the services and functions necessary to enable the sale of their products. Functions such as providing timely and accurate estimates, engineering calculations and drawings, and material take-off lists were necessary because, in general, the market could not provide them. As wood prices continued to rise and steel garnered some favorable publicity, drawings were pouring in and technical staffs began to grow. Sales to the residential market began to grow also, which was the objective. It was only after roll formers began to realize that those sales, made at commodity prices, were not sufficient to allow them to cover all of the additional service costs that they stopped providing these services, for the most part, and the rate of sales growth slowed. Today, steel's market share is between 1 percent and 4 percent, depending upon which expert you believe.

I hope by now it is obvious that the missing ingredient for steel in residential construction is what I have been calling infrastructure. No company can develop the necessary infrastructure, it will take an industry-wide effort. We will not gain significant market share until that has happened. Realizing this, the stud industry has taken some very significant steps over the last year that

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TECHNICAL EXCHANGE SECTION

The Light Gauge Steel Engineers Association needs you and your experience. Please mail or fax your opinions, questions, and design details that are relevant to the light gauge industry (fax to Dean Peyton at 253/941-9939). Upon editorial review your submission may be printed in the Technical Exchange Section of this Newsletter

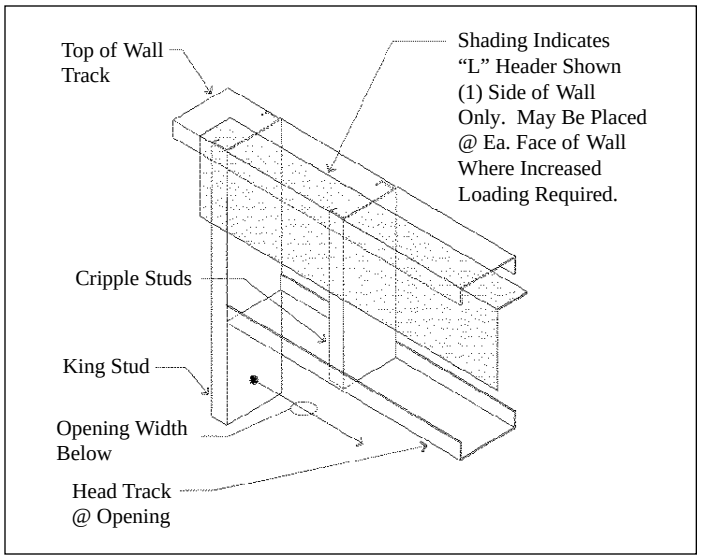
L-Shaped Header More Efficient to Design and Build

Nader Elhajj, P.E., NAHB Research Center

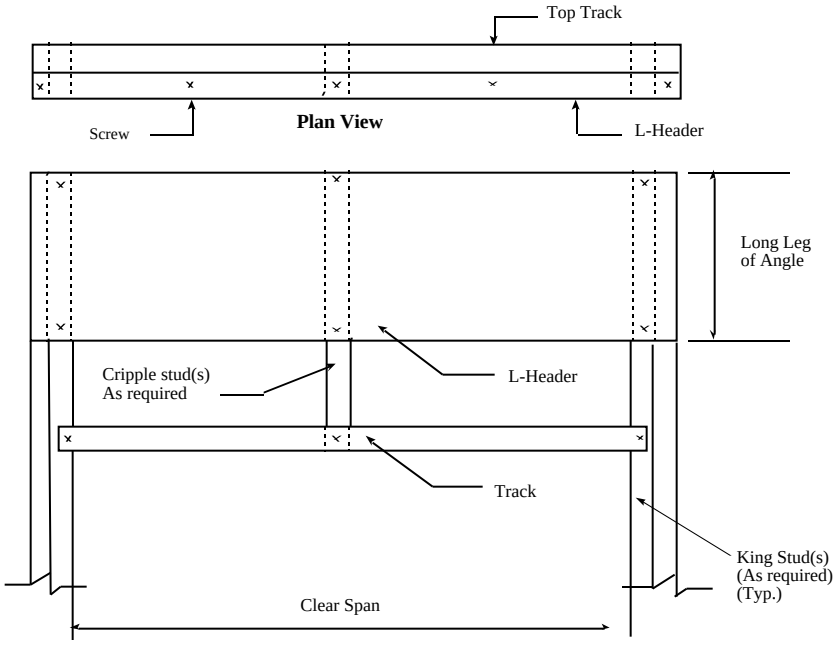
The header is one of the most over-designed and labor intensive components in a typical load bearing steel framed structure. Currently, the box beam and the back-to-back header are widely used. Recently however, a growing number of contractors in the Western U.S. have begun using the L-shaped header because it:

- uses less steel,
- is easier to insulate,
- takes less time to fabricate, and
- uses less screws.

As the name suggests, the main component in this header is a piece of light gauge steel formed into a shape resembling the letter "L". The header is made by lapping L-shaped angles over the top track on one or both sides of the wall. The L-Shaped Header is attached at the top plate (track) of the wall and transfers vertical loads to the next available stud along the side of the window or door opening.



Preliminary tests for single span gravity loads were conducted at the NAHB Research Center laboratory indicates that the L-shaped header can be a viable alternative to the conventional back-to-back or I-beam headers for lightly loaded bearing walls. The test showed that the L-shaped header can be safely used for 4'or 6'openings supporting trusses that are 28' or less in length. Tests were performed on 6', 8', and 12' headers with 6" and 8" leg angles with a thickness of 43 or 54 mils (18 or 16 gauge). Expanded testing for gravity loads and uplift for single span conditions will be performed during early 1998.



"L"-Shaped HeaderAssembly

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Results of Vibration Tests on Floor Systems

by Thomas M. Murray, Professor of Structural Steel Design,Virginia Tech

Although engineers may typically use L/360 as a "live" load deflection criteria for timber floor systems, L/480 is more commonly used by engineers in the design of cold-formed steel floors to ensure that the floor will perform adequately. As part of the development of a Prescriptive Method for cold-formed steel framing, a study was conducted to define a proposed method for determining subjective acceptability of cold-formed steel floor systems to vibration caused by normal occupant activity.

In this study, conducted at Virginia Tech, dynamic and static loading tests were performed on twelve full-size laboratory floors constructed using cold-formed, C-shaped joists. Each floor used nine joists at 24 in. (610 mm) on-center spacing, with 23/32-in. (19 mm) tongue-in-groove oriented strand board (OSB) sheathing as the sub-flooring. The tests included a range of joist depths (8 in., 10 in., and 12 in.) and in some cases joists with web openings were also used. Most of the assemblies were blocked and in several cases drywall ceiling was attached. In all, 26 floor configurations were tested.

Each floor was subject to a series of heel drop and walking tests to determine the natural frequency of the floor assembly. In addition, subjective human response evaluations of the assemblies were conducted.

The test data was compared to four existing floor vibration tolerance criteria: 1) the Australian Standard Domestic Framing Code, 2) the Swedish Building Technology Design, 3) a proposed timber floor vibration criterion developed at Virginia Tech, and 4) the Canadian Timber Floor Criterion. None of these criteria account for differences in floor construction, e.g. blocking, strapping, and drywall. The Canadian criteria, which specifies a maximum deflection based on a given load and the effective number of joists in the system that resist vibration, was found to provide a good approximation for short spans (based on subjective evaluations).

As a result of this testing, it appears that cold-formed steel, C-section supported floors be evaluated using the Canadian criteria with a modification for longer spans. The modified criteria is that a floor will be acceptable if the maximum deflection, Δ_{max}, due to a specified 225 lb. concentrated load is less than:

For $L \le 144$ in. (in.)

$$\Delta_{max} = 41/L^{1.3}$$

For $144 \text{ in.} < L \le 228$ in. (in.)

$$\Delta_{max} = [41/L^{1.3}] \bullet [0.00458L + 0.338]$$

where L is the joist span in inches. The maximum deflection for the joist system may be determined using basic mechanics and the provisions of the Steel Joist Institute (SJI, Technical Digest No. 5, Vibration of Steel Joist-Concrete Slab Floors, March 1988) to account for the effectiveness of adjacent joists. The bracketed multiplier in the second equation adjusts the Canadian criterion for longer spans. The multiplier was calibrated to the performance of the laboratory floors tested in the study. No field-testing has yet been performed to verify the proposed deflection limits.

Atlanta Braces for METALCON

With a head of steam built up from the success of the 1996 show, METALCON rolls into Atlanta at the end of October with the largest number of exhibitors in the show's history, and a comprehensive series of seminars and special educational programs on building with steel. METALCON is the only annual conference and exhibition focusing on the use of metal in design and construction. This year's show is being held at the Georgia Congress Center from October 28-30.

A line up of 29 educational session includes presentations on a variety of hot topics from cyberspace and high tech issues, to the growing market for metal roofing and steel framing, environmental benefits and new technology in metal forming and fabricating. More than 500 companies will also be exhibiting at METALCON, showing the latest in services, equipment and technology for the metal construction market.

On Monday afternoon and evening, October 27, prior to the opening of the show, a special two-part presentation will focus on opportunities in residential construction. Tuesday is Technology Day, featuring two morning programs which focus on using the Internet and providing case studies on metal industry companies who have used online technologies to gain their competitive edge. Later that afternoon, Charles Eley of the ASHRAE 90.1 Standards Committee will attempt to clear up the confusion over this energy code as it applies to metal buildings. Sessions on metal forming and fabricating technology are also being offered on Tuesday and Wednesday.

For METALCON registration information, call 1-800-537-7765 or e-mail PSMJ@tiac.com. An electronic preview of the show can be viewed at the web site www.metalcon.com.

http://LGSEA.com

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The LGSEA's web site (http://LGSEA.com) is intended to be just such a place, offering visitors the ability to quickly find LGSEA members through a comprehensive index. The "Meetings" page give the "when" and "where" for upcoming events. Issues of the LGSEA Newsletter and "Tech Notes" can be downloaded from the "Publications page," and printed out from the users computer. The "Information" page offers a place where a visitor can ask general or technical questions and request information about LGSEA programs and publications. A membership application can also be downloaded and printed.

Personal and Corporate Web Sites Made Available

Although more firms are using the Web as a means of providing information about their products or services, not everyone has the technical expertise to program or design a web page, and having a firm that specializes in designing Web pages can be costly.

The LGSEA has established an arrangement with its Web site designer to offer members a place in Cyberspace at a very low cost. "We get a lot of phone calls every month from builders and buyers who are looking for someone who can engineer or supply a project," says Larry Williams, LGSEA Managing Director. "Generally, we are only able to offer these callers a membership directory with names and phone numbers of people they should contact. We're trying to go one better by creating sort of a mini "Yellow Pages" that will provide much more information about our members."

The re-designed "Members" page contains the LGSEA roster sorted by location, and service or product. The names of participating members are highlighted, and can be selected to contact them via e-mail ($120 per year), or a Hyperlink, which connects users directly to the member's already existing Web site ($240 per year). If the member needs to have a Web site produced, the cost is $100 per page.

If you would like more information about this service, please contact the LGSEA office at (615) 386-78139.

Commercial Messages

For infomation about placing Commercial Messages in this newsletter, please contact Larry Williams at (615) 386-7139.

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❖ NewsBriefs ❖

New AISI Publications

The AISI has added the following reports to its catalog of publications:

RG9712	Design Guide for Cold Formed Steel Beams with Web Penetrations.	*Cost: $10*
RG9713	Prescriptive Method & Commentary, 2nd Edition	*Cost: $25*
RG9718	Monotonic Tests of Cold Formed Steel Shear Walls with Openings.	*Cost: $10*
RG9719	Cold Formed Steel Back to Back Header Assembly Tests.	*Cost: $10*
RG9721	Combined Axial & Bending Load Tests of Fully Sheathed Cold Formed Steel Wall Assemblies.	*Cost: $10*
RG9722	Final Report: "L" Shaped Header Testing.	*Cost: $10*

All publications may be ordered by calling (800) 79-STEEL.

IISI Studies Fastening Technology and Methods

The International Iron and Steel Institute (IISI) conducted a meeting last May to discuss fasteners and connections. Attending were builders, engineers, manufactures, and researchers from around the world. Among the conclusions reached by the group were:

• Fastener prices for steel construction seem to be inflated. Reasons discussed were: low volume, new products, specialty items, non-commodity items;

• Quality of wood for framing is declining and likely to continue declining;

• Since performance criteria for fasteners and fastening systems do not exist, it was recommended that performance targets be developed and transmitted to the tool and fastener industries. In addition, development of ISO Standards also should include fastening criteria;

• Development of the NAHB prescriptive standards for steel framing included implied fastener performance requirements. However, these are not stated as specifics but are "hidden" in the connection requirements of assembly;

• The general feeling of the groups was that future fastener technology will "creep out" rather than "leap-out" of new technology.

Discussion of fasteners and fastening methods continues with meetings in October.

Peanuts, pt. 2

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should go a long way toward enabling the development of this infrastructure. I'll cover those specific steps and other things in the final part of this article. Stay tuned.

HELP WANTED

Irvine, California / Las Vegas, NV — Experienced engineers wanted: CFS or wood. Salary commensurate with experience. Fax resumes to (714) 724-1399.

Licensed engineers needed for consulting work in Florida, Georgia, North and South Carolina, Tennessee, and Alabama. Primarily commercial applications. Experienced in light gauge steel or wood. Contact Bill Edwards at (561) 627-3200.

Seattle, WA -- Engineers experienced in light gauge steel design and construction. Competitive pay and excellent benefits. Fax resumes to: (253) 941-9939.

If you would like to place a "Help Wanted" listing please call (615) 386-7139.

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