LGSEA

Newsletter for the *October 1996*

Light Gauge Steel Engineers Association

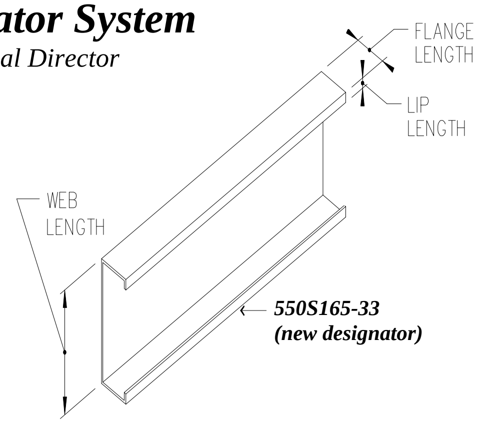
INSIDE page

Upcoming Events

METALCON ' 96 *Chicago, IL* *Info: (617) 965-0055*	Oct 1- 3
Building & Industry Show *Anaheim, CA* *Info:(909) 396-9993*	Nov 7- 8
NAHB Trade Show *Houston, TX* *Info: (800) 368-5242*	Jan 24-27
LGSEA Meetings *Houston, TX* *Info: (615) 386-7139*	Jan 26
Pacific Coast Builders Conference *San Fancisco, CA* *Info: (619) 325-9300*	Jun 18-21

National Cold-Formed Associations Approve A Common Stud Designator System

By Neal Peterson, P.E. - MSMA Technical Director



Standardization of cold-formed steel studs was significantly advanced by the development of a common designator system by the Metal Stud Manufacturers Association (MSMA) and the Metal Lath/Steel Framing Association (ML/SFA), a division of NAMM. The new system was hammered out at a joint meeting of the two organizations, held last April in San Diego, and institutes specific configurations and a system of product identification. Before this agreement, different manufacturers would use their own in-house designator systems to identify their studs. As a result, different manufacturers would have different ways of designating the same stud. This frequently led to confusion for those who wanted to specify steel studs.

The process of developing these stan-

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Residential Steel Framing - West Coast Opportunity

By Donald R. Moody, P.E. - Western Metal Lath

The opportunity represented by the growing use of light gauge steel framing in residential construction is widely regarded as the largest new market boon for steel since the invention of the automobile. But how large and what does it mean, in real numbers, to the steel industry in general, and to the stud industry in particular?

At Western Metal Lath, we think residential construction will be a significant part of our future, and for that reason we undertook a study to identify just how large it might be. We decided to start by determining how many pounds of steel framing are used in an average house.

To come up with that number we analyzed each of our 1995 residential shipments and found that for single story detached homes, the average weight of steel framing was 6.54 pounds per square foot of living area. For two story detached homes, the average weight was 7.86 pounds per square foot of living-area. Guessing that the mix of one-story to two-story homes is roughly 50/50, the average weight per square foot becomes 7.2 pounds. The average house constructed in 1995 contained 1,980 square feet of living area, so the average weight of steel framing per house is 14,256 pounds, or 7.13 tons. The NAHB reported 1,348,000 new home starts in 1995. The total potential for light gauge steel framing represented by residential construction, therefore, is about 9.6 million tons per year, based on 1995 housing starts.

How significant is that number? The domestic steel industry as a whole produces slightly more than 100 million tons per year of steel. Flat rolled (sheet) products account for about 55

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*(**Stud Designators** - Continued from page 1)*

dards began more than one year ago when the MSMA, a leader in promoting standardization, reached an agreement with the ML/SFA to work toward development of a common designator system. The agreement reached on April 19, 1996 was the culmination of this effort. The two groups represent a majority of the cold-formed steel manufacturers in the United States, so this designator standardization will significantly promote the use of cold-formed steel by making specifications easier to understand.

The new designation system will utilize the depth of the member expressed in 0.01 inches (i.e. 3-5/8" = 362, 6" = 600, 1-1/2" = 150, etc.). The shape of the member will be identified by the following characters:

- S - Stud and joist sections with flange stiffeners (lips)
- T - Track sections (no lips)
- U - Cold rolled channel and channel studs (no lips)
- F - Furring channel

The width of the flange will be designated in 0.01 inch increments (i.e. 1-1/4" flange = 125, 1-5/8" flange = 162, 2" flange = 200, etc.).

The member thickness will be identified in mils (0.001") and will be based on the minimum base metal thickness delivered to the job site. The base metal thickness recognized by the adopted standard are as follows:

Thickness *(Inches)*	**Old Gauge** *(Number)*	**New Thickness** *(Mils)*
0.0179	25	18
0.0269	22	27
0.0329	20	33
0.0428	18	43
0.0538	16	54
0.0677	14	68
0.0966	12	97
0.01180	10	118

Additional items included in the agreement are specific flange widths, flange stiffener length (lip length), and corner radii.

To explain how the new designator system will be used, the following examples are offered:

Example No. 1:
Section = Stud
Web Depth = 5-1/2"
Flange Width = 1-5/8"
Base Metal Thickness = .0329"
New Designator: 550S162-33

Example No. 2:
Section =Track
Web Depth = 3-5/8"
Flange Width = 1-1/4"
Base Metal Thickness = .0428"
New Designator: 362T125-43

Both associations will be utilizing the standard designator system for development of their respective association brochures in the near future. ❐

LGSEA Committee Reports

Larry Williams, LGSEA Managing Director

LGSEA committees met on August 19 to continue work on a number of projects and share information on developments with the light gauge steel framing industry. The following is a summary of the meeting highlights.

Truss Committee
Chairman: David Willis, P.E.
Alpine Engineered Products
A task group was formed to begin development of an in-plant quality control procedure. A final committee review of the *Tech Note* on construction bracing was accomplished at the last committee meeting. An additional task group was formed to develop a document to provide installers with guidelines for the handling, erecting, and bracing of steel trusses.

Lateral Load Design Committee
Chairman: Reynaud Serrette, Ph.D.
Santa Clara University
The first in a series of *Tech Notes* on shear wall design, covering chord studs and bottom track has been completed. The final draft should be available this month. Other shear wall *Tech Notes* in progress are Drag Struts and Top Plate Design, Interior Shear Walls, Exterior Shear Walls, and Load Transfer from Horizontal Diaphragms to Shear Walls.

Current work is underway at Santa Clara University to develop a rational procedure for determining performance (safety) levels for shear walls based on hysteretic energy calculations.

Fastener Committee
Chairman: David Nolan, P.E.
ET & F Fastening Systems
The second draft of a *Tech Note* on screw selection was reviewed and discussed at the last meeting. In a discussion concerning fastener standards, a two step action plan was agreed to: first - the committee will establish specifications for the selection of screws to be used in a AISI program to define screw design equations, and second - a consensus document on screw specifications is to be developed, possibly through ASTM.

Tech Note Committee
Chairman: Randy Daudet, P.E.
Dietrich Industries
Drafts of *Tech Notes* currently under development were reviewed in other committee meetings. A preliminary outline of publications in the *Tech Note* series was distributed and the group was solicited for additional topics that need to be addressed.

New Committees:
Two new committees were formed at the August 19 meeting: the Education Committee (chairman: Lee Hernandez, P.E., Western Metal Lath) and the Exterior Finishes Committee (Chairman: George Richards, P.E., BORM Associates).

Editor's Note

The LGSEA invites you to submit your comments and/or concerns to this Newsletter. If you have a particular subject matter that you would like addressed please send your request to the Editor @ Fax: (206) 941-9939 or via email at DTWN65C@prodigy.com Should you desire to get involved on one or more of the committees listed above please feel free to contact the chairman of that committee . ❒

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 (206) 941-9939). Upon editorial staff review your submission may be printed in the Technical Exchange Section of this newsletter.

Hip & Valley Break Metal Angle Calculation Tool

By Steve Walker, P.E. - Consulting Engineer

Table of Common Pitches	
Pitch	**β, degrees**
3:12	160.2
4:12	154.1
5:12	148.4
6:12	143.1
7:12	138.3
8:12	133.8
9:12	129.8
10:12	126.2
12:12	120.0

Break metal is the miscellaneous metal used in light gauge steel (LGS) framing to serve as the boundary element for roof diaphragms. In timber framing, it is common practice to cut and place a piece of blocking to serve as the boundary element in wood roof construction.

Break metal, the LGS equivalent of wood blocking, is a piece of thin strip metal that is broken along its length, usually on a press break, at an angle that matches the angle of intersection of the sheathing materials. This article focuses on a shortcut to calculate the break angle, β,at hips and valleys.

Break metal definition is an item of such apparent simplicity that its importance is often overlooked by engineers working with LGS. It is always required to transfer shear from wind and seismic loads between diaphragm boundaries (see Figure 1).

For those engineers who understand its importance, a general note will usually be placed on the plans which says something like this: "Provide 3" x 3" x 43 mil thick break metal at ridges, hips and valleys, typical." This leaves the calculation of the break angle to the framer in the field.

The shortcoming of this approach is that the break metal doesn't arrive at the project site with the rest of the steel framing package. Many projects are delayed while the framer field measures the break angle and places his order, adding days or even weeks to the erection time. The loss of time and productivity add unnecessary costs that make the LGS product less competitive.

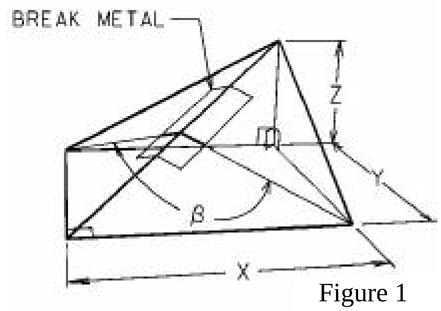


Figure 1

Including the break angle in the working drawings can contribute significantly to increases in erector productivity by allowing for fabrication and delivery with the rest of the steel framing package.

Equation 1, which can be solved on any scientific calculator, can be used to determine the break angle for the hip (or valley) above two walls intersecting at a 90 degree angle. X = Y = Run. Z = Rise.

The table gives the break angle for some common roof pitches and can be used to check calculations for other break angles.

$$b = (2)\arctan\left(\frac{1}{\sin\left[\arctan\left(\frac{Z}{(\sqrt{2})X}\right)\right]}\right) \quad (Eqn.1)$$

Equations for other conditions have been developed and will be presented here in future newsletters.

Where complex geometry's occur that do not lend themselves to quick calculation methods, three dimensional CAD tools can be used to quickly obtain the break angle.

If you have any comments or suggestions, Steven H. Walker, P.E. can be contacted via email at Stahlhaus@aol.com. ❐

Steel Pins: Steel to Steel Connections

***By** Professor Reynaud Serrette - Santa Clara University*
And Les Butler - Aerosmith, Inc.

The use of steel pins in light gauge steel framing connections provides builders with a fast, economical method of fastening steel members. Designers, however, have limited guidance when it comes to determining the capacity of connections which utilize steel pins. In this article, the results of a comprehensive series of lap shear and withdrawal (tension) tests are summarized. The tests were conducted at Santa Clara University and were sponsored by Aerosmith, Inc.

For both the lap shear and withdrawal tests two types of steel pins were used: 0.100 in and 0.144 in. diameter helical thread pins. The connected plates included the following minimum decimal thickness: 0.027 in (22 ga.), 0.033 in. (20 ga.), 0.043 in. (18 ga.), 0.054 in. (16 ga.), 0.068 in. (14 ga.), and 0.097 in. (12 ga). The nominal material properties for decimal thickness between (and including) 0.027 and 0.043 were F_y of 33 ksi and F_u of 45 ksi. For decimal thickness between (and including) 0.054 in. and 0.097 in., F_y was 50 ksi and F_u was 65 ksi.

The results of the lap shear and withdrawal test programs are summarized and compared to the AISI equations for screws (Center for Cold-Formed Steel Structures Technical Bulletin vol. 2, No.1, February 1993) in Figures 1 and 2, respectively.

In general, failure in the lap shear tests resulted from a combination of bearing in the main plate and pin slip in the holding plate. Bearing was the initial mode of failure. In the withdrawal test, failure resulted from slip of the pin in the holding plate.

Overall the comparisons in Figures 1 and 2 show that the AISI screw equations provide conservative estimates of the shear and withdrawal capacity of the steel pins in metal connections. For more information, a detailed report of the test program is available by contacting Les Butler at Aerosmith, Inc., 5050 South 40th Street, Phoenix, AZ 85040. ❐

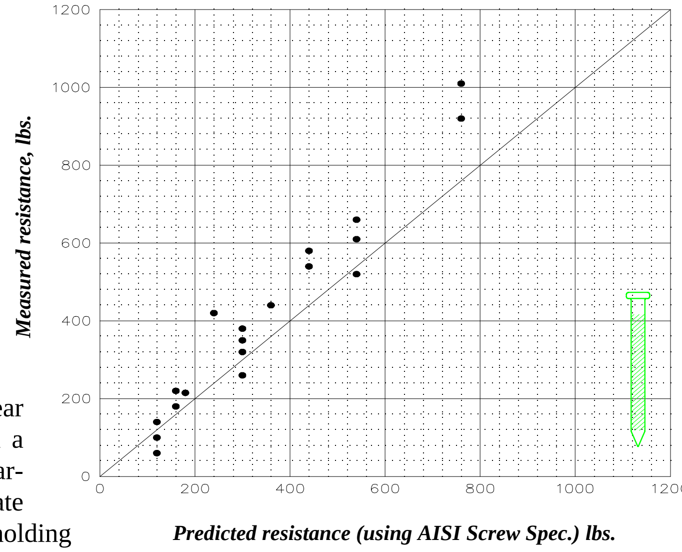


Figure No. 2 Comparison of withdrawal test results

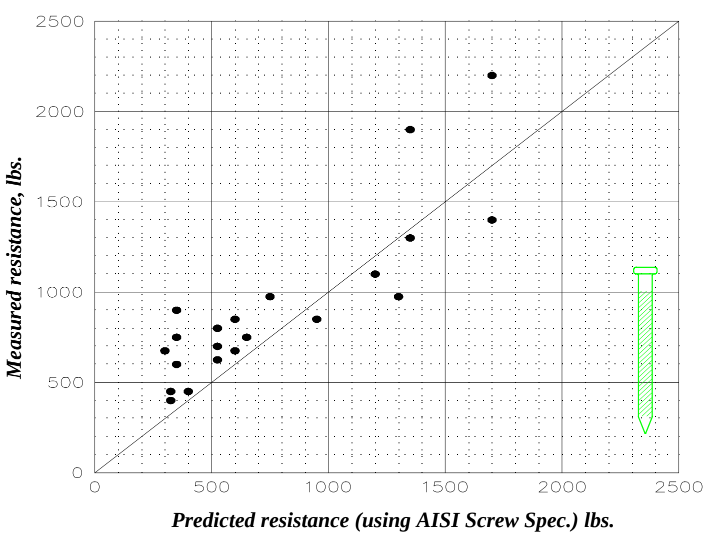


Figure No. 1 Comparison of lap shear test results

The Center For Cold-Formed Steel Structures

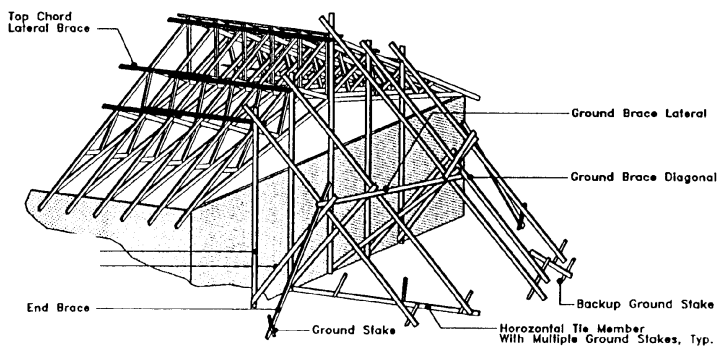
by Professor Roger A. LaBoube, Associate Director

The Center for Cold-Formed Steel Structures (CCFSS) was established at the University of Missouri-Rolla in 1990, with initial funding provided by the American Iron and Steel Institute. Today, CCFSS is financially supported by the American Iron and Steel Institute, Metal Building Manufacturers Association, Rack Manufacturers Association, Steel Deck Institute, and the University of Missouri-Rolla. CCFSS provides an integrated approach for handling research, teaching, engineering education, technical services and professional activity. In addition to coordinating UMR research, the CCFSS co-sponsors national specialty conferences and short courses on cold-formed steel structures, as well as assisting in the development and distribution of educational programs. CCFSS maintains a technical library as a repository for publications related to cold-formed steel. On-line service is available to access the library. For the purpose of disseminating technical information, CCFSS publishes biannual newsletters and technical bulletins. For additional information regarding the services provided by CCFSS, contact Roger LaBoube (573) 341-4481. ❐

Truss Bracing Tech Note Released !

The first in a series of technical papers, called *"Tech Notes"*, has been released by the LGSEA. The four page publication provides design procedures for temporary construction bracing of cold formed steel trusses, and a design example for a truss system with members spanning 42 feet. The discussion of top chord braces, ground bracing systems, and bottom chord and web bracing is illustrated by several details and diagrams. "Although there may be several valid approaches to designing truss bracing systems, this *Tech Note* provides valuable information on one such method that we believe is effective," says Mark Crawford, P.E., author of the publication.

The next *Tech Note* set for publication will address chord studs and bottom tracks in shear wall design, and will be followed by separate *Tech Notes* on the remaining areas in shear wall design (see "Committee Reports" article on page 3).



Ultimately, the *Tech Note* series will include up to 50 reports on various aspects of the design and assembly issues related to light gauge steel framing. *Tech Notes* are distributed to LGSEA members at no charge, and can be obtained by non-members for a nominal price. For more information, call (615) 386-7139. ❐

Lateral Resistance Steel Stud Walls Testing - Update

By Professor Reynaud Serrette - Santa Clara University
And Roger Brockenbrough - American Iron and Steel Institute

Following the recent shear wall test program completed at Santa Clara University, AISI has initiated another test program to develop additional lateral resistance design data for light gauge steel framed walls. The new test program addresses steel sheathed walls, flat strapped x-braced walls, high aspect ratio walls, and walls utilizing 16 and 18 gauge (0.054" and 0.043", respectively) steel studs. In addition to these tests, the Light Gauge Steel Research Group at Santa Clara University is beginning work on the development of performance requirements based on energy calculations. ❐

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(***Residential Steel*** *-Continued from page 1)*
million tons of that total, and galvanized sheet steel is about a 15 million ton per year market. If every new house was framed in steel, the steel industry as a whole would grow by more than 9%, and the sheet and galvanized markets would grow by about 17% and 64%, respectively. Of course, not even the most optimistic steel advocate expects every house to be framed in steel in the near future. Nevertheless, the potential is enormous.

While the opportunity for the domestic steel industry as a whole is huge, it is the stud manufacturers whose total output will literally explode as steel gains share in the residential market. Focusing only on the stud industry in the western 13 states, there are presently 13 stud manufacturers, 8 of which are located in California. Since Western Metal Lath competes to varying degrees with 12 of those 13 manufacturers, we try to keep on top of everyone's relative position in terms of market share. Using that data, our best estimate as to the size of the overall western U.S. stud market is 215,214 tons per year. The NAHB reported 334,500 housing starts in the western region in 1995, which, when multiplied by 7.13 tons of steel per house, represents a total potential opportunity of 2,384,985 tons of steel studs per year due to residential construction. While no reasonable person expects every house to be framed with steel anytime in the near future, every 1% of residential framing market share steel gains means the entire stud industry grows by more than 11%.

What is it going to take for steel to gain serious market share? The answer, predictably, lies in fundamental economics. Steel will gain large market share when it is able to compete, on an installed basis, with wood framing. Steel will not be able to compete on a broad market scale, on an installed basis, until the soft costs of using steel (estimating, engineering, bills of materials, lead times, etc.) are lessened, and framing labor costs are brought in line with wood framing. The soft costs can be greatly reduced, and the market generally enabled, by standardization. Standardization is the first step to ensuring that steel is as easy and inexpensive to use as dimensional lumber, and is as locally and readily available. Tremendous progress has been made on this front over the past year. Labor costs are the next big obstacle. We need more trained labor, better tools, more value added members and assemblies, maybe some new shapes that replace labor consuming field assemblies, and many more improvements.

Present day obstacles not withstanding, we remain very optimistic about the long term potential for steel framing in residential construction. The fundamental dimensioned lumber price/supply/quality relationships that created the original opportunity for steel framing continue to result in a market environment in which steel is increasingly competitively positioned. When we in the stud industry have 10% of the residential framing market, we will have doubled the size of our current total market. With numbers like that, who wouldn't be optimistic! ❒