Newsletter for the
Light Gauge Steel Engineers Association
June 1998

INSIDE

Upcoming Events

Western Building Show — June 25-27
San Francisco, CA
Info: (916) 325-9300

LGSEA Meetings — June 26-27
San Francisco, CA
Info: (615) 279-9251

AISI Residential Advisory Group Meetings — June 26-27
San Francisco, CA
Info: (202) 452-7202

Seminar - Cold-Formed Steel Design *(6-hour)* — July 24
San Francisco Bay Area
Info: (615) 279-9251

Seminar - Cold-Formed Steel Design *(6-hour)* — July 25
San Francisco Bay Area
Info: (615) 279-9251

(See Page 3 for Seminar Calendar)

Southeastern Builders Conference — Aug. 14-16
Orlando, FL
Info: (904) 224-4316

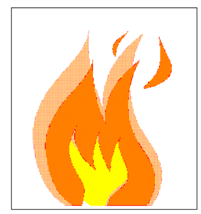
Fire-Resistance and Acoustic Tests Completed

Although cold-formed steel (CFS) construction has been perceived by some as providing reduced fire safety and increased noise transmission, recent tests show that CFS floor construction generally equals equivalent wood construction in both fire resistance and noise attenuation. These conclusions were reached as a result of tests conducted at the National Research Council's Institute for Research in Construction (NRC-IRC). Eighteen companies and organizations contributed to or participated in this program, including the Canadian Sheet Steel Building Institute (CSSBI). Full test results will be published in Fire Protection, Bulletin 26, produced by the Canadian Steel Construction Council. A draft of this document is currently under final review

"The CSSBI has already developed fire resistance and STC ratings for non-load bearing cold-formed steel wall assemblies, but very little data on floor assemblies," says Steve Fox, General Manager of the CSSBI. "The goal of this testing program was to significantly expand the selection of floor assemblies included in the National Building Code of Canada and help eliminate cost penalties associated with steel framing."

Fire Ratings

Thirty five tests were conducted, of which five involved CFS joists with a plywood subfloor, and one which was a CFS joist/concrete topping floor assembly. All assemblies were built with "C" shaped joists. The remaining tests used solid wood joists or wood I-beams.



All CFS structural details in the various assemblies were essentially identical, although various combinations of drywall, types and layers of insulation, joist spacing, and subfloor installation methods were tested. In addition, the cavities

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Shear Wall Testing: ICBO ES Sets New Acceptance Criteria

by Reynaud Serrette, Ph.D.

On April 2, 1998, the ICBO ES Evaluation Committee unanimously voted to require cyclic testing for light gauge steel framed shear wall assemblies intended for use as seismic lateral force resisting elements. The committee cited the need to issue/reissue current evaluation reports in accordance with the methodology used to develop the values provided in Table 22-VIII-C of the 1997 UBC. Thus, as old reports come up for renewal, products presently recognized as providing seismic resistance (but have not been tested cyclically) will be limited to wind load resistance. The test protocol recommended by ICBO is taken from testing sponsored by AISI at Santa Clara University.

This decision does not mean that all systems not directly listed in the 1997 UBC tables be tested. Sub-section 2219.1 of the 1997 UBC states: "As an alternative to the provisions in Table 22-VIII-A [wind load resistance] and Table 22-VIII-C [seismic load resistance], steel stud wall systems sheathed with wood structural panels may be used to resist horizontal forces from wind or seismic loads where allowable shear loads may be calculated by principles of mechanics

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Fire and Acoustic Tests

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of some assemblies were insulated while others were not. The tests were conducted in accordance with CAN/ULC-S101-M89 Standard Methods of Fire Endurance Tests of Building Construction and Methods which required adherence to the standard time-temperature curve. The standard also called for the assemblies to be fully loaded to design capacity.

An analysis of the results from the 35 tests showed that steel joist floors generally equaled the wood joist counterparts. A summary of the results are given in the table below for those assemblies with resilient furring channels anbd two layers of Type X drywall.

The full details of the fire-resistance tests conducted at the NRC-IRC are contained in the NRC-IRC report entitled "Results of Fire Resistance Tests on Full-Scale Floor Assemblies", by Messrs. Sullan, Seguin and Leroux. The report lists a number of conclusions from the tests that would have an effect on the fire endurance of floor assemblies in real buildings, including:

- The type of subfloor (OSB or drywall) had no effect on fire endurance;
- Fire resistance can be improved by locating drywall ceiling screws no closer than 38 mm from the board edge. The type of screw had some effect on fire resistance;
- Glass fibre batte insulation in the floor cavity generally reduced the fire resistance, while rock fibre insulation generally (but not always) increased it.
- For assemblies with two layers of drywall, all types of insulation generally reduced fire resistance;
- A second layer of drywall significantly increased fire resistance;
- In certain manufactured wood I-beam assemblies, joist spacing affected fire resistance, while joist spacing had no effect on steel joist assemblies.

Acoustic Tests

Two types of acoustic tests were conducted on the same 35 assemblies later used for the fire resistance tests. The first was a sound transmission class (STC) rating, and the second being an impact insulation class (IIC) rating. Since these tests were non-destructive, it was possible to conduct many more trials than for the fire tests. Consequently, the results were more complex and varied. In fact, the report cautions that there are still a number of unanswered questions to be resolved before tables can be generated for building codes. As with the fire resistance tests, CFS floor joist assemblies perform equal to wood framed floor systems.

Full results of this part of the test program as contained in the NRC-IRC report "Summary Report for Consortium on Fire Resistance and Sound Insulation of Floors, Sound Transmission Class and Impact Insulation Class Results," by Messrs. Warnock and Birta. For a copy of either report, contact the National Research Council in Ontario, Canada at (613) 993-4114. ❑

Fire Resistance Tests

Mode and Average Time of Failure

(All assemblies with resilient channels and 2 layers of 1/2" Type X drywall)

Assembly Type	No. of Tests	Failure Mode	Fire Resistance
Wood joist, no cavity insulation	1 test	1 Flame	80 Min.
Wood joist, cavity insulation	3 tests	3 Flame & Structural	71 Ave.Min.
Wood I-beam, no cavity insulation	4 tests	1 Flame/3 Structural	72 Ave.Min.
Wood I-beam, cavity insulation	5 tests	5 Structural	70 Ave.Min.
Steel joist, no cavity insulation	2 tests	1 Flame/1 Structural	73 Ave.Min.
Steel joist, cavity insulation	2 tests	2 Structural	67 Ave.Min.
Steel joist/Concrete Composite insulation	1 tests	1 Structural	60 Min.

Seminars on the LGSEA Agenda for 1998

The LGSEA is scheduling a series of seminars and presentations around the country that will provide engineers and architects with a range of learning options, from a basic introduction to cold formed steel framing (CFS) to a more comprehensive seminar on designing with cold formed steel.

An in-depth review of cold-formed steel design is offered in a six-hour lecture developed by the American Iron & Steel Institute (AISI), and presented by Roger LaBoube, Ph.D., P.E. (University of Missouri/Rolla) and Reinhold Schuster, Ph.D., P.E. (University of Waterloo, Ontario). The seminar focuses on CFS member design, and teaches how to use the AISI 1996 Specification for the Design of Cold-Formed Steel Structural Members and 1996 Cold-Formed Design Manual. Subjects covered include Tension Members, Elements and Behavior, Members in Bending, Columns and Beam-Columns, Member Bracing, Connections and Joints, Testing for Special Cases, and Cold-Formed Steel Framing.

A 3-hour lecture is also being offered to help designers and builders get the latest information about cold-formed steel framing. This seminar emphasizes the application of cold-formed steel structures, introduces the AISI Design Specification Standard, residential building design and construction, and reviews the information that is available through a variety of other organizations.

A new 90-minute seminar provides an introduction to the broad concepts of cold formed steel design and construction. This program is currently available by request by calling the LGSEA at (615) 279-9251. ❑

COLD FORMED STEEL SEMINAR SCHEDULE

Location	Seminar	Date
Denver, CO	3-Hour	May 26, 2-5 p.m.
Marriott City Center	6-Hour	May 27, 8 a.m. to 4 p.m.
San Francisco, CA	6-Hour	July 24, 8 a.m. to 4 p.m.
	6-Hour	July 25, 8 a.m. to 4 p.m.
Orlando	6-Hour	August 14, 8 a.m. to 4 p.m.
	3-Hour	August 15, 9 a.m. to Noon
San Diego	6-Hour	October 23, 8 a.m. to 4 p.m.
	3-Hour	October 24, 9 a.m. to Noon
Atlanta	6-Hour	November 20, 8 a.m. to 4 p.m.
	3-Hour	November 21, 9 a.m. to Noon
Nashville	6-Hour	December 18, 8 a.m. to 4 p.m.
	3-Hour	December 19, 9 a.m. to Noon
Chicago	6-Hour	January 1999
	3-Hour	January 1999

Tuition for both the 6-hour and 3-hour sessions may vary from city to city.
(For more information, or to enroll in a specific seminar, call (615) 279-9251)

New "Tech Notes" Released

Three new Tech Notes have been released by the LGSEA, covering truss design, fasteners, and diaphragm design.

"Design Guide for Permanent Bracing of Cold-Formed Steel Trusses" (TN 551e) reviews the basic requirements and design parameters for bracing of CFS roof systems. The design example is based on a truss system with members spanning 42 feet, using 1/2 inch plywood attached to the top chord with self-drilling screws at 12 inches on center. Web lateral and diagonal bracing are illustrated by three details.

"Pneumatically Driven Pins for Wood based Panel Attachment" (TN 561b) provides information on specifications, selection and field inspection of pins driven by pneumatic nailing systems. In the Fastener Selection section of the publication, proper pin driving depths, panel edge distances, and installation of subflooring and warped wood panels is reviewed.

"Lateral Load Resisting Elements: Diaphragm Design Values" (TN 558b-1) includes a brief discussion of some of the structural issues that the designer should consider while designing and detailing the diaphragm. The derivation of service load values for structural diaphragms that utilize plywood sheathing over cold-formed steel framing also are examined in this Tech Note.

When completed, the Tech Note series will include up to 85 reports on various aspects of cold-formed steel framing design and assembly issues. Tech Notes are free to LGSEA members, and $5 per issue for non-members. For more information, call (615) 386-7139. ❑

TECHNICAL EXCHANGE

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 cold-formed steel 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

Shear Wall Performance of Rigid Foam Insulated Framing Systems

by Joe Charlson, United States Building Technology, Inc.

While wall assemblies using steel studs can be designed to achieve a desired thermal performance, often it is necessary to include a thermal break in the design. Most frequently, this is achieved by attaching an exterior insulative sheathing such as extruded polystyrene or poly-isocianurate to the exterior stud flange. While this significantly increases R-values, rigid foam also decreases the lateral resistance of the sheathed wall to wind and seismic loads.

To determine the impact of a foam surface on the shear value of a wall assembly, static tests were conducted earlier this year by the Light Gauge Steel Research Group, Department of Civil Engineering, Santa Clara University.

The tests were performed on 4-foot x 8-foot assemblies using 20 gauge steel studs. The assembly descriptions are summarized in Table 1. All of the assemblies in this research program were tested statically.

The test results are summarized in Table 2, and the following preliminary conclusions can be surmised. Adding foam inserts of relatively low compressive strengths (less than 100-psi resistance to 10% compression) imparts ductility to the wall assembly in proportion to the

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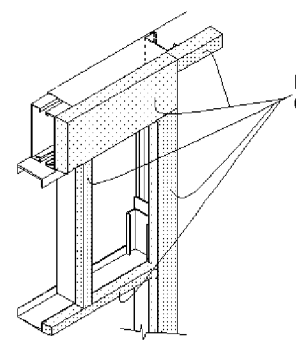


Jamb and Header Detail Showing the Application of a Rigid Foam Thermal Break

Table 1. Shear wall assembly descriptions 1,2,3,4

Test Specimen	Foam Insert	Assembly Description and Fastener Schedule
Pilot2	1/2-in 25 psi	OSB: No. 8 screws at 4 in./12 in GWB: No 6 screws at 6 in./12 in.
A7	1/2-in 30 psi	OSB: No. 12 screws at 6 in./12in. one side of the assembly left open
A9	1/2-in 30 psi	OSB: No. 12 screws at 3 in./12in. one side of the assembly left open
A1 and A2	½-in 100 psi	Plywood: No. 12 screws at 3 in./12 in.; 2 in. washers used with screws; GWB: No. 6 screws at 6 in./12 in.
A3	1-in 100 psi	Plywood: No. 12 screws at 3 in./12 in.; 2 in. washers used with screws; GWB; No. 6 screws at 6 in./12 in.
A4	1-in 100 psi	Plywood: No. 12 screws at 3 in./12 in GWB; No. 6 screws at 6 in./12 in.
A5	1-in 30 psi	Plywood: No. 14 screws at 3 in./12 in.; GWB; No. 6 screws at 6 in./12 in.
Pilot1	2-in 25 psi	OSB: No. 8 screws at 4 in./12 in. GWB; No. 6 screws at 12 in./12 in.
A6	2-in 100 psi	Plywood: No. 12 screws at 3 in./12 in. GWB.; No. 6 screws at 6 in./12 in.

1 All walls framed with 20 gauge studs and tracks.

2 15/32-inch APA rated plywood sheathing and 7/16" APA rated OSB sheathing are denoted in the descriptions as Plywood and OSB respectively. 1/2-inch gypsum wallboard is denoted as GWB in the descriptions.

3 Cap track installed over chord stud for increased capacity in compression

4 The rigid foam insert is extruded polystyrene foam material in all cases.

A Design Concept for Composite Wood Structural Panel and Steel Frame Box Beams

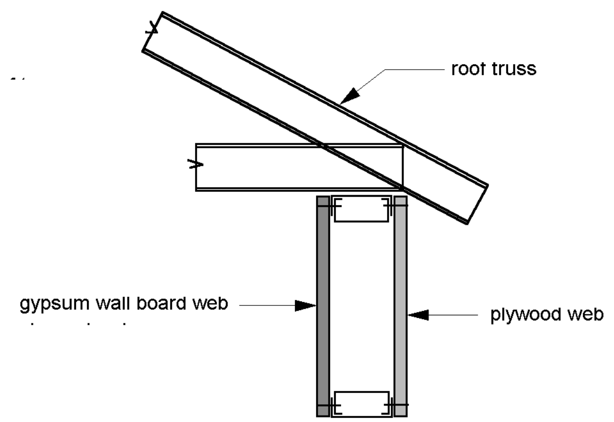
by Reynaud Serrette, Ph.D.

As attempts are made to make steel framing more competitive, practical economical solutions for some situations may involve composite forms of construction. One possible solution is a cold-formed steel framed beam with structural-use panels. Box beams constructed of lumber and plywood panels have long been used in light frame wood construction. The American Plywood Association (APA), in a Technical Note (No. C426C) showed that useful design data can be obtained for these box beam systems. In Data File Form No. 2416P, APA also presents a series of tables containing calculated design values for box beams.

If lumber is replaced by cold-formed steel sections, can the same principles be applied to estimate strength and stiffness? Absolutely. However, as with any procedure that is based primarily on mechanics, the designer must control the quality of the materials used and fabrication of the beam for specific applications. In addition, the following items should be kept in mind:

1. Deflection of the composite beam should be evaluated using transformed sections.
2. The shear strength of the screw connection may be estimated from the National Design Specification.
3. The edges of the panel should be flush with the steel flange to limit transfer of vertical shear through the screws alone.
4. Panel splices should be staggered to avoid development of a weak shear zone.
5. The shear strength of the panel material itself.
6. Beam end detailing to transfer the loads.

Box Beam Supporting a Roof Truss



Designers considering box beams with wood structural panel one side and a weaker material on the other side should be aware of possible bending of the beam flange as the supported member rotates. This behavior may result in a lower that expected design strength.

Finally, even though strength and stiffness calculations based on principles of mechanics, suggests that a beam "works," some confirmatory testing should be undertaken to support the calculated values. ❑

ICBO ES Sets New Criteria

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without limitation by using the wood structural panel shear values in the code and approved fastener values." The drawback with this provision is that some jurisdictions may not feel comfortable interpreting a set of computed values based on the 1997 UBC Standard 23-2, Section 23.223--Calculation of Shear Wall Deflection. ❑

1998 Board and Officers Named

In elections that were completed on March 23, 1998, the following Board of Directors was named:

Professional Member Directors:

Neal Peterson, P.E., DEVCO Engineering, Oregon
Dean Peyton, P.E., Anderson-Peyton Structural Engineers, Washington
George Richards, P.E., BORM Associates, California
Steve Walker, P.E., Steven Walker, Professional Engineer, Florida
Tim Waite, P.E., T.J. Waite and Associates, Hawaii

Affiliate Member Directors

Reynaud Serrette, Ph.D., Santa Clara University, California
Ken Vought, USS-POSCO Industries, California

In addition, the Board elected Neal Peterson, P.E. LGSEA President for 1998 and Dean H. Peyton, P.E., Vice President.

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Shear Wall Performance of Rigid Foam Wall System

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thickness of insulator utilized. The test results illustrate that this ductility can be controlled by increasing the diameter of the fastener head or to the same effect by the addition of a washer. The 1/2-inch and 1-inch rigid foam thickness tests utilizing washers (A1, A2, and A3) were stiffened so much so that the mode of failure was screw fracture. With the 2-inch rigid foam and 2-inch washers (A6), the washer's stiffness was tempered by the added ductility (2-inches of unsupported fastener length) so that the mode of failure was pull-through in the sheathing rather than screw fracture. In the assemblies without washers, failure was initiated by deformation of the OSB around the screw head as the head pressed into the OSB and the screws tilted with respect to the plane of the stud flange. Greater ultimate capacities and larger deformations are seen when washers are not used. For assemblies with large ultimate displacements, buckling in the compression chord was the ultimate failure mode.

For the range of insulators tested (25-psi, 30-psi, and 100-psi), the compressive resistance of the insulator had a much smaller impact on the assembly load transfer paths than the shank and head diameters of the fastener. Indeed, the fastener shank diameter had a greater impact than any other component. This is illustrated by comparing the A3, A4 and A5 test results. The two pilot tests (Pilot1 and Pilot2) make use of standard number 8 framing screws; these lower strength results can be used to support exterior wall design for low shear applications. In all of the assemblies with gypsum wallboard, the gypsum wallboard failed at a relatively low lateral displacement of approximately 0.6-inch displacement and had no impact on the ultimate loads.

Based on these preliminary tests, it appears that adequate shear strength can be developed for the applications described here. ❑

Table 2. Assembly ultimate loads, displacements and calculated design loads.

Test ID	Foam Insert	Assembly Description	Ultimate load capacity, lb/ft.	Displacement at ultimate load, inch	Load at 1/2" Displacement, lb/ft.	Load at 1.5" Displacement, lb/ft.
Pilot2 [3]	½-in 25 psi	OSB: No. 8 screws at 4 in./12 in GWB: No 6 screws at 6 in./12 in.	721	1.80	456	691
A7	½-in 40 psi	OSB: No. 12 screws at 6 in./12in. One side left open	883	2.92	320	600
A9	½-in 40 psi	OSB: No. 12 screws at 3 in./12in. One side of the assembly left open	1863	> 4.00 [1]	480	890
A1	½-in 100 psi	Plywood: No. 12 screws at 3 in./12 in.; 2 in. washers used with screws; GWB: No. 6 screws at 6 in./12 in.	1488	2.36	690	1112
A2	½-in 100 psi	Plywood: No. 12 screws at 3 in./12 in.; 2 in. washers used with screws; GWB: No. 6 screws at 6 in./12 in.	1349	2.28	690	1244
A3	1-in 100 psi	Plywood: No. 12 screws at 3 in./12 in.; 2 in. washers used with screws; GWB; No. 6 screws at 6 in./12 in.	1275	2.45	663	1031
A4	1-in 100 psi	Plywood: No. 12 screws at 3 in./12 in.; GWB; No. 6 screws at 6 in./12 in.	1322	> 3.50 [1]	603	872
A5	1-in 40 psi	Plywood: No. 14 screws at 3 in./12 in.; GWB; No. 6 screws at 6 in./12 in.	1779	> 3.25 [1]	640	1069
Pilot1	2-in 25 psi	OSB: No. 8 screws at 4 in./12 in. GWB; No. 6 screws at 12 in./12 in.	507 [2]	2.94 [2]	243	374
A6 [4]	2-in 100 psi	Plywood: No. 12 screws at 3 in./12 in. GWB.; No. 6 screws at 6 in./12 in.	1506	> 4.25 [1]	760	1092

[1] The displacement measurement device was removed at the indicated displacement prior to ultimate load.

[2] Pilot1 was the first assembly to be tested and was not loaded to failure. The value listed occurred at 2.94-inches of displacement.

[3] Pilot2 was loaded and unloaded at 0.5-in., 1-in., 1.5-in., and then to failure.

[4] Cap track installed over chord stud for increased capacity in compression.

❖ NewsBriefs ❖

Energy Efficiency Study Begun

The American Iron & Steel Institute has launched a three-year, $627,000 project on the development of cost-effective, energy efficient methods of steel framing. The project is designed to solve the thermal and other techical barriers to the energy-efficient use of steel in residential construction. Work on the project is expected to begin in the second quarter of 1998.
For more information: Elizabeth Vago, (202) 452-7126.

MASTERSPEC Updates Cold-Formed Metal Framing

MASTERSPEC, published by the American Institute of Architects, is issuing this month an update of Section 05400 - Cold-Formed Metal Framing. This section specfies cold-formed steel, load-bearing, and curtain wall studs; floor or roof joists; rafters and ceiling joists, and roof trusses.

Among the most significant changes are:

- "Summary", "Performance Requirements", "Submittals," and "Quality Assurance" Articles in Part 1 were revised and expanded;
- "Manufacturers" Article was updated and expanded in Part 2, and revised to include new and current ASTM standards and terminology;
- "Wall Framing" and "Joist Framing" articles were replaced with "Load Bearing Wall Framing", "Non-Load Bearing Curtainwall Framing", "Floor Joist Framing", "Roof Trusses", "Rafters," and "Ceiling Joist Framing";
- "Installation, General" in Part 3 was revised to include ASTM C 1007 and expanded to include installation provisions for shop and field fabricated wall panels.

Comments from a number of organizations, as well as practicing architects and engineers were used in preparing the update. For more information, or to obtain a copy, call (800) 424-5080.

Atlanta/Southeast Chapter Under Development

Work has begun on establishment of another LGSEA Chapter, currently named Atlanta/Southeast. The first organizational meeting of this chapter will be at the end of July in Atlanta, with invitations being sent to LGSEA members in Tennessee, Georgia, Alabama, and North and South Carolina. LGSEA members from outside of these states are also welcome to attend and participate.

Several other locations that are prime locations for new chapters include Florida, Southern California, Europe, and the Pacific Northwest. European members have also begun discussing the formation of a Chapter that would first represent members throughout the continent, and then break into regional or country chapters as membership increases.

For more information about new chapters, or ideas and suggestions about the formation of other chapters, call (615) 279-9251 or via e-mail at: LGSEA@AOL.com. ❑

NewsBriefs is designed to provide LGSEA members with news and information about the latest developments in the light gauge steel industry. If you would like to submit an item for consideration, please mail it to: LGSEA, 2400 Crestmoor Road, Nashville, TN 37215, e-mail: LGSEA@AOL.com.

HELP WANTED

Engineer -- Opportunity to innovate and create automated engineering solutions. Knowledge of truss design and cold-formed steel design necessary. Ability to design cold-formed steel trusses is desirable. We offer a fast-paced, dynamic environment located at the foot of the Rocky Mountains. Unlicensed candidates must be prepared to immediately pursue professional registration. Salary commensurate with experience. Fax resumes to: (303) 443-8033.

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If you would like to place a "Help Wanted" listing, call (615) 279-9251.

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