Winter 2003
February 27, 2003

Newsletter for the
Light Gauge Steel Engineers Association

INSIDE

Upcoming Events

OnlineWebcast Seminars:
- Mid-Rise Load Bearing Design — May 13
  Instructor: Don Allen
- Concepts in CFS Shear Wall Design — July 15
  Instructor: Reynaud Serrette

Info / to register: www.lgsea.com

PACRIM Steel Framing Conference — March 9-12
Honolulu, HI
Info: (808) 485-1400

LGSEA Technical Committee Meetings — March 29
New Orleans, LA
Info: (866) 465-4732
www.lgsea.com

Association of Wall and Ceiling Contractors International (AWCI)
Convention: March 25-30
Trade Show: March 28-29
New Orleans, LA
Info: (703) 534-8300
www.awci.org

Construction Specifications Institute — Apr. 9-11
Las Vegas, NV
Info: 1-800-689-2900
www.csinet.org

New UL Load Bearing Fire Rated Party Walls

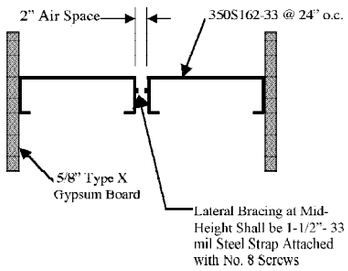
A recent fire test project conducted by the National Association of Home Builders Research Center (NAHBRC) has resulted in significant potential savings to owners, builders, and contractors using cold-formed steel framing. The U.S. Department of Housing and Urban Development (HUD), the Steel Framing Alliance (SFA) and the National Association of Home Builders (NAHB) pooled resources to commission the testing. The project started in early 2002 by pulling together a team of industry experts to identify non-rated steel wall and floor assemblies that are comparable to rated systems framed with wood or other materials. The selected assemblies were tested at Underwriters Laboratories (UL) in Northbrook, Illinois. To date, two wall assemblies have been tested successfully.

Test 1: 1-HR Rated Party Wall (Load Bearing)

One layer 5/8" type X GYP BD. applied parallel to 350S162-33 steel studs spaced at 24" o.c. with 1" drywall screws at 12" o.c. Studs attached to top and bottom tracks with _"-No. 8 pan head screws

Joints staggered 24" o.c. on opposite sides

3 _" glass fiber insulation friction fit in stud space (full batts)



The first test was for a gravity load

Continued on page 7

Army Corps of Engineers Shake Table Test (Part II)

by Jim Wilcoski
James.Wilcoski@erdc.usace.army.mil, (217) 373-6763

Note: this is the 2nd part of a two-part article. The first installment, published in last quarter's LGSEA Newsletter, described the test background, model configuration, and model design. This conclusion gives a summary of key aspects of the data collected. This is still only a small part of the full report. For additional information, see the last paragraph of this article.

Preliminary Observations

Modal Test Results

Shaketable tests were conducted on 5 through 7, June, 2002. Random modal tests were initially conducted with a root mean squared (RMS) amplitude of 0.02 g. To achieve better resolution RMS amplitude was increased to 0.1 g (vertical, longitudinal or in-plane, and yaw or torsion), 0.05 g (lateral or out-of-plane), while pitch (in-plane rocking) and roll (out-of-plane rocking) was held to 0.02 g. Table 7 (on page 2) provides the measured frequencies and damping from these tests.

Linear Seismic Tests

Measured Acceleration Response

Low-level shaketable tests were then conducted at 2, 5 and 8 percent of the filtered SE32 record (synthetic record developed for the SAC steel moment frame project). Several data

Continued on page 2

Newsletter for the Light Gauge Steel Engineers Association

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Shake Table Test

Continued from page 1

channels were checked to ensure data was being properly recorded. The measured strains from the 8 percent test showed that average strain measured in the 1st story diagonal straps was 1281 micro strain (75% of yield) and the peak value was 1396 micro strain (82% of yield). Linear tests ended at this level because measured strains were approaching yield; some strain measurements showed slight offsets during testing (maximum of 40 micro strain), suggesting that slight yielding of the straps might have occurred. If yielding at this level took place across the entire length of a strap between the columns, it would only result in 0.006 in. strap elongation and a 1st story drift of 0.0085 in. This would have very minor influence on later nonlinear testing.

Figure 2 plots the measured acceleration at the base beam (A3x), 1st story slab (A13x) and 2nd story slab (A23x). This plot shows the base motions amplified significantly at the 1st story slab and slightly more at the 2nd story. Figure 3 (page 5) shows the same acceleration records, zoomed in on 13 to 18 seconds region. Figure 2 shows the model responded at slightly greater amplitudes between 50 and 51 seconds, but Figure 3 focuses on the 13 to 18 second range because the response is almost as great, plus the response in this region can be compared later to the nonlinear response during the same time range as the model begins to yield.

Figure 2 and 3 show the 2nd story slab (measured by the A23x accelerometer) responds at only slightly greater amplitudes than the 1st story slab (A13x). Both the 1st and 2nd floor accelerometers show the model responds in both the 1st (1.6 Hz) and 2nd (5.2 Hz) modes of vibration of the model. As expected the 2nd floor response is much more dominated by the 1st mode, while the 1st floor is influenced almost as much by the 2nd mode. The measured response shown in Figures 2 and 3 can be compared with the predicted response for 11% of the SE32 record. The predicted response should be approximately 37% greater than the measured response, caused by the 8% SE32 record, because 11% is 37% greater than 8%. This comparison shows reasonable agreement, but the measured response is proportionally greater especially early on in the test.

Table 7. Predicted and Measured Model Frequencies and Damping

Mode of Vibration	Predicted Frequency (Hz)	Assumed Damping (% critical)	Measured Frequency (Hz)	Measured Damping (% critical)
1st Out-of Plane	—	—	1.22	6.7
1st In-Plane	2.16	4.0	1.65	7.2
1st Torsion	—	—	2.02	4.0
2nd In-Plane	5.82	4.0	5.25	1.6

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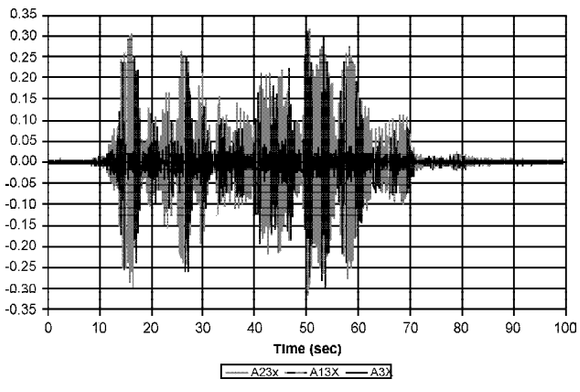

Figure 2. Measured accelerations at the base beam (A3x), 1st story (A13x) and 2nd story (A23x), 8%SE32 test.

LGSEA Unveils New, Expanded Web Site

Four years after its debut on the Web, the LGSEA has unveiled a totally re-designed site that substantially broadens the level of access, services, and programs available to members, as well as non-members who are searching for contacts and information about cold-formed steel.

According to Larry Williams, LGSEA Managing Director, the cost of sophisticated online technology once only available to major retail companies has decreased, while the volume of information developed by the LGSEA and the steel framing industry has increased. He also noted that as the number of LGSEA members grew past 1,000, it became imperative to find better, more efficient ways to communicate with members and deliver programs to them. "We needed a platform that was flexible and easy to use, comprehensive, and that incorporated many of the new automatic processing features that are now available," he says. "We've invested a substantial amount of time evaluating various options and applications, and I believe we now have a site that enables us to serve our members at a much higher level than ever before."

The new site has the same URL as before (www.lgsea.com) but now offers some significant new features that increase the value of membership, and is flexible enough to easily add services that members would like to see. Improvements and additions come in four main areas:

1. The member database and search engine capabilities;
2. Increased member access to information through additional on-line access via a "Members Only" section;
3. Education programs; and
4. The ability of members to request information, and provide feedback and opinions that will guide program development – and even help manufacturers develop or refine products for the cold-formed steel market.

Member Database

The on-line member database is one of the keystones of each of these four areas because it contains a profile of each member, including contact information, states/regions where licensed, and other important information.

Each LGSEA member already has had the basic data for their profiles entered into the new database, but for the first time members can now manage their own records. Now they can post, add or change e-mail addresses, add locations where they are licensed, and provide detailed information about their areas of expertise or the products they offer. This information has always been valuable, but the new search function enables both members and visitors to the site to find members who meet very specific criteria.

For example, a builder using the search engine to look for a "structural engineer" located in "Tennessee" and registered in "North Carolina" is able to find LGSEA members that meet those qualifications. Or, a builder or engineer looking for a "supplier or distributor" located in "Tennessee" that provides "trusses" and "drywall" also could locate just such an LGSEA member.

"Over the years, we've tried to collect this information but it's been difficult to manage, and even more difficult to maintain," says Williams. "Now we're able to provide instant access to important information to a greater degree than ever before, and allow members to use this as a tool for their own marketing efforts." All members are strongly encouraged to review and update their profiles, including adding a company logo, photo of a signature project or a product, or picture of themselves or employees.

The "Members Only" section is another new feature that provides a number of new benefits, including instant access to the full library of downloadable LGSEA publications and ongoing information about the activities of the various LGSEA Technical Committees, including previews of technical documents in development.

New polling/opinion and bulletin board functions also substantially increases members' ability to communicate with others in the LGSEA network, and to tell LGSEA leadership and the steel industry what types of educational programs, publications, research, and other services that you need. "The opinions of our members greatly influence the programs and services that we develop, but we don't feel that we've made it easy enough for members to tell us specifically what they want," says Williams. "The polls and bulletin board can be very easy-to-use, powerful tools, and we're hoping that LGSEA members take full advantage of them to let us know how we can

Continued on page 7

All members have been pre-assigned a Username and Password that will provide them access to "Members Only" areas of the Web site and allow them to review and add to their profiles. This information has been sent to all members, but if you have not received this yet, please contact the main office at info@lgsea.com, or by calling the new toll free number: (866) 465-4732.

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.

Research Study Using Tube Steel Distribution Headers

by Randy Daudet, P.E., President, Dietrich Design Group
ldaudet@dietrichdesigngroup.com

A rectangular hollow structural shape (HSS) is often used as a distribution device at the top of a load-bearing steel stud wall. This detail may be used when wall studs, trusses, or joists from above do not align with the supporting studs below. Recently, a research study was conducted by Dietrich Design Group to evaluate the performance of the supporting studs when a HSS is used in this fashion. The study included 362S165-54 and 68 mil studs, and 600S165-43, 54, and 68 mil studs. Material used in the test (and calculations in table 1) are based on Fy = 79 ksi. The top track thickness matched that of the supporting stud. The HSS was 3/8" thick, and 3.5" wide for the 3.625" studs, and 6" wide for the 6" studs. A picture of the test set-up is shown in Figure 1.

The failure mode in all cases was curling, crushing, and eventual buckling of the web at the end of the stud. As shown in Table 1, it was found that the studs failed prematurely when compared to the AISI Specification, with the average tested load achieving only 44% of the predicted value. (Note that this is ultimate value for short, stubby studs; typical values for full height stud walls with discreet bracing are much less, and would therefore be much closer to test result values.) The premature failure might be attributed to the difference between the effective bearing width of the HSS, and the width of the stud. As shown in Figure 2, the effective bearing width is equal to the width of the HSS, minus 2 times the outside radius. Using an outside bend radius of 3/4" for 3/8" thick steel, the effective bearing widths are 2" and 4.5" respectively for 3.5" and 6" wide shapes. As a result, the HSS does not directly activate the stud bend radii, and the entire stud area does not contribute to resisting the load.

Table 1 - Test Results

Section	Average Failure Load Per Stud Pt (lb.)	Computed Failure Load Per Stud Paisi (lb.)	Pt/Paisi
362S162-54	5737	12648	0.45
362S162-68	11843	27331	0.43
600S162-43	4871	12257	0.40
600S162-54	6552	15293	0.43
600S162-68	14513	31142	0.47

A simplified design procedure has been developed, and has proven to fit the data well. The procedure assumes that only the web, and 70% of each corner –bend radius adjacent to the web is effective in resisting the load. The effective width of the web member is calculated according to AISI Section B2.1 with f=Fy, and k=4.0. Table 2 predicts proposed allowable loads for various Steel Stud Manufacturers Association (SSMA) sections using this procedure.

In conclusion, engineers should be aware that when using HSS distribution headers, the end bearing limit state identified by this study must be checked. In many situations, it may be the controlling limit state. It should also be noted that this limit state may be applicable for other distribution devices such as wood top plates, which do not offer full bearing at the top of the stud. ■

Figure 1

Figure 2

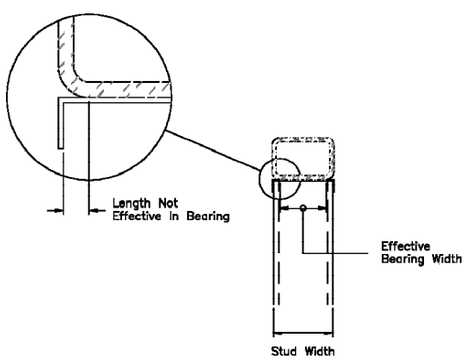

Table 2 -Allowable Loads For Tube Steel Distribution Headers On Steel Studs

Stud Size (in.)	mils	Fy (ksi)	web beff (in)	Ae (in^2)	Pall (lb.)
3.625	33	33	1.718	0.067	1221
	43	33	2.136	0.105	1933
	54	50	2.166	0.137	3794
	68	50	2.564	0.205	5687
	97	50	3.127	0.363	10079
6	33	33	1.821	0.070	1286
	43	33	2.311	0.113	2077
	54	50	2.352	0.147	4087
	68	50	2.869	0.227	6292
	97	50	3.814	0.433	12020

Shake Table Test

Continued from page 2

Nonlinear Seismic Test

Measured Acceleration Response

The model was then tested with the full filtered SE32 record. Figure 4 shows the acceleration at the base beam (A2x), 1st story slab (A12x) and 2nd story slab (A22x). This plot shows that at the beginning of the test the 1st story slab did respond significantly to the base motions, but soon both the 1st and 2nd stories were isolated from the motion at the model base. Figure 5 (page 6) shows the same acceleration records, zoomed in on 13 to 18 seconds region. Very small out-of-plane or torsional response was seen in either the 8% or 100% SE32 tests. Some high frequency, high acceleration spikes can be seen in the accelerometer data for the 1st and 2nd floor levels, but the displacement data does not contain these spikes, indicating the high accelerations were due to snapping of the out-of-plane threaded rods.

Figure 6 (page 6) shows the story drifts for both the 1st story (1st floor minus base beam displacement) and 2nd story (2nd floor minus 1st floor displacement), along with the base beam displacement. These are plotted in only the 13 to 18 second region, showing the very large 1st story deformation.

Figure 7 (page 6) shows an overall view of the model after testing. This shows the significant yielding and elongation of the diagonal straps on the first story. This model

Continued on page 6

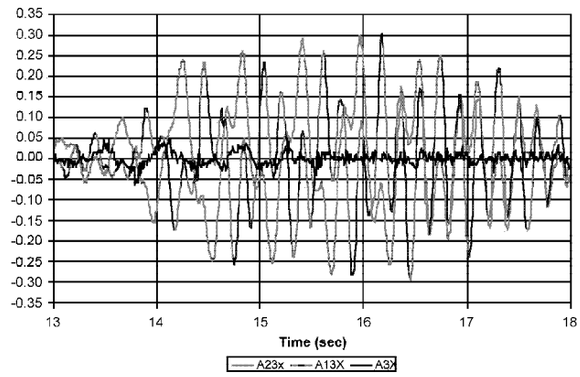

Figure 3. Accelerations at the base beam, 1st story and 2nd story for 13 through 18 sec.

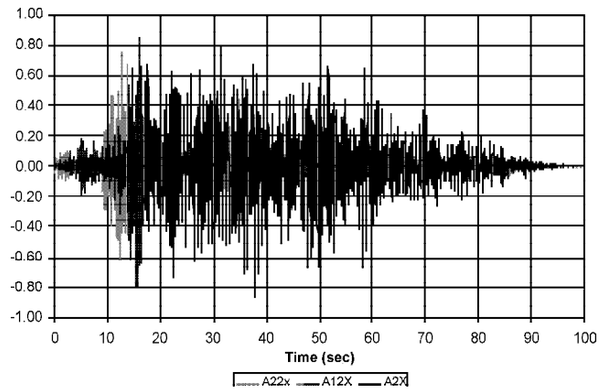

Figure 4. Accelerations at the base beam (A2x), 1st story (A12x) and 2nd story (A22x), 100% SE32 test.

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Shake Table Test

Continued from page 5

deformed significantly in the first floor, but with no damage to the columns, connections or anchorages. This demonstrates the excellent ductile behavior achieved by this structural system, when designed according to the provisions of TI 809-07. Large story drifts were reached, but with no loss of ultimate lateral capacity, damage to the gravity load resisting system, or any risk of collapse. In summary, there are two primary conclusions: the system has higher damping than was initially predicted and would be expected, and the measured periods were smaller than the computed values.

The full report, edited significantly for the LGSEA newsletter, contains additional detailed graphs and analyses, including strap strain values, story drifts, and coupon test values from actual tested elements. For additional information, contact the U.S. Army Engineer Research and Development Center (ERDC) Construction Engineering Research Laboratory (CERL), or visit their web site at http://www.cecer.army.mil/td/tips/product/details.cfm?ID=126. ■

LGSEA Opens "Careers" Page on Web

The Light Gauge Steel Engineers Association has teamed with QuantumCareers to offer a new "job bank" service to its members, whether they are an employer looking to fill a position with just the right person, or an individual looking for just the right place to work. The job board is maintained by QuantumCareers, a national career resource and development center dedicated to bringing employers and candidates together.

"Over the years, we've received numerous calls from companies looking for qualified employees and job seekers, but have never had a formal program to help make these parties connect," says Larry Williams, LGSEA Managing Director. "This new 'Careers' page fills that gap to giving members tools for successfully marketing themselves, and also gives employers tools to advertise available positions for Steel Engineering professionals."

LGSEA members are encouraged to register on-line with QuantumCareers for full access to the member services. The following services are available free of charge:

- An on-line national career searching tool to find the job of your choice;
- The ability to search multiple jobs from multiple employers nationwide;
- The ability to set up a confidential search profile and view profile matches online;
- An online management tool that allows you to view your application submittal history and obtain job status updates;
- An automatic e-mail notification option for newly listed

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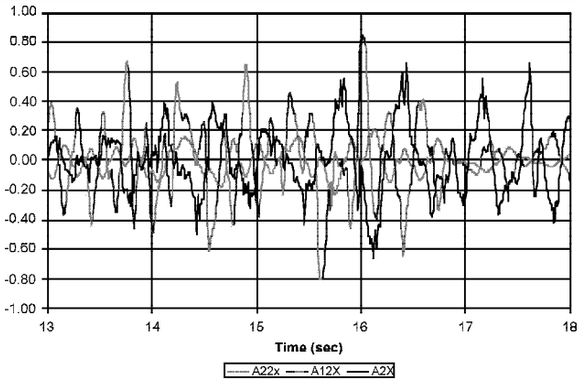


Figure 5. Accelerations at the base beam, 1st story and 2nd story for 13 through 18 sec.

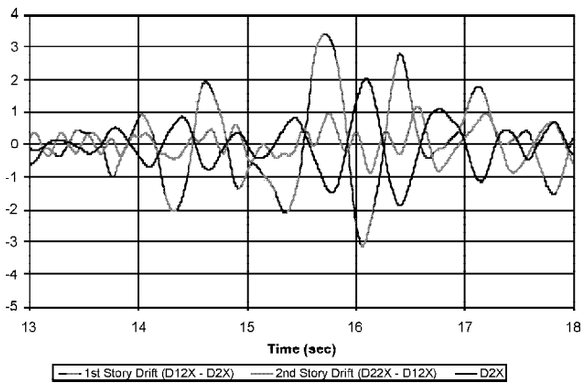


Figure 6. Story drifts at the 1st and 2nd floors, along with base beam displacement, for 13 through 18 seconds.

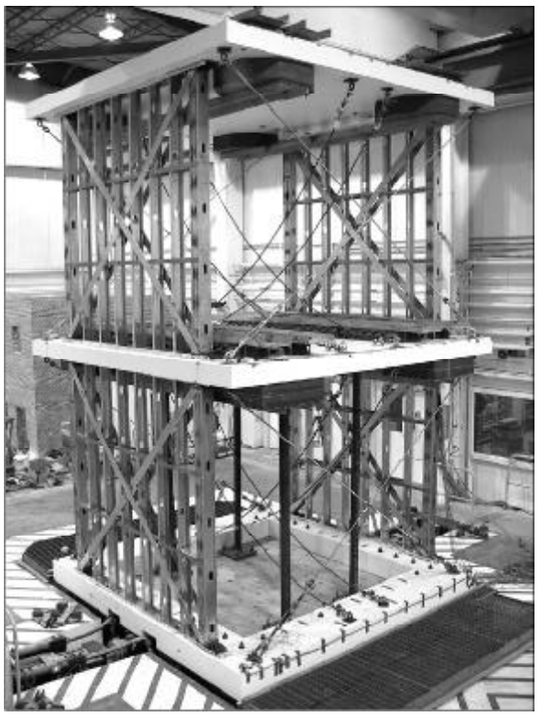


Figure 7. View of the model after testing, showing elongation of 1st story diagonal straps.

Expanded Web Site

Continued from page 3

serve them better."

The LGSEA Web site includes several features that address other needs, including:

- ⇑ A "Careers" service where employers can post openings and job seekers can look for their next career opportunity;
- ⇑ A running calendar of all LGSEA programs, as well as events held by others in pertinent organizations within the construction and design industries;
- ⇑ A "frequently asked questions" page (currently in development);
- ⇑ A page that recognizes the valuable support that we receive from sponsoring organizations;
- ⇑ "Chapters" pages that will provide information about what's happening in the local markets.

New programs and features will also be added to the Web site this Spring, including online seminars (Webcasts and streaming video presentations) that will allow members to learn more about steel framing design techniques and earn continuing education credits without leaving their offices. A schedule of the traditional classroom seminars will also be posted in early February, once a poll of members is completed.

An expanded on-line store will enable members to purchase some of the new industry standards at a discount, as well as details and design software developed by the industry's leading providers.

"This represents a huge step forward for the LGSEA in our ability to serve our members, and meet the needs of the marketplace," says Williams. "As our membership grows, the technology we now have will allow us to keep pace and continue to improve and increase the value they receive." ■

Careers Page on the Web

Continued from page 6

opportunities;

- The option to apply for jobs online;
- Free customer support service;
- Free technical support service;
- Free career center services;
- General headlines, news, and updates;
- Access to additional resources/ links.

Employers are also encouraged to target their job openings to LGSEA members by posting them through QuantumCareers. Those opportunities will appear on the LGSEA site under careers. To access QuantumCareers, go to the LGSEA site (www.lgsea.com), and click on "About the LGSEA", then click the "Careers" button. Registration information will be provided on that page. ■

Fire Test

Continued from page 1

bearing one hour rated party wall, framed as a double wall with two adjacent 350S162-33 studs (see diagram). The walls were insulated with 3-1/2" fiberglass batt insulation, and finished on both outer faces with one layer of 5/8" rated gypsum wallboard installed vertically with #6 screws. The screw spacing was 12" on center around the perimeter of the wallboard, and 12" on center away from board edges. The interior face of each wall was braced at mid-height using 1.5" 33 mil steel strapping, screwed to each stud, and a 2" air gap was left between the two runs of steel.

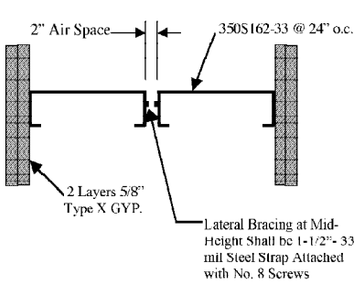
This wall achieved the targeted one-hour rating, with axial capacity of 80% of design load. The test proceeded beyond the target time rating, until failure of the system (see photos).

Test 2: 2-HR Rated Area Separation Wall (Load Bearing)

Base layer 5/8" Type X Gyp. BD. applied parallel to 350S162-33 steel studs spaced at 24" o.c. with 1" drywall screws at 12" o.c. Face layer 5/8" Type X Gyp. BD. applied parallel to each side with 1-5/8" drywall screws 12" o.c.. Studs attached to top and bottom tracks by No. 8 Pan Head Screws.

Joints staggered 24" o.c. each layer and side

3 _" glass fiber insulation friction fit in stud space (full width batts)



The second test was for a two-hour loadbearing party wall. The assembly was basically the same as the one-hour assembly, with one change: double layers of wallboard were applied to each outer face, rather than single layers. Screw attachment of both layers were the same: #6 screws at 12" on center in both the perimeter and field.

This wall achieved the targeted two-hour rating, with axial capacity of 100% of design load.

Nader Elhajj of the NAHBRC witnessed both tests at the UL facility, and documented the results. According to Mr. Elhajj, the assemblies will eventually receive a certified UL rating, however the data has not yet been publicly released. ■

Note: All tests were performed in accordance with ASTM test procedure E119 (ANSI/UL 263; NFPA 251).

Fire testing before (above) and after (right). The test proceeded beyond the target time rating, until failure of the system.

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Now there is a better way to find the right job or the right employee.

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