Newsletter for the *April 2005*
Light Gauge Steel Engineers Association

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LGSEA/SFA Corrosion Seminar, Honolulu, HI	May 24
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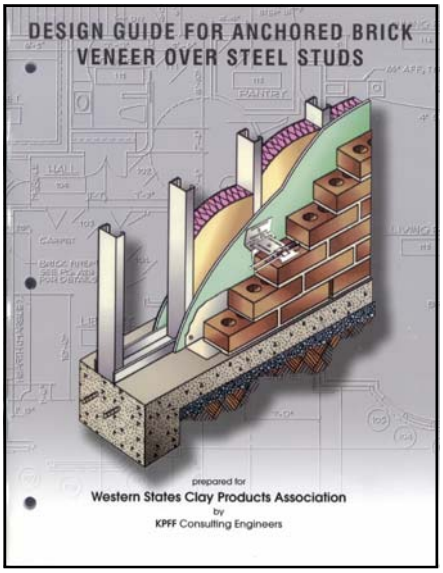
Metal Deck	Dec 8
METALCON International, Chicago, IL Contact: www.metalcon.com	Oct 4-6

Brick Veneer Supported by Steel Studs

By John G. Tawresey, SE , KPFF , WA

Brick veneer using steel studs as a supporting structural wall has been in use since the late 1960s. Before that time the backing wall (support wall) was typically constructed of concrete masonry units (or cinder block for those east of the Mississippi and over 50). The brick veneer over steel studs system (BVSS) finds extensive use today because it typically costs less to construct the backup wall using steel studs than to construct the backup wall using CMU.



When the brick veneer wall is relatively flat (same plane), then a steel stud system should be considered. When the veneer wall is articulated, a steel stud system may or may not be cost effective. In either case, there are basically two general arrangements for the stud wall. In the "Type 1 or Spandrel System" the steel studs are hung from the slab edge or spandrel beam. A ledger is welded to the studs for the

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New ICC-ES Acceptance Criteria Created for Cold-Formed Steel Connectors Assemblies

By Greg Greenlee, PE , USP Structural Connectors, Montgomery, MN

Last fall ICC-ES adopted a new acceptance criteria for connectors used with cold-formed steel structural members. This new acceptance criteria, AC261, is intended primarily for manufacturers of structural connectors seeking evaluation reports for their proprietary products designed and manufactured for use in cold-formed steel construction. The acceptance criteria provides a well defined methodology to determine the structural capacity of a connector where it cannot practically be calculated with the provisions of the code. Ultimately these evaluation reports provide engineers with reliable and complete information to be used in their design of a structure.

Historically manufacturers have had to adapt the provisions created for wood connectors to determine capacities for cold-formed steel connectors. In fact, AC261 is similar to ASTM D1761, the test method for mechanical fasteners in wood, but contains some additional provisions we will likely see in future versions of that document. Specifically the acceptance criteria contains material thickness and yield point variation adjustment factors. These factors adjust the results of the tested specimen by comparing tested specimen material measurements to the product design

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Newsletter for the
Light Gauge Steel Engineers Association

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The President's Corner

Reynaud Serrette, Ph.D.

During the first quarter of 2005 two significant administrative changes occurred with the LGSEA: Don Allen, then Managing Director of LGSEA resigned his position and the LGSEA Board took over all the duties of that position. On behalf of the membership, I would like to express a sincere thank you to the Board for "stepping up to the plate" and delivering. Looking forward, I am encouraged by the response of members with regard to the development and delivery of educational engineering seminars and technical notes, and active participation in the authorship of newsletter articles. These areas of service have been the products that LGSEA members have valued since our inception and continue to value.

The LGSEA, through its members, has also been cooperating with organizations like COFS, SFA, SEAONC, SEAOCC and SEASoN to bring the latest design information to designers. Our membership and number of sponsors have grown over last year's levels and we are looking forward to even more productive 2nd, 3rd, and 4th quarters.

As we move forward, I want to thank each of you for your support over the past quarter as we strive to produce value to our members and advance the state of cold-formed engineering practice, as articulated in OUR mission. ❒

Member Alert !

Many of our members are not receiving emailed information from the LGSEA as your addresses are incorrect in our data base. Starting in January 2005 each member should be regularly receiving an electronic copy of our quarterly Newsletter via email, as well as a printed copy via regular mail. If you received your copy of the January and April Newsletters via email then you need not respond to this alert. If you received your printed copy via regular mail *only* then it is important that you take time to send an email to ***dpeyton@anderson-peyton.com*** with the following note in the subject line: "Please check my LGSEA email address." Your address as sent will be corrected in our data base.

Our LGSEA Mission is:

- To advance the state of engineering knowledge as it pertains to the cost effective design and construction of cold-formed steel structures and systems.
- To promote, support, direct and conduct research for the technical advancement of cold-formed steel materials and construction.
- To develop, compile and publish technical information of benefit to users of structural cold-formed steel materials.
- To cooperate in every lawful way in the adoption and maintenance of engineering standards, specifications and model codes for the design, fabrication and installation of structural cold-formed steel materials.
- To provide engineering and related technical education through seminars, publications, meetings and any other appropriate program or media.
- To develop practical and effective construction techniques.
- To support programs, education and other activities at universities, related associations and companies that further the proper engineering and design of structural cold-formed steel materials and /or the pursuit of increasing the use of structural cold-formed steel materials.

ICC-ES Acceptance Criteria

(Continued from page 1)

specifications.

For manufacturers to obtain a product evaluation report conforming to AC261 it is necessary to provide in advance a test plan for review. This test plan needs to contain a description of the test method, product drawings, sampling methodology and service limit states. The acceptance criteria describes how to determine the structural capacity of the connector for both ASD and LRFD design from the test results. For example, the ASD assigned structural capacity of the product will be the least of the following:

1. The average load at the deflection service limit specified. Typically this limit is defined as 1/8-inch.
2. The nominal strength of the connector determined by applying an adjustment factor to the average of the tested values and dividing that by a safety factor.
3. The calculated strength of fasteners or welds used to attach the connector to the structural members.

Similar to other acceptance criteria, AC261 requires manufacturers to create and provide a quality control manual for review. This manual must contain certain provisions that ensure consistent and reliable manufacturing and inspection methodologies.

By complying with the provisions of the acceptance criteria the resulting product evaluation report contains a great deal of useful information for the engineer. Specifically, included in the report will be product descriptions and dimensions, material specifications, fastener requirements and required cold-formed structural member properties. The development of AC261 is a welcome development in the evolution of cold-formed steel construction. It will enable engineers to confidently apply the published values for connectors tested and calculated in accordance to the criteria. A copy of AC261 is available on the ICC-ES website at www.icc-es.org ❒

LGSEA COMMITTEE MEETINGS

LGSEA
SINCE 1994

Date: June 1, 2005

Location: Santa Clara University
Santa Clara, CA
Benson Memorial Center
Williman Room

Members and guests come join the LGSEA and actively participate in the upcoming committee meetings.

Committee Meeting Times

10:00 am- 11:30pm….Truss , Brad Cameron, Chair

11:30am- 12:30pm …….Lunch (provide by the LGSEA)

12:30pm- 2:00pm……...Fastener/Connector, Greg Greenlee, Chair

2:00pm- 3:30pm……Structural Assemblies, Jeff Ellis, Chair

3:30pm - 4:30pm……..Research Devlpmt, Dean Peyton, Chair

5:00 pm - 8:00pm……Board Meeting

Hotel Reservations: Call the Candlewood Suites, Santa Clara @ (408) 241-9305 and register at the reduced LGSEA rate. The hotel is just a 3 minute walk from the Committee meeting location. Santa Clara University is located just 15 minutes from San Jose Airport. No address needed, just ask for Santa Clara University.

Questions?: Call Melanie Massie @ (408) 554-4061 or email her at *mmassie@scu.edu*

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 **(253) 941-9939**). Upon editorial staff review, your submission may be printed in the Technical Exchange Section of this newsletter.*

Corrosion of Galvanized Fasteners in Coastal Environments

By Ian Robertson, Ph.D., University of Hawaii

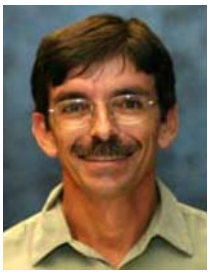

Table 1 – Exposure Category Assignment

Distance from Shoreline (m)	Site Characteristics			
	Onshore Wind		Offshore Wind	
	Unshielded	Shielded	Unshielded	Shielded
L ≤ 200	A	A	A	B
200 < L ≤ 500	A	B	B	B
500 < L ≤ 1000	B	B	C	C
L > 1000	C	C	C	C

Wind, exposure and vegetation are three of several factors that affect the performance of galvanized fasteners in coastal environments. These factors were identified in a significant research project recently completed by the Steel Framing Alliance and University of Hawaii. Funded primarily by the U.S. Department of Housing and Urban Development, "Corrosion of Galvanized Fasteners used in Cold-Formed Steel Framing" provides needed field and laboratory data, along with recommendations for the protection of cold-formed steel framing and fasteners in coastal climates.

The primary objective of this project was to study the effect of corrosion on the structural integrity of galvanized fasteners used in cold-formed steel construction. This was achieved through construction of five field enclosures, each representing typical cold-formed steel residential construction, in various exposure conditions on the island of Oahu, Hawaii. A parallel study of accelerated fastener corrosion in a cyclic corrosion chamber showed the change in strength and ductility of screwed connections with exposure to airborne chlorides (see adjacent pictures).

The results of this study are detailed in a final report which is available for downloading from the Steel Framing Alliance website at www.steelframingalliance.com .

Although more detailed recommendations are included in the comprehensive final report, a shortened version of the results are presented in this article as recommended construction guidelines:

Each building location should be assigned to one of the following exposure categories based on geographical location, surrounding features and meteorological records. Table 1 gives preliminary suggestions for this assignment as follows:

Category A: Extreme exposure.
Category B: Moderate exposure.
Category C: Mild exposure.

Distance from shoreline is the straight-line distance measured perpendicular to the coast.
Onshore and **offshore** wind refers to the predominant wind direction for the building location. If winds are variable or unknown, onshore wind should be assumed.
Shielded refers to the presence of substantial vegetation and/or structures, at least as tall as the proposed building, located between the coast and the proposed site. Sites that do not satisfy these conditions are considered to be unshielded.

Category A Design

- No cold-formed steel members or fasteners should be exposed to ambient atmospheric conditions.
- Attic spaces require particular attention because of the need for venting to prevent moisture accumulation and potential mold development.
- Cold-formed steel framing and fasteners in exterior and interior walls can be protected from airborne chlorides by providing an enclosed wall cavity.
- Consideration should be given to increasing the thickness of galvanizing on cold-formed steel framing members, connection hardware and fasteners throughout buildings in exposure Category A.

Category B Design

- Design recommendations are similar to Category A, but slightly less

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A typical corrosion chamber is shown above. To the right, (2) lapped sections of sheet steel are shown connected with (2) screws. The decayed head and the drill point ends of the screw are each pictured.

Brick Veneer Supported by Steel Studs (continued from page 1)

dead load support of the brick. Typically, a drift joint for lateral wind and earthquake movement is provided at the location of the window head. In the "Type 2 or Floor to Floor" system, the steel studs are anchored to the top of the floor and span to the underside of the floor above. Typically, the drift joint for lateral wind and earthquake movement is provided at the location of the floors. The Type 2 system works best for solid walls or walls with punched windows, whereas the Type 1 system works best for walls with strip windows.

In recent years, other brick exterior wall systems have become common in the Northwestern United States. These systems rely on reinforced hollow brick walls to carry loading, with the backup stud system used to support the air, water and thermal barriers. There are three types of structural brick walls. Structural Brick Veneer (SBV) is a system where the brick is reinforced to span between connectors. The veneer ties are removed. The backup stud system is assumed to not resist gravity loading. Reinforced veneer (RV) is a system just like brick veneer on steel studs except the cavity between the air, water and thermal barrier and the brick is reinforced and grouted. The structural demand on the steel studs is usually significantly reduced allowing for less depth for the stud system. Finally, many brick projects have been designed with the use of panelized reinforced brick masonry. This system is analogous to precast concrete exterior walls.

The most frequently asked question about the BVSS system is what deflection limit should control the design of the steel studs. Do not ask this question without doing further study of the system. It will only show that you have not done your homework on how the system works. This is because the answer about deflection limits varies depending on other dominating criteria for the design.

If you decide that you do not want the bed joints (typically the horizontal brick joint) to crack, then the studs will need to design to L/2000 or greater, depending on the configuration. Not many projects are designed to this criterion, so the BVSS system is typically designed for bed joints to crack. This could be true for either service loading or for strength design loading depending on the level of performance desired. The more deflection allowed of the wall, the more the brick crack will widen and the more water will penetrate the brick veneer. The confidence the design team has in the design of their air and water barrier is a key factor. The more confidence in the performance of the barrier, the more deflection can be tolerated. Unfortunately, it often doesn't work this way. Many projects are simply designed by sub-system cost minimization instead of value tradeoffs, and consequently a compromised water and air barrier is often combined with the maximum design deflection limits. Some designs have used L/175 at service loading, the typical curtainwall value. But, most industry recommendations are for deflection limits of L/360 at service load. Unless you are confident about the installation and other factors affecting the wall performance, L/360 should be considered the maximum permitted deflection.

Another current design issue is that architects sometimes provide weeps above the ledger and vents below the ledger. This is an attempt to create a rainscreen or pressure equalization wall. When this is done, it is important not to use perforated steel stud tracks for stud support at the ledger. The barrier board may not cover the perforations. If not covered, the perforations can leak air, eliminate the pressure equalization and result in water penetration into the building.

The 2002 Building Code Requirements for Masonry Structures, and the 2003 International Building Code require the brick veneer on steel stud systems to be supported at each floor in Seismic Design Category D and above. This provision has been removed in the 2005 Building Code Requirements for Masonry Structures and in the next issue of the IBC. It is still required in Seismic Design Category E and F. The purpose of this provision is to accommodate lateral deflection at each floor and prevent damage. This provision is considered overly simplistic, restrictive, unnecessarily expensive and not consistent with the life safety code objective. It did nothing to address damage at building corners and probably should not be a requirement in E and F as well.

Additionally, the requirement to provide continuous single wire joint reinforcement of wire size 14 W1.7 (MW11) at a maximum spacing of 18 in. (457 mm) on center vertically has been removed from Seismic Design Category D in the most recent versions of the codes.

The BVSS system provides an economical means to clad a building in brick. The design, from the structural engineer's perspective, is not simple and requires experience with both the masonry and steel stud systems. ***For more information on the design of BVSS contact Western States Clay Products Association: www.wscpa.us, 310-222-5743 and ask for a copy of their Design Guide for Anchored Brick Veneer Over Steel Studs , August 2004 edition.*** ❐

Corrosion Study

(continued from page 4)

stringent. It is still important that CFS framing be enclosed in wall or floor cavities to prevent exposure to airborne chlorides.

Category C Design

- This exposure is synonymous with normal inland exposure. Standard industry construction practices should be followed.

For more information on this study, please contact Ian N. Robertson, Ph.D., S.E., at the Department of Civil and Environmental Engineering at the University of Hawaii at Manoa. Phone (808) 956-6536, email ianrob@hawaii.edu . ❐

News Briefs

ASCE-SEI Committee on Cold-Formed Steel Meets in Vegas

A special report on bracing of cold-formed steel structures, planning for three sessions on cold-formed steel at the 2006 Structures Congress in St. Louis, and work on a special issue of the *Journal of Structural Engineering* related to cold-formed steel were the major topics of discussion at the recent ASCE-SEI Cold-Formed Steel Members committee meeting, held in conjunction with the February AISI meeting in Las Vegas. Committee member Thomas Sputo received special project funding from ASCE to develop a design guide on bracing cold-formed steel structures. The final draft of the guide is complete and is currently working its way towards distribution as an ASCE special publication – so look for this guide to be available in a few months. The committee is interested in reaching out to practicing engineers and increasing the presence of cold-formed steel at the annual ASCE Structures Congress; therefore, three sessions will be proposed for the next Congress: (1) Behavior and Design of Load Bearing Cold-Formed Steel, (2) Bracing Cold-Formed Steel Members and Structures, and (3) Cold-Formed Steel 101. Look for these sessions when you go to St. Louis in 2006. The committee is working on a special cold-formed steel issue of the *Journal of Structural Engineering*. The papers are based on the best of the recent CCFSS specialty conference, and committee member Ben Schafer is serving as the Guest Editor for the Journal. The committee has other efforts underway including a paper on frequently asked questions for cold-formed steel. Members of ASCE-SEI who are interested in adding their expertise to the committee should email the Chair, Ben Schafer, at schafer@jhu.edu. The committee maintains a web site with complete information at www.ce.jhu.edu/bschafer/asce-sei-cfs/asce-sec-cfs.htm. ❒

LGSEA & SEAONC Attract Record Numbers to April Engineering Seminar @ Santa Clara University, CA. LGSEA & SEAOCC to Present Sacramento Seminar in May

Just under 100 engineers attended the first, of a two part engineering seminar presented by the LGSEA and SEAONC at Santa Clara University on April 20th. LGSEA President Dr. Reynaud Serrette introduced LGSEA speakers Nader Elhajj and Tony Wu whose presentations were well received. The Seminar will continue on the 27th with a new slate of LGSEA speakers: Bob Warner, Marc Press, and Pat Ford. The two day seminar covered critical design issues using the IBC and all current codes and standards available for cold formed steel design.

This seminar provides the most up-to-date cold-formed steel design standards for the design of walls, floors, and roof framing systems. Specific subjects covered are Introduction to Cold-Form Steel Framing, Light Insulated Panel Systems, Design and Inspection of Steel Floor Joists, Cold-Formed Steel Trusses, ISSI Systems, and Load Bearing Mid-Rise Construction.

The April Seminar was so well received that additional seminars are being expedited at the request of other Structural Engineering Associations. There is still time to sign up for a repeat seminar to be held in Sacramento, California on May 26th. That seminar will be sponsored by LGSEA and SEAOCC and will be held from 1:00-6:00pm. LGSEA and SEAOCC Members may attend for $125.00 and non-members for $225.00. To register or ask questions contact *Lori Campbell at (916) 965-1536 or email to seaocc@aol.com.*

LGSEA is working hard to bring you *"practical"* engineering seminars presented by LGSEA practicing engineers in concert with local Structural Engineering Associations. For questions email our LGSEA Educational Director Ken Vought at kvought@msn.com. ❒

Short Course on Cold-Formed Steel Design

The Wei-Wen Yu Center for Cold-Formed Steel Structures is planning for its 19th Short Course on Cold-Formed Steel Structures. The three-day short course will be held October 18th, 19th, and 20th, 2005 in St. Louis, MO.

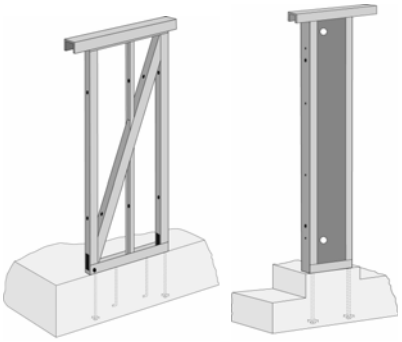
Information regarding the course may be obtained by contacting Ms. Christina Stratman, Center for Cold-Formed Steel Structures, Tel: (573) 341-4471, Fax: (573) 341-4476, e-mail ccfss@umr.edu or Dr. Roger LaBoube, Tel: (573) 341-4481, Fax: (573) 341-4476 or e-mail: laboube@umr.edu ❒

Product Exchange Section

Advertisement Article

Statements and opinions contained in this "Product Exchange" section are produced and prepared by Sponsor Members of the LGSEA. This section is intended to provide a forum for the exchange of relevant product information in the industry and the information is made available with the express understanding that the publisher does not render technical services. All technical matters should be evaluated by a qualified engineer before being relied on for any particular situation. Contact the product manufacturer for all questions.

Engineers Look to Hardy Frame® Shear Wall Systems



Hardy Frames, Inc. has been a leader in the pre-fabricated shear wall industry since 1996. The company manufactures and markets the revolutionary ***Hardy Frame®*** shear wall system. The ***Hardy Frame®*** system consists of pre-fabricated metal shear panels, which are used in wood or steel structures to resist lateral forces resulting from wind or earthquake loads. The system is designed to help meet and exceed the most stringent building code requirements with regards to shear and wall bracing specifically in narrow wall areas.

The ***Hardy Frame®*** system consists of Panels and Brace Frames, which are made by state-of-the-art technology utilizing high tensile cold-formed steel in 12-gauge or 14-gauge steel. The available widths are 12", 18", 24", 32", 48", 64" and 80". Stock Heights are available from 7' to 13' in one foot increments. Please note that custom heights are also available.

Both the ***Hardy Frame®*** Panels and Brace Frames are designed using the most up-to-date code standards, and are thoroughly tested utilizing the latest static and cyclic testing protocols. The result is a shear wall system that is among the safest and most economical solutions for many of the shear wall and bracing challenges facing the building industry.

The ***Hardy Frame®*** shear wall system offers many advantages including the following:

High Strength. One of the highest allowable shear values of any code evaluated pre-fabricated shear panel on the market today.

Exceed wall Aspect Ratio. Can be used where wall Aspect Ratio exceeds 3.5:1 and 2:1

Code Evaluated. Recognized by ICC-ES to comply with UBC, IBC and IRC, by LA City, and is DSA (CA) accepted.

Guaranteed performance. State-of-the-art testing verifies the performance of the ***Hardy Frame®*** in a real world environment.

Quality assurance. Manufactured in an audited and controlled environment that guarantees unparalleled quality.

Simple and quick installation. Faster and easier to install than other traditional shear wall systems.

Service and support. Hardy Frames, Inc. provides one of the most responsive and experienced engineering, technical and field support in the industry.

For more information, please visit our website at www.hardyframe.com or call us at 800-754-3030. ❐

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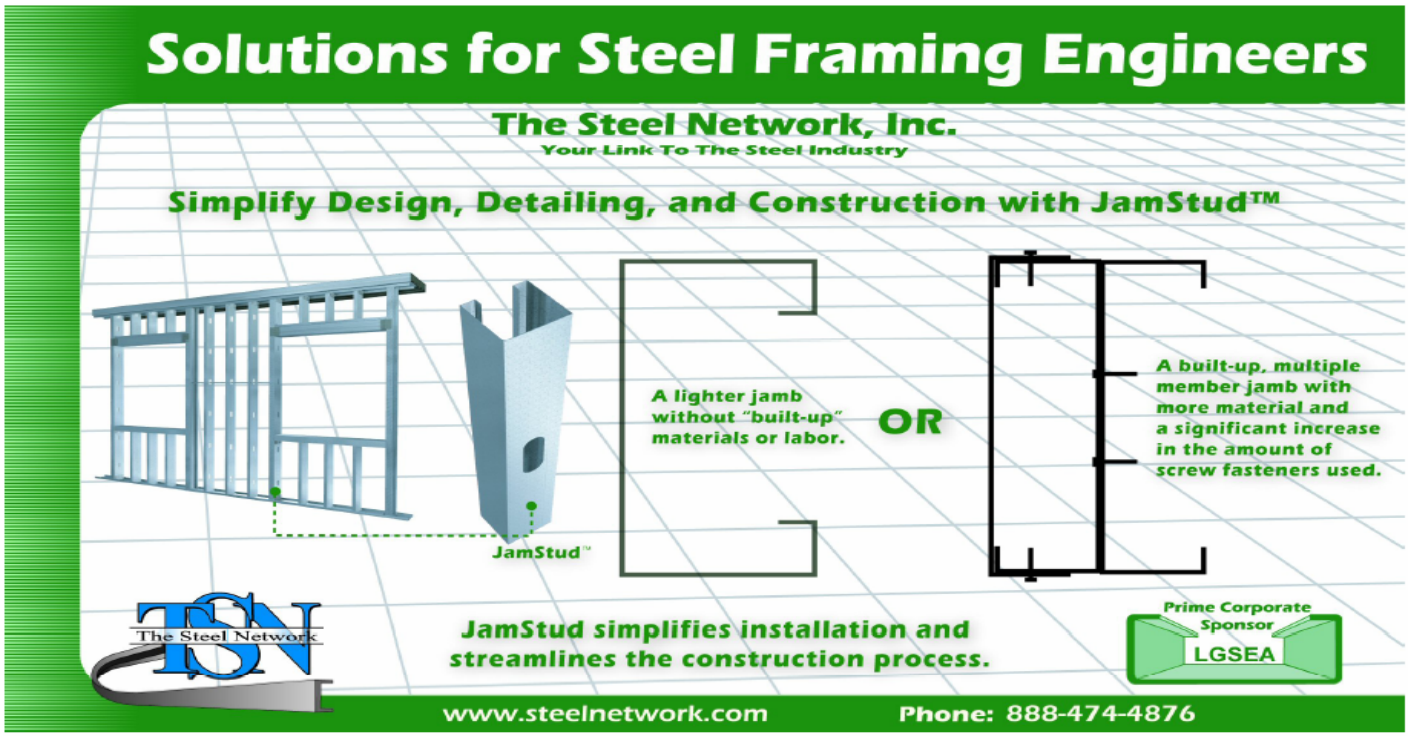

Enhancing the importance of light gauge steel framing engineers and the significance of the role they play to installers, Engineers of Record (EOR), and owners through innovative products has long been a major component of The Steel Network's mission. Continuing with this proud tradition, TSN recently announced the introduction of JamStud™, its uniquely fabricated section designed to successfully eliminate conventional built-up members used in the construction of curtain wall openings.

First among JamStud's exceptional attributes is its ability to deliver previously unrealized installation efficiency while simultaneously reducing the amount of materials used in the design of jamb sections. Also, thanks to its unique shape, the load capacity and stiffness of JamStud is rated much higher than traditional "C-shaped" sections of similar thickness, thereby eliminating the labor-intensive, built-up jambs common in most construction applications. Next, because the single-member JamStud web faces the opening, a flat surface is provided for installing a door or window frame, removing the need for the track section used for closure. Finally, on the technical side, JamStud improves thermal performance in the wall by reducing the thermal bridge that would be present in built-up member jambs.

Along with eliminating built-up sections, JamStud also drastically reduces the amount of fasteners normally needed, as only the attachments to the deck above and below are required. With the fasteners used to build up multiple-member jambs eliminated, it is easy to see why the installation efficiency value of JamStud increases exponentially relative to the amount of openings in a structure.

Use JamStud in conjunction with TSN's labor-saving, engineered connections, and value increases even more dramatically. StiffClip® HE has been redesigned to provide both vertical and lateral load resistance, removing the need for jack studs and clip angles. A shelf tab in the clip provides a convenient ledge upon which to rest the box header prior to screw fastening, and guide holes ensure a fast and accurate screw placement. The VertiClip® series delivers positive, load tested attachments to accommodate anticipated structural deflection through a verifiable load transfer path, while at the same time stiffening the stud web and eliminating the web crippling condition. If a web-crippling connection is required at the base of the wall, StiffClip AL and StiffClip CL become highly efficient options, with each load rated clip containing guide holes for fastener placement.

Through the far-thinking design of TSN's curtain wall opening systems, owners realize material cost advantages, engineers have more options for design and quality, and contractors can erect the same opening more efficiently.

Engineers who deliver these labor and cost solutions who are the ones that will be able to provide greater value to their clients.

For more information on these products or their use contact ***Lance Schloot @ The Steel Network, Inc. @ 888-474-4876.*** ❐

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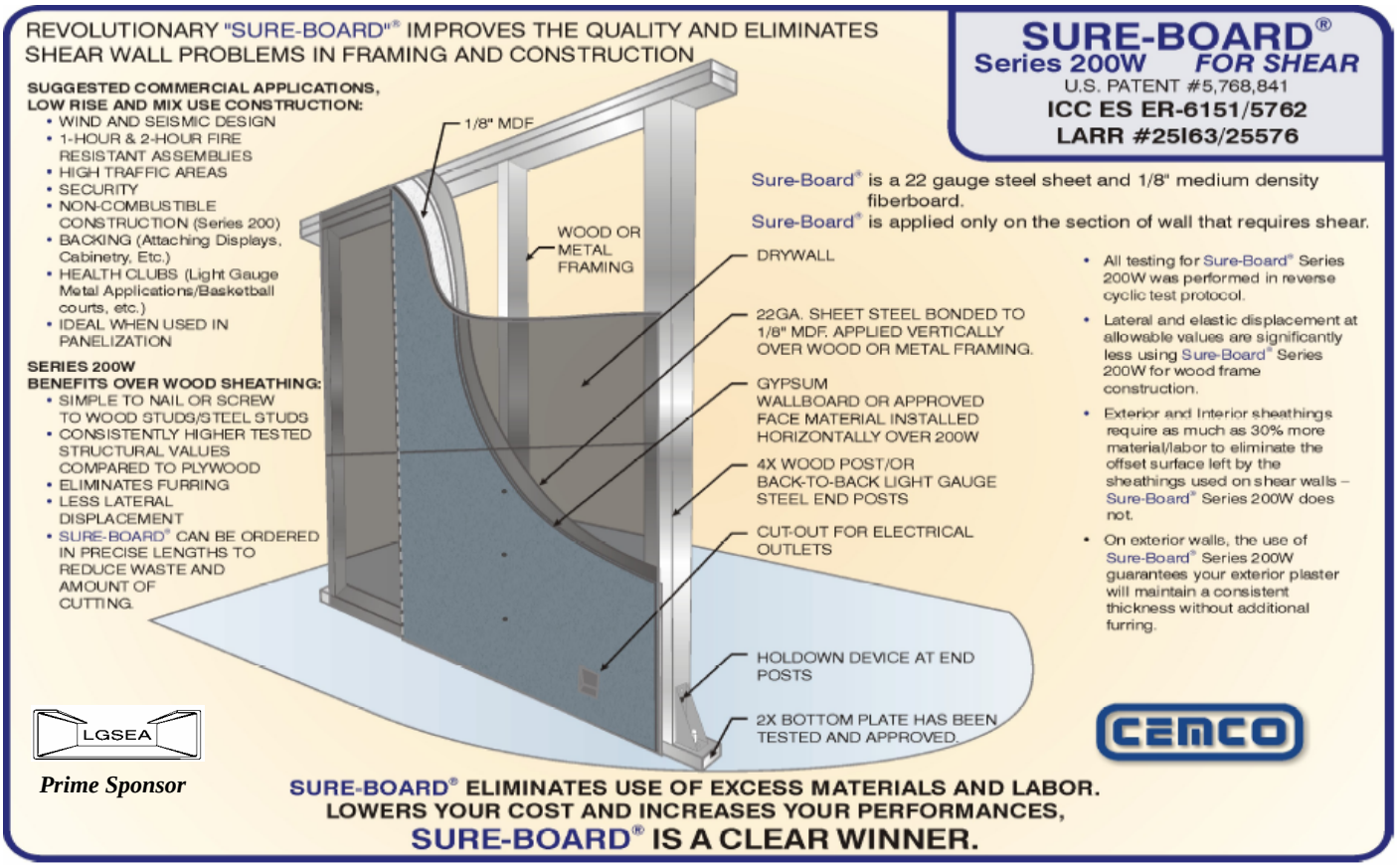
SURE-BOARD® "for Shear" PROVIDES RELIABLE VALUES FOR HIGH LOAD SHEAR WALLS

Whether you design projects in the hurricane state of Florida or in earthquake prone regions, one thing is certain, every structure requires a strong and dependable lateral load resisting system. In the past, engineers have utilized tension only cross bracing or diagonal frames to resist loads imposed by wind or earthquakes. More recently, plywood shear panel or sheet steel have been incorporated into the building codes. There are inherent problems with each of these systems that range from difficult installation and finish application to design load penalties and questionable performance. A new ICC and LA City approved product has been rapidly gaining acceptance by engineers and building departments. Sure-Board®, a patented product manufactured by Cemco in Industry, CA, has been thoroughly tested using reverse cyclic loading and offers an easy, one-step installation, high strength shear panel alternative.

Sure-Board® comes in two basic configurations: Series 200, developed primarily for use on light gage steel framed structures, utilizes gypsum wallboard on the front side bonded to a high strength galvanized steel sheet on the back side. The all new Series 200W improves on the original design concept by using MDF (medium density fiberboard) instead of the gypsum based board. Series 200W has approvals for use on light gauge steel framing, and can be applied to wood framed projects as well. Installation of 200W is done with flat head screws into metal framing or common nails into wood framing.

Primarily as a result of the Northridge and Loma Prieta earthquakes, reverse-cyclic load testing has become the standard procedure for evaluating the strength of shear walls to resist seismic loads. This test protocol calls for constantly increasing reverse displacements at the top of a shear wall test sample. In the past, single direction mono-tonic tests were used to evaluate wall systems. Research shows that this form of test severely overstates the performance of a wall, and as such, some code jurisdictions have reduced the wood shear wall capacities listed in building codes. Comparative tests performed on Sure-Board® walls and code constructed plywood walls show that Sure-Board® can obtain approximately 22% more strength and 47% less displacement than an equally framed and nailed plywood shear wall. Light gauge steel framed systems also benefit from the use of Sure-Board® over code approved sheet steel or plywood. For complete information, ***contact Cemco at www.CemcoSteel.com , or visit www.SureBoard.com***. ❒



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