Light Gage Steel Framing: Use of the Manufacturers literature From the Contractors Perspective

by Gary J. Maylon

About the Author: *Gary J. Maylon is manager of the Building Products Division of Alabama Metal Industries Corporation (AMICO) where he has been employed for 13 years. Prior to joining AMICO, Mr. Maylon was employed by Wheeling Corrugating Company for five years and has been active in the marketing of light gauge steel framing and metal lath and accessories for his entire professional career.*

He is active with AWCI and the Metal Lath/Steel Framing Association (ML/SFA) and currently serves as Vice Chairman of AWCI Technical Subcommittee Number 5 on Light Gage Steel Framing and the Task Force on Tolerances.

This is the third in a series of articles on lightweight steel framing systems. Future articles will discuss panelization, estimating, welding, load-bearing and non-load bearing interior and exterior wall systems as well as joists in floor, ceiling and roofing systems.

In this age of increasing product and design liability, it has been our experience that most designers and specifiers are leaving nothing to chance. Some years ago it was not uncommon for design and load specifications to be left in the hands of the contractor. Today, however, the more common practice is for the specifier to list the specific items that make up the structural framework and to list all pertinent information necessary to bid and complete a job properly. This article will address the possible design criteria that the contractor might use to bid and procure steel framing jobs and how the contractor can use the manufacturers' literature to aid in this process. We will look at the information needed to size jobs properly and to avoid errors and confusion.

Before discussing the use of manufacturer's literature, we must first address the basic information contractors must have at the start. Use of the literature is not difficult once we know what information is needed and what information is typically found in the literature.

Structural Framing

Load Bearing

Let us examine the type of questions you, as a contractor, might need answers to, in order to bid on a structural framing job.

1. What type of load bearing stud is required or specified? Is it a "C" stud, a wide flange, or a channel stud? The structural "C" stud makes up the vast majority of the load bearing studs sold today. There are several flange widths offered for the "C" studs and joist. Although 1-5/8" makes up the majority of what is sold, this product is available in 2" and 2-1/2" flanges from some manufacturers.

2. In some parts of the country, coatings are still in question. Should stud and track be painted or galvanized? Today, painted studs are almost totally unavailable east of the Rocky Mountains. Most manufacturers supply galvanized studs and track as a standard product; in addition some manufacturers offer aluminized steel and galvalume steel which has a zinc and aluminum coating.

3. Stud dimension should be addressed next. Structural studs are available in a wide range of web sizes, from 1-5/8" through 12".

4. Another consideration in placing an order is the actual length of each stud needed. Light gage steel framing can be supplied in lengths as needed for each application, often to within 1/4" tolerance.

5. Lastly, we see occasions when designers and specifiers list the structural items needed by certain design criteria. The designer might state that he wants a 3-5/8" "C" stud that has a section modulus in excess of 0.753 in.^{3} and a moment of inertia in excess of 0.415 in." about the major axis. To the novice this sounds rather overwhelming, but all of this information is available from most manufacturers literature. As you can see in Figure 1, typically the literature provides dimensional information on each individual web size, gage and in some cases, the type of steel, based on yield strength. Structural steel studs are available in yield strengths of 33, 40, and 50 KSI (KSI = 1000 pounds per square inch). Dimensions are given for depth or web size, flange width and return lip, the weight per linear foot, and the effective area in square inches. All of this information is useful in comparing one manufacturers stud with that of another manufacturer. Also typically listed are the physical and structural properties of each stud. These properties are listed for the major axis (x) which passes through the web of the stud at right angles and the minor axis (y), which passes through the flange of the stud at right angles. These include the moment of inertia (Ix) and section modulus (Sx). The moment of inertia (Ix) is used to compute a product's stiffness or resistance to deflection. Section modulus (Sx) is similarly used to compute product resistance to stress. In Table 1, the 3-5/8" "C" stud described earlier in terms of section modulus and moment of inertia was a 3-5/8" 18 ga. "C" stud with 1-5/8" in. flanges.

You will notice other information listed, such as (Rx) radius of gyration as well as Sy and Iy, the section modulus and moment of inertia about the minor or y axis. Some manufacturers also list several other physical properties. However, generally speaking the contractor will usually be confronted with nothing more complicated than the physical and structural properties already explained.

As you can see, when it comes to interpreting manufacturers literature dealing with structural properties, there is no real mystery once the information is explained.

Structural Framing: Wind Loads

Each contractor should understand the subject of wind loads in detail. Structural stuck are used in two basic ways: as load bearing studs that bear axial loads-and/or wind loads, and also load bearing joists. Studs that bear only wind loads are not required to carry an axial load (a load from above) and are generally called curtain wall studs. This wind or lateral force deflects or bends the stud toward the interior or exterior of the building. This load must be considered, not only because of the possi-

Figure 1

DESCRIPTION:
PCS: Punched "C" Stud—1⅝" flange.
PCS-2: Punched "C" Stud—2" flange
PCS-2½: Punched "C" Stud—2½" flange
Punchouts:
3½" through 12" web size: 1½" x 4"
2½" web size: ¾" x 2"

PRODUCT INFORMATION
Web Sizes: 2½", 3½", 3⅝", 4", 6", 8", 9¼", 10", 11½", 12"
Flange Sizes: 1⅝", 2", 2½"
Gauges: 12, 14, 16, 18, 20
Lengths: 4' to 48'

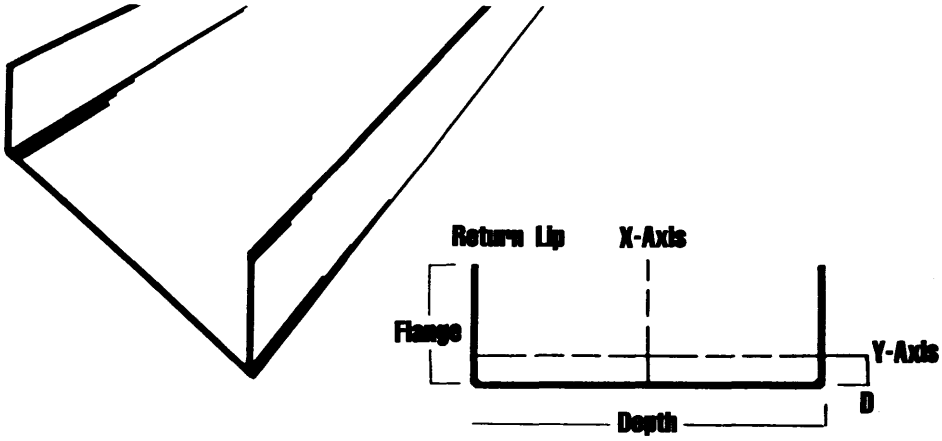

Table 1

Code-Size x Ga. (KSI)	Depth	Flange	Return Lip	Weight (lbs./ft.)	Effect Area (sq. in.)	About Major Axis Ix (in.^{4})	Sx (in.^{3})	Rx (in.)	About Minor Axis Iy (in.^{4})	Ry (in.^{3})	D (in.)	Bending Moment (in.-lbs. x-x)
PCS-2½ x 20	2.500	1.625	0.563	0.848	0.221	0.260	0.202	1.021	0.095	0.632	0.647	4,017
PCS-2½ x 18	2.500	1.625	0.563	1.053	0.299	0.318	0.255	1.014	0.113	0.625	0.645	5,041
PCS-2½ x 16 (33)	2.500	1.625	0.563	1.306	0.384	0.390	0.312	1.009	0.137	0.620	0.645	6,183
PCS-2½ x 16 (50)	2.500	1.625	0.563	1.306	0.372	0.390	0.312	1.009	0.137	0.620	0.645	9,368
PCS-2½ x 14 (50)	2.500	1.625	0.563	1.613	0.474	0.476	0.381	1.002	0.165	0.613	0.645	11,416
PCS-3⅝ x 20	3.625	1.625	0.563	0.993	0.227	0.611	0.330	1.447	0.101	0.625	0.555	6,542
PCS-3⅝ x 18	3.625	1.625	0.563	1.236	0.311	0.753	0.415	1.439	0.131	0.618	0.553	8,222
PCS-3⅝ x 16 (33)	3.625	1.625	0.563	1.535	0.410	0.927	0.511	1.433	0.162	0.612	0.553	10,123
PCS-3⅝ x 16 (50)	3.625	1.625	0.563	1.535	0.388	0.927	0.511	1.433	0.161	0.612	0.553	15,338
PCS-3⅝ x 14 (50)	3.625	1.625	0.563	1.899	0.511	1.135	0.626	1.426	0.195	0.605	0.553	18,781

ble failure of the stud, but also because of the effect of the deflection on the collateral material attached to the studs on the building's exterior. As shown in Table 2, the following information must be known in order to select the proper stud to handle the appropriate wind load for each job. First, we must know the appropriate wind load as specified in the applicable building code. Notice that a 25 pound per square foot wind load is equivalent to a 100 mile per hour wind. Next it is important to know the allowable deflection and the length of the stud. Stucco, for instance, usually requires a maximum deflection rate of L/360. If the stud length is 10' (120/340 in inches) we would have a deflection of .333 inches or 1/3" in 10 feet. This is derived by dividing the length in inches by 360. It is helpful to know what size stud wall is planned, for example 3-5/8". In some instances, the designer may want as thin a wall as possible to maximize floor space and economize on hardware.

As an exercise, let's say that we have a wind load of 20 PSF with a design criteria of L/360 for a 16" stud spacing. If we are trying to find a stud that will span at least 10' we simply follow the L/360 column under the 25 PSF heading down to discover that a 4" "C" stud 18 ga. will span 10.3 feet.

With a little practice, you will find that this is a simple operation as long as all pertinent information is available.

Finally, most manufacturers list combined load tables. These tables consider the effects of axial loads (dead and live loads) combined with wind loads. Generally speaking these tables are designed for use by designers and specifiers. Information in this section is usually listed in maximum allowable axial load in KIPS (1000 lbs. per square inch) per stud.

Due to the complex nature of the product, a great deal of information is required for structural studs. The selection of load bearing studs which support the weight of multi-story structures requires detailed engineering analysis to aid the designer in his comprehensive and demanding task.

Non load bearing studs, on the other hand, must only support their own vertically applied weight, and that of the collateral material attached to them. Though this is the case, manufacturers will supply the physical and structural properties in the same manner as they do for structural studs. Also included are limiting height tables which list maximum allowable heights for drywall and curtain wall studs which are non-load bearing or used to support wind loads only.

With regard to drywall studs other factors must be addressed. Most important of these is the minimum decimal thickness of the stud. Because steel purchased for these studs falls within a range of thicknesses, manufacturers generally offer studs that have a minimum thickness, uncoated, of .0179" in conformance with ASTM C-645. It is important to know what minimum thickness the designer has specified. Every manufacturer wants to provide a product that meets specifications in every way; only by having complete information is this possible.

This article provides brief insight into the use of the manufacturers literature. Though most literature has basic similarities, each varies to some extent. Take the time to become familiar with your supplier's literature. Then, take any questions you might have to their technical services department. Also let me suggest that the Metal Lath/Steel Framing Association, now a division of National Association of Architectural Metals Manufacturers (NAAMM), offers excellent information on steel framing that is readily available. Ask for NAAMM Standard ML/SFA 540-87, *Lightweight Steel Framing Manual*, 3rd Edition.

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Many contractors have become so well acquainted with the manufacturer's data and design procedures that they have instilled much confidence in the designers. This confidence has led to a certain dependence by these designers, on the contractors. Contractors should double check the structural selections made by the designer, thus doubling the chances of an error free job.

Also we have seen many jobs specified in competitive products such as concrete block, which have been

Table 2

Member:		5 PSF/45 MPH			15 PSF-75 MPH			20 PSF-90 MPH			25 PSF-100 MPH			30 PSF/110 MPH		
Size	Gage	L/240	L/360	L/600	L/240	L/360	L/600	L/240	L/360	L/600	L/240	L/360	L/600	L/240	L/360	L/600
CSN—C Studs—16″ on center (cont.)																
4″	20	18.5	16.2	13.6	12.8	11.2	9.5	11.7	10.2	8.6	9.9	9.5	8.0	8.2	8.2	7.5
	18	20.2	17.7	14.9	14.0	12.3	10.3	12.8	11.1	9.4	11.8	10.3	8.7	11.1	9.7	8.2
	16	21.7	18.9	16.0	15.0	13.1	11.1	13.7	11.9	10.1	12.7	11.1	9.3	11.9	10.4	8.8
	14	23.2	20.3	17.1	16.1	14.1	11.9	14.6	12.8	10.8	13.6	11.9	10.0	12.8	11.2	9.4
6″	20	25.5	22.3	18.8	14.3	14.3	13.1	10.8	10.8	10.8	8.6	8.6	8.6	7.2	7.2	7.2
	18	28.0	24.4	20.6	19.4	16.9	14.3	17.6	15.4	13.0	16.4	14.3	12.1	15.4	13.5	11.4
	16	30.0	26.2	22.1	20.8	18.2	15.3	18.9	16.5	13.9	17.6	15.3	12.9	16.5	14.4	12.2
	14	32.1	28.1	23.7	22.3	19.5	16.4	20.2	17.7	14.9	18.8	16.4	13.9	17.7	15.5	13.0

changed to steel framing because the contractor, working with the steel framing manufacturer, was able to redesign and prove to the architect and owner that a sizable cost savings could be realized. Imagine, if you will, how much additional business could be realized using this procedure.

Though light gage steel framing is a relative newcomer in terms of available construction products, it will continue to grow. Contractors must become familiar with these products if they intend to compete and participate in the construction markets of the future. Do not let your lack of experience in these products become a deterrent. Remember that the manufacturers are ready, willing and able to help you in every way possible. Confidence and knowledge will come with the use of this material.