



FROM THE FOUNDATION

# Light Gauge Steel Framing: I N T E R I O R S

**L**ight gauge steel framing provides an effective support method for interior finishes: gypsum drywall systems, veneer plaster systems, and conventional plaster systems. These systems help satisfy the performance requirements of a building structure by forming the backbone for a wide variety of wall, partition and ceiling assemblies. These include basic space dividers, sound attenuating space dividers, fire resistive space dividers, shaftway enclosures, exterior wall furring, ceiling systems, etc. Light gauge framing in interior walls is typically non-load bearing but can range from 25 to 12 gauge.

## ASTM Standards

Light gauge steel framing members for interior uses are typically addressed by two pertinent ASTM standards:

*ASTM C-645:* "Non-Load (Axial) Bearing Steel studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board"



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*ASTM C-754:* "Installation of Steel Framing Members to Receive Screw-Attached Gypsum."

ASTM C-645 establishes a bare (uncoated) steel thickness of 0.0179" minimum. Some manufacturers of light gauge steel framing provide products of lesser steel thickness. As the steel thickness decreases, the potential for screw stripping in-

creases. Reduced steel thickness can impact on structural, fire, and sound characteristics possible with light gauge steel framing. This standard also indicates that the members shall have a protective coating to prevent corrosion in normal use. The various coating possible include electro-galvanizing hot-dip galvanizing, aluminum-zinc, and paint-each providing varying degrees of protection.

ASTM C-754 includes a tabulation of allowable limiting heights for partitions. These were established from physical tests conducted in the 60s and are not necessarily representative of products available today. Since physical properties of steel sections vary with manufacturers, the current limiting height tables of the manufacturer of particular light gauge steel studs should be consulted.

## Fasteners

A key component that probably made light gauge steel framing a practical reality is the self-drilling self-tapping screw with a corrosion resistant coating. There are a vast array of screw types and lengths to accommodate different thicknesses of finish material and to fasten metal framing members. The basic screw for applying gypsum drywall has a Phillips Head recess for rapid driving

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

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and a bugle head for seating in the gypsum drywall. An electric screw-gun with an automatic clutch drives and seats the screws to the proper depth. Properly driven screws will not break the face paper and will be sufficiently recessed to be concealed by joint compound.

**Partitions**

Partitions constitute the major use of light gauge steel framing for interior finishes. In this application, runner tracks are secured to the floor using suitable fasteners typically spaced 24" o.c. Top runner tracks are secured either to the structure or to the suspended ceiling membrane components. Studs sized and selected based on the height of the installation are installed into the top and bottom runners. If potential

concrete slab creep deflection is a concern, the studs are cut "short" of the full height (usually 3/8"). Greater potential deflection concerns will usually require special detailing. Studs are typically spaced 24" apart maximum but may be installed at 16" or 12" depending on particular job requirements.

Closer stud spacing will provide a stiffer wall section and thus higher height capacity. Some manufacturers consider that gypsum panel facings provide a partial composite stiffening addition to the wall section. Considering an allowable deflection criteria of 1/240, nominal 25 gauge 2½" steel studs with a Moment of Inertia (I) of 0.103 in. and a Section Modulus of 0.076 in., and single layer gypsum panel on each side, the following heights are attained:

***Partitions constitute the major use of light gauge steel framing for interior finishes.***

studs spaced 24" o.c.	10'-9"
Studs spaced 16" o.c.	12'-6"

Heavier gauge (greater bare metal thickness) studs provide increased stiffness. Studs as cited above formed from nominal 20 gauge steel provide the following height capabilities:

Studs spaced 24" o.c.	12'-3"
Studs spaced 16" o.c.	14'-4"

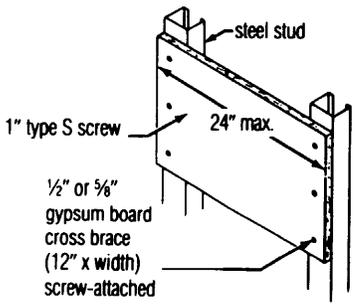
**Door Frames**

Doors installed in steel framed systems must be properly addressed to insure that the integrity of the assembly is not impaled. Door frames should be minimum 18 gauge with 16 gauge steel plates welded to trim flanges for anchorage to the floor with two power-driven anchors per plate. Frames should be finished with proper 18 gauge steel jamb anchor members welded in place. Stud reinforcing as required for the opening size and door weight is screw attached to the jamb anchors.

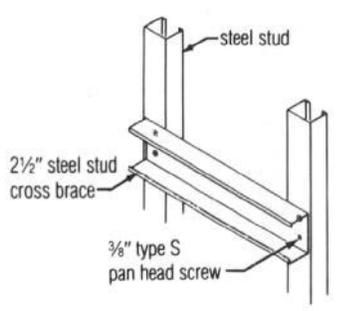
**Chase Walls**

chase walls are constructed using two rows of studs spaced apart as necessary to accommodate pipes and other service installations. These walls require bracing of the unsupported stud flange king into the chase. This can be accomplished by connecting the opposing rows of studs with gypsum cross braces or light gauge steel bracing.

**Figure 1. Chase Walls.  
Gypsum Brace**



**Figure 2. Chase Walls.  
Steel Stud Brace.**



**Fire Rated Assembly**

For fire-resistance considerations, Underwriters Laboratories (UL) addresses the gauge (thickness) and width of steel-stud framing. The following is quoted from their *Fire Resistance Directory*:

“For steel stud walls, the dimensions and gauge of studs specified for an individual design are minimums. The hourly Classifications apply to the design when constructed of steel studs of a heavier gauge

and/or larger dimensions than the stud specified in a design.”

Fire ratings are possible with light gauge steel stud gypsum drywall partitions ranging from one to four hours, thus satisfying virtually all building code requirements.

**Acoustical Assemblies**

Sound attenuation is also satisfied with partitions constructed with light gauge steel stud framing. The web of a nominal 25 gauge steel stud in effect acts as a decoupler of the two finish membranes. A single layer of 5/8" Type X gypsum panel on each side of 3-5/8" nominal 25 gauge steel studs spaced 24" o.c. will yield a Sound Transmission Classification (STC) rating of 40. Steel studs spaced 16" o.c. will not reduce that rating. Conversely, stiffer 2x4 wood studs substituted for the steel studs will yield 37 STC and a further drop to 34 STC when the studs are spaced 16" o.c. A three point STC difference is considered noticeable.

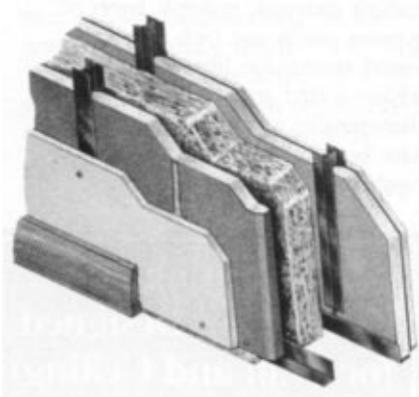
Partitions utilizing light gauge steel stud framing in conjunction with resilient channels, multiple layers of gypsum panels and high density sound attenuation blankets can achieve sound attenuating characteristics as high as 65 SIC and have been further evaluated for their capability to control low frequency

**Table 1. Typical Fire-Rated Partition**

RATING	DESCRIPTION	UL TEST
One hour	2-1/2" Steel Studs; 1/2" SHEETROCK Brand Type X FIRECODE C Gypsum Panels each side, plus THERMAFIBER Brand SAFB in the cavity	OSU T-3362
One hour	3-5/8" Steel Studs; 5/8" SHEETROCK Brand Type X FIRECODE Gypsum Panels each side	U-465
Two hour	2-1/2" Steel Studs; 1/2" SHEETROCK Brand Type X FIRECODE C Gypsum Panels, 2 layers each side or 5/8" SHEETROCK Brand FIRECODE (Type X) Gypsum Panels, 2 layers each side	U-412 & U-411
Three hour	1-5/8" Steel Studs; 1/2" SHEETROCK Brand Type X FIRECODE C Gypsum Panels, 3 layers each side	U-435
Four hour	1-5/8" Steel Studs; 1/2" SHEETROCK Brand Type X FIRECODE C Gypsum Panels, 4 layers each side	U-435

Chase walls qualify for one- and two-hour fire rating per UL Design U-420.

**Figure 3. Double H Wall.**

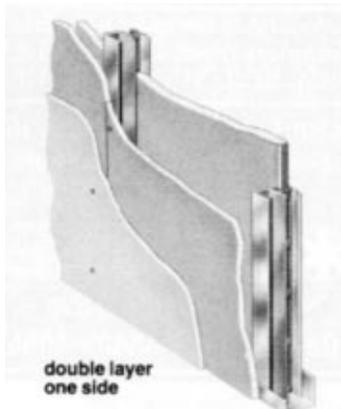


sound transmission, which is prevalent in machine noise and music. Thus, sound attenuation can be addressed from a basic space divider to an exotic high performance specialty music studio enclosure.

**Shaftwall Systems**

Progress in construction technology necessitated development of specialty partitions utilizing light gauge steel framing. The prime example of this is the Shaftwall System developed to enclose the required fire rated elevator, stair and mechanical shaftways necessary in multi-story construction. In this case light gauge steel framing provided the basis for satisfying the performance parameters stipulated for the twin tower World Trade Center in New York City. Foremost was the

**Figure 4. Shaft Wall System.**



**Table 2. Partition Sound Attenuation Potential.**

PARTITION DESCRIPTION	SOUND RATING
3-5/8" Steel Studs; 5/8" SHEETROCK Brand Type X FIRECODE Gypsum Panels, single layer each side	40 STC
3-5/8" Steel Studs; 5/8" SHEETROCK Brand Type X FIRECODE Gypsum Panels, single layer each side; 3" THERMAFIBER SAFB in the cavity	49 STC
3-5/8" Steel Studs; 5/8" SHEETROCK Brand Type X FIRECODE Gypsum Panels, 2 layers each side	48 STC
3-5/8" Steel Studs; 5/8" SHEETROCK Brand Type X FIRECODE Gypsum Panels, 2 layers each side; 3" THERMAFIBER SAFB in the cavity	56 STC
6"-20 gauge SJ Steel Studs; RC-1 Channel direct to studs one side; 1/2" SHEETROCK Brand Type X FIRECODE C Gypsum Panels, 3 layers each side; 5" THERMAFIBER SAFB in the cavity	65 STC

ability to build the shaft walls from one side to eliminate scaffolding. Equally important was the ability to resist air pressure loads created by high speed elevator movement. Over 20 years of improvements to the system have resulted in a strong,

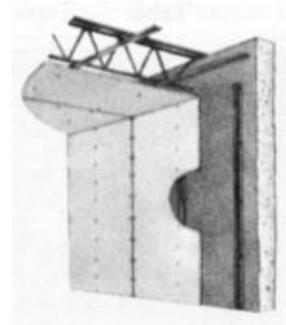
*Light gauge steel framing helped satisfy the performance parameters for the World Trade Center's twin towers in New York..*

economical lightweight partition capable of satisfying the fire safety requirements of building codes. The system today is the accepted standard for shaftway enclosures in all types of low, medium, and high rise buildings.

**Furring**

Furring the interior surface of exterior concrete masonry or concrete

**Figure 5. Metal Channel Wall Furring**



walls is accomplished using non-combustible steel furring which supports the finish membrane. Furring products are available in several depths to accommodate different thicknesses of insulation.

Any exterior wall should be constructed with consideration of climatic conditions and should properly address the need for and proper location of a vapor retarder Failure to do this can result in condensation in the wall with potential development of mildew and rust.

## Ceiling Systems

Suspended and contact ceiling are achieved with light gauge steel framing members. Suspension can incorporate 1-1/2" cold-rolled channels cross furred with screwable type channels, or direct suspension utilizing a grid system. When the ceiling membrane is part of a fire-rated assembly, the requirements of the particular fire-rated design must be followed. A typical floor-ceiling assembly with bar joists supporting a concrete deck will usually require additional furring channels at the gypsum panel end joints. An assembly utilizing priority wood floor joists usually requires furring channels wire-tied to the bottom chord of the truss—not screw attached. If insulation is used in the

plenum of a fire rated ceiling assembly, it might impair the fire resistance rating by contributing to early failure of the gypsum panel membrane. 

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### ABOUT THE AUTHOR...

*Robert J. Lindegard* is architectural & construction services manager at United States Gypsum where he has been employed for 29 years.

He is active in the Construction Specifications Institute (CSI) and serves on the Chicago Committee on High Rise Buildings and several AWCI Technical Committees.

Mr. Lindegard received his bachelors degree in civil engineering from the Georgia Institute of Technology.