



## Steel Framing

Cold-formed steel members in c- sections with standard dimensions used for framing

### Summary

Residential steel framing utilizes cold-formed steel members for walls, floors, and/or roofs. The framing members are C-sections with standard dimensions similar to wood framing studs. Steel framing can be a cost effective alternative to wood framing.

Steel mills produce galvanized sheet steel, the base material for steel members. Sheet steel is roll-formed into shapes used for framing.



The sheets are zinc coated (galvanized) to prevent corrosion. Although there are a variety of shapes available, the primary shapes used in residential construction are the C-shape stud and the U-shaped track. Framing members are generally produced in thickness of 12 to 24 gauges with 3-1/2" and 5-1/2" widths.

Manufacture of steel framing members adheres to strict tolerances, which results in consistent strength, straightness, and dimensionally stable members. Steel framing provides excellent design flexibility due to the inherent strength of steel, which allows it to span longer than wood, and also resist wind and earthquake loads.



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### PATH Attributes

-  Steel-framed homes can be as energy efficient as wood-framed homes, provided that adequate insulation is used. You will need at least as much cavity insulation (providing the same R-value) in a steel framed home as with wood. In some markets, you will need to add exterior rigid insulation. Consult the Steel Framing Alliance's (SFA) Thermal Design Guide for Exterior Walls available on-line at [www.SteelFramingAlliance.com](http://www.SteelFramingAlliance.com). Note: Open shape metal studs will require the use of full width batts, commonly used in commercial framing and available at most building material dealers. The International Energy Conservation Code (IECC) also provides prescriptive tables for insulation levels for steel-framed homes, based on the heating degree days.
-  All light gauge steel framing contains a minimum of 25% recycled steel. The major environmental benefits of steel framing include: a 25% minimum recycled content and 100% recyclability; minimal job site waste due to standard quality (2% for steel vs. 20% for wood); life cycle energy savings due to the air tightness of the structure; and a long structure life reducing the need for future building resources (zero depletion of iron resources). The use of steel-framed members enables builders and designers to earn credit points under Leadership in Energy and Environmental Design (LEED) Programs. The recycled content value of the steel produced exceeds the 5% and 10% goals in LEED.



Steel framed members have consistent material quality. They are produced in strict tolerances in accordance with national standards. There are no regional variations in the manufacturing of steel-framed members. The use of zinc coating on the steel framing protects the steel from corrosion for the life of the structure. The American Iron and Steel Institute's (AISI) publication RG-9605 titled "Durability of Cold-Formed Steel Framing Members" summarizes the performance of steel-framed members in common residential applications.



Natural disasters, especially earthquakes, are unpredictable in terms of magnitude, frequency, duration, and location. Consequently, the ideal structure to withstand earthquake forces will behave in a consistent and predictable manner. Light gauge steel is capable of meeting this standard due to the strict process used to manufacture steel studs, inherent properties of steel and typical construction methods used in steel framing. Specific advantages offered by the use of steel framing in a seismic event include the following considerations: 1. Steel is a stable material with consistent chemical attributes. Once the steel stud has been formed, it will remain straight with virtually no change to the thickness, width or other dimensional properties. 2. Because the material and geometric properties of a steel framing member are stable, the overall strength of the structure will depend upon the quality of connections between the studs. Steel framing typically uses screws that provide a mechanical locking connection.

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### Ease of Implementation



There are many manufacturers throughout the country. These manufacturers typically have a network of distributors who sell directly to building materials suppliers, builders and home remodeling centers. In addition, the number of building suppliers that stock steel framing is increasing.

While the steel frame lays out similarly to the wood, there can be a significant learning curve for the carpenter to change over. Using a screw gun rather than a hammer or pneumatic nailer, is an ergonomic adjustment. The process of fastening steel members includes two steps - clamping the assembly, and then driving the screw. Overhead connections can be difficult and a step ladder may be required for the tradesperson building a steel wall in the air. There is a trend to panelize steel walls in a factory setting before shipping it to site. This way, labor and material costs are reduced, and other obstacles that are common in the field are eliminated.

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### Initial Cost

Steel framing uses the same layout, spacing and general framing techniques used in traditional wood framing. So learning how to use steel is very easy because many of the same principles apply. The only difference lies in fastening and cutting. With steel, typically a fastener (screw) and screw gun is used, vs. a nail and nail gun with wood. Steel is cut with a carbide or metal cutting blade. Using historical averages, steel framing material prices have been about the same or slightly higher than wood framing. However, if the builder, framing contractor or other subcontractor is new to steel, then labor costs could account for a \$1.00 - 2.50 per square foot premium over wood. The steel industry

continues to improve the processes by which steel homes are built, bringing hard construction costs down to a minimum, so that builders will be able to enjoy a competitive and stable framing package price.

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Operational Cost  
Not Applicable

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#### U.S.Code Acceptance

Steel framing is recognized by all major building codes. A set of prescriptive methods for residential steel framing was adopted by the International Residential Code (IRC 2000 and 2003). The prescriptive methods contain tables for stud sizing and spacing, joist and rafter spans, fastener schedules and construction details. In areas that have adopted these recent codes, the prescriptive methods will allow construction of site built framed steel homes without the certification of a professional engineer. Otherwise, a professional engineer may be required to design, review and seal plans. The American Iron and Steel Institute has also produced several ANSI accredited standards for the design and construction of light gauge steel framing (refer to [www.steel framing.org](http://www.steel framing.org) for the Standard for Cold-Formed Steel Framing – Prescriptive Method for One and Two Family Dwellings).

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#### Field Evaluations

Hopke Buildings & Grounds: MADE to Last Home, Sturgeon, Missouri

Hughes Construction: Lexington, North Carolina

K. Hovnanian Inc: College Park Estates. Freehold Township, New Jersey

Valparaiso Demonstration Homes

Beaufort Demonstration Homes

Fargo Demonstration Homes

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#### Installation

Site-built or conventional steel framing is typically a one-for-one substitution for wood framing members used for both non-load-bearing and load-bearing applications. The steel studs, joists and rafters fit into a top and bottom track. Steel members can be cut with a chop saw, circular saw, aviation snips or electric shears. The primary fastener used in steel framing is the self-drilling screw which takes longer time to drive than pneumatic framing nailers used in wood framing. However, there are new fastening systems that utilize pneumatics (pins), crimping, and welding that promise to speed up the construction process. Typically, in-line framing is required (trusses, joists, and studs must be vertically aligned with a tolerance of 1/4") unless a load distribution members are installed.

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Warranty  
Not Applicable

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#### Benefits/Costs

Steel framing contains up to 28%-recycled material and construction waste generated during framing is 100% recyclable. It is resistant to corrosion, warping, and termites. Framing members can be ordered cut-to-length which can result in reduced on site labor costs and reduced on site waste. Framing weighs up to two-thirds less than conventional materials. Lightweight steel framing lends itself to panelization techniques that can speed the on site construction process by allowing the assembly of walls in controlled environments. Steel framing members also have pre-punched holes that allow for easy installation of electrical wiring and plumbing. There are a number of inherent functional attributes of steel that are beneficial. For example, steel is:

*flexible*-- it can serve as stick-built, panelized, or pre-engineered frames for houses. The variety of sizes and thicknesses of steel contribute to flexibility. For example, to obtain a desired design you can reduce the width of a joist but compensate with a heavier gauge steel and not change the spacing of members.

*durable*-- it will not shrink or warp, resulting in fewer call-backs for nail pops or split seams in gypsum board. Also, steel is inorganic and therefore, it is resistant to moisture and insect infestation and will not rot, warp, split, crack or creep.

*light weight* – it is easy to handle, contributing to reduced labor costs and worker fatigue.

*strong*-- it can meet the highest seismic and wind load specifications. Its allowable stress values on the average range from 21,000 to 33,000 pounds per square inch (psi).

*dimensionally stable*-- since steel is a processed material rather than organic, it is straight, uniform and consistent in quality.

*fire resistant*-- it is non-combustible. It does not burn or contribute fuel to the spread of a fire, and may contribute to lower home owner insurance rates.

*strength*-- cold-formed steel has the highest strength-to-weight ratio of any building material.

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Please visit Path's website at [www.toolbase.org](http://www.toolbase.org) for additional and up to date information about this subject.