



A Beginner's Guide to Cold-Formed Steel Framing

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Cold-Formed Steel Framing Resource
Center for Building Professionals



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If you're unfamiliar with cold-formed steel (CFS) framing or simply haven't used it in a while, you may have several questions: What is it? How can I use it? Why should I use it?

CFS certainly isn't a new building material. It actually has been used in North America for over 100 years. Because of its light weight and durability, it can be used in a range of applications – from interior, non-loadbearing partition walls to structural members in mid-rise and multi-family buildings.

Whatever your current level of knowledge, consider this eBook a primer on all things CFS framing. In it, you'll learn what CFS is, how it can benefit a construction project, the basics of designing with and ordering CFS, and training options for expanding your CFS knowledge.



Tip: Before you get started, familiarize yourself with industry and technical terms related to cold-formed steel framing by accessing the [Cold-Formed Steel Introductory Glossary](#).



What is Cold-Formed Steel Framing and How Can I Use It?

Because cold-formed steel (CFS) framing is **light weight, extremely strong, noncombustible**, and relatively easy to install, it has dominated the market for interior, non-loadbearing partition walls in commercial construction. Now, with advanced technological developments like panelized systems, the building community is using CFS for structural applications in mid-rise and multi-housing buildings.

In fact, cold-formed steel framing is rapidly becoming the material of choice for student dormitories, assisted living facilities, and hotels across the country where prudent developers are interested in maximizing their return on investment.

WHAT IS COLD-FORMED STEEL?

Cold-formed steel (CFS) members are made from structural quality sheet steel that are formed into C-sections and other shapes by roll forming the steel through a series of dies. No heat is required to form the shapes (unlike hot-rolled steel), hence the name cold-formed steel. A variety of steel thicknesses are available to meet a wide range of structural and non-structural applications.

VALUE-BENEFIT OF STEEL

CFS as a construction material has many advantages. For example, CFS doesn't shrink or split, won't absorb moisture, and resists warping, termites, and fire.

As a uniformly manufactured product, the quality of CFS is very consistent. That consistency translates into less scrap to haul off because there is less waste — all of it recyclable. In addition to lowering scrap disposal expense, the fire resistance of CFS framing also can help reduce project costs through discounts on builders' risk and other course of construction insurance requirements.

CFS' physical properties allow it to be used in a wide range of environments. Its strength and ductility, for example, make it ideal for construction in regions subject to high winds or earthquakes. Moreover, a [study](#), conducted by the National Association of Home Builders (NAHB) Research Center, showed that the zinc coating on steel framing materials can protect against corrosion for hundreds of years.


And because each piece of CFS contains a minimum of 25 percent recycled content, is 100 percent recyclable at the end of its lifespan, and emits no volatile organic compounds — it's an exceptionally sustainable building material.



ON THE JOBSITE

CFS also provides numerous advantages in terms of the construction process itself. CFS is light making it easy to ship, handle and assemble.

Moreover, greater strength means less material. For example, if a project calls for stick framing, the strength of CFS allows it to be installed on 24" centers rather than traditional 16" centers — meaning fewer studs to install.



CFS as a construction material has many advantages. For example, **CFS doesn't shrink or split, won't absorb moisture, and resists warping, termites, and fire.**

And because CFS is manufactured to exacting standards, it is ideally suited for manufacturing into panels and trusses which – because CFS is light in weight – can be quickly and easily installed with fewer framers on the job.

Given those advantages, some builders have found that ordering factory-manufactured steel panels and trusses is an ideal way to move into steel framing because it minimizes the need for skilled framers, and provides access to experienced design and layout pros.

In addition to speeding up the framing process, CFS panels contain pre-punched holes designed to accommodate rapid mechanical, electric and plumbing installation after the framing is complete.

TRAINING

The list of basic CFS framing tools is rather short. A typical toolset might include an adjustable-torque screw gun, bits and bit holders for structural steel-to-steel connections, a hand seamer for positioning and bending steel, a chop saw, a pneumatic pin-nailer for steel-to-steel connections and sheathing-to-steel connections, clamps, aviation snips, a swivel-head electric shear, and a magnetic level.



WIDE ACCEPTANCE

With the adoption of the American Iron and Steel Institute's North American Standards for Cold-Formed Steel Framing into the International Code Council's International Building Codes, builders and designers can find comprehensive provisions for steel. These standards are also available as a free download from the [American Iron and Steel Institute](#).





The 6 Most Critical Design Steps to Take Before Starting Your Next Cold-Formed Steel Framed Project

Getting ready to design a cold-formed steel (CFS) framed building? You've made a great choice for a resilient system that will deliver years of quality performance. But where should you begin? What are the steps to designing successfully with CFS framing? While there are many steps to doing it right, here are six of the most critical.

STEP 1: CONSULT YOUR LOCAL BUILDING DEPARTMENT

Start by having a conversation with officials in your local building department. If needed, provide them with resources like the American Iron and Steel Institute's (AISI) cold-formed steel framing standards, which are available to download free of charge at www.aisistandards.org. That's the best way to uncover the particular requirements that relate to your project and will help it move along smoothly.

Details of many provisions for CFS framing are found in the International Code Council's "International Building Code and International Residential Code," recognized as the governing building codes by most building departments in the U.S. In general, the codes reference CFS framing standards developed by AISI, including the AISI S100 and S200 [series of design standards](#). These are available for free download at www.aisistandards.org.

- The American Iron and Steel Institute's [online Steel Store](#) has additional resources, such as design manuals, guides, and earlier versions of AISI S100, "North American Specification for the Design of Cold-Formed Steel Structural Members," [available for purchase](#).
- The Steel Framing Industry Association (SFIA) offers webinars on CFS design. For example, the webinar, "[FAQs on Cold-Formed Steel Design: What Everyone Needs to Know](#)," discusses fastener connection strength, installation tolerances, yield strength, bridging and bracing, and other design issues.
- [The Cold-Formed Steel Engineers Institute \(CFSEI\)](#) offers [webinars](#) on many CFS design-related topics and a library of published technical notes that are [available for purchase](#).

STEP 2: KNOW YOUR LOCAL ENERGY CODE

New energy codes require continuous insulation on all exterior CFS-framed walls. These changes came with the 2009 and 2012 International Energy Conservation Code® (IECC). The latest codes — 2015 IECC and ASHRAE Standard 90.1-2016, "Energy Standard for Buildings Except Low-Rise Residential Buildings" — maintain stringent insulation requirements.

While the codes adopted by state and local jurisdictions can vary, many codes require exterior continuous insulation on all CFS exterior walls. Even in cold climates, a thicker foam board layer is generally required. This can significantly affect your work as a designer because:

- Windows, doors, and light fixtures that once attached directly to CFS framing must now factor foam insulation into their attachment systems. Special extensions may be needed.
- Fasteners must support not just the exterior cladding, but the continuous insulation as well.

So, take time to verify the energy-efficiency provisions in place locally and their [impact on CFS systems](#).





STEP 3: IDENTIFY THE DESIGN REQUIREMENTS FOR THE PROJECT

The building designer is responsible for the overall design of a structure as required by the applicable building code. But in some cases, multiple designers may be involved in ensuring the stability and integrity of a structure. For example:

- A military project may require blast resistance as a structural feature.
- An industrial building may need progressive collapse resistance included in its design.
- The design of such additional requirements may be performed by a specialty designer or CFS component designer.

In such cases, the building designer must specify the design criteria, design load parameters, level of protection, and other details. Check AISI S202-15, “Code of Standard Practice for Cold-Formed Steel Structural Framing, 2015 Edition,” which is available for free download at www.aisistandards.org. AISI S202-15 addresses trade practices for the design, fabrication, and installation of cold-formed steel structural framing products.

You do not need an engineer to design a two-story above-grade structure using the prescriptive method, but some jurisdictions may require an engineer’s stamp. AISI S230-15, “Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings, 2015 Edition,” is available for free download at www.aisistandards.org.

STEP 4: REVIEW THE CFS INDUSTRY PRODUCT DESIGNATOR SYSTEM

Before you select CFS framing products, make sure you’re conversant with the industry’s nomenclature. CFS members are identified by a [four-part designator](#), which we explain in detail on page 6 of this eBook.

STEP 5: CONSIDER PANELIZATION AND OTHER OFF-SITE CONSTRUCTION SERVICES

CFS wall panels, flooring assemblies, and roof trusses can be built off-site in controlled environments. Off-site construction has many benefits:

- CFS panelization can save time and costs, and can improve quality control.
- Many CFS panel and truss manufacturers provide engineering services and work straight from the architectural drawings.
- Some CFS panel manufacturers offer turn-key solutions by including product installation.

STEP 6: REVISIT YOUR LOCAL BUILDING DEPARTMENT FOR A PLAN CHECK

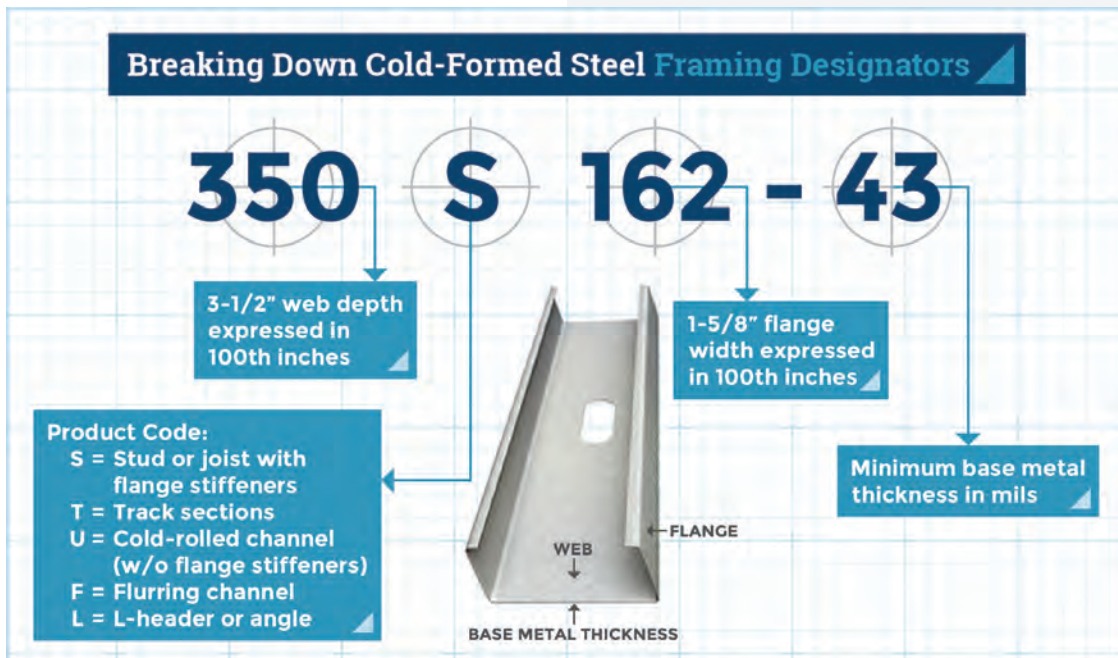
Plan checks are helpful. The reviewer at your local building department can verify that your CFS framing designs are accurate and in line with local code requirements.

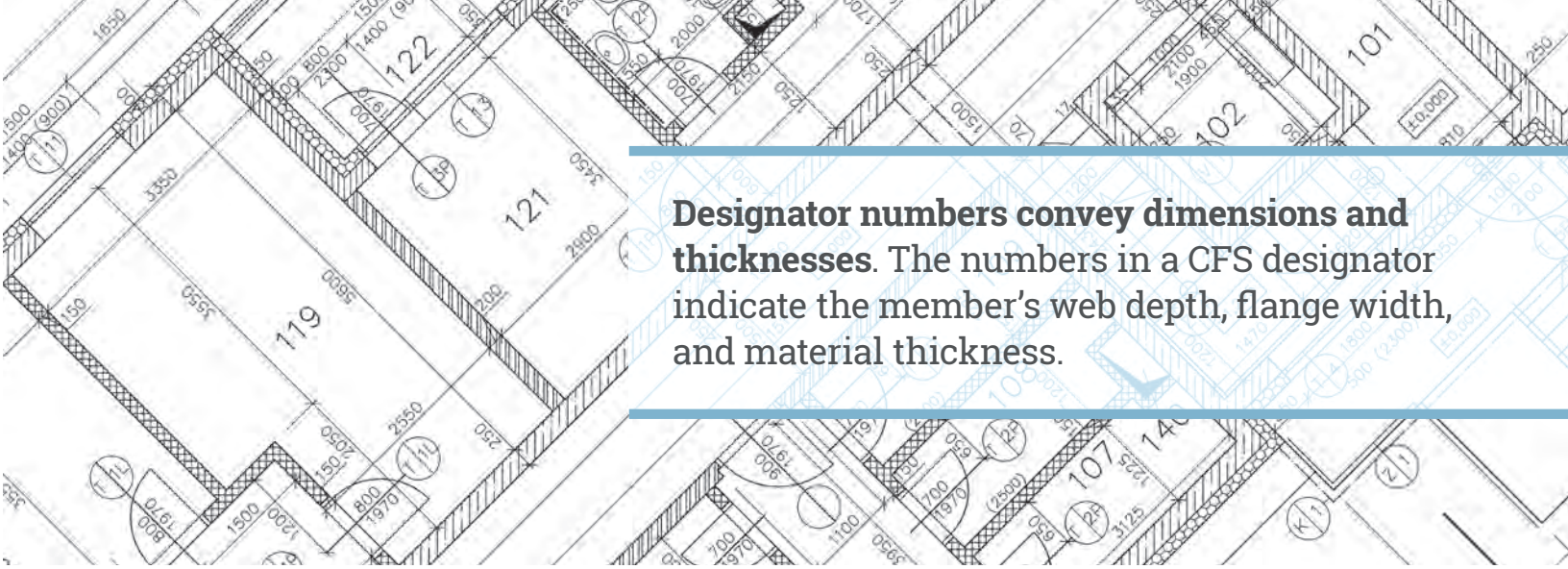
Need to Order Cold-Formed Steel Framing? Start With This Simple Guide

Do you need to order cold-formed steel framing (CFS) for your next project – but aren't sure where to start? When ordering CFS, you must first be aware of the different types of products and how they're designated by manufacturers and distributors.

Since a wide variety of CFS member profiles, depths, widths, and material thicknesses exist, the steel framing manufacturing industry developed a standard designator system that all CFS manufacturers and suppliers use. It is important to note that this universal designator system is used in identifying cold-formed steel framing in building codes as well. Understanding the designator system makes it easy to specify the right CFS components – and once you do that, you can then move on to finding the CFS distributor for your project.

The system is alpha-numeric. For example, a CFS member might have the designation 350S162-43. Without knowledge of the designation system, you can't tell much from that number. Is it a stud? Track? U-channel? What about its thickness and other material dimensions? Once you understand the system, you can identify the member at a glance.

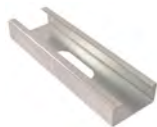
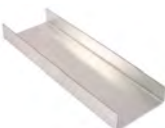







Designator numbers convey dimensions and thicknesses. The numbers in a CFS designator indicate the member's web depth, flange width, and material thickness.

DESIGNATOR LETTERS CONVEY THE TYPE OF CFS FRAMING MEMBER

There are five CFS profiles. To remember them, think of the acronym STUFL: stud, track, U-channel, furring channel, and L-headers.

STUFL			
S	Studs (or joists, or rafters)		Studs include wall studs, joists, and rafters, all of which have the same shape. All studs have returns or lips. Typical return sizes are 1/2" and 5/8".
T	Track		Track is used as the top and bottom plates of a CFS wall, or as the rim track of floors and rafters.
U	U-Channel		U-channel is used for bridging, blocking, and custom applications. U-channel members do not have returns or lips.
F	Furring Channel		Furring channel is used as purlins, bridging, and backing. Also, furring can be used as framing for suspended ceiling assemblies.
L	L-Header		L-headers are used in load-bearing wall framing as headers, eliminating the labor needed to field-assemble those headers.

Images Courtesy of ClarkDietrich

WEB DEPTH

The first number in the designator refers to the profile's web depth. In the case of 350S162-43, the example above, the depth classification is the number 350.

Generally, depth is measured from the outside of the web. The exception is track, or "T" sections, where member depth is the inside-to-inside dimension. However, all CFS web depths are taken in 1/100th of an inch. Let's say you're ordering a 3-5/8" stud. That width equals 3.625", which is approximately 362 x 1/100." So, the designator would be 362.

In the sample designator 350S162-43, the number 350 means the stud has a web depth of 3-1/2".

FLANGE WIDTH

Flange width is the second number in the CFS designator, the first to occur after the profile letter. Like web depths, flange widths are measured in 1/100 inches.

In the 350S162-43 sample, the number 162 designates a flange 162 x 1/100" wide, or 1-5/8".

THICKNESS

The number after the dash signifies material thickness. Unlike web depth and flange width, material thickness is measured in "mils." Mils stands for 1/1000th of an inch.

So, now you can go back to the original example: 350S162-43. You can immediately tell that it's a 3-1/2" stud (350 x 1/100") with a 1-5/8" flange (162 x 1/100") with a material thickness of 43 mils. This stud would be similar to a common wood 2"x4".

If you wanted the same stud in a thinner material, then 362S162-33 might work. If you need a thicker stud, talk to your supplier about 362S162-54.

You'll see many published figures for thickness. The table below shows the common thicknesses as they relate to minimum thickness, design thickness, the thickness associated with a corner member and respective corresponding gauging:

Designation Thickness (Mils)	Minimum Thickness (in)	Design Thickness ¹ (in)	Design Inside Corner Radii ² (in)	Reference Gauge No.
18	0.0179	0.0188	0.0844	25
27	0.0269	0.0283	0.0796	22
30	0.0296	0.0312	0.0782	20-Drywall
33	0.0329	0.0346	0.0765	20-Structural
43	0.0428	0.0451	0.0712	18
54	0.0538	0.0566	0.0849	16
68	0.0677	0.0713	0.1070	14
97	0.0966	0.1017	0.1526	12
118	0.1180	0.1242	0.1863	10

CFS thickness table. (1) Minimum thickness represents 95 percent of the design thickness and is the minimum acceptable for projects based on section A2.4 of the AISI S100-07 with S2-10 Supplement. (2) Thickness based on inside corner radii. Table courtesy of Steel Framing Industry Association.



To locate distributors, check with a CFS manufacturer. Many link to distributors on their websites. Some manufacturers supply framing packages and uncommon CFS shapes and sizes.

FINDING A CFS DISTRIBUTOR

CFS framing is typically supplied by a regional distributor. Distributors include traditional lumberyards and gypsum board supply warehouses. Larger contractors may be able to purchase directly from manufacturers

To locate distributors, check with a CFS manufacturer. Many link to distributors on their websites. Some manufacturers supply framing packages and uncommon CFS shapes and sizes.

Of course, this is just the beginning when it comes to ordering CFS materials. Some CFS members have different coating options, come in varying stock lengths, and can be ordered in a variety of packaging bundles. The quantities of your order will depend on the specific assembly designs, which will determine their spans and spacing and, therefore, the lengths and quantities you'll need.

And, don't forget that if you're working on a green building project, you'll want help choosing a nearby supplier, so you can qualify for all allowable green building points.



Quick Guide: Training for Cold-Formed Steel Framers

Training for cold-formed steel (CFS) framers has been available for decades – and in a wide variety of formats. Training options include high school shop classes, union apprenticeship programs, and non-union training providers. And behind just about every program stands an organization committed to enabling the widespread use of steel: the Steel Framing Alliance (SFA).

Over the years, SFA has partnered with several groups to provide training to CFS framers:



HIGH SCHOOLS AND VOCATIONAL SCHOOLS

SFA's cold-formed steel framing curriculum was adopted in whole or in part by high schools and vocational schools throughout North America. The CFS training curriculum touches on all aspects of CFS framing, including what it is, how it's cut, and how it's joined.



UNITED BROTHERHOOD OF CARPENTERS

The United Brotherhood of Carpenters and Joiners of America (UBC) provides training in both classroom and hands-on settings at more than [200 training centers](#) across North America.



SKILLSUSA

SkillsUSA brings together high school and post-high school young people pursuing careers in the building trades. Each year, the organization sponsors the SkillsUSA Championships in Louisville, Kentucky. Ten years ago, the incoming contestants had little or no prior experience with CFS framing. Today, more than half the contestants come into the competition with a working knowledge of framing with CFS.



NATIONAL CENTER FOR CONSTRUCTION EDUCATION AND RESEARCH

[National Center for Construction Education and Research](#) (NCCER) provides open-shop craft professionals with training at more than 4,000 NCCER-accredited locations across the United States. The NCCER Registry System is an online database that allows participants to provide easy verification of their training to employers.



DECADES OF CFS TRAINING

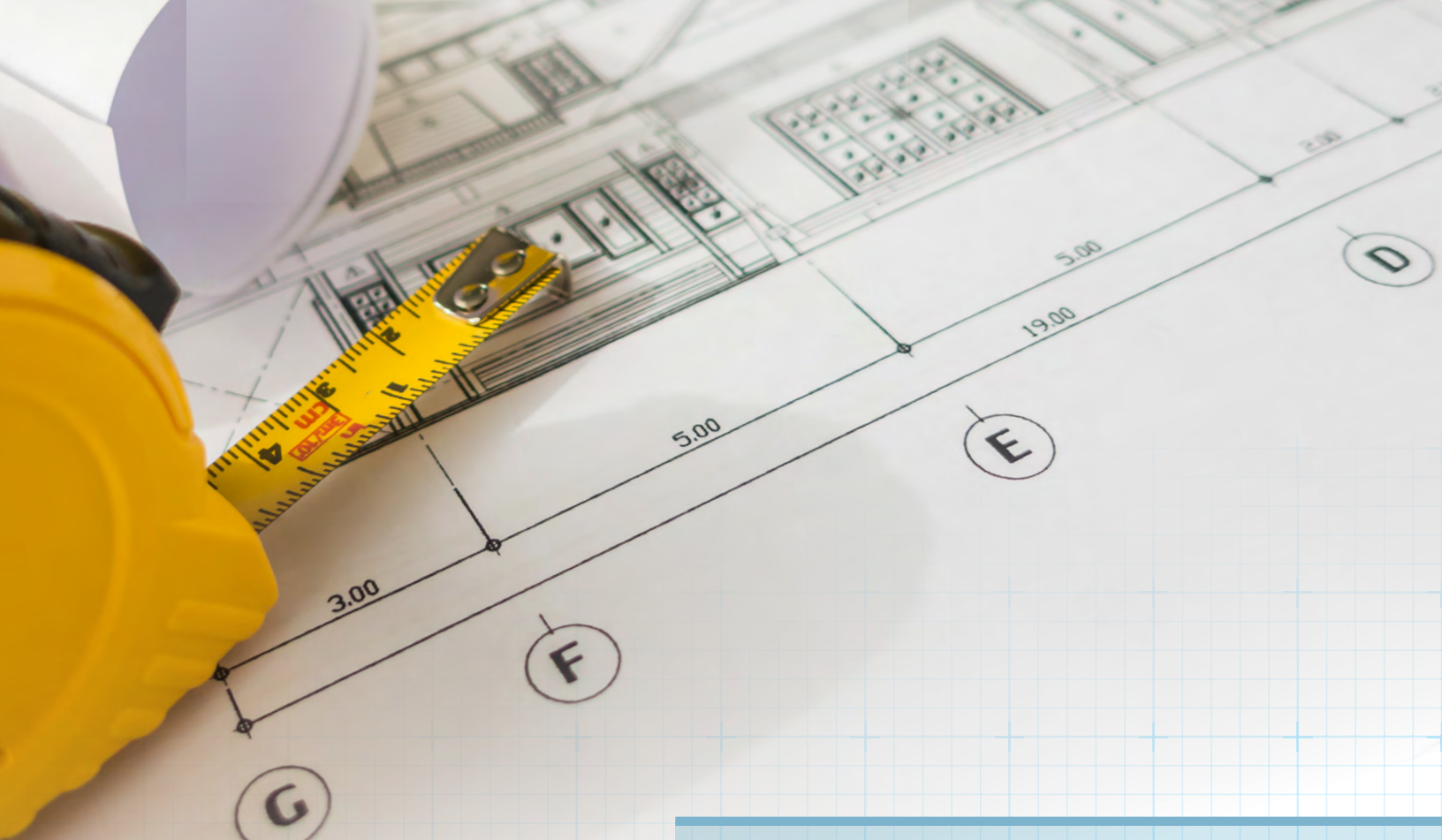
In addition to the programs mentioned, SFA has conducted STUD University, Steel University for vocational building trades instructors, and countless other seminars. STUD University is a two-day session that provides technology transfer via discussion, demonstration, and hands-on experience on a mini-cold-formed steel framing project using state-of-the-art industry tools. It is specifically designed for architects, builders, contractors, engineers, building inspectors, and building trades instructors.



ASSOCIATION OF THE WALL AND CEILING INDUSTRY (AWCI)

More than 10 years ago, SFA co-developed a CFS training program with AWCI called [Steel—Doing It Right®](#). The two-day seminar is aimed at framers, foremen, superintendents, architects, and others who work with steel in design and construction. The event presents the construction methods associated with CFS load-bearing wall assemblies, interior wall systems framing, roof systems floor assemblies, and more.





With a foundational knowledge of the benefits, training options, and ordering process for cold-formed steel (CFS) framing, you are now well prepared to move forward with your next CFS-framed project.


But if you still have questions, we can help. Whether you're stuck in the design or planning process, or would like ideas for how to reduce costs or speed up your construction timeline, the BuildSteel team of experts can address your concerns. We offer complimentary project assistance for new or existing cold-formed steel framed projects. Request assistance now.

About BuildSteel

BuildSteel provides valuable resources, education, and complimentary project assistance related to the use of cold-formed steel framing in low and mid-rise and multi-family construction projects.

As a centralized source for information, BuildSteel offers resources to help move your next cold-formed steel framing project forward efficiently and effectively.

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