TECH SPECS

THE BASICS
Steel has a proven track record in a number of industries from automobile and railroad manufacturing to bridge and commercial construction. Over the past two decades, cold-formed steel has seen increased usage as the structural frame for residential and multi-story commercial buildings due to inherent features that overcome the downsides of conventional products. Rigorous building environs, like Hawaii and California have seen the largest increase in residential steel framing where earthquakes, high winds, termites and brush fires wreak havoc on less-durable materials. Steel is:

- **Code Compliant.** Cold-formed steel (CFS) framing can be used prescriptively in single and multi-family structures. The specifications for cold-formed steel, span tables and prescriptive use methods are contained in the International Residential Code (IRC), sections R505 Steel Floor Framing, R603 Steel Wall Framing and R804 Steel Roof Framing.

- **Consistent In Quality.** Steel is manufactured to strict tolerances, dimensionally stable in all climates and does not contain knots, twists, or warps.

- **Light Weight.** Steel members weigh less than conventional lumber, reducing total building loads, transportation and storage costs and worker fatigue.

- **Resistant to Termites and Pests.** Cold-formed steel members are impervious to termites and cellulose-eating insects.

- **Noncombustible.** Steel does not burn and can be designed to meet multi-family fire rating requirements in the building codes.

- **Framed In-line.** Cold-formed steel frame assemblies do not usually include structural top plates. Joists, studs, and roof members are installed in-line for continuous load transfer from roof to footing. When 24" spacing is specified,
DOLLARS AND SENSE
A real-world example of the cost differences between wood and steel framing.

| Location: Valparaiso, IN  
| Frame Start: Dec. 1999  
<table>
<thead>
<tr>
<th>Finished Sq. Ft. 2,259</th>
<th>Wood</th>
<th>Steel</th>
<th>Cost differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Cost</td>
<td>$16,178.00</td>
<td>$13,836.00</td>
<td>-14.5%</td>
</tr>
<tr>
<td>Total House Hard Cost</td>
<td>$78,208.00</td>
<td>$80,835.00</td>
<td>+3.4%</td>
</tr>
<tr>
<td>Rough Frame Labor (hrs.)</td>
<td>267.9</td>
<td>293.0</td>
<td>+9.4%</td>
</tr>
</tbody>
</table>

*Rigid foam board was applied to the exterior of the steel structure. The foam required 17.64 additional labor hours and $706 in materials (included in these totals).

FOOD FOR THOUGHT
This section provides some things to think about before switching to this building technology – make sure it’s the right choice for you.

- Cold-formed steel framing will be most successful in designs and projects where its use resolves multiple challenges – for instance, a home in a high wind speed zone and hot-humid climate with heavy termite infestation probability.
- In-line framing requires the framers’ full attention to plans and layout. An accurate bill of materials, pre-planning, and precision are required.
- Steel designs should include details to minimize thermal conductivity like rigid foam sheathing board and full size (24") insulation batts.
- Some builders advocate starting with one assembly, such as the floor joists, in steel and working up to framing the whole structure with CFS. Others successfully converted to steel framing with pre-fabricated systems – wall panels, floor decks, and trusses.
- All trades will be required to modify their practices. Engage the trades in project planning from the start.
- Steel integrates easily with many alternative building materials such as structural insulated panels (SIPs), insulated concrete forms (ICFs) and formed concrete walls. Resource materials detailing connections to these and other materials are available at [www.toolbase.org/steelframing](http://www.toolbase.org/steelframing).

TECH CHECK
Below is a checklist of steps to follow in order to implement this technology in each of your projects.

- To reduce waste and streamline the project, work with designs that are based on 4-foot modules and space studs at 24 inches-on-center.
- Include panel layout drawings on architectural plans to simplify lining up joists, studs, and roof rafters.
- Work with a supplier that will furnish exact lengths of stud, joist and rafter material. Or work with a wall panel, floor assembly and truss fabricator that will also provide the installation team.
- Include a steel veteran on the team – on-site technical representative (panelized approach) or framing crew lead person.
- Encourage trades people to purchase, use and maintain the right tools and fasteners for the job.
- Encourage trades persons using steel for the first time to experiment with fasteners and equipment before beginning the job. As the trades become more familiar with steel framing tools and techniques (usually within three to five houses), the time spent operating or adjusting equipment or reworking a job should become insignificant and a reasonable pace should become established.
- Enforce safety – gloves and glasses should be worn at all times when working with steel.
- Streamline the job, by fostering training and education. Keep current, as the CFS marketplace is continually evolving.

MAKING THE SWITCH
What is required to transition from your current building practices to using this technology?

**Design.** Finished cold-formed steel homes will be indiscernible from all of the other homes on the block as seen from the curb because the framing material doesn’t affect the architectural style. The greater span capability of steel allows designs to incorporate larger interior open spaces and dramatic architectural features.

Architectural plans should be amended to include the cold-formed steel structural details that satisfy the design requirements, like member size and header size and configuration. Plan approval and site inspections should follow the same protocol as conventional houses, but it is always good practice to have a conversation with your local building department before you start.

Structurally, CFS designs that follow the IRC will have all members, from foundation to roof, installed with a continuous load path or in-line framed. In cold climates a continuous thermal barrier, usually ⅜” to 1” of rigid foam board, is applied to the exterior.

**Training.** Gaining cold-formed steel framing experience on the job is possible with homework and prior planning. Some builders introduce steel members on a small scale initially and work up to a complete steel framing package as successive houses are built. Using steel studs for interior walls or floor joists is a good way to gain experience with the material. The Steel Framing (SFA) Alliance’s How to Build Interior Walls with Steel provides guidance; numerous manuals developed by the SFA and the NAHB Research Center for PATH are also available. A National Training Curriculum that covers steel framing and the sub trades has been developed by SFA for trade instruction through community vocational/technical colleges across the country. The

Continued on next page
Role of Cold-Formed Steel in Construction

Cold-formed steel (CFS) is a lightweight, high-strength structural material that is used in the construction of buildings. It is made from thin-gauge steel sheets that are rolled into various shapes and sizes, such as studs, joists, and headers. CFS is commonly used in both residential and commercial buildings.

Advantages of CFS

- **Lightweight:** CFS is lightweight compared to other traditional framing materials like wood. This makes it easier to handle and transport, especially for second-story additions.
- **Corrosion Resistance:** CFS is galvanized to resist corrosion, making it a durable choice for outdoor applications or areas exposed to moisture.
- **Thermally Conductive:** CFS can transfer heat more efficiently than other framing materials, making it a good choice for thermal performance.
- **Advanced Framing Techniques:** Specifying CFS in a way that maximizes thermal performance, efficiency, and performance reduces energy costs.

Using CFS

- **Frame Design:** CFS can be used as a structural frame for both interior and exterior walls.
- **Roofing:** CFS can be used in roofing applications, providing a lightweight, durable option.
- **Flooring:** CFS can be used in floor slabs, providing a strong, lightweight option.

Specifying Steel Components

- **Shape:** CFS comes in a variety of sizes and shapes, some of which are equivalent to dimensional lumber. The acronym STUF-L covers the common shapes - stud, track, U-channel, furring, and L-header.
- **Thermally Conductive:** CFS is designed to provide better thermal performance. A steel-framed home will be more comfortable, save on heating and cooling costs, and reduce energy usage.
- **Corrosion Resistance:** CFS is typically galvanized, providing a protective layer against corrosion.

Fasteners

- Steel fasteners are used to connect CFS elements. They include screws, nails, and bolts.
- **Screws:** Screws are used to fasten CFS elements to each other. They are available in different lengths and types, such as Phillips and flathead screws.
- **Nails:** Nails are used to fasten CFS elements to other materials. They are available in various sizes and types, such as common and finish nails.

Tools

- **Screw Guns:** Screw guns are used to drive screws into CFS elements. They are available in different models, such as cordless and pneumatic.
- **Pneumatic Nails:** Pneumatic nails are used to drive nails into CFS elements. They are available in different models, such as framing and finish nails.

Specifying CFS

- **Thickness:** The thickness of CFS is specified in mils or thousandths of an inch. CFS can be specified in thicknesses ranging from 0.012 to 0.030 inches.
- **Grade:** CFS is available in different grades, such as G40 and G60. G40 is used for non-structural applications, while G60 is used for structural applications.
- **Type:** CFS comes in different types, such as hot-rolled and cold-rolled. Hot-rolled CFS is used for structural applications, while cold-rolled CFS is used for non-structural applications.

Conclusion

Cold-formed steel is an efficient and versatile framing material that is used in a wide range of applications. By specifying CFS in a way that maximizes thermal performance, efficiency, and performance reduces energy costs. CFS provides a lightweight, durable, and cost-effective solution for building construction.
RESULTS FROM THE FIELD
This technology has been used by other builders in real-world building situations – learn from their experiences.

Beaufort Demonstration Homes, SC
- Two side-by-side homes of 1,428 sq. ft.; one framed with lumber and the other with cold-formed steel.
- The cost of the steel framed home was 14.2% more than the wood home.
- Framers’ labor hours for the steel-framed home were 4.3% higher than the wood home.
- The steel interior non-load bearing walls were cost competitive with wood.

Davis, Maryland and Hopke, Missouri
- Comparison of actual labor time and construction cost of two floor assemblies - wood and steel.
- Net steel floor assembly savings of 8% on a framer’s first cold-formed steel effort.
- Wood floor required less labor.

DEFINITIONS

Furring Channel
A cold-formed steel shape that are primarily used like shims between a finish material and structural members. Hat channel and resilient channel are furring channels.

Grommet
An accessory used in steel frames to finish the edges of factory punchouts in studs and joists so that wire and pipe will not be damaged. Insulators and isolators are similar accessories.

In-Line Framing
A framing style whereby all structural members are aligned vertically to transfer loads continuously to the foundation. In-line frames will have floor joists, wall studs, roof joists and rafters stacked atop each other and at the same spacing from member to member.

Knurled Pin
A fastener used to attach sheathing and finish materials (drywall and trim) to cold-formed steel frames that is seated with a pneumatic gun. Some pins are designed for making steel to steel connections.

L-Header
An angle-shaped piece of sheet steel that can be used as a structural member to transfer loads over door and window openings. L-headers can be used prescriptively in pairs whereby one angle is installed on each side of a wall.

Mils
Thousandths of an inch; a measure of the thickness of cold-formed steel.

Track
The steel shape that is used as the top or bottom plate of steel studs, as well as, the rim (band) board for joists and rafters.