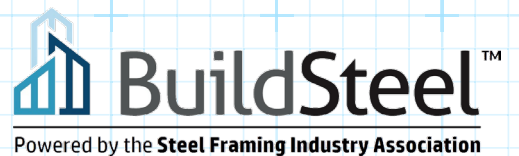


# Strength in the Face of Disaster: How Cold-Formed Steel Framing Keeps Buildings Safe

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Cold-Formed Steel Framing Resource  
Center for Building Professionals

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**Most builders, developers, and contractors expect a few minor interruptions in any construction project. What they don't always plan for are significant disasters like hurricanes, fires, flooding, or even extreme cold weather — which may not just delay a project, but have the potential to destroy it before it is even completed.**

While you can't always predict these types of events, you can choose building materials that can help your projects stand up to these challenges during construction and throughout the life of the building. This eBook explores the durability of cold-formed steel (CFS) framing when confronted with fire, cold weather, hurricanes and flooding. You'll also learn how the use of CFS framing can lead to lower insurance rates and fewer construction delays.

In the face of natural disasters and other unpredictable events that have the potential to wreak havoc on construction projects, learning to construct resilient CFS-framed buildings is vital to builders, developers and contractors, and offers lasting value and peace of mind to owners and residents.



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**This eBook explores the following topics:**

- **Don't Get Burned: Steel for Fire Safety and Insurance Savings**
  - **5 Reasons Why Cold-Formed Steel is Ideal for Construction Projects that Span the Winter**
  - **Built to Last: A Q&A on the Future of Resilient Construction in Areas Prone to Hurricanes and Flooding**
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## Don't Get Burned: Steel for Fire Safety and Insurance Savings

**Every 20 seconds. That's how often firefighters in the United States respond to a fire.** Fire is the nation's fifth leading unintentional cause of injury and death. No wonder North American building codes require materials and assemblies that limit fire hazards.

The construction phase of a project poses additional fire safety challenges and financial risks because code-prescribed active and passive fire protection (e.g., sprinklers, wallboard and firewalls) and egress measures (e.g., stairs) are likely not yet in place. When it comes to fire safety, one light-frame construction material stands apart from the others: cold-formed steel (CFS).

**For superior fire safety, floor, wall and roof construction should feature CFS framing. Here's why:**



### STEEL IS NON-COMBUSTIBLE

Steel can't burn, because it contains no elements that can serve as fuel. Steel provides no means for a fire to start, it does not contribute to fire growth or fire spread, and it does not contribute to the generation of smoke and toxic combustion products in fires.

Building codes recognize steel framing as non-combustible construction. The codes make CFS eligible for use in Type I buildings, which have the most stringent fire-resistance requirements. CFS framing is also common in Type II buildings, which are required (with few exceptions) to be built of non-combustible materials. Buildings of

non-combustible construction Types I and II are permitted to have larger areas and heights compared to buildings of combustible construction types, because non-combustible construction contributes to reduced risks of fire ignition, fire growth, and fire spread.

The advantage of non-combustible materials is extremely important during the construction phase of a project when the unprotected framing is exposed to workplace fire hazards, including welding, electrical sparks, open flames, pilot lights, heaters, smoking, and even vandalism and other criminal activity.



### STEEL MAINTAINS ITS NON-COMBUSTIBILITY

Steel remains non-combustible throughout the entire lifecycle of the building — during building construction, occupation, and future renovation and repair.

The melting point of steel is approximately 2,700 degrees Fahrenheit. Since building fire temperatures average 1,000 degrees Fahrenheit, and rarely exceed 1,800 degrees Fahrenheit, the steel in structures will not melt. While the stiffness and yield strength of steel are reduced at ultra-high temperatures, modern building codes and fire protection methods take these reductions into account.



## STEEL-FRAMED BUILDINGS LOWER THE FIRE RISK TO WORKERS AND OCCUPANTS

Decades of research into understanding the behavior of structural steel components when exposed to fire has given designers the confidence to engineer buildings that will provide optimum fire safety.

Fire resistance-rated walls and floors help limit or slow the spread of flames in a building and maintain the integrity of the structure. Tests conforming to [ASTM E119](#) (Standard Test Methods for Fire Tests of Building Construction) have proven that CFS-framed assemblies are fireproof up to four hours.

[A Guide to Fire & Acoustic Data for Cold-Formed Steel Floor, Wall & Roof Assemblies](#) is a searchable directory of fire-rated assemblies for both load-bearing and non-load-bearing conditions. The directory is based on fire test data from [Underwriters Laboratories of Canada](#), [National Research Council of Canada](#), [Underwriters Laboratories Inc.](#), [Gypsum Association](#), [Factory Mutual Global Research](#), and [Intertek Testing Services NA Inc.](#)



## STEEL-FRAMED BUILDINGS LOWER THE IMPACT ON MUNICIPAL FIRE SERVICES

Recent building code changes that permit increased building heights and areas for wood framing have had devastating results. [A rash of catastrophic, multi-story, wood-frame building fires in](#) Canada and the United States have destroyed entire building complexes both during construction and after completion and occupancy.

The three-story, [wood-framed Marshall Square Retirement Community](#) in Evans, Georgia, was completed in December 2014. Six months later, a fire broke out that destroyed much of the facility. The blaze displaced more than 80 residents and killed one elderly woman who was trapped in her third-floor apartment. Most of the destruction took place within three hours.

In December 2013, a massive fire broke out at a wood-framed multi-family residence under construction in [Kingston, Ontario](#). So sudden was the onset and spread of the fire that a crane operator had to climb to the top of his crane's boom and hang there until he could be rescued by helicopter. The fire forced the evacuation of nearby buildings, which remained uninhabitable for months.

Such fires have challenged the resources of fire services. Fires, such as the one that occurred in Kingston, have prompted several municipalities to implement site-safety regulations for the construction of combustible buildings that will reduce fire hazards but ultimately increase the construction costs and timeframes of such projects. Other cities, such as the affluent Atlanta suburb of [Sandy Springs](#), are working to ban combustible framing above three stories.



## STEEL-FRAMED BUILDINGS TEND TO COST LESS TO INSURE

Insurers traditionally offer steel-framed structures [lower builder's risk and general liability premiums](#) compared to structures framed with wood.

For example, CFS framing saved \$1.32 million in builder's risk insurance premiums for the 24-month construction of a four-story, [400-unit hotel in Mason, Ohio](#). Thereafter, CFS framing saved \$66,000 a year in property insurance premiums in comparison to framing the hotel with wood.

The builder of a four-story, [190-unit condominium in Los Angeles](#) was able to save \$300,000 in general liability insurance premiums by using CFS framing instead of concrete. The builder also saved \$100,000 in builder's risk insurance and worker's compensation policy premiums by using CFS.

A fire may occur every 20 seconds, but steel can help you avoid getting burned. Steel-framed floors, walls, and roofs lead to safer outcomes and can even put insurance money back in your pocket.

## 9 Areas for Assessing Building Material Resiliency

1. **Safety** — Ability to withstand a natural hazard and continue to function as designed
2. **Security** — Ability to resist a man-made event and continue to function as designed
3. **Energy Conservation** — Ability to contribute to efficient energy use over the life of the building
4. **Environment** — Ability to use less energy and other resources initially, then reduce other environmental impacts over the life of the building
5. **Durability** — Ability to provide a long lifecycle, minimize maintenance, and resist deterioration
6. **Predictable Performance** — Ability to plan for natural hazards and man-made events in the design, construction, and operating phases of a building project
7. **Serviceability** — Ability to deal with conditions other than strength that can render buildings unusable
8. **Repairability** — Ability to restore a building's functionality after damage caused by a natural hazard or man-made event
9. **Adaptability** — Ability to accommodate needs throughout the service life of a building



## 5 Reasons Why Cold-Formed Steel is Ideal for Construction Projects that Span the Winter

Construction in the winter brings concerns that builders and contractors don't have to worry about in the warmer months: thermal work clothing, ice removal operations, and the structural integrity of materials in below-freezing conditions, for example.

But cold temperatures don't have to halt operations completely. By taking the right steps now to plan, you may be able to save time, money, and headaches on an upcoming winter project.

For example, large projects that stretch over multiple seasons may require special sequencing so that, for instance, you don't pour concrete in January in Minnesota. Instead, you slate that pour for September and use the frigid months to erect cold-formed steel (CFS) assemblies. Or, you might save money on temporary heating for concrete curing and cut labor hours by using panelized CFS framing systems — or even switching the structural framing system entirely to load-bearing CFS.

In these examples, CFS is essential to keeping the construction timeline on pace throughout the cold weather. Here are five reasons why CFS is ideal for building during winter.



### **CFS IS STRONG, DUCTILE, AND STRUCTURALLY READY FOR INSTALLATION IN WINTER**

CFS framing and panel erection on a job site is not restricted by weather conditions. CFS does not warp, twist, or bend when exposed to the elements, and it

is not affected by cold temperatures. That's not the case with other building materials.

To reach its necessary strength, concrete "can't be allowed to freeze for the first 24 hours after being poured," according to an article on [ConstructionDive](#) that cites the Portland Cement Association. The same principle applies to building walls with masonry in winter. The mortar mix used in bricklaying must be kept from freezing.

In contrast, no special measures are needed to protect CFS' structural integrity during winter.



### **CFS REQUIRES NO PORTABLE HEATERS IN COLD WEATHER**

Cast-in-place (CIP) concrete tends to incur higher costs during wintertime versus other seasons. That's because CIP concrete requires time to cure, and that time is extended in cold conditions. Ready-mixed suppliers often charge extra to mix and deliver concrete in frigid temperatures. General contractors, or concrete subcontractors, have to rent temporary heaters and extra plastic sheeting to maintain sufficient temperatures for concrete to set.

But, CFS requires no special temperature or humidity conditions in order to be installed.



### CFS FACILITATES THE MEP TRADES' WORK DURING WINTER

Once CFS framing is installed, the mechanical, electrical, and plumbing (MEP) trades can get right to work. They don't have to use their own equipment to create punchouts or alter the framing assemblies to accommodate their runs. CFS wall studs and floor joist systems are normally fabricated with factory-made punchouts for MEP equipment pass-throughs.

For example, most CFS joist punchouts will align with the joist assembly. This allows the MEP trades to run pipes, electrical conduit, and HVAC ducting efficiently. CFS framing makes it easy for these runs to stay within the plane of the floor assembly, thereby integrating everybody's work in an easy and cost-effective way.

In other words, the predictability, accuracy, and inherent features of CFS studs and joists enhances overall job site productivity. CFS fast-tracks work, and may help MEP trades finish ahead of schedule — perhaps before winter even begins.



### CFS ERECTION CAN BE SCHEDULED DURING WINTER TO KEEP A MULTI-SEASON PROJECT ON TRACK

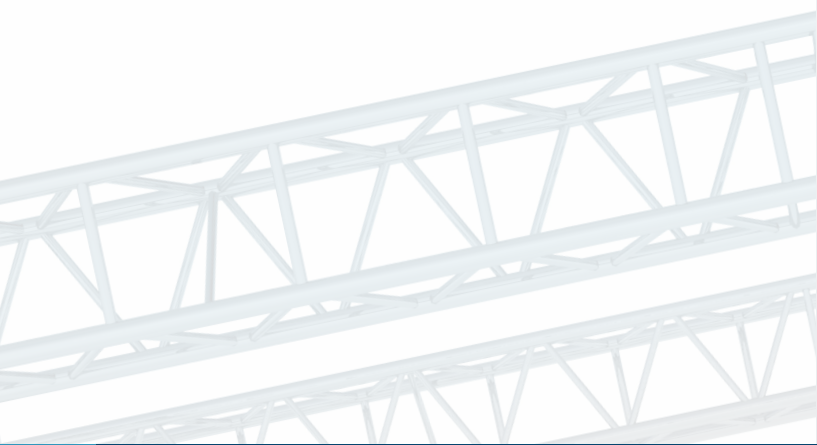
Consider the Trafalgar Campus of Sheridan College, Oakville, Ontario, which needed a [new student dormitory](#) in time for the fall semester of the following year. Work was ready to begin in the fall the year before. How could the GC build without a Canadian winter interfering with the delivery timeframe?

The solution was to use load-bearing CFS walls instead of CIP concrete or concrete block and have the concrete foundations poured by autumn.

By pouring the structure's foundations in the fall and installing load-bearing CFS framing during winter, Sheridan College and its public-private partner, Campus Living Centres, finished the project early — and likely saved hundreds of thousands of dollars in carrying costs because of it.

The crews installed load-bearing CFS wall systems and hollow-core floor and roof joists in 14 to -4 degrees Fahrenheit (-10 to -20 degrees Celsius). Concrete structures would not have gone up as efficiently, if at all, in such temperatures.

The CFS framing also helped to shorten the construction cycle. In the end, students got their new dormitory in time for the new semester.







### CFS PANELIZATION DURING WINTER SAVES MONEY, TOO

CFS lends itself to pre-fabrication. This is work that can be done off site under controlled, regulated, and safe conditions.

Sheridan College benefitted by using a prefabricated structural system that could support a variety of exterior claddings. CFS exterior wall panels were later finished with an Exterior Insulation Finishing System (EIFS). The combination of prefabricated CFS panels and EIFS cladding saved the owners money by not having to heat the scaffolding needed for an in-situ stucco application.

“It was a great design — speedy and perfect for the winter timeframe,” [the installer said.](#)

CFS is an all-seasons product that saves projects time and money — as long as you start planning now for projects that will span the next winter.

The cold weather advantages of CFS framing do not stop when construction is completed. Energy-efficient CFS framing solutions with cavity and exterior insulation exist for all climate zones, allowing CFS framing to contribute to efficient energy use over the life of the building.

## Durability of Cold-Formed Steel Framing



**CFS framing resists corrosion,** with up to **700-year** life predictions.



**CFS framing resists termites** in every climate and building type.



**CFS framing resists mold and decay** because it does not absorb moisture and will not function as a food source for mold.

## Safety of Cold-Formed Steel Framing



**CFS framing is strong, up to 7x greater strength-to-weight ratio** than wood — highest of all commonly used construction materials.



**CFS framing is non-combustible.** There are assemblies with ratings up to 4 hours.



**CFS framing resists extreme environmental loads,** with prescriptive one- and two-family residential designs for wind, snow, and seismic loads up to **190 mph**, **70 psf**, and Seismic Design Category **E**.



## Built to Last: A Q&A on the Future of Resilient Construction in Areas Prone to Hurricanes and Flooding

**The term “resilience” and its importance to the built environment has resulted in many discussions on how this term relates to systems, society, and the individual.**

**Resilience even extends to our need to establish a preparedness protocol for natural and man-made disasters.**

From academia to Federal, state, and local governments, these discussions have the potential to change our thinking on sustainability and building design.

### Q: What is resiliency?

Resiliency is associated with a building’s robustness, resourcefulness, and recovery. Resiliency encompasses safety, security, durability, energy conservation, and environmental friendliness. It is a measure of a building’s ability to serve its intended purpose with minimal disruption, such as keeping a family from being displaced from their home or keeping a business or community service in operation.

It means different things depending on the circumstances. In high-moisture climates, mold and mildew resiliency can be a real safety net. In seismic areas, resiliency involves resistance to progressive collapse. After 9/11, building owners started looking for impact resistance in their structures.

### Q: How do North American structures fare in the aftermath of catastrophic events?

If you look at data on deaths from earthquakes and hurricanes from around the world, you see that most storms are not nearly as strong as Andrew or Katrina. Yet, thousands of people die from them. In contrast, North America doesn’t have quite the loss of life in our catastrophic events, relatively speaking.

But when you look at data on costs, you find that we have costly repair scenarios related to our natural disasters. Resilient construction is about reducing those costs. It doesn’t have to cost so much to get going again.

## Q: Tell us more about Hurricane Sandy.

When people think of hurricanes, they think of high winds and water. But many New York communities were devastated by fires after Sandy. Using fire-rated materials and non-combustible materials could have helped the communities fare better.

Of course, the water was devastating. But, what really hurt people was having to wait for the right inspections from government agencies, and the funds for those inspections. They had to wait weeks. Some waited months. By then it was too late. Homes developed severe cases of mold and mildew contamination, because the framing materials — wood, in many cases — fostered moisture.

## Q: What was Katrina like?

I was in New Orleans probably 30 days after Katrina hit, and I saw structures picked up from their foundations and dropped blocks away. The high winds ripped off roofs. The communities were devastated.

## Q: Did the government issue resiliency guidelines after Katrina?

o a degree. For example, we started to see new specifications for wood. It turns out that wood needs special clips to hold wood trusses to walls and wood walls to footings and foundations. Wood framing can't deal with the high winds of a major storm.

## Q: Will building codes start to include resiliency requirements?

This is an economic battle. If you make the codes more stringent, then initial construction costs will go up. But, in the long run, overall costs can be more favorable because resilient materials will hold up better after natural disasters and, therefore, generate fewer expenses related to reconstruction, repair, and remediation.

Overall, change won't come easy. Builders often focus on least initial cost, while owners and insurance companies often have a longer-term perspective.

## Q: Are owners and developers up to speed on resilient construction?

I feel they need more education. But, that education has to appeal to their appetite for bottom-line profits. When they look at the expense of maintaining a structure over 25 or 30 years, some developers are starting to think long term. They're starting to see that certain framing materials have the potential to expose them to high upkeep costs, to mold and mildew problems, and to the potential for greater losses after catastrophic events.

## Q: Any new developments in resilient construction?


There's a new group in California, [the U.S. Resiliency Council \(USRC\)](#). It's geared toward earthquakes, but it seems to want to expand to cover other types of disasters.

It's a code-plus program similar to LEED. Building owners buy into the program, and USRC has structural engineers qualified to rate their buildings on resiliency. I think what they're going to find is that buildings constructed with cold-formed steel will be consistently rated higher in resiliency than structures framed with other materials.

## Q: Why would CFS get higher resiliency ratings?

Consistency of material. Quality of workmanship in commercial low-rise and mid-rise markets. [Cold-formed] steel framing is consistent stud to stud. It's resistant to mold, termites, and lends itself to reuse.

We've put up metal houses in Gulfport, Mississippi and New Orleans. We've erected some prior to Katrina, and those houses have held up. I can say without bias that steel's time has arrived. It's time to think about the long-lasting benefits [cold-formed] steel brings to the table.



You can't always predict extreme weather or other construction-halting incidents. But you can create buildings that are durable and safe, even in the event of a disaster. The durability and resilience of cold-formed steel framing makes it an ideal material to stand up to cold-weather, high winds, flooding, and fire — during construction and throughout the life of the building.

If you have an upcoming project and want to learn more about incorporating cold-formed steel framing, request [free assistance](#) from the BuildSteel team of experts.

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"Images courtesy of SFIA and ClarkDietrich Building Systems."

## 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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