Advantages of Building with Lightweight Steel Framing (LSF)

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Introduction

Steel is a major and essential construction material, offering unique value and unmatched performance in many end uses. It is strong, safe, durable, versatile, cost-effective, and has the exceptional environmental advantage of being highly recycled and infinitely recyclable. Steel is tough and doesn’t rot, crack, split or absorb moisture like other building materials. And from an aesthetic or architectural viewpoint, steel structures can deliver great design options as well as excellent value.

Fire Safety

Life safety (specifically fire protection) has been and will always be a primary concern of the building codes. Steel is a non-combustible material with a melting point of approximately 1500°C (2700°F) and therefore doesn’t burn and does not contribute to the ignition of fires, the spread of fires, or the size and severity of fires. It maintains its non-combustibility throughout the entire lifecycle of building; during building construction, occupation or future renovation/repair. This provides a reduced fire risk to occupants, minimizes the impact on municipal fire services, and results in less property damage and collateral damage to adjacent buildings if a fire should ever occur.

The National Building Code of Canada (NBCC) and provincial building codes recognize differences between combustible and non-combustible construction. Here are just some of the main advantages of noncombustible steel construction in midrise buildings versus combustible construction in the NBCC:

- No fire resistance ratings or sprinklers are required in midrise residential (Group C) and business (Group D) buildings up to 3 storeys
- Significantly larger floor area allowances are allowed in buildings up to six storeys when sprinklers are specified
- No maximum floor area or height limitations exist for buildings greater than six storeys when fire rated
- Steel framing systems are permitted beyond six storeys, unlike combustible construction
- No restrictions related to building distance/stand-off from streets or percentage of building facing streets
- No requirement for non-combustible roofing or cladding or sprinklering of balconies or concealed spaces such as attics and closets
- Unlike wood, which propagates a fire, bare and prepainted steels have no flame spread rating or smoke developed classification. Flame spread is primarily a surface burning characteristic of materials, and a flame-spread rating is a way to compare how rapid flame spreads on the surface of one material compared to another.
Recent changes to relax building codes to permit increased building heights for combustible wood framing have had a predictable result: a rash of large, catastrophic fires in Canada and the US that have destroyed entire building complexes and caused significant damage to adjacent properties and infrastructure. These urban forest fires have challenged the resources and equipment of fire services, increased course of construction insurance rates for builders, and prompted several concerned provinces and municipalities to implement regulatory strategies for site safety practices during the construction of combustible buildings that will ultimately increase construction costs and lengthen building occupancy periods. The mounting evidence of these building code changes calls into question whether the relentless pursuit of supposedly cheaper construction methods is really worth putting the public at risk.

Cost Effectiveness

Builders, contractors and design professionals must be concerned with overall system construction costs from the design phase through to the operational phase, and not simply the raw material costs of structural and nonstructural systems. While it is not uncommon for certain materials industries and special interest groups to promote the affordability of a specific building material over others, there is a growing concern that the overall impact of material selection is being ignored or concealed. This is a result that will be costly for all stakeholders involved. It is paramount for developers, designers, building professionals, owners and other stakeholders to consider the case for steel and its many proven cost advantages, choose the best material for the building project based on all direct and indirect economic benefits, and challenge the claims of competing materials industries.

Consider: The Facts

Cold formed steel framing systems are cost-effective alternatives for midrise buildings, and are competitive with any other building material when all related construction costs are taken into consideration.

Several midrise building project case studies have been completed in Canada and the US which support the fact that steel’s versatility, ease of use and non-combustibility make it a superior framing system to wood and concrete systems. On a typical five-story residential project\(^1\), cold-formed steel shaved at least six weeks from the construction timeline versus poured concrete or masonry. Such time savings meant dollar savings in lower construction financing charges, pared site supervision needs and less labour. The developer had worked with the steel building system supplier on another project specified for wood construction, but that project was upgraded to cold-formed steel framing for its greater durability and non-combustibility characteristics. For these reasons, the developer “never considered using wood framing on this project”.

\(^1\) SFIA Case Study, “Cold-form Cash Flow”, Brantford, Ontario
Choose: The Best Material for the Job

To ensure that an informed decision is made when selecting based on a complete cost perspective, consider the following attributes of LSF building systems and how these compare with competitive building materials.

**Design Savings**

From a design perspective, steel framing systems provide a significantly greater strength-to-weight ratio than wood or concrete, which allows for lighter assemblies to be built. The higher strength-to-weight ratio of steel allows for greater design flexibility for architects and engineers. LSF building systems enable off-site fabrication of wall panels, especially in midrise building construction, which tends to involve repetitive sections. Pre-fabrication of panels significantly reduces on-site labour costs and construction waste, and can shave months off the total project cycle time by offering contractors a more predictable construction schedule that is less affected by rain, snow, excessive heat, and other weather delays. Shorter construction time reduces project financing costs, reduces the window for construction-related liability, and allows for earlier building occupancy.

The National and provincial building codes recognize the fact that buildings designed with non-combustible systems like lightweight steel framing pose less of a fire risk to the public than combustible systems, and as a result are limited to six storeys in height. Since there are no height or floor size restrictions when building with steel, building owners can maximize the number of units built on an available footprint of land, making it a much more profitable alternative than wood framing. Additional building code restrictions for wood framing, involving the building’s distance/stand-off from streets and the percentage of the building’s exterior that must be facing streets for access by fire services, limit architects and designers from optimizing a building’s footprint, resulting in less income for the building owner.

**Expedited Installation and Erection**

LSF building systems can be erected rapidly. The predictability and accuracy of LSF components speeds up the process and allows subsequent trades to get to work sooner. Off-site pre-fabrication of wall panels and the speed of erection is often some of the main criteria for selecting LSF buildings. In many inner city projects, it is also important to reduce disruption to nearby buildings and roads. Short construction periods leads to savings in site preliminaries, earlier return on investment and reduced interest charges. Time related savings can easily amount to between 3% and 5% of the overall project value\(^2\), reducing the client’s requirements for working capital and improving cash flow.

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\(^2\)SteelConstruction.info, The free encyclopedia for UK steel construction information, [http://www.steelconstruction.info/The_case_for_steel](http://www.steelconstruction.info/The_case_for_steel)
**Reduced Insurance Rates**

Builders risk and property insurance premiums are typically lower for steel than wood³. “Frame” or “Wood” construction has a greater likelihood to burn or be damaged by a peril (such as fire) and that the event will be a total loss versus a partial one. Loss history for wood construction has been poor and carriers are very restrictive of the amount of risk they will take (known as capacity). They will then restrict their limits to $25,000,000 or less with most carriers only offering $5,000,000 to $7,500,000 capacity. Total costs increase when multiple carriers are needed to provide coverage. As an example, builders risk insurance on a four storey, 400 unit hotel built over 24 months in Ohio cost $360,000 for cold-formed steel compared with the $1.6 million it would have cost for a policy if the project had been built with wood - a savings of $1.3 million. Property insurance for cold-formed steel costs $66,000 less than it would have cost for a wood framed system. As an annually recurring cost, the owners can expect to save $660,000 over a 10-year period.⁴

**Fire Related Legal Costs**

While builders risk insurance provides coverage to the building during the course of construction, and property insurance provides coverage to an owner or occupant against fire and loss after the building is occupied, legal costs are typically not considered when choosing a building material. Owners of wood framed midrise buildings now need to consider the possible lawsuits that could arise following a construction or building fire which results in damage to, or destruction of, adjacent properties. In the case of the Avalon at Edgewater midrise apartment fire that occurred in Edgewater, NJ in January, 2015, which displaced approximately 500 tenants and affected a similar number of residents from neighboring buildings, lawsuits against the building owner have been filed citing that the “risk of fire during construction and for maintenance was known, and that the risk increased when using lightweight wood construction”⁵. Using noncombustible steel construction rather than wood framing will minimize the risk of any fire spreading to adjacent buildings and reduce the possibility for subsequent legal action, thereby putting less burden on building owners.

**No Hidden Site Construction Costs**

In March 2015, the Toronto Planning & Growth Committee recommended that Toronto City Council request the Province of Ontario to “move expeditiously on a provincial regulatory strategy for site safety practices during the construction of combustible buildings” and recommended a review of best practices similar to those from British Columbia in order to mitigate the risk of fire during construction when wooden structures are most vulnerable and present the greatest risk to surrounding buildings⁶. Many municipalities in British Columbia implemented these additional construction site requirements after several devastating midrise residential construction fires occurred soon after this province changed its building code to allow an increase in height for wood-framed buildings in 2009. The site safety practices include, but are not limited to, the submission of a detailed fire safety plan during the permit

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³ Developers manage dollars crunch by going “light” on construction, Hotel Business article, Sep 2007
⁴ SFIA, “Insurance Savings with Cold-Formed Steel”
⁵ AWCI’s Construction Dimensions, “Re-thinking the Building Codes”, April 2015
⁶ Toronto City Council agenda item PG2.3 (March 31, 2015)
approval stage, installation of sprinklers as each floor is built, increased supervision during hot
work, a general increase in site supervision and a significant increase in site security. Several
jurisdictions are requiring builders to post 24-hour security guards at wood frame construction
sites. One builder has reported additional costs of $6,000 to $10,000 per month while
construction is underway, and another reported that the additional security added $20,000 to
an $8 million project. These costly site safety practices are not required for non-combustible
buildings, which provides owners and builders with peace of mind when building with LSF
systems.

*Increased Durability = Lower Life Cycle Costs*

Cold formed steel is resilient, adaptable and durable and does not decay or age as quickly as
other construction materials, which reduces life cycle costs. Properly designed and
constructed LSF structures provide long-term durability. The hot-dipped metallic coating of
sheet steel products for LSF members provides corrosion protection as required within
building codes and industry standards. A recent 10-year study\(^8\) conducted by the National
Association of Home Builders (NAHB) Research Center provided extrapolated coating life
predictions for galvanized steel framing systems ranging from 300 to 1000 years for enclosed
locations (walls, attics, floors), and 150 years of coating life for exterior exposures or semi-
exposed locations in aggressive environments subject to higher humidity and exterior
pollutants, which was well beyond the life expectancies of modern buildings.

*Dimensional Stability and Moisture Resistance*

Cold formed steel is dimensionally stable and does not expand or contract with changes in
moisture content. As a result, LSF members will not warp, split, crack or creep. When
materials like wood or brick are exposed to moisture, they swell. When dried, wood will warp,
crack, chip, split and spall, while concrete and concrete block will shrink and form shrinkage
cracks. Dimensional stability concerns are magnified when these types of materials are used
in taller midrise buildings. Wood is particularly prone to dimensional instability and related
twisting and shifting of structural materials. Unintended structural movement can have
expensive and potentially disastrous consequences on structural, mechanical, and finish
systems. Additionally, with the increased emphasis on energy conservation, the long-term
effects of shrinkage on the building envelope and building energy and maintenance costs
must be considered.

Steel is inorganic, is resistant to mold, and does not provide a food source for mold growth.
LSF building systems not only solves issues with structural movement due to changes in
moisture content or humidity, but eliminates or greatly reduces other moisture related issues
such as rot and mold. To the owner and occupant of a midrise building, using steel framing
systems rather than wood framing will avoid significant remediation costs associated with
mold growth and related damage due to rainwater infiltration, similar to the widespread
damage that caused the leaky condo crisis in BC between the 1980’s and early 2000s.

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\(^7\) [Oregonlive.com](https://www.oregonlive.com) (May 16, 2014)

\(^8\) “Durability of Galvanized Steel Framing in Residential Buildings”, NAHB Research Center, January 2009.
estimated $4 billion in damage has occurred to over 900 buildings and 31,000 individual housing units, establishing it as the most extensive and most costly reconstruction of housing stock in Canadian history. The best way to avoid dimensional stability problems and the costs related to additional engineering, maintenance, repair and remediation is to build with a dimensionally-stable and moisture resistant material such as LSF.

**Resistance to Pests**

In North America, termites cause more damage to structures than fire, floods, and storms combined. Unfortunately, termite damage is costly and is rarely covered by insurance. Fortunately, LSF members are not vulnerable to termites since they are inorganic, and unlike wood, do not provide termites with a food source. In addition, several provincial building codes have provisions in place to reduce the impact of termites of wood framed systems, and these practices involve extra costs that could be avoided with LSF construction. Building with steel not only allows owners to avoid long term, costly termite problems; it provides a healthy building with no off-gassing from chemical termite treatments or pressure-treated lumber.

**Challenge: Competitive Material Industry Claims**

There is evidence in the field and through third party case studies and comparative cost studies that steel building systems offer significant cost benefits over competitive building materials when the total cost of construction is considered. The Canadian lumber industry and their paid consultants and pro-wood advocates have made general statements regarding how wood framing is the most affordable material for midrise construction, but much of this information is exaggerated and misleading, since it rarely considers the full impact of wood frame construction on overall building costs. “Potential” cost savings are often overstated. The unfortunate result is that builders, contractors and building owners will end up paying the premium in the long run. Stakeholders are advised to challenge generic statements and claims related to wood framing products, and make informed decisions. Consider the following about several wood industry cost comparisons:

- Typically involve only raw material framing costs, rather than the material's' impact on the entire building system;
- Fail to consider the impact of a building material on operational lifecycle costs, including repairs required to framing and interior finishes resulting from inferior durability, dimensional variability (i.e., shrinkage) and susceptibility to moisture damage
- Often fail to consider regional economic factors, site characteristics and parameters of a structure;
- Frequently boast labour and time savings associated with prefabrication, but fail to point out that this practice is atypical with respect to wood framing, while very commonly used for LSF systems;
- Incorrectly assume that framing costs are similar between low-rise and midrise buildings, and fail to consider the required engineering costs and material selection (i.e. dimensional lumber vs. cross-laminated timber) associated with the latter.
The premise and sales pitch of the wood industry, as stated in several of their own reports and promotional literature, is that using a cheaper building material will inevitably result in more affordable housing, since there is an assumption that any potential cost savings “realized with wood frame would be passed through the system resulting in a more affordable condo or rental unit brought to the market”\(^9\). However, what isn’t stated clearly and what is typically left to the fine print is that structural costs will vary according to a building’s design, fireproofing, parking arrangements, exterior wall treatment, as well as seismic and structural requirements. These reports frequently fail to quantify the impact of these variables, and rarely include non-material costs such as builders risk insurance rates and property insurance which are known to be significantly greater for wood than for non-combustible materials like LSF members. The fact is that many of these “hidden costs” will seriously impact the bottom line of a construction project and certainly make the use of wood products much less appealing.

**Sustainability and Environmental Factors**

Steel is one of the most sustainable construction materials. Its strength and durability coupled with its ability to be recycled, again and again, without ever losing quality make it truly compatible with long term sustainable development.

**Steel Recycling**

Steel is the world’s most recycled material. In 2012 alone, 88 million tonnes of steel were recycled in North America.\(^{10}\) Steel, when recycled, loses none of its inherent properties and can be recycled into different products such as cars, bridges, cans and appliances as well as higher grades of steel.

**Quick Facts**\(^{11}\)

- Steel in North America is always made with avg. minimum of 25 percent recycled content.
- Steel is continuously recyclable—meaning it can be recycled over and over without loss of quality.
- Today, 97 percent of steel by-products can be re-used and the recycling rate for steel itself is 81 percent.
- Every ton of steel recycled conserves 2,500 pounds of iron ore, 1,400 pounds of coal and 120 pounds of limestone.
- Steel is North America’s most recycled material with more steel recycled than paper, plastic, aluminum and glass combined.
- Through recycling, the steel industry saves the energy equivalent to power 20 million homes for one year.

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\(^9\) Unlocking the potential for midrise buildings (Six storey wood), Prepared for BILD GTA by Paul J. Bedford, February 2013.

\(^{10}\) Steel Recycling Institute - http://www.recycle-steel.org

\(^{11}\) Steel Recycling Rates Fact Sheet from Steel Recycling Institute
- The steel industry has reduced its energy intensity by 32 percent and CO2 emissions by 37 percent per ton of steel shipped since 1990.
- According to the U.S. EPA’s Sector Performance Report, the domestic steel sector is recognized as having the steepest decline of total air emissions among nine manufacturing sectors studied.

**LEEDing with Steel**

Buildings have a profound impact on our natural environment, economy, health and productivity. In North America, the built environment accounts for approximately one-third of all greenhouse gas emissions, energy, water and material consumption and generates similar proportions of pollution. Indoor air quality is regarded as one of the top environmental health risks today, affecting the well-being, productivity and performance of many people.

As concerns increased about sustainability in building design and operation, there was a need to develop a framework for assessing and quantifying buildings so that questions such as, “What is sustainable design?” and “How green is this project?” could be addressed. In response to this, the Leadership in Energy and Environmental Design (LEED) green building rating system was developed to provide such a framework for North America.

It should be noted that most of the points require an integrated design approach by the design team and cannot be achieved merely by using a particular material or technology. Nevertheless, **it may be possible to achieve some points merely by using steel, and use of steel components can contribute to obtaining over 30 points in LEED Canada NC version 1.0 and over 50 points in LEED Canada NC 2009 as part of a holistic approach.**

**Site Waste and Reuse of Steel Components**

Steel is a valuable material and is generally either recycled or reused when occurring as part of construction or demolition waste. Thus, any steel generated from demolition can be readily sent for recycling or reuse. In addition, the use of LSF components on-site generates very little waste, as the components are generally manufactured to tight tolerances in a factory and delivered to site for assembly and erection. Any LSF component off-cuts that may arise are valuable and can be readily recycled.

Examples of major projects where recovered steel has been used include the Students’ Centre for the University of Toronto Scarborough Campus (UTSC). The engineers for this project were also working on renovations to the Royal Ontario Museum (ROM) where demolition work provided steel components suitable for use in the new Students’ Centre. This helped to meet the students’ aims to address issues of the environment in their new building. Another example is the Philips Eco-enterprise Centre in Minneapolis which used 189 steel joists from a demolished warehouse saving an estimated 50 tonnes of steel.

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Thermal Performance of Steel-Framed Homes: Proof is in the Field

One of the more common concerns amongst home buyers and building officials when it comes to steel framed homes is their energy efficiency. There is a difference between the insulating value in walls and ceilings and the thermal performance or energy efficiency of a home. Energy efficiency depends on the entire home acting as a system, from the basement to the attic including the space conditioning equipment. Most of the energy lost in the home is due to air filtration, while most of the heat loss is attributed to air leakage through the building envelope.

In general, the effect of a structural component in an exterior wall is to act as a “thermal bridge”, that is, it provides a path for conducting heat rapidly. Both wood framing and steel framing act as thermal bridges. It is important to note that an exterior wall made from either type of material can be designed to provide the desired thermal performance.

Although steel is more conductive than some other building materials, it is only one of several components within a building envelope that can be designed to provide an effective thermal barrier. To validate this, the American Iron and Steel Institute (AISI) sponsored research at the National Association of Home Builders (NAHB) Research Centre to develop R-values for typical steel framed walls. The research demonstrated that the R-value for steel framed walls is not considerably affected by the thickness of the steel studs because steel stud web thicknesses are small, thereby limiting heat conduction. In addition, in climate zones where higher R-values are required, the use of exterior insulative sheathing, such as extruded polystyrene or polyisocyanurate, is considered an effective thermal break that will significantly increase the wall system’s thermal resistance.

Furthermore, it is known that the thinner steel thickness and “C-channel” shape of steel framing allows for high quality insulation to be inserted into spaces normally occupied by low R-value wood. Unlike kiln-dried wood framing, which contains a moisture content up to 19%, steel remains straight and true once tensioned, regardless of contact with moisture, and does not warp or shrink. In the long term, this reduces the chance of air gaps forming in the building exterior, thereby minimizing heat loss and conserving energy.

To compare the thermal performance of wood versus steel framing under realistic conditions, thermal modelling case studies involving infrared (IR) thermography have also been conducted in Canada on virtually identical homes built in the same subdivision and framed in steel and wood. These studies have confirmed that the thermal performance of steel framed homes is similar to wood framed homes. The results of the IR tests demonstrated that the temperature differential at framing components in opaque walls, built-up members and sill connections was minor and they were comparable in both systems. Lintels in steel framed homes actually performed better because of the ability to incorporate a greater amount of insulation due to the shape of the steel components as mentioned above. When detailed with expanded polystyrene (R-5) and expanded foam insulation in the stud cavities, the steel

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homes used 7% less energy than their wood counterparts which were built to the same nominal R-value.

Design Versatility & Ease of Installation

**Design Versatility**

The versatility of LSF construction gives architects and engineers the freedom to achieve their most ambitious visions, and provides contractors with a highly engineered, high quality building material. LSF building systems are ideal for repetitive construction or buildings that stack where relatively straightforward load paths are involved, such as condominiums, student housing, hospitality, apartments, mixed-use, assisted living and military barracks. With load-bearing cold formed steel, in-line framing is typically a requirement and allows for a much cleaner load path and transfer to a podium slab or concrete foundation. However, if modified balloon framing (hanging the joist system off the inside of the walls) is implemented, the joists can be offset from the wall studs, allowing for more flexibility within the system. The utilization of modified balloon framing also allows the framing contractor to drive the critical path of construction, providing true single-source accountability.\(^{15}\)

The fact that steel is dimensionally stable and can be manufactured to very tight tolerances makes it easier for engineers to use in building design, unlike softwood products which are susceptible to shrinkage due to varying moisture content and structural design properties that have recently been downgraded by up to 30\(^{\%}\)\(^{16}\) due to changes in wood resource mix.

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\(^{15}\) The Evolution of Cold-formed Steel Joist Framing Products, Clark-Dietrich Building Systems, September 2013.

\(^{16}\) SFIA fact sheet "Downgrade of Southern Pine Values Increase Cost of Building with Wood", November 2013
Ease of Installation

LSF building systems offer consistently high quality standards, precision products and guaranteed strength and durability in the most challenging environments. Cold formed steel is produced to the most exacting specifications under highly controlled conditions, eliminating the risks of on site variability which is an inherent disadvantage with other building materials. LSF building systems are mechanically fastened using screws, bolts and/or welded attachments, rather than much less secure nail connections.

Lightweight steel framing wall studs and floor joist systems are normally fabricated with pre-extruded knock-outs (i.e., punch-out’s) for mechanical, electrical and plumbing (MEP) pass-throughs. In floor systems, the knock-outs align with the joist assembly, which allows the MEP trades more access to run pipes, wires, mechanical and HVAC ducting while staying within the plane of the floor assembly. This ultimately maximizes ceiling heights, and by integrating all the trades involved, can reduce construction schedules and allow buildings to be occupied much sooner than with traditional construction methods. **Steelform’s patented DeltaStud and MegaJoist systems provide a larger knockout to accommodate even more MEP components and further maximize ceiling heights. Visit www.steelform.ca for more information on these systems.**

LSF construction lends itself well to pre-fabrication, where the fabrication of the individual steel elements takes place offsite under controlled, highly regulated and safe factory conditions where the use of leading edge fabrication systems delivers precision-engineered components. With so much work carried out offsite, the on site construction program is reduced and the build program is relatively unaffected by adverse weather conditions. Furthermore, LSF components can be pre-assembled or fabricated into modules/panels either offsite or at ground level, which reduces the need for working at height. These pre-fabricated modules/panels can then be delivered to the building site as and when they are required, reducing the need for potentially hazardous on site storage.

Resilience

Over the last few years there has been an emerging awareness of the term “resilience” and its importance to the built environment. Resilience is defined by Miriam-Webster as “an ability to recover from or adjust easily to misfortune or change”. There is a suggestion in these definitions that “resilience” isn’t limited to the ability of a building to provide for life-safety and just barely surviving a major event, but also extends to the ability of a building to continue operating as designed. A reasonable approach to that dimension of resilience recognizes that there are other conditions in the built environment other than extreme events that can negatively impact the ability of a building to operate as originally intended. For example, decay or termite damage, moisture from condensation or hidden plumbing leaks, or inadequate fire protection can degrade or destroy a building’s useful life. Given that resilience of the overwhelming majority of buildings is threatened more by events other than those that are sudden and catastrophic, it makes sense from a sustainability perspective that we construct buildings to last and remain in service as long as their expected economic life. Further, buildings should be adaptable in order to avoid functional obsolescence in order to achieve or possibly even extend their economic life.
LSF building components are inherently non-combustible, and do not burn nor contribute to the spread or intensity of a fire. Cold-formed steel is ductile and has inherent strength in uplift and gravity loading, and can be designed to resist lateral loads on exterior walls, making it more forgiving than other more brittle materials in earthquakes and high-wind conditions. Of all commonly used construction materials, steel has the highest strength-to-weight ratio. When cold-formed steel sheet is formed into a C-shape, like a stud, the bends act as stiffeners and increase the strength of the steel sheet dramatically, providing a strength-to-weight ratio that is up to seven times greater than that of dimensional lumber. **Steelform’s patented DeltaStud obtains additional bends in the stud, thus creating an even more improved strength-to-weight ratio than a standard C-shaped stud (www.steelform.ca).** Steel behaves in a highly predictable manner when subjected to the structural loads and movements imposed by high wind and seismic events. This is because steel is an inherently stable, manufactured material with consistent chemical and mechanical properties, and is dimensionally stable. Likewise, steel fasteners used to join steel members retain their strength and reliability over time. Additionally, because the material and geometric properties of an LSF member are stable, the overall strength of the structure will depend upon the quality of connections between the studs. LSF construction typically uses screws that provide a mechanical locking connection where the load is carried in shear. This is in direct contrast to wood, where connection strength is often limited—not by the strength of the fastener, but by the resistance of the wood in bearing or withdrawal.\(^\text{17}\)

In addition to natural hazards, cold-formed steel framing has also been shown as a framing component in systems that perform well in resilience to man-made hazards. Federal agencies, as well as many other building owners, have significant desire to protect their personnel and operations from potential terrorist acts. Mitigation strategies include maximizing standoff distance, preventing building collapse, and minimizing hazardous flying debris. Recent research demonstrate that steel stud walls can be utilized to resist blast threats using conventional construction methods that add little cost to traditional designs.\(^\text{18}\)

The use of cold-formed steel can play an integral role in developing resilient exterior wall systems that meet the stringent requirements of the 2011 National Energy Code of Canada for Buildings and the 2012 International Energy Conservation Code, IECC. On a prescriptive basis, these codes mandate the use of continuous insulation to fully sheath what are considered opaque walls. Further, there are requirements for air/water barriers that are continuous from below grade, up the exterior walls, and unto the roof membrane. Four exterior wall systems that use cold-formed steel are currently available that meet these requirements, including cement plaster, brick veneer, EIFS and rain screen systems. The main difference in the four is the final exterior finish. All of these systems utilize cold-formed steel framing for its structural capacity, and all meet energy code requirements. This certainly proves that cold-formed steel framing can be used integrally with other components to provide a high performance exterior envelope.

\(^\text{17}\) Source: ASCE Manuals and Reports on Engineering Practice No. 84, Mechanical Connections in Wood Structures, American Society of Civil Engineering

\(^\text{18}\) http://ascelibrary.org/doi/abs/10.1061/(ASCE)ST.1943-541X.0000760
Long life is a primary attribute necessary for all building materials and a key component of resilience, but is especially important for structural materials and finishes in areas where moisture from atmospheric conditions or inadvertent exposure to moisture occurs. Even though all materials need to be protected through effective claddings and barriers, it is reasonable to assume some breakdown of those protections will occur. Plumbing or roof leaks are also unplanned but do occur. Similarly, a breakdown in the building envelope creates opportunities for pest like termites and carpenter ants to attack a structure. Consequently, choosing materials that won’t sustain significant damage from moisture or pests is essential. Cold-formed steel has a resistant coating that effectively protects steel from corrosion. With the proper coating and construction techniques, the protective barrier over cold-formed steel will last nearly 700 years before the level of corrosion resistance deteriorates (or well beyond the expected lift of a building), even under extreme conditions such as near aggressive salt-laden waters.

Conclusion

LSF building systems and components offer unique and unparalleled design and construction techniques that today’s ever evolving construction industry demands. Its factors like non-combustibility, cost efficiency, environmental sustainability, and design versatility that makes it one of the leading choices for design/construction professionals and building owners across North America. For additional information, please contact your local Steelform branch or visit the website at www.steelform.ca

Steelform would like to acknowledge the Canadian Steel Construction Council in their contribution to the development of this narrative.
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