Strength of Steel – the case for cost-efficient sustainable construction

By Mark Nowak

The state of the global economy has changed the construction market for at least the next several years. In a down economy, developers are implementing strategies to maximize their return on investment and this has resulted in evaluating construction techniques and technologies being used. Never before has the awareness and interest in environmental conservation been as high as they are today. And nowhere is this more evident than in the construction industry, where sustainable building practices have become as important to the success of a project as quality construction and good design. There is an increased interest in using materials that are cost effective, green/recyclable and last one-third as long as masonry, and provide a shorter construction cycle time. Given the market demands, an immense interest in the use of cold-formed steel (CFS) in primary load-bearing applications exists. Today, load-bearing applications for CFS are being used across the country for new projects in the hospitality, retail, assisted living, multifamily and other mid-rise markets.

Mark Nowak is the president of the Steel Framing Alliance (SFA), a market development group charged with making cold-formed steel framing the building material of preference in both the residential and commercial construction markets.

A Misconception That CFS Framing Is 'New'

While many still consider load-bearing, cold-formed steel framing to be a "new" building product, it has been used in construction projects throughout North America for more than a century. The use of cold-formed steel as a construction material for buildings got its start in both the United States and England during the 1850s, although it was largely experimental and limited to a few basic structures. Steel framing gained momentum again in 1945 when the U.S. government sought to provide attractive, permanent, affordable housing for the soldiers returning from World War II.

In the past, CFS has dominated the market for curtain walls and partitions in commercial construction, due to its light weight, high strength, non-combustible nature and ease of installation. But with advanced technological developments like panelized systems, the building community has started using CFS for structural applications on mid-rise buildings as high as nine stories.

Mid-rise structures, which are typically four to nine stories in height, frequently are used for hotels, motels and other short-term lodging. Other residential structures also are being built in the mid-rise category, including apartments, dormitories, extended-stay lodging, and multi-family housing projects.

Varied Applications of CFS

CFS has gained market share in recent years for several reasons. CFS provides builder and consumers flexibility in design option that cannot be economically accommodated using concrete and other traditional framing materials (i.e., larger open space, longer spans, higher ceilings, arched ceilings and doorways). Additionally with CFS, builders can build faster than other heavy construction materials. Because steel is non-combustible, the building codes allow steel framing to be used in structures taller than the four-story height limit imposed on wood-framed buildings.

Lower Construction Costs: The use of structural CFS framing in typical mid-rise construction projects can mean lower construction costs. Today, CFS is an excellent and costcompetitive choice for structural applications on buildings and in the past few years, several builders have used steel framing for structural applications on multi-story buildings as high as nine stories. Built by **Galaxy Builders, Ltd.** of San Antonio, **Park 4200**, a six-story apartment project built over a three-story parking garage in Dallas, found CFS to be a cost-effective solution. Compared to the cost of an all concrete structure, Park 4200 was able to save $4.20 per square foot. This amounts to more than $400,000 for the 99,000 square foot of interior space.

"By reducing the time for construction of the project, the owner can reduce the interest carry on their loan and they can begin to realize the revenue from the operations of the project. Additionally, a shorter construction time will reduce the hard costs of the project by reducing the general contractor's project overhead or general conditions." says **Ryan Penlerick**, VP of commercial operations, Galaxy Builders. Penlerick estimated the general conditions for a project of this size typically will be in the range of 8 percent to 12 percent of the total project costs. The time savings Galaxy realized in a project of this size will result in savings in the "hundreds of thousands."

Faster Construction Schedule: For commercial construction projects especially hotels, timing is extremely important. Once a commitment is made to construct a hotel, the owner must hire and train staff within a two- to three-week window. An opening date that is firm is critical to start generating cash flow. One such example out of many is the **Embassy Suites**, a seven-story hotel built by **Brackett Builders** of Troy, Ohio. The time from groundbreaking to finish was 13 months. The CFS framing was complete in 96 days. According to **Vern Hoying**, president, Brackett Builders, "There are many other savings beyond the material such as the added time to construct the concrete building that made it worthwhile to use steel framing for Embassy Suites Hotel. The panelized steel system schedule is very dependable and predictable. Panelized steel systems obviously do not experience weather delays during cold weather as you would see with concrete, block, and precast planks. As there is no concrete shoring to get in the way, mechanical and electrical trades can get started quicker with their rough-in work."

Yet another impressive example of shorter construction cycle time is **Poly Canyon Village**. A model for sustainable design using CFS load-bearing members, Poly Canyon Village is the largest CFS load-bearing project in California and the most sizable student housing complex ever undertaken by an American university in a single construction project. Spanning 30 acres at the base of the picturesque Poly Canyon, the Poly Canyon project is comprised of nine buildings, four and five stories over slabs or podiums, and adds nearly

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 usually by roll forming the steel through a series of dies. No heat is required to form the shapes (unlike hot-rolled steel), and thus the name cold-formed steel. A variety of steel thickness is available to meet a wide range of structural and non-structural applications.

Steel has the highest strength-to-weight ratio of any building material and behaves in a highly predicable manner when subjected to the structural loads and stresses imposed by high wind or seismic forces.

2,700 new beds to **California Polytechnic State University (Cal Poly)** in San Luis Obispo, Calif. The scale of Poly Canyon Village is 820,000 square feet with 11,000 load-bearing wall panels. Originally scheduled for a 20 month schedule, the project was successfully completed in 14 months, shaving off six months from the original schedule.

CFS framing was the primary factor in the success at Poly Canyon. The flexibility to pre-fabricate panels off-site definitely contributed to the project's success. The efficiencies gained through pre-fabrication made it possible to start several components in several places at the same time, which significantly cut down on any potential downtime for workers and subcontractors.

A properly planned steel framing project can be easier to coordinate and require less area for storage and staging (especially important on urban in-fill projects), as well as infrastructure and equipment for handling and installing other systems. Most construction projects are panelized, meaning the components of the structure (walls, floors, roofs) are assembled in a controlled manufacturing environment.

Lower Insurance Premiums: In addition to builders' risk, significant savings on both construction and ownership insurance costs can occur, including general liability, worker's compensation, and commercial property. Cold-formed steel's unique material characteristics such as noncombustibility played an important role in the development of the builders risk discount program made available in 2005 through **Zurich Insurance Services**.

For more information, visit www.steelframing.org/sfa_insurance programs.shtml

Why Consider CFS?

If you are a builder, developer or commercial real estate investor, here's why you should look at CFS very closely.

Steel has many advantages with regard to the demands of sustainable development. Today, the market demands an increased need to look at environmentally responsible materials like steel for construction. More steel is recycled each year than all other construction materials combined. But that's just the beginning of steel's environmental story. As a recognized green building material, steel framing projects also can earn credits or points for green building rating programs as well as other government incentives. Steel is the only building material that is infinitely recyclable. While many people agree that steel's recycled content is its hallmark environmental attribute, steel has several other benefits.

Consistent Quality - Steel does not contain knots, twists or warps, commonly found in lumber. It is always dimensionally correct and manufactured to strict tolerances. Steel is protected from corrosion by a galvanized zinc coating.

Resistance to Termites and Pests - Cold-formed steel members are impervious to termites and other wood-destroying insects. Cold-formed steel is resistant to mold and mildew – Steel does not provide a breeding ground for mold as does organic materials.

High-performance material - Steel has the highest strength-to-weight ratio of any building material and behaves in a highly predica-

ble manner when subjected to the structural loads and stresses imposed by high wind or seismic forces. Steel studs cannot absorb moisture. This substantially eliminates the expansion and contraction of construction materials and the related cracks, pops, and other deformities in finishes.

Non-combustible - Steel does not burn and will not contribute to the spread or intensity of a fire. Cold-formed steel projects can easily be designed to meet code fire rating requirements. Visit the home page of the **Steel Framing Alliance's** at www.steelframing.org for more information.

Sustainable building material - As a highly durable, non-combustible, galvanized zinc-coated material (a natural element), steel-framed structures can last hundreds of years, which also reduces the need for future building resources. With the highest strength-to-weight ratio, steel framed projects require less material.

Future of CFS

The steel industry is continuing to pursue an even more sustainable product, building on more than 30 percent reduction in energy used to produce a ton of steel since the early-1990s. Today, high strength steels have been used successfully in the auto industry to improve safety, while lowering vehicle weight is being investigated for use in buildings. At the same time, coatings that now last 500 years or more will be even better in the future.

In the near term, we already see many proprietary products being developed and released to the market. Wall panel systems with builtin thermal breaks are creating highperforming, energy-efficient buildings. Unique designs to studs that lower the amount of steel are delivering lighter products that maintain the same strength as traditional shapes. For floor and ceiling joists, the steel industry has taken on the challenge of making buildings more energy efficient by moving heating and cooling ducts into the conditioned space. Multiple products now are on the market or entering it with large openings to allow ductwork to be run in the joists, rather than through bulkheads or other architecturally distracting features inside the building.

Finally, a building can't be designed in a vacuum. The integration of design software with manufacturing capability already is having an impact on the future of steel framing. Plants will produce and install products with virtually zero waste as more of these technology improvements enter the market.

"As steel framing continues to grow, so do its opportunities. Innovative assemblies are on the horizon to continually improve the performance of steel buildings and make them compatible with newly evolving insulation and finishing products. Further, integrated panelization and design software and roll-forming equipment is making it easier for a builder to work with steel. Design efficiencies continue to improve as well. CFSEI is a group of engineers dedicated to developing and disseminating information to others in the field to enable cost effective use of CFS," says **Mark Nowak**, president, Steel Framing Alliance. CCR