Cold-Formed Steel

Trends, Techniques, and Resources

By Don Allen, P.E., SECB

As the demand for non-combustible, cost-effective construction solutions for mid-rise projects continues to grow, engineers and designers are becoming increasingly innovative with cold-formed steel framing (CFSF), and other structural products and combinations of materials. Engineers, architects, and builders are stretching the limits of load-bearing CFSF construction, designing 7 to 10 stories in some cases. Mixed systems (CFSF combined with precast concrete, engineered lumber, structural steel, composite concrete deck, and other systems) are also showing up in construction projects across the country. While no single, specific system is currently saturating the market in any particular region, several options are being used that make sense in different wind, seismic, and loading zones. These include:

- Bearing CFSF walls with hollowcore precast plank floors (most recently addressed in STRUCTURE® magazine, August 2006 and July 2007).
- Bearing CFSF walls with either proprietary or generic composite deck with poured concrete. (*Figure 1*)

Figure 1: Composite poured concrete on Cold-Formed Steel Framing.

- Bearing CFSF walls with engineered lumber floor systems.
- Bearing CFSF walls with CFSF joists and one of the following topping systems:
  - Where permitted, **fire retardant treated plywood (FRTW)**. Note that while there are no longer corrosion issues with FRTW, there are still some corrosion issues with some of the new pressure-treated preservatives for prevention of termites, mold, and other organic growths and wood-consuming organisms. (*Figure 2*)

Figure 2: Engineered lumber (plywood or OSB) on CFSF.

  - **Cement-based decking**, which consists of cement with fiber or other reinforcement, capable of spanning 24 inches between joists and maintaining a non-combustible rating. (*Figure 3*)
  - **Pan deck and poured gypsum**: typically a leveling type compound, that may or may not include gypsum between levels at the bearing walls. (*Figure 4*)
  - **Pan deck and poured concrete**: often less than 2½ inches total thickness. (*Figure 4*)
- Shearwalls in conjunction with the above systems:
  - Strap bracing in tension-only systems.
  - Sheathing-braced systems, using engineered lumber (plywood or oriented strand board), sheet steel, gypsum, and proprietary sheathing.
  - Boundary elements made from proprietary materials or structural steel, to go with one of the above systems. (*Figure 5, page 66*)

Figure 3: Cement-based flooring: proprietary product from USG called Fortacrete. Courtesy of USG.

With all of this innovation, engineers have shown a renewed interest in CFSF details, codes and standards, and information. Recently released documents include a compilation of standards relating to CFSF (ASTM International: keyword FRAMING07), 2007 versions of the American Iron and Steel Institute (AISI) codes and standards, and an update of the 2002 AISI *Cold-Formed Steel Framing Design Guide*. The design guide is one of the most popular documents among specifying engineers, since it gives step-by-step design examples for using CFSF and designing members, connections, and bracing for typical applications.

In addition, the Cold-Formed Steel Engineers Institute (CFSEI), the new name for the former Light Gauge Steel Engineers Association, has ramped up their production of technical documents. During 2007, CFSEI published Technical Notes on *Specifying and Using ASTM Standards, Coastal Corrosion Protection of CFSF*, and *Use of the "Tests for Special Cases"* (Chapter F) of the AISI *North American Specification* to define and calculate capacities and safety factors for members, connections, and assemblies using CFSF. This note has already yielded several comments about the more realistic (lower) factor of safety that can be derived for pins and other connectors by following the example that is presented. The CFSEI has also updated their Technical Note on *Durability of CFS Members*.

Figure 4: Pan deck and poured gypsum or concrete.

Upcoming Technical Notes include: a guide to the available software for CFSF design; *Corrosion Protection of Screws*; specifying the appropriate sheet steel for CFS members (a specifier and user introduction to ASTM A1003); and an update of the old *LGSEA Fastener Corrosion* technical note. The first-ever CFSEI design guide on CFSF Lateral System is currently going through the technical review process, and should be out in early 2008. (*Figure 6, page 66*) Furthermore, the Steel Stud Manufacturers Association (SSMA) has updated their tables for their new *Product Technical Information Catalog*, and will release the catalog pending approval of their new Evaluation Service Report. SSMA will also be providing updates to their tech notes and some of their details, which will be available for free download at **www.ssma.com**.

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Other issues currently being discussed within the industry include methods for less expensive bracing of axially loaded members, especially since more multi-story structures are being built with some wall axial loads in excess of 10 kips per foot! Issues such as end bearing on concrete, in-line framing, uplift anchorage for both wind and shearwalls, and connection detailing, are all being considered for updated technical information. The steel industry also has free services available for engineers, specifiers and builders, including the steel hotline (800-79-STEEL) and for corrosion issues, the Galvinfo Center (**www.galvinfo.com**). All completed Technical Notes and AISI standards listed in this article are available for purchase (and some for download) at **www.cfsei.org**. ▪

Figure 5: Boundary elements of structural steel or proprietary members.

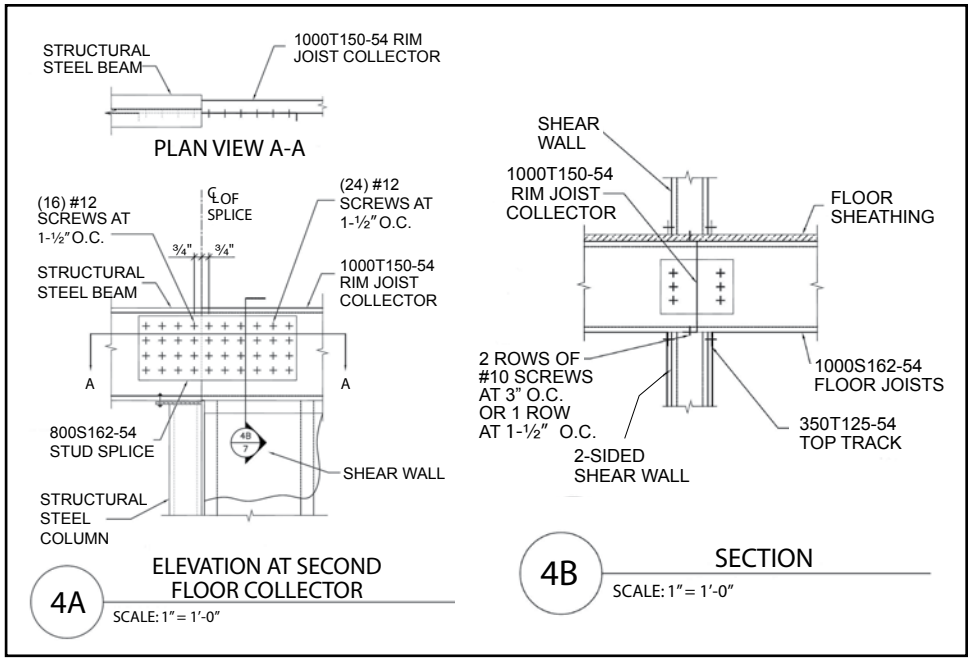

Figure 6: Draft detail from CFSEI Lateral Design Guide.

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