Trends in Cold-Formed Steel

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Cold formed steel framing used for the structural system on a mid-rise building in Seattle, WA.

Cold-formed steel (CFS) is widely used in conventional construction as well as in metal building systems. It continues to show promise, even with the overall size of the construction market shrinking during the latest economic turndown. More than ever, building owners and contractors are seeking buildings and materials that are cost-effective but also meet specific code requirements for non-combustible construction. Throw in the increasing demand for sustainable or "green" products, and CFS starts to make a lot of sense.

In conventional construction, the interest is in structural use in buildings that traditionally have relied on heavier materials. This includes hotels, multi-family housing, dormitories and mixed-use buildings in the mid-rise markets from four stories to as many as nine stories. However, the healthcare field is also a growth market, with most of these buildings falling under the IBC's use group I-2 that requires non-combustible construction for any building over one story.

From the structural engineer's perspective, the challenge is in expanding the number of designers experienced in taller CFS buildings. Fortunately, groups like the Cold-Formed Steel Engineers Institute (the technical institute of the Steel Framing Alliance) and the Hawaii Steel Framing Alliance are actively engaging their members in educational activities to expand the industry's expertise for CFS mid-rise design.

Cold formed steel framing spanned up to 30 feet in this final assembly building for the largest radio telescope in the world, Atacama Desert, Chile.

For metal building system applications, CFS has traditionally been used for secondary members. This includes girts, purlins, wall cladding, and roofing. In the past, metal building systems were primarily used for "backstreet" buildings such as warehouses and manufacturing. Now they are often selected for "main street" buildings such as schools, offices, retail, etc. This reflects a decrease in the manufacturing sector, as well as the emergence of more architecturally aesthetic solutions using metal buildings.

Although the traditional structural design challenges are part of the ongoing market development, perhaps no other issue is impacting the state of the CFS industry as much as sustainability. There is a growing push for increased energy efficiency and the use of Life Cycle Assessments (LCA) to evaluate building materials.

Although LCA is not really appropriate as a tool to compare different building materials, that has not stopped its proponents from trying to gain traction through different "green" programs and various codes and standards. It may be only a matter of time before someone from the steel industry involved in a project's design has to step up and become proficient at the practice of LCA. The structural engineer may very well be that professional.

The latest energy codes will change the way buildings are designed. If the use of CFS is to continue to grow, no longer will it be acceptable for the structural engineer (or any of the other designers in the process) to operate with a sole focus on the structure. More cooperative design among the different disciplines will be the norm.

For example, the structural capacity of some CFS members is based on testing that was done with a certain amount of fiberglass insulation sandwiched between cladding and supporting elements. Energy codes are now requiring greater thermal efficiency, and therefore more insulation or different types of insulation than previously assumed. This has to be considered, and will impact both strength and serviceability. Deflections and rotations of members may be increased because of longer fasteners required to penetrate thicker insulation. Condensation issues must also be thoroughly addressed as tried and true roof and wall assemblies are re-engineered to be more energy efficient.

Another trend that is on the horizon in CFS design in the U.S. is the use of more efficient sections, utilizing more complex profiles. This is being facilitated by an alternate design methodology in the AISI Specification called the Direct Strength Method. This permits the optimization of sections using more stiffening elements in webs and flanges of CFS members that can be easily incorporated in the roll forming process. A recent student competition sponsored by the University of North Texas utilized this design method and yielded some imaginative entries. That is the advantage of this method – for any cross section that you can imagine, you can determine its critical elastic buckling load.

As we move forward and the economy recovers, the CFS industry is well-positioned to expand. The structural engineering community will be an important part of the process along the way.▪

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