



▶ The Evolution of Cold-Formed Steel Joist Framing Products

By ClarkDietrich™ Building Systems

September 2013

▶ The Evolution of Cold-Formed Steel Joist Framing Products

Proprietary Joist Framing Products Minimize Jobsite Clashes
and Help Mid-Rise Construction Projects Finish Faster

By ClarkDietrich™ Building Systems



COLD-FORMED STEEL FRAMING (CFS) HAS BEEN AROUND FOR DECADES and has been widely used throughout commercial construction since the early 1960s. Throughout the last 50-plus years, many other CFS products have been developed for specific applications, mostly focusing on labor savings for the contractor.

Floor joist framing had always been a traditional C-stud member, turned on edge to carry lateral loads throughout the horizontal plane of the structure. This was a very labor-intensive and costly installation for the contractor. Each end joist connection required a web stiffener to connect to the rim track. This web stiffener prevents web crippling and is a requirement for all platform frame projects. Platform framing is defined as a floor joist system sitting on top of the wall plate, with the next level's walls sitting on top of the floor system. This creates a point load on the floor joist, which is the reason the end connection needs the reinforcement with the web stiffener. Traditional C-stud floor joist systems usually require additional clips (both in the 1-1/2" and 4" variety), bridging bars, lateral blocking, joist hangers, web stiffeners and/or squash blocks. This all amounts to more parts and pieces on the jobsite and added labor for the contractor.

Every building deflects and every floor joist deflects—in some conditions more than others, depending on the live load of the rooms above and the design criteria specified for the building type. Deflection is measured with an “L” over number (i.e., L/240)—the higher the number, the more rigid the framing will be or the less it will deflect.

To meet building code, floor joist assemblies must be designed to L/360 specifications in most markets; but if designed responsibly, these assemblies are often designed to L/480 to stiffen the system and mitigate bounce or noticeable movement within the floor. C-studs used as floor joist members could potentially "oil can" or make a popping/panning sound if there is more deflection over the floor than what it was designed for.

In the wood industry, traditional floor joist members were dimensional lumber (i.e., 2x10 or 2x12); but as the industry has evolved, there has been increased demand for I-Joist and Open Web Floor Truss systems. The same is true in the CFS industry with the evolution from C-studs to proprietary floor joist systems such as the TradeReady® Floor Joist System manufactured by ClarkDietrich Building Systems. These assemblies have increased spanning capability, allowing them to span greater distances than their traditional C-stud counterparts. Proprietary floor joist systems also have fewer parts and pieces, which result in significant labor savings for the contractor. Another installation benefit is the large pre-extruded knockouts that align within the joist assembly. This allows the MEP trades more access to run pipes, wires and mechanical equipment while staying within the plane of the floor assembly.

▶ JOIST KNOCKOUTS

In floor joist applications, a traditional 10" C-stud has a knockout that measures 1-1/2" x 4" in diameter. However, this presents the challenge of not having adequate space for the trades to run their pipes, wires, etc. Proprietary floor joist systems have various-sized holes—triangular in shape and ranging in diameter from 5-1/2" to 9-3/16". Others, like ClarkDietrich's TradeReady system, have knockouts as large as 10". In most cases, these knockouts are greater in the larger joist depths. For example, the 9-1/4" (nominal 2x10), 10", and 11-1/4" (nominal 2x12) TradeReady joists have an oval-shaped hole that measures 6-1/4"x9". A 12" TradeReady joist comes with an 8" round hole, and a 14" joist comes with a 10" round hole. The variation in hole size allows flexibility depending on the size of the MEP work, particularly for mechanical/HVAC applications. In addition, on each side of the large knockout, there are a series of four smaller knockouts (1-3/8" in diameter) that can accommodate most electrical wires once a plastic grommet has been snapped into place.



The proprietary TradeReady system includes larger knockouts, as well as four additional knockouts to run electrical wiring.

► PRE-PLANNING: EFFECTIVE CLASH AVOIDANCE

Just about all large knockouts, regardless of the manufacturer, can accommodate the necessary plumbing, sprinkler, and electrical work. However, when it comes to mechanical work, planning and consideration is of the utmost importance. BIM (Building Information Modeling) is becoming more widespread and is a significant improvement to the old method of clash detection with trades.

Regardless of whether BIM is used or not, pre-planning—especially with respect to the mechanical trade—is critical to the success of a project. Pre-planning is often done in the form of kick-off meetings with all trades prior to the start of the project. The MEP trades, framing contractor, and CFS engineer typically discuss the location of toilet traps, knockouts in joists, mechanical return/main trunk locations, size and location of flex piping being pulled off the main trunk, etc. This ensures proper hole alignment and careful consideration for the locations of the mechanical equipment, and typically works best if the architect and/or general contractor takes the lead—facilitating and making communication a requirement prior to any work commencing. On the front end, the architect can also take it a step farther by carefully coordinating the HVAC system design and location with the mechanical and CFS engineers on the project. They can coordinate their design work in tandem so that potential clashes in the field are eliminated. The CFS engineer would be involved as he/she is responsible for the joist system design, hole alignment, locations of in-floor girders, etc., which can all impact the mechanical trades' accessibility within the system.

Figure 1



When planned correctly, all trade work including mechanical/HVAC can be kept within the plane of the floor assembly, providing increased efficiency for mechanical units and eliminating unnecessary and costly bulkhead/drop ceiling framing conditions. Figure 1 offers a good example of a clean mechanical system installation done with proper planning. The main portion shows the large HVAC run inside the joist bay (parallel with the joist framing), with a smaller round duct fitting perfectly inside the large knockouts. Careful consideration and planning prior to the project start was critical to this successful installation. More commonly installed today is the main HVAC with smaller flex-type ductwork pulled through the knockouts within the floor assembly.

While flex ductwork provides flexibility for the mechanical trade, careful consideration and planning still needs to occur to allow for the main HVAC run and alignment of knockouts. This particular project utilized a 9/16" corrugated steel deck (CSD) that has some load carrying capacity—in some cases the deck can clear spans up to 29 or 30 inches, which allows for the offset of floor joist members to accommodate these larger HVAC runs. There are many projects that utilize proprietary joist systems, all of which are far more successful when proper planning and attention to detail is taken.

▶ THE GROWTH OF PROPRIETARY JOIST SYSTEMS IN MID-RISE CONSTRUCTION

Mid-rise construction is a growing trend in many markets throughout the United States. Wood framing is typically limited to four or five stories, depending on the local codes and systems being utilized. Concrete and Structural Steel (“red-iron”) systems are not typically cost effective until you reach high-rise heights (13+ stories). CFS framing is a cost-effective alternative for buildings ranging from five to 12 stories. With the implementation of a lightweight joist assembly such as the TradeReady + 9/16" corrugated steel deck + 1-1/2" concrete topping pour, CFS buildings are able to reach up to 11 or 12 stories.

Heavier systems—such as composite metal deck plus structural concrete fill—provide a solid concrete deck option, but because of their weight are often limited to about eight stories. The 1-1/2" topping pour over the CSD joist assembly is a self-leveling gypsum-based product; but to meet the UL tested assemblies they often have to setup to a minimum 3,500 psi. This is significantly greater than traditional gypcrete, and helps to eliminate extensive cracking, flaking, powdering, and extensive wear of the gypcrete materials. The 3,500-psi material provides a solid concrete feel, and keeps the system lightweight, allowing for higher building heights.

Mid-rise CFS systems are most commonly used in building types that have relatively straightforward load paths or ones that stack, such as student housing, hospitality, apartments, mixed-use, assisted living and military barracks. With load-bearing CFS, 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. ClarkDietrich's TradeReady system includes a proprietary rim track component manufactured with prepunched clips set at the on-center spacing of the project, eliminating the need for clip angle installation and reducing labor costs from the project. The TradeReady rim track can also carry loads between stud bays or be used as a header device when the floor joist system is hung from the inside of the walls. The gauge of the track may have to be increased, but it can often clear spans of up to six feet, while carrying and distributing the load over the window opening. The rim track can replace costly box beam headers, one of the most labor-intensive details in CFS construction. The utilization of modified balloon framing also allows the framing contractor to drive the critical path of construction, providing true single-source accountability. The framing contractor stands the wall panels, installs the floor joist + 9/16" corrugated steel deck system, and moves to the next level's wall panels, stacking wall panel on top of wall panel. There is no other trade in the framing contractor's path of construction. Coordination among the concrete trade to lay rebar, wire mesh, pour concrete and install shoring is all eliminated, as there is no load-bearing concrete within the structure. The only load-bearing concrete element would be the elevated podium slab or concrete foundation. The 1-1/2" topping pour is applied over the joist and deck system after the entire structure has been framed as it is nonload-bearing and not a structural element.



The construction methods described within have been available for several years. Today, more framing contractors throughout the U.S. have the capability to successfully perform on mid-rise CFS projects. With some foresight on the front end of your next project, you can successfully integrate all the trades involved, which will have a drastic impact—reducing the construction schedule and allowing the building to be occupied much sooner than with traditional construction methods. The result will be a positive experience for everyone involved including the building owner, architect, engineer, and the entire contracting team.

Turn to ClarkDietrich for a complete lineup of steel construction products and services nationwide:

Interior Framing · Exterior Framing · Interior Finishing · Clips/Connectors · Metal Lath/Accessories · Engineering



9100 Centre Pointe Dr. Suite 210
West Chester, OH 45069

P 513.870.1100
F 513.870.1300

clarkdietrich.com
Clarkwestern Dietrich Building Systems LLC