

From Flat to Fluted

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Flutes—the ridges in metal deck—are what give deck its strength. MSC recently got the skinny from various metal deck industry representatives on what keeps their industry going strong.

What are some recent developments with metal deck design/erection practices, materials, and equipment?

Rutherford: We have seen a rise in fabricator use of BIM software, and we see a benefit in deck layout accuracy and speed with this type of technology. In addition, we've seen an increase in demand for pneumatic sideseam attachment tools, both for seismic diaphragm design enhancement and for labor savings.

Heilbrun: More and more attention is being paid to the working conditions associated with deck installation. Leading-edge power tool and fastening system companies like Hilti have responded with technologies that reduce the time spent on the job, and improve ergonomics. High fastening-rate stand-up, ergonomically designed powder-actuated fastening systems, new powder-actuated fasteners, and high-speed screw fastening systems for metal deck attachment are now available. Not only are contractors finding that the ability to work standing up helps keep their productivity high all day, but these fastening systems require less expertise to install and provide extremely reliable performance, which can minimize rework and speed installation.

Many fasteners have been tested and evaluated to the latest IBC code requirements under ICC-ES AC43 Acceptance Criteria for Steel Deck Roof and Floor Systems. ICC-ES issues evaluation service reports for steel deck applications including specific combinations of proprietary fasteners.

Hilti also offers a steel deck diaphragm design software program called Profis DF available on our web site for free download (www.hilti.com).

Day: In order to maximize the allowable clear span of composite deck, higher strength steel is being specified on more projects. Designers must recognize the deflection limitations that come with higher yield steel. But with the proper steel frame and deck design, there are potential cost savings. We are also furnishing more roof deck, with open-web steel joists and joist-girders, for projects that are erected “panelized”—where steel roof deck is attached to several joists, with the necessary bridging, on the ground and the completed “panels” are erected in sections. This saves installation time and limits the number of structural steel and deck installers that must be on the steel frame.

Holman: As costs for construction materials and shipping all continue to rise at unprecedented rates, the construction industry is taking a hard look at new cost-reduction strategies. For projects using large-span roof decks, one way to reduce costs is the use of crimp-curved profiled panels.

Crimp-curving is a process in which metal panels are fed through a computerized press that shapes the panel into the specified angles and curves while greatly increasing the load factor. When crimp-curving is used for roof decks, panels can be installed “against the grain” or across the top of the structure, as opposed to curved decks formed from straight panels that are laid parallel to the length of the building. The resulting deck is so strong that it is possible to reduce panel gauge and/or the required amount or type of support. For structural decks, we recommend 20- or 22-GA panels in place of 18-GA. Today more than ever, material savings can exceed the relatively modest fees for panel-curving.

Roehrig: The most significant recent accomplishment by the Steel Deck Institute has been obtaining ANSI approval for Standards for Composite Steel Floor Deck, Non-Composite Steel Floor Deck, and Steel Roof Deck. These three standards provide a comprehensive guide for the design of these products and continue the efforts of the industry to provide up-to-date information for use by the design community. Another major effort is the ongoing presentation of joint seminars around the country with the Steel Joist Institute regarding the correct design and use of steel decks for roofs and floors as well as detailed information pertaining to diaphragm shear design.

Darsey: Vulcraft continues to respond to code-driven changes such as more demanding uplift requirements, which typically require higher strength steels and effective fastening methods. Various fastener manufacturers have been active with the introduction of new fasteners or improvements in existing options.

The introduction of mechanical clinching tools such as the PunchLok tool by Nucor's Verco Decking, Inc. for side laps of interlocking deck has largely eliminated the need for welded side laps in areas requiring high diaphragm capacities, such as the west coast.

Given the recent increases in raw material costs, have you put into place any mechanisms to provide price stability for your customers?

Day: We continue to hold contract prices firm with our customers, primarily structural steel fabricators, for extended periods of time—depending on project duration—without raw material surcharges. Raw material inventory sourcing, timing, and backlog management have never been more important to our deck business. We must maintain higher inventory levels to protect against sudden, and dramatic, mill increases. Through this period of price volatility, CMC Joist and Deck has maintained the necessary inventory levels for continued on-time deliveries of deck to all of our customers.

Rutherford: We are still working through these issues and are considering mechanisms such as pre-payment and storage, escalations based on indexes, and possibly other ways developed by owners or our customers.

Darsey: Raw material increases have definitely been a challenge to our industry, as we have been dramatically affected by higher energy and steel costs. Increases in those two items alone have tended to drive increases in most other components and consumables used in our manufacturing processes.

Despite these challenges, Vulcraft/Verco continues to honor our quotes and delivery commitments.



Coils of flat steel at a deck producer, waiting to be turned into deck.

What, if any, are some recent innovations/changes with acoustic/perforated metal deck?

Rutherford: Deeper roof deck profiles with acoustical perforations and properties are becoming more common, although their use is still limited due to higher product costs.

Day: CMC Joist and Deck continues to suggest that all of our acoustic roof and cellular-acoustic floor and roof deck are furnished with a galvanized finish—even if the specifier has chosen painted acoustic deck. This ensures that there is no staining through the perforations, considering that acoustic deck is always exposed from the bottom side. A hot-dip galvanized coating seals the exposed edges of perforated deck. The cost of a galvanized coating versus cold-rolled (non-galvanized) steel is a good investment for the owner.

Darsey: Relative to the rest of the deck market, acoustical deck volumes continue to be a small, although important, component.

One related change has been new Steel Deck Institute Noise Reduction Coefficients (NRC) in the *Design Manual for Composite Decks, Form Decks and Roof Decks* (Publication No. 31).

How has your facility changed in recent years? Have you added more roll-forming lines or expanded your services?

Rutherford: Over the past six years we have added two production facilities (Bradenton, Fla. and Fallon, Nev.).

Day: We continue to refine our material-handling processes to safely and more efficiently produce all of the deck profiles we offer. Our customers require very fast delivery lead-times, one week and less in some cases, on a regular basis. We operate multiple roll-forming lines in all of our plants to ensure we are rolling the required deck profiles every day and every week.

Voigt: In 2007, our Salem, Va. operation added a 50,000-sq.-ft metal deck manufacturing facility. Like our Lake City, Fla. facility, Salem is able to produce 3-in. composite metal decking, along with standard roof and form decking.



Kevin Walsh Photography

Exposed metal roof deck in a Department of Motor Vehicles facility in southern California (see "Getting the Green Light," January 2008).

Participants

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www.curveline.com

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www.newmill.com

Nucor-Vulcraft Group

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Steel Deck Institute

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How has the metal deck market changed in recent years?

Rutherford: We can confirm the increase in stadium projects using composite deck and the trend toward vertical construction using composite deck. As of this printing, we are working on four high-rises in Chicago and the Freedom Tower in New York. All five employ composite deck.

Day: Designers have increased the use of composite steel deck in multi-story residential and hotel projects. The expanded use of staggered structural steel trusses and the all-weather construction capabilities of steel deck have been driving the increased use of our product. Designers are also specifying composite deck in multi-level parking garages. Multi-story office, manufacturing, health-care, and school projects continue to be built primarily with composite steel deck.

Holman: When Curveline launched its panel-curving service in the 1980s, most orders were for curved walls and fascias. Over the past five or six years, curved metal decking has become our most frequently requested item. As the industry recognizes the cost and aesthetic benefits of curved decking, demand is increasing. The projects most frequently employing curved decks are schools, gymnasiums, maintenance buildings, transportation facilities, and commercial building applications.

Roehrig: In my opinion, the market is focused on using the most cost-effective approach to design. For example, the most common 1½-in.-deep roof profile used today is the wide rib deck (Type WR) because of its efficiency in developing a high strength-to-weight ratio. In addition, the use of long-span products (3 in. and deeper) is growing, since it permits significantly increased spacing between structural supports. The deck industry is also investigating use of its products in other markets such as residential construction, since steel offers inherent advantages with regard to wind, fire, durability, etc.

Heilbrun: Significant changes in the metal deck industry involve development of ANSI standards, AISI test standards, ICC-ES Acceptance Criteria, and ongoing university research. University research into the inelastic seismic load performance of steel deck diaphragms is being conducted at Ecole Polytechnique Montreal by Dr. Robert Tremblay and Dr. Colin Rogers. University research into steel deck diaphragm performance involving deep deck and cellular deck has also been conducted at Virginia Tech University by Dr. Sam Easterling. Dr. Easterling has also recently completed research into the performance of arc spot “puddle” welds in steel deck applications. This research has investigated the actual performance of arc spot puddle welds in thick steel deck

layer conditions as well as lap joint shear strength vs. arc time.

A challenge is to remain on time and on budget since design-build and value engineering are becoming more common. Even with the most skilled and hardened ironworkers, there are simply finite limitations to how much metal deck can be fastened in a single day. Several years ago, Hilti initiated an extensive research project to address this limitation. In early 2009, Hilti will launch improved diaphragm load data, which was achieved through a proprietary sidelap connector. In certain instances it is now possible to reduce the deck gauge and save on the steel package—a smart option for whoever buys this material. It is also possible to optimize the fastening pattern—a solid option for installers. Using fewer fasteners reduces labor by needing fewer pins and screws to achieve the lateral and uplift load demands on the structure.

Darsey: Markets have remained fairly stable over the years, obviously varying in volume as economic climates have varied over the years. There has been a noticeable shift from prime coat-finished over black metal to a higher usage of galvanized materials.

Growing emphasis in the markets to “go green” dovetails with our products. With our steel decks being fabricated from largely recycled materials, and our primer coatings being water-based, LEED points are available when our products are provided. **MSC**

Steel deck being formed, with flutes being created from the center out.

