

Steel Deck: An Evolution

Charles Ross

Perhaps unglamorous, but decidedly essential, steel decking has become an integral structural element in steel-framed construction—quite a change from its initial role as an innovative alternative to plywood forms when it was introduced 80 years ago. Over that time, it's developed from what was essentially corrugated sheet metal, to a specialized, quality-controlled component of many buildings' structural designs. And, as this product has become more important to designers, manufacturers have broadened their offerings to include a greater variety of corrugations, embossments, coatings and other options, while meeting a changing array of government standards.

HUMBLE ORIGINS

A birth date for steel decking is hard to identify. It began as a simple replacement for the wood forms that contractors had been using to shape concrete as it was poured. Some engineering was required to enable steel to carry the concrete load, but once this was perfected, steel decking became a labor-saving alternative for builders. Where wood forms were temporary, the new steel forms could stay right where they were.

"Steel, in order to carry a load, needed to be corrugated," says Carl Koehler, executive vice president of Nicholas J. Bouras, Inc., the sales and engineering affiliate of manufacturer United Steel Deck. "But the beauty of it was, you didn't have to take it out."

By 1939, the product had gained its own association, the Steel Deck Institute, an assemblage of manufacturers who came together to develop standards and procedures for manufacturing and installing their products. Since then, steel deck has been further engineered. Although it still often serves as simply a stay-in-place (SIP) form, an accommodating structural design can incorporate steel deck as a



Photo courtesy D-MAC Industries, Inc.

load-bearing member, even under the diaphragm-loading conditions presented by wind or seismic loads.

POPULARITY GROWTH

This growing role began in the 1950s, according to Walter Schultz, with Nucor's Vulcraft division. By welding reinforcement wires to the deck before concrete was poured, manufacturers had created what is now called composite deck. By protruding into the concrete, the wires tied the steel deck to the poured material, creating a single structural unit. In appropriate applications, this design helped eliminate the need for reinforcing bar. Designers only had to incorporate steel mesh to control concrete shrinkage and cracking. Today, instead of welding wire to the deck, manufacturers roll embossments into the material as it is made, creating an even stronger bond between steel and concrete.

Steel deck also has become common for roof applications. Though roof demands are generally lighter those for floors, these applications can see loads up to 100 pounds per foot under snow drifts, according to Schultz.

Additionally, acoustical designs, incorporating perforations and acoustic batting for noisy or sound-sensitive installations, have been on

the market since the 1970s. Welding the corrugated deck to a flat steel panel creates cellular decking, which can be used to create channels for electrical and data wiring. Although this approach was popular when first introduced, raised access flooring is often used today to create a more flexible wiring approach, says Bouras' Carl Koehler.

PRODUCT INNOVATION

The most recent development in steel-deck design is a growing variety of corrugation depths. Deeper corrugations allow decks to carry loads across wider spans. Koehler says acoustic versions of these stronger designs often are incorporated into school natatoriums and cafeterias, as well as into airport terminals, all of which can be wide-open—and noisy—spaces.

In parking garages, steel deck tends to revert to its non-structural role as a stay-in-place concrete form because of the potential for corrosion. However, new corrosion-resistant coatings significantly reduce corrosion problems—or eliminate them altogether in more temperate regions of the country not subject to freeze-thaw cycles or road salts.

The Occupational Safety and Health Administration has included steel deck as part of its "Safety Standards for Steel Erection," finalized in January 2001 and applicable regardless of project type. These standards set maximum weights for steel-deck bundles and address how manufacturers, designers and contractors should treat penetrations through the deck as a building is being constructed. The full document can be found online at www.osha.gov. The Steel Deck Institute has written a position paper outlining its interpretation of responsibilities relating to these standards, available online at www.sdi.org/papers/PPOSHA.pdf.

Charles Ross is a freelance writer based in Chicago, IL.