Development of Composite Steel Deck

By Thomas Sputo, Ph.D., P.E., S.E.

Steel decking was first used to support a concrete floor in the 1920s. Loucks and Giller described a steel-deck system in a patent filed in 1926. In this early development, the steel deck provided all the structural resistance, concrete was added to provide a level walking surface and fire resistance. The use of steel deck was attractive to constructors as it served as permanent formwork and construction platform, and was an attractive alternative to reinforced concrete slab floors.

By 1938, engineers were using a non-composite cellular floor system produced by the H.H. Robertson Company (referred to as the keystone beam because of the dovetail shape of the steel deck cross section) in industrial buildings.

The first composite slabs, concrete reinforced by the steel deck, appeared in the 1950s. The first was a product known as Cofar, produced by the Granco Steel Products Company, which was a trapezoidal deck section with cold drawn wires (T-wires) welded transversely across the deck ribs. The slab was analyzed as a traditional reinforced concrete slab and found to be in good correspondence between predicted and experimental strengths.

In 1961, the Inland-Ryerson Company produced a trapezoidal steel deck with indentations rolled into the profile to achieve horizontal shear transfer between the concrete and steel. This floor deck, known as HiBond, was the forerunner of most modern composite steel decks that use embossments to develop bond between the concrete and the deck.

By the mid 1960s, a number of manufacturers were producing composite steel decks, validating the load carrying capacity of the composite slab through proprietary testing. Each steel deck manufacturer, employing sound engineering design principles, developed their product by extensive independent research so that the approving building code agency would grant acceptance of the particular steel deck system. In many cases the local building code official requested additional test data from the manufacturer, depending on the particular construction situation. This, resulting from the independent nature of the competitive product, created costly situations that caused an adverse affect on steel deck reinforced floor construction.

Recognizing the need for one design standard, the American Iron and Steel Institute (AISI) initiated a research project in 1967, at Iowa State University under the direction of the late Professor Carl Ekberg, to develop a basis for the design criteria related to composite steel deck-slabs. Extensive research by both Professors Carl Ekberg and Max Porter at Iowa State, and other researchers at University of Waterloo, Lehigh University, Virginia Polytechnic Institute and State University, West Virginia University, and the University of Washington, resulted in a body of public domain knowledge on composite steel deck-slabs.
These research efforts resulted in the American Society of Civil Engineers (ASCE) developing the ASCE 3-84 Specifications for the Design and Construction of Composite Slabs by the Steel Deck with Concrete Standard Committee under the leadership of Professor Porter. This document was again revised in 1991. Both the 1984 and 1991 documents were recognized by the model building codes as an acceptable standard for the design of composite deck-slabs. Having a building code recognized design standard simplified the acceptance process for composite steel deck by building officials, and resulted in the growth of the market for this product.


Over the past 80 years, the design of composite steel floor deck has evolved from empirical design based on testing into a product with well-understood behavior and mature design standards that are recognized by the building codes. This evolution has lead to a more efficient and cost effective floor system.

H.H. Robertson Patented Composite Deck.

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