



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.

History of the Steel Deck Institute

Organized in 1939 as the Steel Roof Deck Industry Technical Committee, the name of the organization was changed in 1947 to the Metal Roof Deck Technical Institute and changed again in 1964 to the Steel Deck Institute.

The steel roof deck industry's first design specification was dated June 1945 and *Suggested Architect's Roof Deck Specifications and Code of Recommended Standard Practice* were adopted in 1948. Standard load tables for roof decking were first adopted in 1966. Specifications and commentary for composite steel floor deck were adopted and published in 1978.

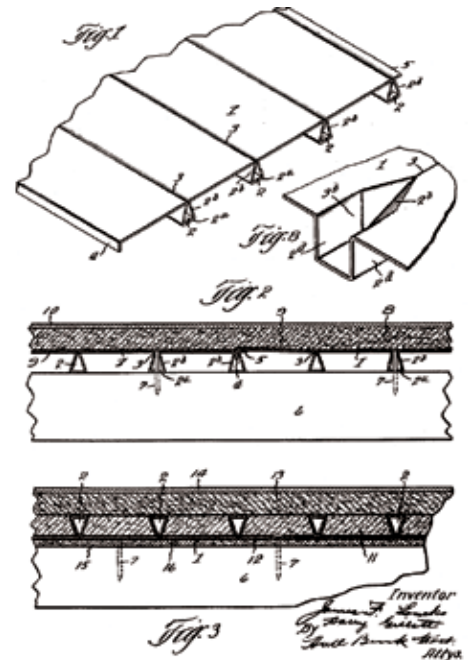
The SDI today consists of 16 Member Companies that manufacture steel deck, and 14 Associate Member Companies that manufacture related products used in the production or erection of steel deck. The Institute is involved in a broad range of activities associated with the engineering, design, production and field usage of steel decks developed through the combined efforts of the entire membership. SDI Member Companies are responsible for the production of approximately 95 percent of the steel deck used in the United States.

Free downloads of all SDI Standards, white papers, additional technical resources, and additional information regarding the SDI and its member companies can be found on the SDI website, www.sdi.org.

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.

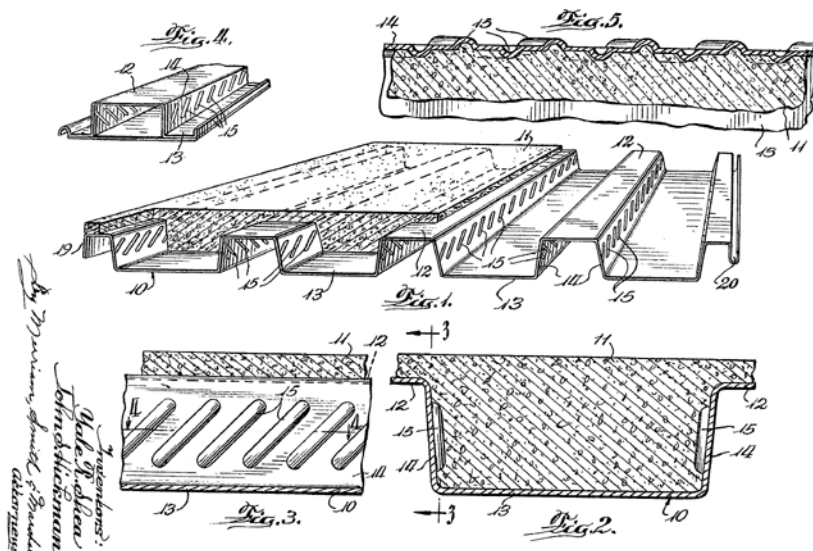
In 1961, the Inland-Ryerson Company produced a trapezoidal steel deck with indentations rolled into the profile to achieve horizontal shear transfer between the concrete and steel. This floor deck, known as HiBond, was the forerunner of most modern composite steel decks that use embossments to develop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

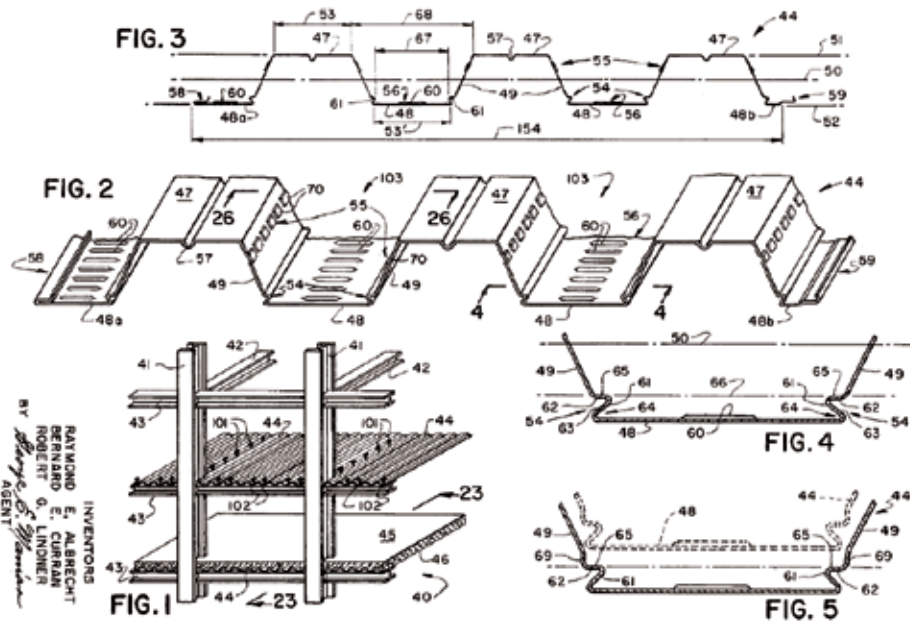


Loucks 1926 Patented Deck.

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.



Inland Steel Patented Composite Deck.



BY
 H.H. ROBERTSON
 PATENT AGENT
 INVENTORS
 RAYMOND E. ALBRECHT
 BERNARD E. CURRIAN
 ROBERT O. LINDEN

H.H. Robertson Patented Composite Deck.

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.

The first Steel Deck Institute (SDI) *Composite Deck Design Handbook* was published in 1991, with a revised edition in 1997. Recognizing changes in technology, the SDI began activities to develop new standards for composite deck slabs, initially publishing the ANSI/SDI C1.0 *Standard for Composite Steel Floor Deck* in 2006. The 2006 Standard was revised and expanded in 2011 with the ANSI/SDI C-2011 *Standard for Composite Steel Floor Deck-Slabs* and the ANSI/SDI T-CD-2011 *Test Standard for Composite Steel Deck-Slabs*.

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 led to a more efficient and cost effective floor system. ■

Thomas Spoto, Ph.D., P.E., S.E. is the Technical Director of the Steel Deck Institute. Additionally, he is a consulting structural engineer with the Gainesville, FL firm of Spoto and Lammert Engineering, LLC, and a Senior Lecturer in the Department of Civil and Coastal Engineering at the University of Florida.

ADVERTISEMENT - For Advertiser Information, visit www.STRUCTUREmag.org



No, we didn't misspell insurance. Insurance is for after the fact, when you need financial restitution after something has gone wrong.

Unlike *insurance*, Uniform Evaluation Services (ES) provides *assurance* for yourself, end users and building regulators that the code – which sets the bar for building component acceptability – has been satisfied. We ask the tough questions, and when we get answers we are happy to provide you with an IAPMO Uniform ES Evaluation Report that tells the report holder, and the reader, that someone with the right expertise asked the right questions and got the right answers.

Our Assurance Program benefits everyone. The code official saves time by using our detailed review, freeing staff to perform other tasks. Manufacturers do not have to answer the same questions over and over again. Consumers are assured that the product has been evaluated against the building code enforced in the places they work and live.

It's a thorough process, but not onerous. See for yourself at our Website.



909-472-4100
www.iapmoes.org