



AMERICAN NATIONAL STANDARDS INSTITUTE/ STEEL DECK INSTITUTE

T-CD - 2017 Test Standard for Composite Steel Deck-Slabs

INCLUDES ERRATA #1 - 11.07.17



1. Scope

- 1.1 This Standard shall apply to testing of composite steel deck-slabs under load transverse to the deck span, and the determination of the nominal resistance and stiffness thereof.
 - 1.1.1 For composite steel deck-slabs for which the nominal strength is computed in accordance with SDI-C, Appendix 2, testing to confirm strength shall not be required.
 - 1.1.2 For composite steel deck-slabs for which the nominal strength is determined in accordance with SDI-C Appendix 3, shear bond testing shall be performed in accordance with this Standard.
 - 1.1.3 For composite steel deck-slabs which are outside of the scope of SDI-C, Appendix 2 and 3, performance testing shall be performed in accordance with this Standard.
- 1.2 The user notes and commentary shall not be part of the Standard.

User Note: User notes and commentary are intended to provide practical guidance in the use and application of this Standard.

2. Reference Codes, Standards, and Documents:

- 2.1 Codes and Standards: The following codes, standards and documents or portions thereof are referenced in this Standard and shall be considered part of the requirements of this Standard
 - 2.1.1 American Iron and Steel Institute (AISI)
 - a. AISI S100-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
 - b. AISI/AISC, Standard Definitions for Use in the Design of Steel Structures, 2007 edition.
 - 2.1.2 ASTM International (ASTM)
 - a. ASTM A370-14, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
 - b. ASTM C39/C39M-15a, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 - c. ASTM E6-09be1, Standard Terminology Relating to Methods of Mechanical Testing
 - 2.1.3 American Concrete Institute (ACI)
 - a. ACI 318-14, Building Code Requirements for Structural Concrete
 - 2.1.4 Steel Deck Institute (SDI)
 - a. SDI-C-2017, Standard for Composite Steel Floor Deck-Slabs

3. Terminology

- 3.1 Terms not defined in this Standard, AISI S100, AISI/AISC, ASTM E6, or SDI-C shall have the ordinary accepted meaning for the context for which they are intended.
- 3.2 The following terms are defined for use with this Standard.
- 3.2.1 **Approved Agency:** A qualified registered professional engineer, firm, or corporation approved by the reviewing authority to conduct the testing and provide the reports required by this Standard.
- 3.2.2 **Configuration:** An arrangement of a specific assembly of panel geometry, concrete thickness, mechanical properties, span(s) and attachments that is unique to that test.
- 3.2.3 **Confirmatory Testing:** Testing performed to verify strength is not less than the strength predicted by an established empirical or rational design methodology.
- 3.2.4 **Performance Testing:** Testing performed to establish performance where there is not an established empirical or rational design methodology, or the configuration exceeds the limitations of an established empirical or rational design method.
- 3.2.5 **Shear Bond Testing:** Testing performed to establish shear bond performance as required by SDI-C Appendix 3.

4. Symbols

b	=	Unit slab width = 12 inches (1000 mm)
b_d	=	Width of composite test slab, in. (mm)
C_p	=	Correction factor
C_Φ	=	Calibration coefficient
d	=	Effective slab depth, measured from top of slab to the gross section neutral axis of the deck unit, in. (mm)
d_d	=	Depth of steel deck unit, in. (mm)
e	=	Natural logarithmic base
f'_c	=	Concrete cylinder compressive strength, psi (MPa)
F_m	=	Mean value of the fabrication factor
F_y	=	Measured yield strength of steel, ksi (MPa)
F_u	=	Measured tensile strength of steel, ksi (MPa)
h	=	Overall depth of the composite slab, measured from bottom of deck to top of concrete, in. (mm)
h_t	=	Overall depth of composite slab at failure crack, measured from bottom of deck to top of concrete, in. (mm)
k_1, k_2, k_3, k_4	=	Shear bond coefficients obtained from multi-linear regression analysis of test data from three or more deck thicknesses tested.
k_5, k_6	=	Shear bond coefficients obtained from a linear regression analysis of the test data for each individual deck thickness tested.
l	=	Length of span, measured from center of supports, in. (mm)
l'	=	Length of shear span, in. (mm)

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M_m	=	Mean value of the material factor
n	=	Number of tests
P_m	=	Mean value of the professional factor
P_t	=	Ultimate failure load from test, pounds/ft (N/m) of slab width
t	=	Base metal thickness, in. (mm)
V_f	=	Coefficient of variation of fabrication factor
V_m	=	Coefficient of variation of material factor
V_p	=	Coefficient of variation of test results
V_Q	=	Coefficient of variation of load effect
V_t	=	Tested shear bond resistance, pounds/foot (N/m) of slab width
W	=	Weight of the composite slab specimen, pounds/ft (N/m) of slab width
β_0	=	Target reliability index
Φ	=	Resistance Factor (LRFD)
Ω	=	Safety Factor (ASD)

5. Units of Symbols and Terms

- 5.1 Equations that appear in this Standard are compatible with the US Customary System (USCS) inch-pound system of units. However, any consistent system of units shall be permitted to be used. SI units or equations shown in parenthesis in this Standard are for information only and are not part of this Standard.

User Note: The USCS is also referred to as English Units or the inch-pound system.

6. Precision

- 6.1 Loads shall be recorded to a precision of 2 percent of the anticipated ultimate load during application of test loads.
- 6.2 Deflections shall be recorded to a precision of 0.01 in. (0.25 mm).

7. Test Specimen

- 7.1 General:
- 7.1.1 The number of specimens tested shall comply with Section 10.
- 7.2 Concrete:
- 7.2.1 Concrete used in the composite specimens shall be prepared and cured in accordance with standard construction practice in accordance with Chapter 19 of ACI 318.
- 7.2.2 Concrete used in the composite specimens shall be representative of the compressive strength and unit weight of the concrete in the actual field installation. Structural normal-weight concrete and structural light-weight concrete shall be permitted.

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7.2.2.1 Compression strength of the concrete shall be determined in accordance with ASTM C39. A minimum of three concrete cylinders shall be tested for each identical set of test specimens. Testing of the cylinders shall be performed within 24 hours of the testing of the composite specimens. Concrete cylinders shall be cured under the same ambient conditions as the test specimens.

7.3 Steel Deck Units

7.3.1 The coating of all steel deck units shall be in a condition which simulates the condition found in actual field installation.

7.3.2 The steel deck units shall be representative of the units in the end-use construction, including profile of the steel deck, deck embossment pattern, deck thickness, steel tensile properties, and all other properties that affect the strength and stiffness of the steel deck.

7.3.2.1 Standard tensile tests of the steel from which the deck units were produced shall be conducted in accordance with ASTM A370. A minimum of three steel coupons shall be tested for each identical set of test specimens.

7.4 Dimensions and Construction of Composite Specimens

7.4.1 Span. Test specimen spans shall encompass the range of spans used in field applications for the deck profile tested. Single span, 2-span or 3-span specimens shall be permitted.

7.4.2 Width. Width of all specimens shall not be less than 2 feet (600 mm).

User Note: Test specimens of two or more deck unit width are preferred as representative of actual installation. Test specimens of a single unit width will typically yield lower (conservative) tested capacities.

7.4.3 Depth. Slab depths shall encompass the range for which the deck unit shall be utilized.

7.4.4 Support and sidelap fastener type, size, and installation shall be representative of the actual field installation. Fastener installation shall be in accordance with SDI-C.

7.4.5 Slab end details (including fastening) and steel headed stud anchor installation (if any) shall be representative of the actual field installation. The distance from the centerline of the support fastener to the end of the deck unit shall not be greater than the depth of the deck unit, unless the minimum allowable edge distance for the specific fastener requires a larger distance.

7.4.6 Deck used for 2-span or 3-span tests shall include at least one butted joint.

7.4.7 The test specimen shall be permitted to be shored during concrete placement and curing when required to meet strength or deflection requirements of SDI C.

7.4.8 Test specimens shall be permitted to be moved after the concrete has been placed. Specimens which are moved shall be supported in a manner such that the integrity of the specimen is not compromised.

User Note: It is not advisable to move specimens because moving may damage the specimens, which could result in lower bond strength and lower (conservative) tested capacities.

8. Test Setup

8.1 Test Support Frame

- 8.1.1 Single-span test: The test support frame shall consist of either two exterior support wide-flange steel beams, as shown in Figure 1, or bar stock as shown in Figure 3.
- 8.1.2 Two-span or three-span test: The test support frame shall consist of two exterior support wide-flange steel beams and one (two span test) or two (three span test) interior support wide-flange steel beams, as shown in Figure 2. It shall be permitted to vary span lengths within an individual test specimen, however the length of any exterior unloaded spans for a three span test shall not be less than 50% of the length of the interior loaded span, nor shall the unloaded span of a two span test be less than 50% of the length of the loaded span.
- 8.1.3 The test frame shall be wide enough to accommodate the width of the test specimen.
- 8.1.4 Wide flange support beams shall have minimum flange width of 4 inches (100 mm), a maximum flange width of 6 inches (150 mm), a minimum flange thickness of ¼ inch (6 mm), and a maximum flange thickness of 1 inch (25 mm). Flat bar or plate stock shall be permitted to substitute for wide-flange beam support. Flat bar stock shall be a minimum width of 4 inches (100 mm) and a maximum width of 6 inches (150 mm), with a minimum thickness of 3/8 inch (9 mm) and a maximum thickness of 1 inch (25 mm).
- 8.1.5 Rollers and pins as shown in Figure 3 shall be permitted if bar stock deck bearing points are used.

9. Test Procedure

- 9.1 Testing shall be conducted after the concrete has reached its specified compressive strength, but not less than seven days after casting. Except as noted, structural lightweight concrete shall be permitted a longer curing time if required. High early strength concrete shall be permitted to be tested earlier than seven days.
- 9.2 Specimens shall be tested using concentrated line loads as shown in Figures 1 and 2. Alternatively, uniform loading in accordance with Section 9.2.1 shall be permitted to be used with l' equal to the distance from the support to the intersection of the first vertical flexural crack with the bottom of the deck, but need not be less than $l/4$.
- 9.2.1 Uniform loading using air bags, vacuum boxes, or other means shall be permitted as an alternate to Figures 1 and 2, provided that the test method does not provide stiffening to the test specimen.