



AMERICAN NATIONAL STANDARDS INSTITUTE/ STEEL DECK INSTITUTE

C - 2017 Standard for

Composite Steel Floor Deck-Slabs

INCLUDES ERRATA #1 - 11.07.17



Documents

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1. General

1.1 Scope:

- A. This Standard for Composite Steel Floor Deck-Slabs, hereafter referred to as the Standard, shall govern the materials, design, and erection of composite concrete slabs utilizing cold formed steel deck functioning as a permanent form and as reinforcement for positive moment in floor and roof applications in buildings and similar structures.
- B. The Appendices shall be part of the Standard.
- C. 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.

- D. Where the Standard refers to “designer,” this shall mean the entity that is responsible to the Owner for the overall structural design of the project, including the steel deck.

User Note: This is usually the Structural Engineer of Record.

- E. Equations that appear in this Standard are compatible with the US Customary System (USCS) 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.

- F. Terms not defined in this Standard, AISI S100 or AISI/AISC shall have the ordinary accepted meaning for the context for which they are intended.
- G. It shall be permitted to specify deck base steel thickness either by dimensional thickness, or by gage when the relationship of base steel thickness to gage has been defined by the deck manufacturer. However, for the purpose of design, the dimensional thickness shall be used.

User Note: Both AISI and SDI now specify steel thickness in terms of design thickness in lieu of gage thickness. Gage thicknesses, however, are still commonly referred to in the metal deck industry. Table UN-1.1 shows common gages and corresponding uncoated design and minimum steel thicknesses.

Table UN-1.1

Gage No.	Design Thickness		Minimum Thickness ¹	
	in.	mm.	in.	mm.
22	0.0295	0.75	0.028	0.71
20	0.0358	0.91	0.034	0.86
18	0.0474	1.20	0.045	1.14
16	0.0598	1.52	0.057	1.44

¹ Minimum delivered thickness is 95% of the design thickness.

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- H. Except as specifically required by this Standard, ACI 318 shall not be applicable to the design or construction of composite steel deck-slabs.

User Note: Refer to Section 1.4.9 of ACI 318.

1.2 Reference Codes, Standards, and Documents:

- A. Codes and Standards: The following documents or portions thereof are referenced in this Standard and shall be considered part of the requirements of this Standard. Where these documents conflict with this Standard, the requirements of this Standard shall control:

:

1. American Concrete Institute (ACI)
 - a. ACI 318-14, Building Code Requirements for Structural Concrete
2. American Iron and Steel Institute (AISI)
 - a. AISI S100-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
 - b. AISI S310-16, North American Standard for the Design of Profiled Steel Diaphragm Panels.
 - c. AISI S905-13, Test Methods for Mechanically Fastened Cold-Formed Steel Connections
 - d. AISI/AISC, Standard Definitions for Use in the Design of Steel Structures, 2007 edition
3. American Institute of Steel Construction (AISC)
 - a. ANSI/AISC 360-16, Specification for Structural Steel Buildings
4. American Society for Testing and Materials (ASTM)
 - a. ASTM A820 / A820M – 11, Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
 - b. ASTM A1008 / A1008M - 15, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - c. ASTM C1116 / C1116M - 10a(2015) Standard Specification for Fiber-Reinforced Concrete
 - d. ASTM D7508 / D7508M - 10 Standard Specification for Polyolefin Chopped Strands for Use in Concrete
5. American Society of Civil Engineers (ASCE)
 - a. SEI/ASCE 7-16, Minimum Design Loads for Buildings and Other Structures
6. American Welding Society (AWS)
 - a. AWS D1.1:2015, Structural Welding Code-Steel
 - b. AWS D1.3:2008, Structural Welding Code-Sheet Steel
7. Steel Deck Institute (SDI)
 - a. SDI-T-CD-2017, Test Standard for Composite Steel Deck-Slabs

Commentary: The following documents are referenced within the Commentary and User Notes:

1. American Association of State Highway and Transportation Officials (AASHTO)
 - a. AASHTO LRFD Bridge Design Specifications, Customary U.S. Units, 7th Edition, with 2015 Interim Revisions
2. American Concrete Institute (ACI)
 - a. ACI 215R-92, Considerations for Design of Concrete Structures Subjected to Fatigue Loading
 - b. ACI 302.1R-04, Guide for Concrete Floor and Slab Construction
 - c. ACI 224.1R-07, Causes, Evaluation, and Repair of Cracks in Concrete Structures
 - d. ACI 318-14, Building Code Requirements for Structural Concrete
 - e. ACI 544.3R-08, Guide for the Specification, Proportioning and Production of Fiber Reinforced Concrete
 - f. ACI Concrete Terminology, <http://terminology.concrete.org>
3. American Institute of Steel Construction (AISC)
 - a. AISC Design Guide No. 11, Floor Vibrations Due to Human Activity, 1997
 - b. AISC Design Guide No. 18, Steel-Framed Open-Deck Parking Structures, 2003
 - c. ANSI/AISC 360-16, Specification for Structural Steel Buildings
4. American Iron and Steel Institute (AISI)
 - a. AISI S100-16, North American Specification for the Design of Cold-Formed Steel Structural Members.
5. American Society for Testing and Materials (ASTM)
 - a. ASTM A653 / A653M - 15 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - b. ASTM A1008 / A1008M - 15, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
 - c. ASTM E119 - 14, Standard Test Methods for Fire Tests of Building Construction and Materials
6. Steel Deck Institute (SDI)
 - a. SDI COSP-2017, Code of Standard Practice.
 - b. SDI-DDM, Diaphragm Design Manual, 4th Edition.
 - c. SDI FDDM, Floor Deck Design Manual, 1st Edition.
 - d. SDI-MOC, Manual of Construction with Steel Deck, 3rd Edition
 - e. SDI Position Statement "Use of Composite Steel Floor Deck in Parking Garages."
7. Underwriters Laboratories (UL)
 - a. Fire Resistance Directory

- 1.3 Construction Documents:** The construction documents shall describe the composite slabs that are to be constructed and shall include not less than the following information:
- A. Loads
 - 1. Composite slab loads as required by the applicable building code. Where applicable, load information shall include concentrated loads.
 - 2. Assumed construction phase loads.
 - B. Structural framing plans for all composite slabs showing the size, location and type of all deck supports.
 - C. Deck and Deck Attachment
 - 1. Depth, type (profile), and design thickness.
 - 2. Deck material (including yield strength) and deck finish,
 - 3. Deck attachment type, spacing, and details.
 - D. Concrete and Reinforcing
 - 1. Specified concrete strength, f'_c
 - 2. Specified concrete density (and tolerance if required for fire rating assembly)
 - 3. Specified strength or grade of reinforcing steel or welded wire reinforcement (if used)
 - 4. Size, extent and location of all reinforcement (if used)
 - 5. Slab thicknesses (and tolerance if required for fire rating assembly)
 - 6. Discontinuous fiber reinforcement material, type and dosage (if used).

User Note: The following is an example of a composite slab as it could be specified on the contract drawings: "Composite slab shall consist of 1-1/2 inch deep G-60 galvanized composite steel deck, design thickness 0.0358 inch (20 gage), $F_y = 50$ ksi (Type XX by YY, Inc or approved equivalent) with 3 inch thick, 3000 psi, normal-weight concrete topping (total thickness = 4-1/2 inches) reinforced with XXX. Deck shall be attached to supporting framing using #12 screws in a 36/7 pattern. (4) #10 sidelap screws shall be installed per deck span."

2. Products

2.1 Material:

- A. Sheet steel for deck shall conform to AISI S100, Section A3, as modified in Section 2.1.C.

User Note: AISI S100, Section A3.1 notes an exception that "For steels used in composite slabs, the requirements of SDI-C shall be followed exclusively." The intention of this exception is to permit that the requirements of Sections 2.1.C.2 and 2.1.C.3 shall be followed regarding limits on design yield stress and ductility.

- B. Sheet steel for accessories that carry defined loads shall conform to AISI S100, Section A3. Sheet steel for non-structural accessories that do not carry defined loads shall be permitted to be any steel that is adequate for the proposed application.

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- C. All sheet steel used for deck or accessories that carry defined loads shall have a minimum specified yield stress that meets or exceeds 33 ksi (230 Mpa).
1. For the case where the steel deck acts as a form, design yield and tensile stresses shall be determined in accordance with AISI S100, Section A3.
 2. For the case where the steel deck acts as tensile reinforcement for the composite deck-slab, the steel shall conform to AISI S100, Section A3. When the ductility of the steel measured over a two-inch (50 mm) gage length is 10% or greater, the maximum design yield stress shall not exceed the lesser of 50 ksi (345 Mpa) or F_y . When the ductility of the steel measured over a two-inch (50 mm) gage length is less than 10%, the maximum design yield stress shall not exceed the lesser of 50 ksi (345 Mpa) or $0.75 F_y$.
 3. When the ductility of the steel used for deck, measured over a two-inch (50 mm) gage length, is less than 10%, the ability of the steel to be formed without cracking or splitting shall be demonstrated.

Commentary: Most steel deck is manufactured from steel conforming to ASTM A1008 /A1008M, Structural Sheet for uncoated or uncoated top/painted bottom deck or from ASTM A653 / A653M, Structural Sheet for galvanized deck. In most cases the designer will choose one finish or the other. However, both types of finish may be used on a project, in which case the designer must indicate on the plans and project specifications the areas in which each is used. (Refer to Section 2.3 of this Standard). Stainless steel is not recommended due to the lack of available performance data.

- D. Concrete and Reinforcement:
1. Concrete placed on steel deck shall conform to ACI 318, Chapter 19, except as modified by Sections 2.1.D.2 and 2.1.D.3.
 2. The specified concrete compressive strength shall not be less than 3000 psi (21 MPa). The maximum compressive strength used to calculate the strength of the composite deck-slab shall not exceed 6000 psi (42 MPa).

User Note: Load tables and labeled fire resistant rated assemblies may require concrete compressive strengths in excess of 3000 psi. The average compressive strength of the concrete may exceed 6000 psi, but a maximum strength of 6000 psi is to be used in calculating the strength of the composite deck-slab.

3. Admixtures containing chloride salts or other substances that are corrosive or otherwise deleterious to the steel deck and embedded items shall not be permitted.
4. Steel Reinforcing shall conform to ACI 318, Section 20.2
5. Discontinuous fiber reinforcement shall conform to the following:
 - a. Steel fibers: ASTM A820.
 - b. Macrosynthetic fibers: ASTM D7508.

2.2 Tolerance of Delivered Material:

- A. The minimum uncoated steel thickness as delivered to the job site shall not at any location be less than 95% of the design thickness, however lesser thicknesses shall be permitted at bends, such as corners, due to cold-forming effects.

User Note: The minimum delivered thickness is in accordance with AISI S100.

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- B. Panel length shall be no less than $\frac{1}{2}$ inch (13 mm) shorter than the specified length nor greater than $\frac{1}{2}$ inch (13 mm) longer than the specified length for single span or butted end deck. Panel length shall be no less than $\frac{1}{2}$ inch (13 mm) shorter than the specified length for lapped end deck.

User Note: No restriction is placed on over length panels in lapped applications because there is no adverse consequence in this application.

- C. Panel cover width shall be no less than $\frac{3}{8}$ inch (10 mm) less than the specified panel width, nor more than $\frac{3}{4}$ inch (19 mm) greater than the specified width.
- D. Panel camber and/or sweep shall not be greater than $\frac{1}{4}$ inch in a 10 foot length (6 mm in 3 m).
- E. Panel end out of square shall not exceed $\frac{1}{8}$ inch per foot of panel width (10 mm per m).
- F. Embossments (if used) shall not be less than 90% of the design embossment depth.

2.3 Finish:

- A. The finish on the steel deck shall be specified by the designer.
- B. Galvanizing or other metallic coatings (if specified by the designer) shall conform to the requirements of the applicable steels in AISI S100, Section A3.

User Note: The most commonly specified galvanized sheet steel is ASTM A653 / A653M.

- C. A shop coat of primer paint (bottom side only) shall be applied to steel sheet if specified by the designer.

Commentary: The finish on the steel composite deck must be specified by the designer and be suitable for the environment to which the deck is exposed within the finished structure. Because the composite deck is the positive bending reinforcement for the slab, its service life should at least be equal to the design service life of the structure. Zinc-Aluminum finishes are not recommended. When composite deck with an unpainted top and painted bottom is used, the primer coat is intended to protect the steel for only a short period of exposure in ordinary atmospheric conditions and shall be considered an impermanent and provisional coating. In highly corrosive or chemical atmospheres or where reactive materials could be in contact with the steel deck, special care in specifying the finish should be used, which could include specialized coatings or materials. If specifying painted deck in areas that require spray-on fireproofing, the paint must be permitted by the applicable fire rated assembly. Not all paints are approved for fire rated assemblies. This requirement must be clearly called out in the contract documents. In general, there are three types of fire resistive assemblies; those achieving the fire resistance by membrane protection, direct applied protection, or with an unprotected assembly. Of these three, only the systems that utilize direct applied protection are concerned with the finish of the steel deck. In these systems, the finish of the steel deck can be the factor that governs the fire resistance rating that is achieved. In assemblies with direct applied fire protection the finish (paint) is critical.

In the Underwriters Laboratories Fire Resistance Directory, some deck manufacturing companies have steel deck units that are classified in some of the D700, D800, and D900-series concrete and steel floor units. These classified deck units (Classified Steel Floor and Form Units) are shown as having a galvanized finish or a phosphatized/painted finish. These classified deck units have been evaluated for use in these specific designs and found acceptable.

2.4 Design:

A. Deck as a form

1. Design by either Allowable Strength Design (ASD) or Load and Resistance Factor Design (LRFD) shall be permitted. The section properties and allowable strength (ASD) or design strength (LRFD) for the steel deck shall be computed in accordance with AISI S100.
2. Deck shall be evaluated for strength under the following load combinations:
 - a. Allowable Strength Design

$$W_{dc} + W_{dd} + W_{lc} \quad (\text{Eq. 2.4.1})$$

$$W_{dc} + W_{dd} + P_{lc} \quad (\text{Eq. 2.4.2})$$

$$W_{dd} + W_{cdl} \quad (\text{Eq. 2.4.3})$$

Where:

W_{dc}	=	dead weight of concrete
W_{dd}	=	dead weight of the steel deck
W_{lc}	=	uniform construction live load (combined with fluid concrete) not less than 20 psf (0.96 kPa)
W_{cdl}	=	uniform construction live load (combined with bare deck), not less than 50 psf (2.40 kPa)
P_{lc}	=	concentrated construction live load per unit width of deck section, 150 pounds on a 1 foot width (2.19 kN on a 1 meter width)

User Note: The uniform construction live load of 20 psf is considered adequate for typical construction applications that consist of concrete transport and placement by hose and concrete finishing using hand tools. The designer typically has little control over means-and-methods of construction, and should bring to the attention of the constructor that bulk dumping of concrete using buckets, chutes, or handcarts, or the use of heavier motorized finishing equipment such as power screeds, may require design of the deck as a form using uniform construction live loads, w_{lc} , of 50 psf or greater. Section A1.3 requires that the designer include the assumed construction loads in the construction documents and it is suggested that the constructions documents require verification of adequacy by the constructor.

User Note: The designer should account for additional loads attributable to concrete ponding due to deflections of the structural system, including deck and support framing. See SDI-FDDM for additional information.

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b. Load and Resistance Factor Design

$$1.6w_{dc} + 1.2w_{dd} + 1.4w_{lc} \quad (\text{Eq. 2.4.4})$$

$$1.6w_{dc} + 1.2w_{dd} + 1.4P_{lc} \quad (\text{Eq. 2.4.5})$$

$$1.2w_{dd} + 1.4w_{cdl} \quad (\text{Eq. 2.4.6})$$

Commentary: The load factor used for the dead weight of the concrete is 1.6 because of delivering methods and an individual sheet can be subjected to this load. The use of a load factor of 1.4 for construction load in LRFD design is calibrated to provide equivalent design results in ASD design. Refer to the commentary of AISI S100 for additional information.

3. Cantilever spans shall be evaluated for strength under the following load combinations:
 - a. Allowable Strength Design: Equations 2.4.1 and 2.4.2 shall be applied to both the cantilever span and the adjacent span. The concentrated construction live load (P_{lc}) shall be applied at the end of the cantilever.
 - b. Load and Resistance Factor Design: Equations 2.4.4 and 2.4.5 shall be applied to both the cantilever span and the adjacent span. The concentrated construction live load (P_{lc}) shall be applied at the end of the cantilever.
4. Special loading considerations:
 - a. The specified construction live loads shall be increased when required by the construction operations.
 - b. Loads shall be applied in a sequence that simulates the placement of the concrete, in accordance with Appendix 1. Rational analysis shall be permitted to be used for developing shear and moment diagrams and calculating deflections for non-uniform spans.

Commentary: The loading shown in Figure 1 of Appendix 1 is representative of the sequential loading of fresh concrete on the deck. The 150 pound per foot of width (2.19 kN per 1 m of width) load is the equivalent of distributing a 300 pound (1.33 kN) worker over a 2 foot (600 mm) width. Experience has shown this to be a conservative distribution.

Single span deck conditions have no redundancy because they are statically determinate, as opposed to multi-span conditions that are statically indeterminate. Because of this lack of redundancy, additional consideration should be given to proper specification of construction live and dead loads. Allowable construction spans for single-span deck may be shorter than for multi-span applications, and the designer must consider this in locations where it is impossible to install the deck in a multi-span condition, such as between stair and elevator towers. Whenever possible, the deck should be designed as a multi-span system that does not require shoring during concrete placement.

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The specified construction live loads reflect nominal loads from workers and tools and do not include loads of equipment such as laser screeds or power trowels nor additional concrete weight due to ponding. If anticipated construction activities include these additional loads, they should be considered in the design.

5. Deck Deflection

- a. Calculated deflections of the deck as a form shall be based on the load of the concrete as determined by the design slab thickness and the self-weight of the steel deck, uniformly loaded on all spans. Deflections shall be limited to the lesser of $1/180$ of the clear span or $3/4$ inch (19 mm). Calculated deflections shall be relative to supporting members.
- b. The deflection of cantilevered deck as a form, as determined by slab thickness and self-weight of the steel deck, shall not exceed $a/90$, where “a” is the cantilever length, nor $3/4$ inches (19 mm).

Commentary: The deflection calculations do not take into account construction loads because these are considered to be temporary loads. The deck is designed to always be in the elastic range, so removal of temporary loads will allow the deck to recover, unless construction overloads cause the stress in the deck to exceed the elastic limits of the deck. The supporting structural steel also deflects under the loading of the concrete.

The designer is urged to check the deflection of the total system. Typical load tables are based on uniform slab thickness. If the designer wants to include additional concrete loading on the deck because of frame deflection, the additional load should be shown on the design drawings or stated in the deck section of the contract documents.

6. Minimum Bearing and Edge Distance: Minimum bearing lengths and fastener edge distances shall be determined in accordance with AISI S100.

User Note: Figure 2 in Appendix 1 indicates support reactions. The designer should check the deck web crippling capacity based on available bearing length. The deck should be adequately attached to the structure to prevent the deck from slipping off the supporting structure.

7. Diaphragm Shear Capacity: Diaphragm strength and stiffness shall be determined utilizing the bare steel deck capacity without concrete in accordance with AISI S310.

User Note: SDI-DDM contains diaphragm load tables that comply with AISI S310.

8. Connections: Deck shall be attached to supports to resist loads and to provide structural stability for the supporting member. Connections shall be designed in accordance with AISI S100 or strengths shall be determined by testing in accordance with AISI S905. Tests shall be representative of the design. When tests are used and the design allows either end laps or single thickness conditions, both conditions shall be tested.

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- B. Deck and Concrete as a Composite Slab:
1. Design by either Allowable Strength Design (ASD) or Load and Resistance Factor Design (LRFD) shall be permitted.

Commentary: The ASD Factor of Safety is calibrated to the LRFD resistance factor at a live to dead load ratio of 3 to 1, which is a reasonable load ratio for composite deck slabs and matches the ratio used in the AISC 360 Standard.

2. Flexural Resistance: Flexural resistance of the composite deck-slab shall be determined in accordance with one of the following methods:
 - a. "Prequalified Section Method" as per Appendix 2.
 - b. "Shear Bond Method" as per Appendix 3.
 - c. "Ultimate Strength Method" as per Appendix 4.
 - d. Full scale performance testing as per SDI-T-CD.
 - e. Other methods approved by the authority having jurisdiction.
3. Resistance to limit states other than flexure shall be determined in accordance with the other provisions of Section 2.4B.
4. Deck shall be evaluated for strength under the load combinations required by the applicable building code. In the absence of a building code, the load combinations prescribed by ASCE 7 shall be used.
5. Load Determination: The superimposed load capacity shall be determined by deducting the weight of the slab and the deck from the total load capacity. Unless composite deck-slabs are designed for continuity, slabs shall be assumed to act on simple spans.

Commentary: Most published live load tables are based on simple span analysis of the composite system; that is, a continuous slab is assumed to crack over each support and to carry load as a series of simple spans.

Commentary: By using the reference analysis techniques or test results, the deck manufacturer determines the live loads that can be applied to the composite deck-slab combination. The results are usually published as uniform load tables. For most applications, the deck thickness and profile is selected so that shoring is not required; the live load capacity of the composite system is usually more than adequate for the superimposed live loads. In calculating the section properties of the deck, AISI S100 may require that compression zones in the deck be reduced to an "effective width," but as tensile reinforcement, the total area of the cross section may be used. (See Appendix 5)

Coatings other than those tested may be investigated, and if there is evidence that their performance is better than that of the tested product, additional testing may not be required.

6. Concrete: Specified concrete compressive strength (f'_c) shall comply with Section 2.1 and shall not be less than 3000 psi (21 MPa), nor less than that required for fire resistance ratings or durability.

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Commentary: Load tables are generally calculated by using a concrete strength of 3000 psi (21 MPa). Composite slab capacities are not greatly affected by variations in concrete compressive strength; but if the strength falls below 3000 psi (21 MPa), it would be advisable to check shear anchor design for composite beam action.

- a. Minimum Cover: The concrete thickness above the top of the steel deck shall not be less than 2 inches (50 mm), nor that required by any applicable fire resistance rating requirements. Minimum concrete cover for reinforcement shall be in accordance with ACI 318 Section 20.6.1.
- 7. Deflection: Deflection of the composite slab shall be in accordance with the requirements of the applicable building code.
 - a. Cross section properties shall be calculated in accordance with Appendix 5.
 - b. Additional deflections resulting from concrete creep, where applicable, shall be calculated by multiplying the immediate elastic deflection due to the sustained load by the following factors:
 - i. (1.0) for load duration of 3 months
 - ii. (1.2) for load duration of 6 months
 - iii. (1.4) for load duration of 1 year
 - iv. (2.0) for load duration of 5 years.

Commentary: Live load deflections are seldom a controlling design factor. A superimposed live load deflection of span/360 is typically considered to be acceptable. The deflection of the slab/deck combination can be predicted by using the average of the cracked and uncracked moments of inertia as determined by the transformed section method of analysis. Refer to Appendix 5 of this Standard or SDI-FDDM.

Commentary: Limited information on creep deflections is available. This method is similar to the procedure for reinforced concrete slabs. Because the steel deck initially carries the weight of the concrete when constructed without shoring, only the superimposed loads should be considered when creep deflections are a concern. When shoring is used, the weight of the concrete should be considered in the loads which contribute to creep.

Commentary: Floor vibration performance is the result of the behavior of entire floor system, including the support framing. The designer should check vibration performance using commonly accepted methods, which may include AISC Design Guide No. 11.

- 8. Special Loads: The following loads shall be considered in the analysis and calculations for strength and deflection:
 - a. Suspended Loads.
 - b. Concentrated Loads
 - c. Moving Loads
 - d. Cyclic Loads

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9. One-way Shear Strength: This section shall be used to determine the one-way shear strength of the composite deck-slab.

LRFD:

$$\phi V_n = \phi_v V_c + \phi_s V_D \leq \frac{\phi_v 4 \sqrt{f'_c} A_c}{1000} \quad (\text{Eq. 2.4.7a}) \text{ (USCS)}$$

$$\phi V_n = \phi_v V_c + \phi_s V_D \leq \phi_v 0.332 \sqrt{f'_c} A_c \quad (\text{Eq. 2.4.7b}) \text{ (SI)}$$

ASD:

$$V_n / \Omega = V_c / \Omega_v + V_D / \Omega_s \leq \frac{4 \sqrt{f'_c} A_c}{1000 \Omega_v} \quad (\text{Eq. 2.4.7c}) \text{ (USCS)}$$

$$V_n / \Omega = V_c / \Omega_v + V_D / \Omega_s \leq \frac{0.332 \sqrt{f'_c} A_c}{\Omega_v} \quad (\text{Eq. 2.4.7d}) \text{ (SI)}$$

Where:

$$V_c = 2\lambda \sqrt{f'_c} A_c \quad (\text{Eq. 2.4.8a}) \text{ (USCS)}$$

$$V_c = 0.166\lambda \sqrt{f'_c} A_c \quad (\text{Eq. 2.4.8b}) \text{ (SI)}$$

V_D	=	nominal shear strength of the steel deck section calculated in accordance with AISI S100, kips (kN)
A_c	=	concrete area available to resist shear, in ² (mm ²), see Figure 2-1.
f'_c	=	specified compressive strength of concrete, psi (MPa)
λ	=	1.0 where concrete density exceeds 130 lbs/ft ³ (2100 kg/m ³); 0.75 where concrete density is equal to or less than 130 lbs/ft ³ (2100 kg/m ³).
ϕ_v	=	0.75
ϕ_s	=	0.85
Ω_v	=	2.00
Ω_s	=	1.75

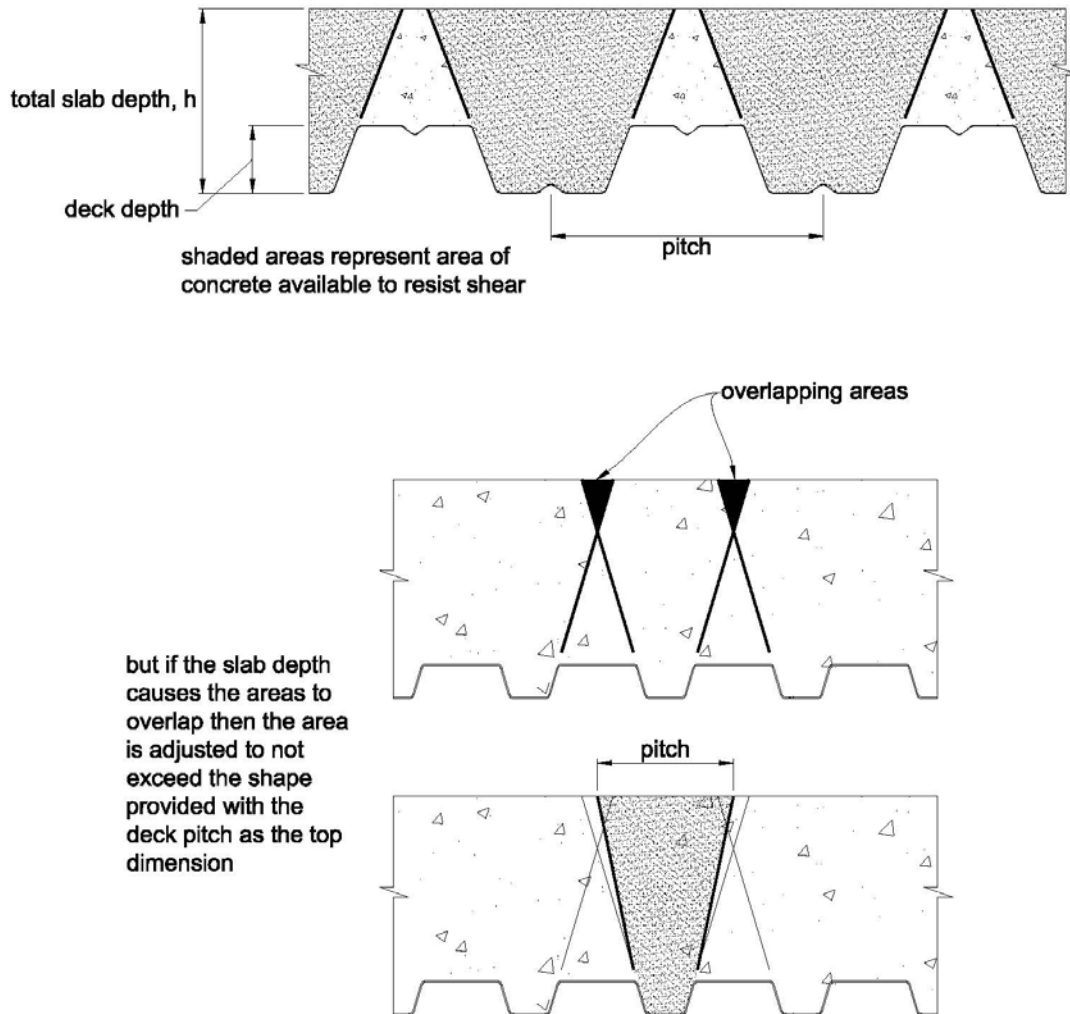


Figure 2-1 One-Way Shear Parameters

User Note: The area of the concrete, A_c defined in Figure 2-1 is relative to the pitch width of the steel deck. The vertical shear strength of two webs of the steel deck should be used in combination with A_c in Equation 2.4.8a or b. The vertical shear strength is then for the pitch width of the deck. This may be converted to a unit width basis by multiplying by the ratio of the unit width to the pitch width of the steel deck.