

1. Scope

This specification and commentary pertains to the use of non-composite steel deck as a form for reinforced concrete slabs.

2. Materials

2.1 The steel deck units shall be manufactured from steel conforming to ASTM designation for grades A653, Structural Quality Grades 33, 37, 40, 50 or 80. The unit design stress shall not exceed the yield strength multiplied by 0.60, with a maximum of 36 ksi.

Commentary: Most of the "centering" materials are offered in grade 80 steel (ASTM A611 or A446); this steel, has a minimum yield strength of 80 ksi and is generally over 90 ksi. In the past, 30 ksi design stress was used for grade 80 material; however, the AISI specifications now allow a design stress of 36 ksi.

Commentary: Finishes available are:
1. Galvanized (Conforming to ASTM A525);

Centering materials are usually available galvanized or uncoated. When unshored galvanized material is used to support a reinforced concrete slab, the weight of the slab, the weight of the slab is considered to be permanently carried by the deck; when uncoated or painted deck is used to support a reinforced concrete slab the form is considered impermanent and the weight of the concrete should be deducted from the load capacity of the reinforced slab.

For any permanent load curing function, a minimum galvanized coating conforming to ASTM A525, G60 is recommended.

3. Design

3.1 The section properties for the steel deck unit shall be computed in accordance with American Iron and Steel Institute, Specification for the Design of Cold-Formed Steel Structural Members, 1980 edition.

3.2 Deck used as a form for structural (reinforced) concrete slab:

3.2a Stress shall not exceed 0.60 times the yield strength with a maximum of 36 ksi under the combined weights of wet concrete, deck and the following construction live loads: 20 pounds per square foot uniform load or 150 pound concentrated load on a 1'-0" wide section of deck. Loads shall be applied in a manner which stimulated the sequence of concrete placement.

See Figure 1.

3.2b: Calculated Form Deflection shall be based on the weight of the wet concrete (as determined by the design slab thickness) and on the weight of the steel deck, uniformly loaded on all spans, and shall be limited to L/180 or ¾ inch, whichever is smaller.

Deflection shall be relative to supporting member.

See Figure 2.

Commentary: The deflection limitation of L/180 or ¾ inches are intended to be minimum requirements. Architectural or other considerations may influence the designer to use more stringent limitation.

3.2c The bearing length of applicable profiles shall be determined in accordance with the AISI specification; the uniform loading case of wet concrete plus deck weight plus 20 pounds per square foot construction load shall be used. Minimum bearing shall be 1 ½" unless otherwise shown.

Commentary: Form decks made of grade # steel may have a radius to thickness ratio not covered by the AISI specification. Experience has shown that 1 ½" of bearing is sufficient for these decks. If less than 1 ½" is available for any form deck, or if high support reactions are expected, the deck must be adequately attached to the structure to prevent slip off.

3.2d: Design of the concrete slabs shall be done in accordance with the ACI 318 Building Code. Either Working Stress Design of Ultimate Strength Design may be used. The cover over the top of the deck shall not be less than 1 ½".

Commentary: In the following the ACI 318 requirements for temperature reinforcement, the designer may eliminate the concrete area that is displaced by the deck rib.

For slabs with total depth of 3" or less, the reinforcing mesh may be considered to be at the center of the concrete above the deck. See Figure 3. If uncoated or painted deck is used as the form, the weight of the concrete slab must be deducted from the allowable live load of the reinforced concrete slab. If galvanized form is used, the weight of the slab is considered to be permanently carried by the deck and need not be deducted from the live load. If temporary shoring is used, the weight of the slab must be deducted from the allowable live load of the reinforced slab regardless of the finish.

Except form some diaphragm values, the deck should not be assumed to act

compositively with the concrete even though strong chemical bonds, can and do, develop.

4. Installation & Site Storage

4.1 Site Storage: Steel deck shall be stored off the ground with one (1) end elevated to provide drainage and shall be protected from the elements with a waterproof covering, ventilated to avoid condensation.

4.2 Fastening:

4.2a Deck sheets shall be welded to supporting steel immediately after alignment. Welding washers shall be used on all deck units with metal thickness less than 0.028 inches thick; welding washers shall be a minimum thickness of 0.0568 inches (16 gauge) and have a nominal 3/8" diameter hole. Where welding washers are not used, a nominal 0.626 inch (5/8") diameter arc puddle weld shall be used.

Commentary: Steel deck, when adequately attached, provides lateral support to the compression flanges of supporting structural steel sections.

4.2b Deck units with spans greater than five feet shall have side laps fastened at midspan or 36" intervals – whichever is smaller.

4.2c Laps and Butted Ends: Deck ends may be either butted or lapped over supports. Standard tolerance for ordered length is plus or minus ½ inch.

***Commentary: See Figure 4.** For minimum frame fastening patterns. Side lap fasteners can be welds, screws, crimps (button punching), or other method approved by the designer. The frame fastening shown in figure 4 and the side lap fastening of 4.2b ARE MINIMUM REQUIREMENTS. The SKI Diaphragm Design Manual, Second Edition, should be used to determine fastening requirement. When the deck will be designed to resist horizontal loads, the most stringent fastening requirements, of this specification or the Diaphragm Design Manual, should be used. One objective of side lap fastening is to prevent differential sheet deflection (opening of side lap) during concrete loading. The five foot span limitation on side lap fastener spacing is based on experience. Welding steel deck side laps with base metal thickness less than 0.028 inches may cause large burn holes and is not recommended.

The deck contractor should not leave loose deck at the end of the day as the wind may displace the sheets and cause injury to persons or property. If studs are being welded to the top flange of the beams, then deck sheets

should be butted over supports. Gaps are acceptable at butted ends.

Staggering floor deck end lap is not recommended practice. The deck capacity as a dorm is not increased by staggering the lap ends; layout and erection costs are increased.

4.3 Mechanical Features

Power-actuated, screws, pneumatically-drive fasteners, etc., are recognized as viable anchoring methods, providing the type and spacing of said fastener satisfies the design criteria. Documentation in the form of test data, design calculations, or design charts should be submitted by the fastener manufacturer on the basis for obtaining approval. The deck manufacturer may recommend additional fasteners to stabilize the given profile against sideslip of any unfastened ribs.

4.4 Construction Practice

The need for temporary shoring shall be investigated and, if required, it shall be designed and installed in accordance with the applicable ACI Code and shall be left in place until the slab attains 75% of its strength. Prior to concrete placement, the steel deck shall be free of soil, debris, standing water, loose mill scale or coating, and all other foreign matter. Care must be exercised when placing concrete so that the deck will not be subjected to any impact that exceeds the design capacity of the deck. Concrete shall be placed in a uniform manner over the supporting structure and spread towards the center of the deck span. If buggies are used they shall only operate on planking. Planks shall be of adequate stiffness to transfer loads to the steel deck without damaging the deck. Deck damage caused by roll bars or careless placement must be avoided.

4.4a All deck sheets shall be adequate bearing and fastening to all supports so as not to lose support during construction. Deck areas subject to heavy or repeated traffic, concentrated loads, impact loads, wheel loads, etc. shall be adequately protected by planking or other approved means to avoid overloading and/or damage. Damaged deck (sheets containing distortions or deformations caused by construction practices) shall be repaired, replaced, or shored to the satisfaction of the architect before placing concrete. The cost of repairing, replacing, or shoring of damaged units shall be the liability of the trade contractor for responsible for the damage.

Commentary: For temporary construction loads prior to concreting, it should be safe to assume that the deck will support a minimum uniform load of 50 psf without further investigation.

4.4b The need for temporary shoring shall be investigated and, if required, it shall be designed and installed in accordance with the applicable ACI Code and shall be left in place until the lab attains 75% of its specified compressive strength.

4.4c Prior to concrete placement, the steel deck shall be free of oil debris, standing water, loose mill scale and all other foreign matter.

4.4d Care must be exercised when placing concrete so that the deck will not be subjected to any impact that exceeds the design capacity of the deck. Concrete shall be placed from a low level to avoid impact in a uniform manner over the supporting structure and spread toward the center of the deck span. If buggies are used to

place the concrete, runways shall be planked and the buggies shall only operate on planking. Planks shall be of adequate stiffness to transfer loads to the steel deck without damaging the deck. Deck damage caused by roll bars or careless placement must be avoided.

4.5 Information
Steel form deck may be used in a variety of ways, some of which do not blend themselves to a standard "steel deck" analysis for span and loading. There are, in these cases, other criteria

which must be considered besides that give by the Steel Deck Institute. Make sure that this investigation starts with a review of the applicable Codes and that any special conditions are included in the design.

4.6 Fireproofing
The metal deck manufacturer shall not be responsible for the cleaning of the underside of metal deck to ensure bond of fireproofing. Adherence of fireproofing materials is dependent on many variables; the deck manufacturer (supplier) is not responsible for the adhesion or adhesive ability of the fireproofing.

FIGURE 1

Loading Diagrams and Bending Moments

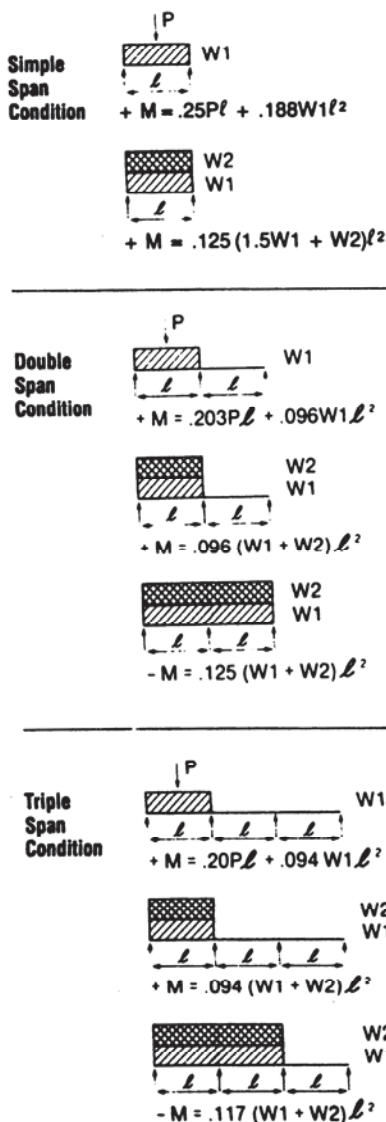
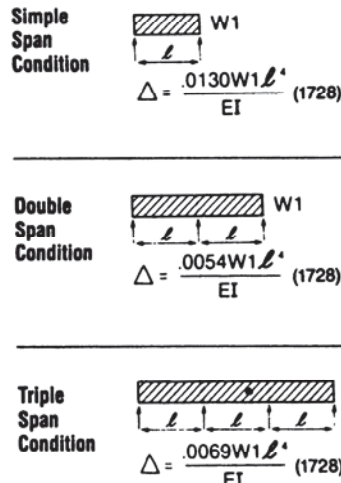


FIGURE 2

Loading Diagrams and Deflections



Notes for Figures 1, 2 and 3
 P = 150-pound concentrated load
 W1 = slab weight + deck weight
 W2 = 20 pounds per square foot construction load
 l = span length (ft.)

FIGURE 3

Form Deck Typical Slabs

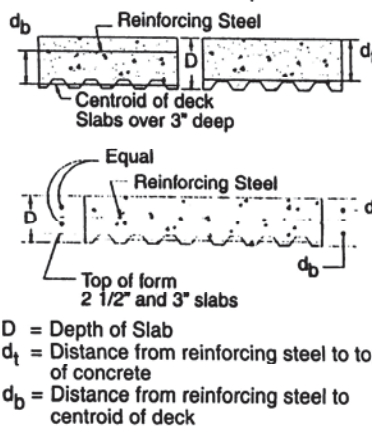
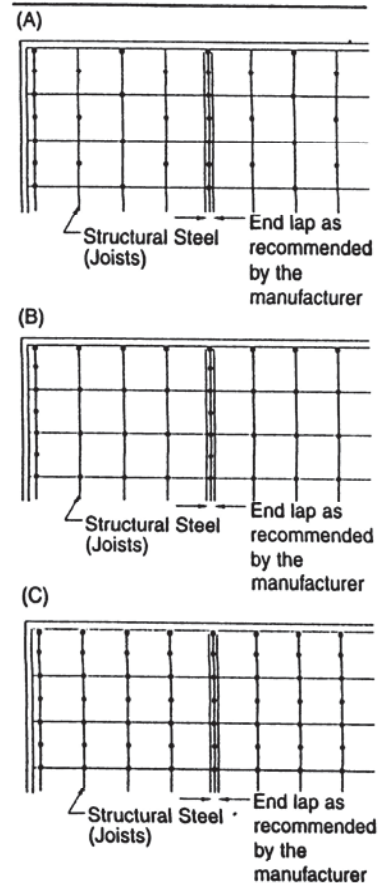


FIGURE 4

Minimum Fastening Patterns



Intermediate side lap attachments not shown. See Section 4.4 Anchorage non-composite steel form deck.

Note:
 Fastener patterns A and B are for deck spans up to 4'-6". Fastener pattern C is for deck spans from 4'-6" to 8'-0". If spans exceed 8'-0", fastener should be placed so that the average spacing (at supports is not more than 12".