
DESIGN PROCEDURES FOR STEEL DECK DIAPHRAGMS WITH STRUCTURAL CONCRETE FILL

IR 22-1

References:

2001 California Building Code (CBC), Section 2205A.4.1
2007/2010 CBC, Section 2209A.3

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Discipline: Structural

This Interpretation of Regulations (IR) is intended for use by the Division of the State Architect (DSA) staff, and as a resource for design professionals, to promote more uniform statewide criteria for plan review and construction inspection of projects within the jurisdiction of DSA which includes State of California public elementary and secondary schools (grades K-12), community colleges and state-owned or state-leased essential services buildings. This IR indicates an acceptable method for achieving compliance with applicable codes and regulations, although other methods proposed by design professionals may be considered by DSA.

This IR is reviewed on a regular basis and is subject to revision at any time. Please check the DSA web site for currently effective IRs. Only IRs listed in the document at <http://www.dgs.ca.gov/dsa/Resources/IRManual.aspx> at the time of plan submittal to DSA are considered applicable.

Purpose: The purpose of this Interpretation of Regulations (IR) is to provide guidelines and limitations, additional to the California Building Code (CBC), for the design of steel deck composite diaphragms with structural concrete fill.

1. General: Designs of metal deck diaphragms with concrete weighing from 95 to 150 pounds per cubic foot, detailed in accordance with International Code Council Evaluation Service (ICC ES) Evaluation Service Reports (ESR), will be accepted at 80% of the Report values. For projects submitted to DSA under the 2007 and 2010 CBC, 100% of the ESR value will be accepted if the report values were based on test data, per ICC-ES AC-43 (CBC, Section 2209A.3).

Where diaphragm shears exceed 80% of the ESR values, the structural concrete fill is to be designed to resist the entire horizontal load, in accordance with CBC, Section 1901A.2 (Section 1911A in the 2001 CBC).

2. Shear Transfer: Transfer lateral loads to chords, reaction members and drags as follows:

2.1 Diaphragms with Shears Not Greater than 80% of ESR Shear Value: Shear may be transferred entirely by welding the metal deck to the steel framing in accordance with the ESR, except use weld values given in Table J2.5 (AISC, 360-05).

The first sheet of steel decking adjacent and parallel to chords, reaction members and drags (on one or both sides as applicable) is required to be a full width sheet. This arrangement will reduce the shear in the concrete along the line of the first seam and will provide maximum bond area of concrete to deck in the most highly stressed regions.

2.2 Diaphragms Using Structural Concrete Fill to Resist the Entire Shear: Transfer lateral loads directly from the concrete by means of dowels or welded shear connectors to the building frame. Do not consider deck welding to be part of the shear transfer connection.

Use allowable shear values for dowels equal to the values for bolts of the same diameter as given in 2007/2010 CBC, Section 1911A for Allowable Design Load (ASD) and 1912A for Load Resistance Factor Design (LRFD) (for projects submitted under the 2001 CBC, see Table 19A-D and Section 1923A). Note that allowable shear values for welded connectors given in Section I1.3 of AISC 360-05 are for composite design only, and allowable values for diaphragm shear transfer to drag members,

reaction members and chords, etc., are subject to the CBC required reduction on the available strength per 2010 CBC Section 2204A.1.3 (2007 CBC, Section 2204A.1.2).

Please note that the reduction is different between the 2007 and 2010 editions of the CBC. The reduction is 67% and 25% for projects under the 2007 and the 2010 CBC respectively. This reduction is not applicable to community college projects under the provisions of IBC.

3. Reinforcing for Concrete Slabs on Metal Deck:

- 3.1** The minimum requirements for reinforcing steel in structural concrete fill on metal deck may not be less than the minimum called for in CBC, Section 1907A.12.
- 3.2** Provide temperature and shrinkage reinforcement perpendicular to the direction of the ribs with an area not less than that specified in CBC, Section 1907A.12, considering the net area of the concrete above the ribs. Provide slab reinforcement parallel to the ribs which is not less than that used in establishing diaphragm shear values as shown in ICC-ES AC 43. Provide continuity and other special reinforcement as required by calculations.