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ESR-2494

Reissued 09/2017
This report is subject to renewal 09/2019.

DIVISION: 03 00 00—CONCRETE
SECTION: 03 21 00—REINFORCING STEEL

REPORT HOLDER:

DECON, INC.

35 DEVON ROAD
BRAMPTON, ONTARIO L6T 5B6
CANADA

EVALUATION SUBJECT:

DECON® STUDRAILS®

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Section: 03 21 00—REINFORCING STEEL

REPORT HOLDER:

DECON, INC.
35 DEVON ROAD
BRAMPTON, ONTARIO L6T 5B6
CANADA
(905) 458-5855
www.deconusa.com

EVALUATION SUBJECT:

DECON® STUDRAILS®

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2012, 2009 and 2006 *International Building Code*® (IBC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

Structural

2.0 USES

Decon® Studrails® are used as shear reinforcement in flat concrete slabs to replace stirrups, drop panels or column capitals in increasing the punching shear resistance of the slabs.

3.0 DESCRIPTION

3.1 General:

Decon Studrails are large-head shear studs that are welded to steel plates. The assembly complies with the requirements of ASTM A1044. The available stud sizes and corresponding head dimensions are shown in Table 1.

3.2 Materials:

3.2.1 Shear Studs: The shear studs are formed from ASTM A108 Grades 1010 through 1020 steel and conform to the following physical and mechanical requirements prescribed in Table 1 of ASTM A1044:

- Yield strength: 51,000 psi (350 MPa), minimum.
- Tensile strength: 65,000 psi (450 MPa), minimum.
- Elongation: 20 percent in 2 inches (51 mm).
- Reduction of area: 50 percent, minimum.
- Dimensions of the shear studs are shown in Table 1.

3.2.2 Base Rails: The rails are formed from CSA 44W steel and conform to the following physical and mechanical requirements of Table 2 of ASTM A1044:

- Yield strength: 44,000 psi (300 MPa), minimum.
- Tensile strength: 65,000 psi (450 MPa), minimum.
- Elongation: 20 percent in 8 inches (203 mm).

Dimensions of the rails are shown in Table 1.

3.2.3 Stud Welding: The studs are factory-welded to the rails in conformance with ASTM A1044, AWS D1.1 and the Decon quality documentation.

4.0 DESIGN AND INSTALLATION

4.1 General:

Installation of the stud/plate assemblies must comply with Sections 3.5.5, 7.7.5 and 11.11.5 of ACI 318-11 for the 2012 IBC (ACI 318-08 for the 2009 and 2006 IBC), and the approved plans. The specified yield strength of transverse reinforcement, f_{yt}, must not exceed the specified yield strength of the shear studs defined in Section 3.2.1 of this report.

The structural design must determine and specify the following items, based on design requirements in this report:

a. The number of studs per rail

b. Stud spacing(s)

c. Studrail overall assembly height (OAH)

d. Rail length (OAL)

e. Distance between column face and first line of studs (s_o)

f. Stud size

g. Stud/rail material specifications

h. Rail thickness, width and length

4.2 Earthquake-resistant Structures:

4.2.1 General: The provisions in this section apply to structures in Seismic Design Categories C, D, E, and F. Lateral force–resisting elements of the structure must be designed in accordance with the IBC.

4.2.2 Shear Strength: The nominal shear strength provided by concrete in the presence of the headed shear stud reinforcement referenced in Section 11.11.5 of ACI

318-11 (ACI 318-08 for the 2009 and 2006 IBC), must be revised as follows:

$$V_c = 1.5\lambda\sqrt{f'_c}(b_0 d) \qquad \text{Eq. (1)}$$

This revision requires the nominal shear strength, V_n, and the nominal shear stress, v_n, to be revised accordingly.

Two-way slabs without beams not designated as part of the seismic-force-resisting system must comply with Section 21.13.6 of ACI 318-11 (ACI 318-08 for 2009 and 2006 IBC), except that V_c must be limited as set forth in Eq. (1) of this report, and the design story drift ratio specified in Section 21.13.6(b) of ACI 318-11 (ACI 318-08 for the 2009 and 2006 IBC) must not exceed the drift ratio specified in Table 12.12-1 of ASCE/SEI 7-10 (ASCE/SEI 7-05 for the 2009 and 2006 IBC).

4.3 Installation:

Installation must comply with IBC Chapter 19 and the approved engineering plans. Concrete cover must comply with ACI 318-11 Section 7.7 (Section 1907.7 for the 2009 and 2006 IBC). Figure 1 shows typical details.

4.4 Special Inspection:

Special inspection of studrails and their installation at the jobsite must comply with Section 1705.3 of the 2012 IBC (Section 1704.4 of the 2009 and 2006 IBC). The special inspector is responsible for verifying identification of the studrail per Section 7.0 of this report, along with its condition, location, positioning, clearances, and concrete cover.

5.0 CONDITIONS OF USE

The Decon Studrails described in this report comply with, or are suitable alternatives to what is specified in, those codes noted in Section 1.0 of this report, subject to the following conditions:

5.1 The welded and fabricated shear stud reinforcement plate assemblies must be designed and installed in accordance with the applicable code, this report (Sections 4.1 and 4.2 for structural design; Section 4.3 for installation) and the manufacturer's instructions. In case of conflict between the manufacturer's published installation instructions and this report, this report governs.

5.2 Calculations and details demonstrating that the applied loads are less than the resistance of the reinforced concrete must be submitted to the code official for approval. Calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.3 The design for the finished assemblies must specify the details described in Section 4.1.

5.4 Special inspection must be provided in accordance with Section 4.4 of this report.

5.5 The studrails are fabricated at the Continental Decon, Inc., facility located in Ontario, Canada, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Headed Shear Stud Reinforcement Assemblies for Concrete Slabs or Footings (AC395), dated October 2008 (editorially revised February 2012).

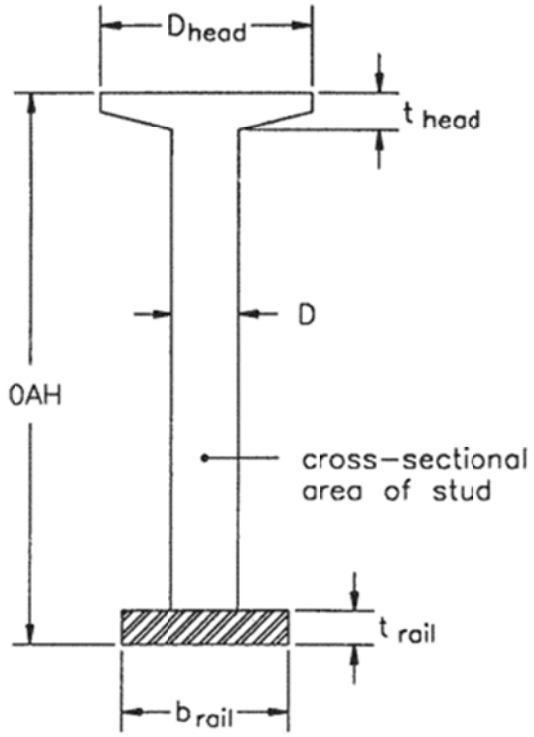
7.0 IDENTIFICATION

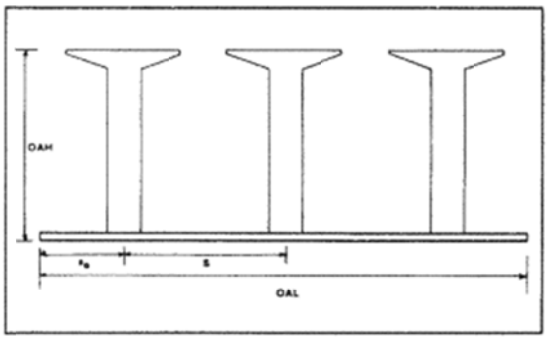
Decon Studrails are identified on packaging with the part name, part number, manufacturer's name and address, and evaluation report number (ESR-2494).

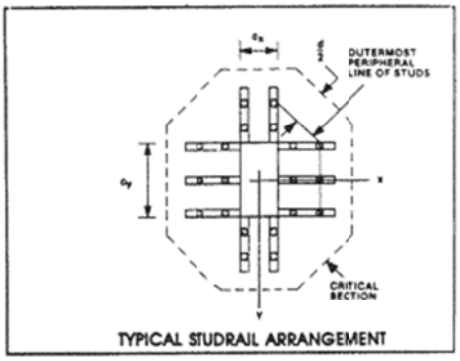
TABLE 1—DECON STUDRAIL DIMENSIONS

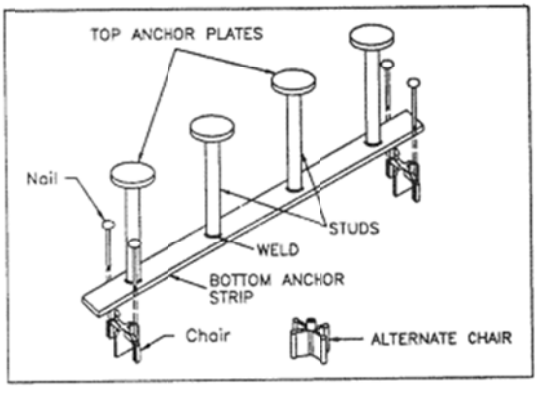
D in. (mm)	X–sect. area in^2 (mm^2)	D_{head} in. (mm)	t_{head} in. (mm)	b_{rail} in. (mm)	t_{rail} in. (mm)
3/8 (9.5)	0.110 (71)	1.19 (30.1)	0.21 (5.3)	1 (25.4)	3/16 (4.8)
1/2 (12.7)	0.196 (127)	1.58 (40.2)	0.28 (7.1)	1–1/4 (31.8)	1/4 (6.5)
5/8 (15.9)	0.307 (199)	1.98 (50.2)	0.35 (8.9)	1–3/4 (44.5)	5/16 (7.9)
3/4 (19.1)	0.442 (287)	2.37 (60.2)	0.42 (10.7)	2 (50.8)	3/8 (9.5)

Note: Overall height (OAH) of the stud is determined by the slab thickness and the required concrete cover.









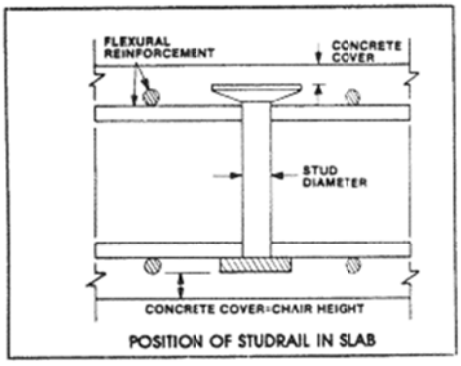


FIGURE 1—TYPICAL DETAILS