



EVALUATION SUBJECT: DAYTON SHEAR RESISTANCE SYSTEM

REPORT HOLDER:

Dayton Superior Corporation
1125 BYERS RD
MIAMISBURG, OH 45342
(800) 745-3700
www.daytonsuperior.com

CSI Division: 03 00 00 Concrete

CSI Section: 03 21 00 Reinforcing Steel

1.0 SCOPE OF EVALUATION

1.1 Compliance to the following codes & regulations:

- 2015, 2012 and 2009 International Building Code® (IBC)

1.2 Evaluated in accordance with:

- ICC-ES AC395, approved October 2008 (Editorially revised February 2016)

1.3 Properties assessed:

- Structural

2.0 PRODUCT USE

The Dayton Shear Resistance System (DSR) D-140 Series complies with IBC Chapter 19 and ACI 318-14 Section 20.5.1 (ACI 318-11 and -08 Section 3.5.5.1) as headed shear stud reinforcement assemblies in flat concrete slab and footing locations.

3.0 PRODUCT DESCRIPTION

3.1 Product information: The DSR is a headed shear stud assembly, comprised of single-headed steel studs welded to a steel base rail. The assemblies comply with ASTM A1044, in accordance with Section 20.5.1 of ACI 318-14 (Section 3.5.5.1 of ACI 318-11 and -08). Stud and rail dimensions are given in Tables 1 and 2 of this report, respectively. Figures 1 and 2 of this report illustrate the characteristic DSR D-140 headed shear stud reinforcement stud rail assembly. The number of studs per rail, stud spacing, stud rail assembly height and length, and distance from the end of the plate to the first stud shall be determined by the project-specific structural design.

3.2 Material information

3.2.1 Headed Studs: The headed studs are formed from steel bars conforming to ASTM A29 Grades 1010 through 1020, and satisfy the tensile requirements in ASTM A1044, as follows:

- Yield strength: 51,000 psi (350 MPa), minimum.
- Tensile strength: 65,000 psi (450 MPa), minimum.
- Elongation: 20 percent in 2 inches (51 mm), minimum.
- Reduction of area: 50 percent, minimum.

3.2.2 Base Rails: The rails are cut from steel plates conforming to ASTM A36, and satisfy the tensile requirements as follows:

- Yield strength: 44,000 psi (300 MPa), minimum.
- Tensile strength: 65,000 psi (450 MPa), minimum.
- Elongation: 20 percent in 8 inches (200 mm), minimum.

4.0 DESIGN AND INSTALLATION

4.1 Design

4.1.1 General: Design for shear strength shall comply with Chapters 8 and 22 of ACI 318-14 (Chapter 11 of ACI 318-11 and -08), including specific provisions for headed shear stud reinforcement in slabs and footings in Sections 8.7.7 and 22.6.8 of ACI 318-14 (Section 11.11.5 of ACI 318-11 and -08). The following information shall be determined on a case-by-case basis in accordance with the applicable provisions in Section 8.7.7.1 of ACI 318-14: number of studs per stud rail assembly; stud diameter; stud spacing; stud rail assembly height and length; and distance between column face and first line of studs.

4.1.2 Earthquake Loads: In Seismic Design Categories C, D, E, and F, the headed shear stud reinforcement assemblies at slab-to-column connections shall conform to the following conditions:

1. Lateral force-resisting elements of the structure shall be designed in accordance with the IBC, ACI 318, and other referenced standards.
2. The nominal shear strength provided by concrete in the presence of shear studs, determined in accordance with Section 4.1.1 of this report, shall be calculated by (Eq-1):

$$V_c = 1.5 \lambda \sqrt{f'_c} b d \quad (\text{Eq.-1})$$

This value replaces the concrete shear strength determination in Section 22.6.6.1 and Table 22.6.6.1 of ACI 318-14 (Section 11.11.5.1 of ACI 318-11 and -08), and shall be used to determine the nominal shear strength, V_n , and the maximum shear stress, v_n as set forth in ACI 318.

3. The design of two-way slabs without beams, designated as part of the seismic force-resisting system, shall comply with Section 18.4.5.8 of ACI 318-14 (Section





21.3.6.8 of ACI 318-11 and -08), with the following exception:

- a. V_c shall be calculated by (Eq-1) of this report.

4. The design of two-way slabs without beams, which are not designated as part of the seismic force-resisting system, shall comply with the provisions in Section 18.14.5.1 of ACI 318-14 (Section 21.13.6 of ACI 318-11 and -08), with the following exceptions:

- a. V_c shall be calculated by (Eq-1) of this report.
- b. design story drift ratio shall be the lesser of the design story drift ratio given in Table 12.12-1 of ASCE/SEI 7 and design story drift ratio set forth in Section 18.14.5.1 of ACI 318-14 (Section 21.13.6(b) of ACI 318-11 and -08).

4.2 Installation: The Dayton Shear Resistance System shall be installed in accordance with the approved plans, the IBC, ACI 318, and the manufacturer's instructions. The approved plans shall be available on the jobsite at all times during installation. Surface conditions of the assemblies shall comply with Section 26.6.1.2 of ACI 318-14 (2015 IBC); Section 7.4 of ACI 318-11 (2012 IBC) or 1907.4 of the 2009 IBC. The headed shear stud reinforcement assemblies shall be installed in the positions specified in the approved plans. The furnished chairs shall be attached to the base rails of each DSR System rail and a chair top shall be placed over the chairs at each end of the DSR System rail. The chairs shall be fastened to the formwork using the blind holes in each chair leg. After the DSR System rails are in place, the reinforcing bars, post-tensioning tendons, conduit and other embedded items shall be placed in accordance with the approved plans. Placement shall comply with Section 26.6.2 of ACI 318-14 (2015 IBC); Section 7.5 of ACI 318-11 (2012 IBC) or Section 1907.5 of the 2009 IBC. Concrete cover shall comply with Section 20.6.1.3.5 of ACI 318-14; Section 7.7 of ACI 318-11 (2012 IBC) or 2009 IBC Section 1907.7. Figure 2 of this report provides typical installation details.

4.3 Special Inspection: Special inspection of the headed shear stud reinforcement assemblies and installation shall comply with 2015 and 2012 IBC Section 1705.3 or 2009 IBC Section 1704.4; and ACI 318-14 Section 26.13 (2015 IBC). The special inspector is responsible for verifying identification of the stud rail assembly in accordance with Section 7.0 of this report, condition of the assembly, placement, positioning, clearances and concrete cover.

5.0 LIMITATIONS

The Dayton Shear Resistance System described in this report complies with, or is a suitable alternative to what is specified in, the code indicated in Section 1.0 of this report, subject to the following conditions:

5.1 The stud rails shall be designed, manufactured and installed in accordance with this report, the approved plans, and the manufacturer's instructions. In the event of a conflict, the more restrictive governs.

5.2 Drawings and design details showing compliance with the design requirements of Section 4.1 of this report shall be submitted to the code official for approval. The drawings and calculations shall be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be constructed.

5.3 Special inspections shall be provided in accordance with Section 4.3 of this report.

5.4 The stud rails are manufactured in Surrey, British Columbia, Canada, under a quality control program with inspections by Progressive Engineering, Inc. (AA-699) and QAI Laboratories, Inc. (AA-723), respectively.

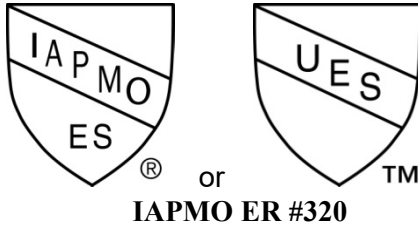
6.0 SUBSTANTIATING DATA

Data in accordance with the ICC-ES Acceptance Criteria for [Headed Shear Stud Reinforcement Assemblies for Concrete Slabs or Footings](#) (AC395)—Approved October 2008, Editorially Revised February 2016.



7.0 IDENTIFICATION

Bundles of the stud rails used in the Dayton Shear Resistance System are labeled with a tag showing the manufacturer's names (Dayton Superior and SRL Industries Ltd.) and address, the product name, project specific location information, the Uniform Evaluation Report Number (ER-320), one of the IAPMO UES marks shown below, and the name of the inspection agency (Progressive Engineering, Inc.).



Brian Gerber, P.E., S.E.
Vice President, Technical Operations
Uniform Evaluation Service

Richard Beck, PE, CBO, MCP
Vice President, Uniform Evaluation Service

GP Russ Chaney
CEO, The IAPMO Group

For additional information about this evaluation report please visit
www.uniform-es.org or email at info@uniform-es.org



Table 1—Shear Stud and Plate Dimensions (D140)

SD Shank Diameter in (mm)	HD Head Diameter in (mm)	HD/SD	SA Shank Area in ² (mm ²)	HA Head Shank Area in ² (mm ²)	HA/SA	HT Minimum Head Thickness in (mm)	PW Plate Width in (mm)	PT Plate Thickness in (mm)	PL Plate Length	ES Edge Spacing	SS Stud Spacing	OAH Overall Height	SL Stud Length
3/8 (9.5)	1.19 (30.1)	3.17	0.110 (71)	1.112 (718)	10	0.21 (5.3)	1.00 (25.4) or 1.25 (31.8)	0.188 (4.8) or 0.25 (6.5)	Determined by the registered design professional				
1/2 (12.7)	1.58 (40.2)	3.16	0.196 (127)	1.961 (1265)	10	0.28 (7.1)	1.25 (31.8)	0.25 (6.5)					
5/8 (15.9)	1.98 (50.2)	3.17	0.307 (199)	3.079 (1986)	10	0.35 (8.9)	1.75 (44.5)	0.3125 (7.9)					
3/4 (19.1)	2.37 (60.2)	3.16	0.442 (287)	4.412 (2846)	10	0.42 (10.7)	2.00 (50.8)	0.375 (9.5)					

For SI: 1 inch = 25.4 mm, 1 in² = 645 mm².

FIGURE 1—DSR D140 Shear Resistance System

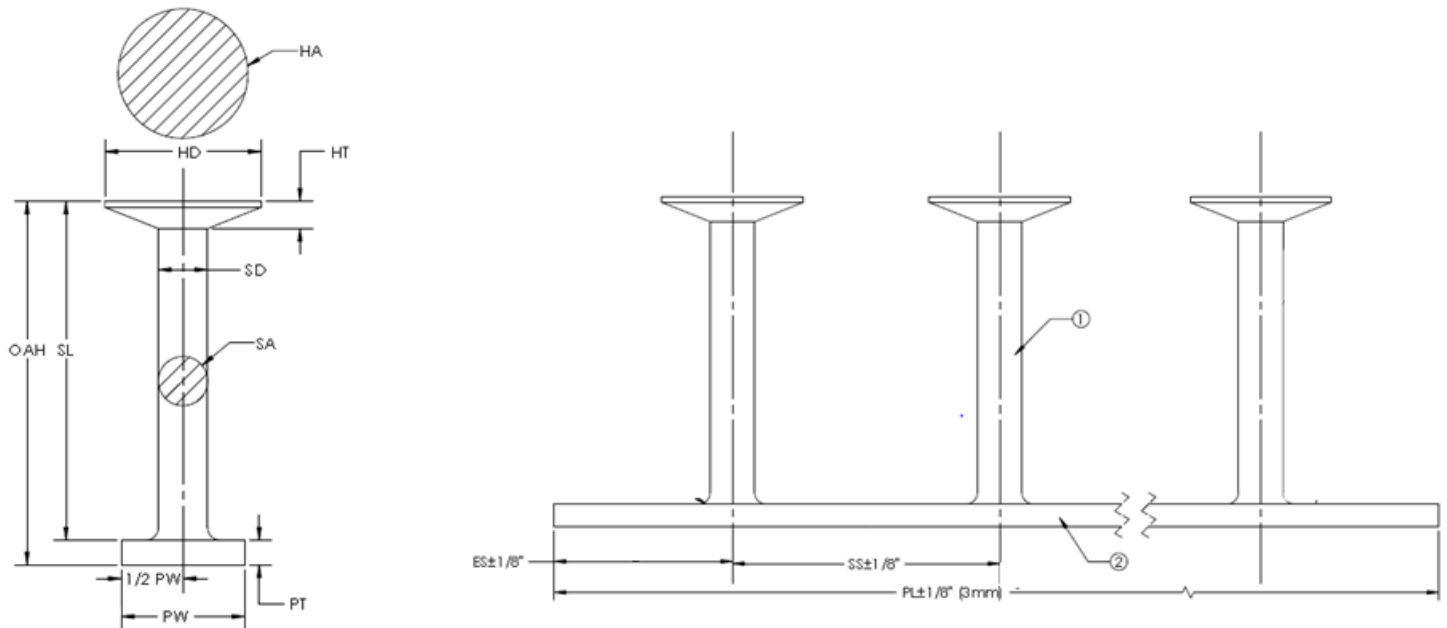




FIGURE 2—DSR D140 Shear Resistance System Typical Installation Details

