ICC-ES Evaluation Report

ESR-2938

Reissued March 2025

This report also contains:

- **CA Supplement**

Subject to renewal March 2026

DIVISION: 03 00 00—CONCRETE **Section: 03 15 00—Concrete Accessories** **Section: 03 21 00—Reinforcement Bars**	**REPORT HOLDER:** **SRL INDUSTRIES LTD.**	**EVALUATION SUBJECT:** **SRL PUNCHING SHEAR RESISTOR SHEAR RAILS**	

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021, 2018 and 2015 *International Building Code*® (IBC)
- 2012, 2009 and 2006 *International Building Code*®*
- 2013 *Abu Dhabi International Building Code* (ADIBC)*

*Codes indicated with an asterisk are addressed in Section 8.0.

Property evaluated:

Structural

2.0 USES

The SRL Punching Shear Resistor (PSR) Shear Rails are used as shear reinforcement in concrete slabs to replace stirrups, drop panels or column capitals to increase the punching shear resistance of the slabs.

3.0 DESCRIPTION

3.1 General:

The SRL PSR Shear Rails are reinforcement assemblies that are formed by welding large-headed shear studs to steel base rails. The studs are provided in $^{3}/_{8}$-, $^{1}/_{2}$-, $^{5}/_{8}$- and $^{3}/_{4}$-inch (9.5, 12.7, 15.9, and 19.1 mm) diameters. The stud dimensions are given in Table 1 and base rail dimensions are given in Table 2. The assembly configuration is shown in Figure 1.

The SRL PSR Shear Rails comply with the provisions of ASTM A1044.

3.2 Materials:

3.2.1 Studs: Studs are produced from ASTM A29 Grade 1010 through 1020 steel and conform to the following physical and mechanical requirements prescribed in Table 1 of ASTM A1044.

- Tensile strength, min, psi [MPa]: 65,000 [450]
- Yield strength, min, psi [MPa]: 51,000 [350]
- Elongation in 2 in. [50 mm], min, %: 20
- Reduction of area, min, %: 50

3.2.2 Base Rails: Base rails are produced from steel plates conforming to ASTM A36 and the following physical and mechanical requirements prescribed in Table 2 of ASTM A1044.

- Tensile strength, min, psi [MPa]: 65,000 [450]
- Yield strength, min, psi [MPa]: 44,000 [300]
- Elongation in 8 in. [200 mm], min, %: 20

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Structural design and installation of SRL PSR Shear Rails used as punching shear reinforcement in reinforced concrete slabs must comply with the applicable provisions of ACI 318.

4.2 Design Considerations: The structural design of SRL PSR Shear Rails must determine and specify the following items, based on design requirements in this report:

a. The number of studs per rail.

b. Stud shank diameter.

c. Base rail length.

d. Shear rail assembly overall height (OH), which must comply with Section 8.7.7.1.1 of ACI 318 (-19 and -14).

e. Stud spacing (s).

f. Distance between column face and first peripheral line of studs (S_o).

g. Arrangement of headed shear stud reinforcement, which must comply with Section 8.7.7.1.2 of ACI 318 (-19 and 14).

4.1.1 Earthquake Loads: The shear rail assembly may be used at slab-to-column connections of structures where the flat slab is used together with the primary seismic force–resisting systems in structures assigned to Seismic Design Categories C, D, E and F, such as concrete shear walls, under the following conditions:

4.1.3.1 General: Lateral force–resisting elements of the structure are designed using the IBC.

4.1.3.2 Shear Strength: The nominal shear strength provided by the concrete in the presence of the headed shear stud reinforcement, referenced in Section 22.6.6.1 of ACI 318 (-19 and -14), must be revised as follows:

$$V_c = 1.5\lambda\sqrt{f'_c}b_o d$$

This revision requires revisions to the nominal shear strength, V_n, and the maximum shear stress, v_n.

Two-way slabs without beams designated as part of the seismic-force-resisting system, must comply with the provisions in Section 18.4.5.8 of ACI 318 (-19 and -14), except that V_c must be limited as set forth in this section.

Two-way slabs without beams, which are not designated as part of the seismic-force-resisting system, must comply with the provisions in Section 18.14.5.1 of ACI 318 (-19 and -14), except that V_c must be limited as set forth in this section and the design story drift ratio specified in Section 18.14.5.1 of ACI 318 (-19 and -14) must not exceed the drift ratio referenced in Table 12.12-1 of ASCE/SEI 7.

4.3 Installation:

Installation of the SRL PSR shear rails must comply with the applicable code and the approved engineering plans. The SRL PSR shear rail assemblies must be positioned correctly around columns and set in accordance with the IBC and the approved construction documents. Concrete cover must comply with Section 20.5.1.3.6 of ACI 318-19 and Section 20.6.1.3.5 of ACI 318-14. See Figure 1 for typical installation details.

4.4 Special Inspection:

Special inspection of shear rail reinforcement and its installation at the jobsite is required in accordance with IBC Chapter 17. The special inspector is responsible for verifying identification of the shear rail assembly per Section 7.0 of this report, verifying the condition of the shear rail assembly, and verifying that the location, positioning, clearances, and concrete cover for the shear rail assemblies comply with the approved engineering drawings and the applicable code.

5.0 CONDITIONS OF USE:

The SRL PSR Shear Rails described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The shear rails must be designed, manufactured, and installed in accordance with this report and the approved plans. In the event of a conflict between this report and the approved plans, this report governs.

5.2 Design details and drawings must be in compliance with the design requirements of Section 4.1 of this report and must be approved by the code official. The calculations and drawings must be prepared by a registered design professional when required by the statutes of the jurisdiction in which the project is to be built.

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

5.4 The shear rails are manufactured at the SRL Industries facility in Surrey, British Columbia, 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 and Footings (AC395), dated June 2017 (editorially revised February 2022).

7.0 IDENTIFICATION

7.1 The SRL PSR shear rails are identified by a label which includes the part name, manufacturing date, manufacturer's name (SRL Industries Ltd.) and address, and the evaluation report number (ESR-2938).

7.2 The report holder's contact information is the following:

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101-18725 52nd AVENUE
SURREY, BRITISH COLUMBIA V3S 8E5
CANADA
(604) 575-3855
www.srlindustries.com

8.0 OTHER CODES

8.1 Scope:

In addition to the 2021, 2018 and 2015 IBC, the products described in this report were evaluated for compliance with the requirements of 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.

8.2 Uses:

See Section 2.0.

8.3 Description:

See Section 3.0.

8.4 Design and Installation:

8.4.1 Design:

8.4.1.1 General: Structural design and installation of SRL PSR Shear Rails used as punching shear reinforcement in reinforced concrete slabs must comply with the applicable provisions of ACI 318-11 for the 2012 IBC or AC318-08 for the 2009 IBC, as applicable. Under the 2006 IBC, compliance must be with ACI 318-05 and Sections 3.5.5, 7.7.5 and 11.11.5 of ACI 318-08.

8.4.1.2 Design Considerations: The structural design of SRL PSR Shear Rails must determine and specify the following items, based on design requirements in this report:

a. The number of studs per rail.
b. Stud shank diameter.
c. Base rail length.
d. Shear rail assembly overall height (OH), which must comply with Section 11.11.5 of ACI 318-11 or -08.
e. Stud spacing (s).
f. Distance between column face and first peripheral line of studs (S_o).

g. Arrangement of headed shear stud reinforcement, which must comply with Sections 11.11.5.2 and 11.11.5.3 of ACI 318-11 or -08.

8.4.1.3 Earthquake Loads: See Section 4.1.3.

8.4.1.3.1 General: See Section 4.1.3.1.

8.4.1.3.2 Shear Strength: The nominal shear strength provided by the concrete in the presence of the headed shear stud reinforcement, referenced in Section 11.11.5.1 of ACI 318-11 or 08, must be revised as shown in Section 4.1.3.2.

This revision requires revisions to the nominal shear strength, V_n, and the maximum shear stress, v_n.

Two-way slabs without beams designated as part of the seismic-force–resisting system, must comply with the provisions in Section 21.3.6.8 of ACI 318-11 or -08, except that V_c must be limited as set forth in Section 4.1.3.2.

Two-way slabs without beams, which are not designated as part of the seismic force–resisting system, must comply with the provisions in Section 21.13.6 of ACI 318-11 or -08 for the 2012 and 2009 IBC, respectively, or Section 21.11.5 of ACI 318-05 for the 2006 IBC, as applicable, except that V_c must be limited as set forth in Section 4.1.3.2 and the design story drift ratio specified in Section 21.13.6 ACI 318-11 or -08 or Section 21.11.5 of ACI 318-05, as applicable, must not exceed the drift ratio referenced in Table 12.12-1 of ASCE/SEI 7.

8.4.2 Installation: Installation of the SRL PSR shear rails must comply with the applicable code and the approved engineering plans. The SRL PSR shear rail assemblies must be positioned correctly around columns and set in accordance with the IBC and the approved construction documents. Concrete cover must comply with Section 7.7.5 of ACI 318-11 or -08. See Figure 1 for typical installation details.

8.4.3 Special Inspection: See Section 4.3.

8.5 Conditions of Use:

See Section 5.0.

8.6 Evidence Submitted:

See Section 6.0.

8.7 Identification:

See Section 7.0

TABLE 1—SRL PSR STUD DIMENSIONS

SHANK DIAMETER, D [in. (mm)]	HEAD DIAMETER, H [in. (mm)]	H/D RATIO	SHANK AREA, S_A [in.^{2} (mm^2)]	HEAD AREA, H_A [in.^{2} (mm^2)]	H_A/S_A RATIO	HEAD THICKNESS, T [in. (mm)]
3/8 (9.5)	1.19 (30.1)	3.17	0.110 (71)	1.112 (712)	10.1	0.26 (6.6)
1/2 (12.7)	1.58 (40.2)	3.16	0.196 (127)	1.961 (1,269)	10.0	0.33 (8.4)
5/8 (15.9)	1.98 (50.2)	3.17	0.307 (199)	3.079 (1,979)	10.0	0.40 (10.2)
3/4 (19.1)	2.37 (60.2)	3.16	0.442 (287)	4.412 (2,846)	10.0	0.47 (11.9)

TABLE 2—BASE RAIL DIMENSIONS

STUD SHANK DIAMETER, D [in. (mm)]	PLATE WIDTH, W [in. (mm)]	PLATE THICKNESS, TH [in. (mm)]	PLATE LENGTH
3/8 (9.5)	1.00 (25.4)	0.188 (4.8)	Determined by the registered design professional
1/2 (12.7)	1.25 (31.8)	0.250 (6.5)	
5/8 (15.9)	1.75 (44.5)	0.313 (7.9)	
3/4 (19.1)	2.00 (50.8)	0.375 (9.5)	

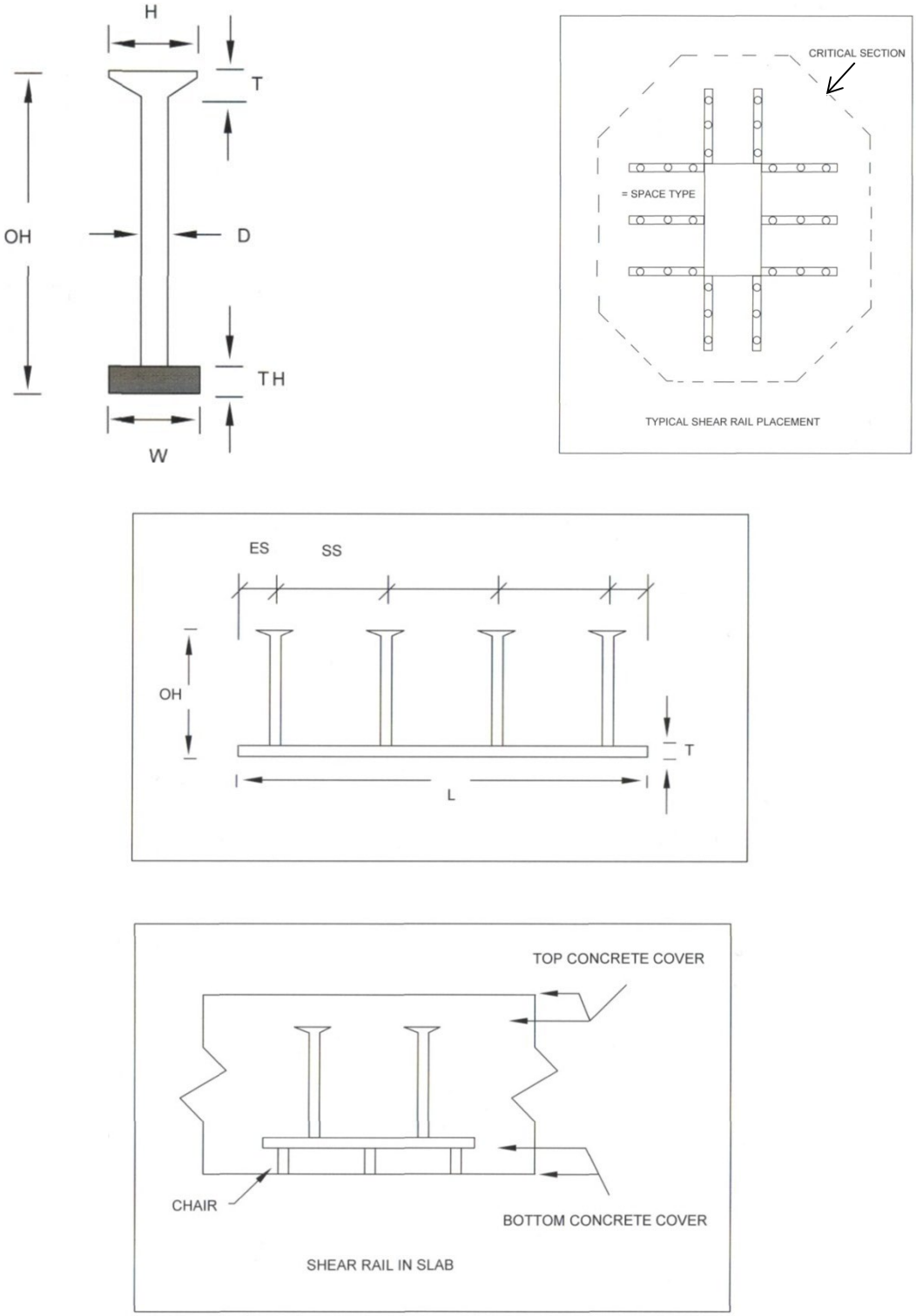

FIGURE 1—SRL PSR SHEAR RAIL DIAGRAM AND INSTALLATION

DIVISION: 03 00 00—CONCRETE
Section: 03 15 00—Concrete Accessories
Section: 03 21 00—Reinforcement Bars

REPORT HOLDER:

SRL INDUSTRIES LTD.

EVALUATION SUBJECT:

SRL PUNCHING SHEAR RESISTOR SHEAR RAILS

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the SRL Punching Shear Resistor Shear Rails, described in ICC-ES evaluation report ESR-2938, have also been evaluated for compliance with the code noted below.

Applicable code edition:

2022 *California Building Code* (CBC)

For evaluation of applicable Chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

2.0 CONCLUSIONS

2.1 CBC:

The SRL Punching Shear Resistor Shear Rails, described in Sections 2.0 through 7.0 of the evaluation report ESR-2938, comply with CBC Chapter 19, provided the design and installation are in accordance with the 2021 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapter 16, 17 and 19, as applicable.

2.1.1 OSHPD:

The applicable OSHPD Sections and Chapters of the CBC are beyond the scope of this supplement.

2.1.2 DSA:

The applicable DSA Sections and Chapters of the CBC are beyond the scope of this supplement.

This supplement expires concurrently with the evaluation report, reissued March 2025.