DIVISION: 03 00 00—CONCRETE
SECTION: 03 15 00—CONCRETE ACCESSORIES
SECTION: 03 21 00—REINFORCING STEEL

REPORT HOLDER:

JOBSITE STUD WELDING, INC.
6939 SCHAEFER AVENUE, BOX D-141
CHINO, CALIFORNIA 91710

EVALUATION SUBJECT:

JOBSITE STUD WELDING PUNCHING SHEAR RESISTOR SHEAR RAIL ASSEMBLIES

"2014 Recipient of Prestigious Western States Seismic Policy Council (WSSPC) Award in Excellence"
ICC-ES Evaluation Report

DIVISION: 03 00 00—Concrete
Section: 03 15 00—Concrete Accessories
Section: 03 21 00—Reinforcing Steel

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EVALUATION SUBJECT:

JOBSITE STUD WELDING PUNCHING SHEAR RESISTOR SHEAR RAIL ASSEMBLIES

1.0 EVALUATION SCOPE

Compliance with the following codes:

Property evaluated:
Structural

2.0 USES

The Jobsite Stud Welding (JSW) punching shear resistor (PSR) shear rail assemblies are large-headed shear studs that are welded to flat steel bars (base rails) and 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:
The JSW PSR shear rail assemblies are reinforcement assemblies that are formed by welding large-headed shear studs to flat steel base rails. The studs are 3/8", 1/2", 5/8" and 3/4-inch-diameter (9.5, 12.7, 15.9 and 19.1 mm) Tru-Weld studs recognized in ICC-ES evaluation report ESR-2822. The stud dimensions and base rail dimensions are given in Tables 1 and 2, respectively. The JSW PSR shear rail assembly and installation instructions are shown in Figures 1 and 2.

The JSW PSR shear rail assemblies comply with the provisions of ASTM A1044.

3.2 Materials:

3.2.1 Studs: The studs are produced from ASTM A29 Grade 1010 through 1020 steel and must conform to the following physical and mechanical requirements in accordance with the prescribed values 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: The base rails are produced from ASTM A36 steel plates and must conform to the following physical and mechanical requirements in accordance with the prescribed values 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

3.3 Stud Welding: The PSR studs are factory-welded by Jobsite Stud Welding to the flat steel base rails using welding equipment in accordance with procedures recommended by the PSR stud manufacturer. All welding complies with AWS D1.1 requirements.

4.0 DESIGN AND INSTALLATION

4.1 Design:

4.1.1 General: Structural design and installation of JSW PSR shear rail assemblies used as punching shear reinforcement in reinforced concrete slabs must comply with the applicable provisions of ACI 318-11 for the 2012 IBC (ACI 318-08 for the 2009 IBC). Under the 2006 IBC, structural design and installation of JSW PSR shear rail assemblies used as punching shear reinforcement in reinforced concrete slabs must comply with ACI 318-05, including Sections 3.5.5, 7.7.5, and 11.11.5 of ACI 318-08.

4.1.2 Design Considerations: The structural design shall 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. Shear rail assembly overall height (OAH).
d. Stud shank diameter.
e. Distance between column face and first line of studs (S_o).
f. Base rail plate length (L).

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

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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 shear studs referenced in 11.11.5 of ACI 318-11 for the 2012 IBC (ACI 318-08 for the 2009 and 2006 IBC) must be revised as follows,

\[ V_c = 1.5 \alpha \sqrt{f'_c} b_0 d \]

This revision requires revisions to the nominal shear strength, \( V_c \), and the maximum shear stress, \( \nu_c \).

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 for the 2012 IBC (ACI 318-08 for the 2009 and 2006 IBC), except that \( V_c \) must be limited as set forth in Section 4.1.3.2 of this report.

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 for the 2012 IBC (ACI 318-08 for the 2009 and 2006 IBC), except that \( V_c \) must be limited as set forth in Section 4.1.3.2 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 referenced in Table 12.12-1 of ASCE/SEI 7.

4.2 Installation:

Installation of the JSW PSR shear rail assemblies must comply with the applicable provisions of the 2012, 2009 and 2006 IBC and the approved engineering plans. The JSW PSR shear rail assemblies must be positioned correctly around columns and set in accordance with the IBC and the approved engineering plans and details. Concrete cover must comply with ACI 318-11 Section 7.7 for the 2012 IBC (Section 1907.7 for the 2009 and 2006 IBC). See Figure 2 for typical installation details.

4.3 Special Inspection:

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

5.0 CONDITIONS OF USE

The JSW PSR shear rail assemblies 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 JSW shear rail assemblies 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, the more restrictive 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 JSW shear rail assemblies are manufactured at the Jobsite Stud Welding facility in Lake Stevens, Washington, or Downey, California, under a quality control program with third-party 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 October, 2008 (editorially revised February 2012).

7.0 IDENTIFICATION

The JSW PSR shear rail assemblies are identified on the packaging with the product name, manufacturing date, manufacturer’s name (Jobsite Stud Welding, Inc.) and address, evaluation report number (ESR-3264).

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**TABLE 1—JSW PSR STUD DIMENSIONS**

<table>
<thead>
<tr>
<th>SHANK DIAMETER, D [in. (mm)]</th>
<th>HEAD DIAMETER, H [in. (mm)]</th>
<th>H/D RATIO</th>
<th>SHANK AREA, S_a [in.² (mm²)]</th>
<th>HEAD AREA, H_a [in.² (mm²)]</th>
<th>H_a/S_a RATIO</th>
<th>HEAD THICKNESS, T [in. (mm)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{3}{16} ) (9.5)</td>
<td>1.19 (30.1)</td>
<td>3.17</td>
<td>0.110 (71)</td>
<td>1.112 (712)</td>
<td>10.1</td>
<td>0.26 (6.6)</td>
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<tr>
<td>( \frac{1}{2} ) (12.7)</td>
<td>1.58 (40.2)</td>
<td>3.16</td>
<td>0.196 (127)</td>
<td>1.961 (1269)</td>
<td>10.0</td>
<td>0.33 (8.4)</td>
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<tr>
<td>( \frac{5}{16} ) (15.9)</td>
<td>1.98 (50.2)</td>
<td>3.17</td>
<td>0.307 (199)</td>
<td>3.079 (1979)</td>
<td>10.0</td>
<td>0.40 (10.2)</td>
</tr>
<tr>
<td>( \frac{1}{4} ) (19.1)</td>
<td>2.37 (60.2)</td>
<td>3.16</td>
<td>0.442 (287)</td>
<td>4.412 (2846)</td>
<td>10.0</td>
<td>0.42 (10.7)</td>
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**TABLE 2—JSW PSR SHEAR RAILS RECTANGULAR SHEAR REINFORCEMENT PLATE DIMENSIONS**

<table>
<thead>
<tr>
<th>SHANK DIAMETER, D [in. (mm)]</th>
<th>PLATE WIDTH, W [in. (mm)]</th>
<th>PLATE THICKNESS, TH [in. (mm)]</th>
<th>PLATE LENGTH, L</th>
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<tbody>
<tr>
<td>( \frac{3}{16} ) (9.5)</td>
<td>1.00 (25.4)</td>
<td>( \frac{3}{16} ) (4.8)</td>
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<tr>
<td>( \frac{1}{2} ) (12.7)</td>
<td>1.25 (31.8)</td>
<td>( \frac{1}{4} ) (6.5)</td>
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</tr>
<tr>
<td>( \frac{5}{16} ) (15.9)</td>
<td>2.00 (50.8)</td>
<td>( \frac{5}{16} ) (7.9)</td>
<td></td>
</tr>
<tr>
<td>( \frac{1}{4} ) (19.1)</td>
<td>2.00 (50.8)</td>
<td>( \frac{1}{6} ) (9.5)</td>
<td></td>
</tr>
</tbody>
</table>

Determined by the registered design professional
FIGURE 1—TYPICAL JSW PSR RAIL REINFORCEMENT SYSTEM ASSEMBLY

FIGURE 2—TYPICAL JSW PSR RAIL REINFORCEMENT SYSTEM DETAILS

**TABLE**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>D</td>
<td>SHANK DIAMETER</td>
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<td>OAH</td>
<td>Overall Height</td>
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<tr>
<td>L</td>
<td>Plate Length</td>
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</table>

TYPICAL JSW PSR RAIL REINFORCEMENT SYSTEM

Arrangement for an interior column
(Ref: ACI-421.1R-08).
Structural rebar not shown for clarity.

$n_x$ - The number of studs in the X direction
$n_y$ - The number of studs in the Y direction
$s_x$ - The stud spacing in the X direction
$s_y$ - The stud spacing in the Y direction

$d/2$ - Outermost line of peripheral studs

SEC. - A

SEC. - A