DRAFT

1st Edition 03/15/07

The
JVI
Spider Plate
User Guidelines

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RECOMMENDATIONS

1. **The Spider Plate with model numbers 66DLCT and 66SLCT is made of 1/8" thick, weldable, A36 type material.**
2. **When The Spider Plate is used against a concrete edge, place non-legged side against the edge. Add a #4 ASTM A706, "U" shaped rebar through the side slots and laying on top of outward legs back into the concrete. See attached detail.**
3. **Because of the 1/8" plate thickness, a ¼" weld is the maximum throat size that should be used.**
4. **Design welds between The Spider Plate and the field connection plate for the required loads. The maximum fillet weld shall be ¼". Do not oversize the weld for added safety. Over-welding creates excess heat, which could cause other unwanted results. For examples of welding calculations, see WJE letter attached.**
5. **The maximum capacity of The Spider Plate in tension and in lateral shear was achieve using one (1) ¼" weld x 3" long. No additional weld is needed. See attached details.**
6. **The maximum shear capacity, perpendicular and parallel to the edge, of The Spider Plate was achieve using two (2) ¼"welds x 3" long, one on either side of the loose connection plate. No additional weld is needed. See attached details.**
7. **The typical, loose connection plate should be flat plate at least 1/16" thicker than the weld size. A 3/8" connection plate was used in the testing of The Spider Plates. Do not use multiple connection plates.**
8. **Keep the top and all edges clean of any concrete.**
9. **REMEMBER: DO NOT OVER WELD!**

For further information and discussion, please contact Chuck Magnesio, 413-442-4147 or Dave Jablonsky, 860-643-2065.

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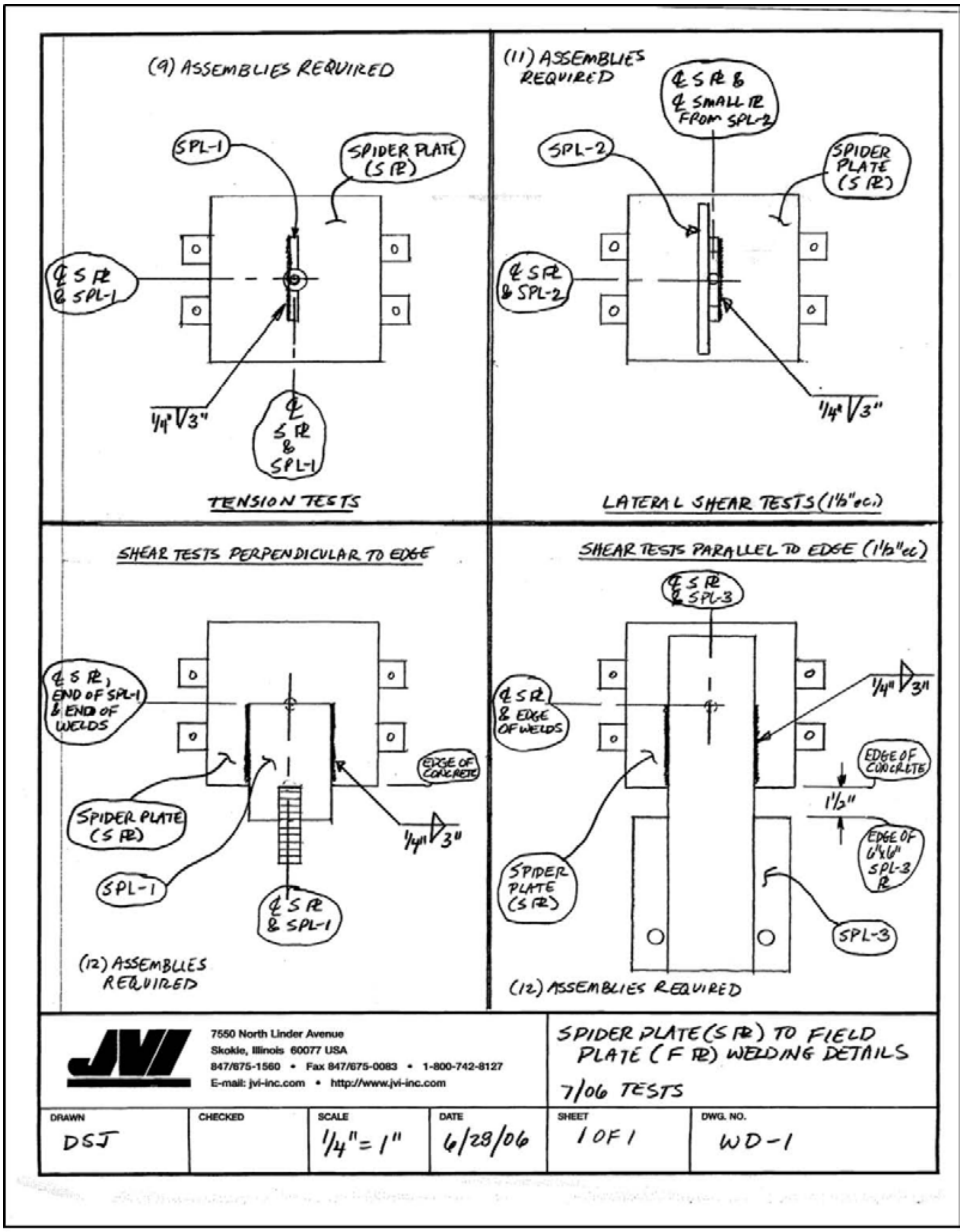

Figure A-10: Field plate to Spider plate connection details.
NOTE: Orientation of field plate welded on Spider plate shown on Tension Tests and Lateral Shear Test details will vary depending on test performed. See Tables 3 and 4 for orientation of specific tests.

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847.272.7400 tel | 847.291.9599 fax
www.wje.com

17 October 2006

Mr. Chuck Magnesio
JVI Pittsfield
30 Bishop Parkway
Pittsfield, Massachusetts 01201

Re: Welding Attachment
Spider Plate Embed
WJE No. 2006.4386

Dear Mr. Magnesio:

As per your request, Wiss, Janney, Elstner Associates, Inc. (WJE) has evaluated the physical conditions that exist when a strap plate is welded to the face of your proprietary spider plate embed (SPE). In addition, the appropriateness of the American Welding Society (AWS) D1.1 Structural Welding Code - Steel, Figure 2.1 will be examined.

The technical information provided indicates that the SPE is specified as being 0.126 in. or alternatively 0.184 in. thick. The steel material conforms to SAE J 1392, 045XF which is nominally classified as a high strength low alloy (HSLA) steel. The specified minimum yield point for this steel is 45 ksi, a tensile value of 55 ksi and an elongation of 20 percent. With a nominal maximum carbon of 0.22 percent or a lower percentage it is readily welded using an AWS E70XX electrode or equivalent.

The design of the weld size will be based on the American Institute of Steel Construction, Inc (AISC) Specification. "Specification for Structural Steel Buildings" dated 9 March 2005. The same answer will essentially be obtained if allowable strength (ASD) or load and resistance factor design (LRFD), i.e. ultimate strength is used. The limiting weld size is obtained by equating the strength of the weld to the through thickness strength of the SPE. See the attached figures for the schematic layouts. The welds are governed by AISC Section J2.4 and the SPE steel by AISC Section G2.

In Figure 1 because the fillet weld is loaded transversely, the higher weld strength by the AISC is permitted. When the calculations are performed assuming the failure in the weld throat occurs at the time the SPE plate shears along the two planes on either side of the weld, for a SPE plate thickness of 0.126 in. A fillet weld size of 0.183 in. (3/16 in.) results. If the equating is performed using a lower strength longitudinally loaded fillet weld then the limiting weld size is increased to 0.275 in. Any weld size larger than this can be made but it will not increase the capacity.

When the SPE plate thickness is increased to 0.184 in., the limiting weld sizes are 0.268 in. and 0.402 in. for transverse and longitudinal loaded welds, respectively.

If the strap is loaded perpendicular to the plane of the Figure 1 detail then the longitudinally loaded fillet weld condition governs, as subsequently discussed in conjunction with Figure 2.

It is probable that test loads greater than that indicated by a 3/16 in. or 0.268 in. weld will be obtained because the strength of the bracket steel generally exceeds the 45 ksi specified minimum and similarly the electrode strength typically exceeds 70 ksi.

The second condition occurs when the connecting strap plate is parallel to the SPE plate as shown in Figure 2. In addition to the weld size and length the distance between the two welds, α L, is an important variable as the tear out occurs along a distance of (2L and α L). This assumes the SPE at a location along "α" does not contribute to the connection strength, which is not correct.

For nominal strap plate thicknesses the limiting failure condition is the failure through the throat of the longitudinally loaded weld and not through the base metal adjacent to either fillet weld leg. Tests by Higgins[1] and Butler[2] verified this. As a result, the welds can be designed based on a convenient combination of L and W. For this case the weld size is limited to 1/16 in. less than the strap thickness as per AWS Figure 2.1, unless the strap edge and thickness can be seen near the fillet weld, or AWS Section 2.3.2.9 can be invoked.

To demonstrate these concepts welds for a connection using SPEs and strap is shown in Figure 3. One SPE is embedded in a vertical member and the second SPE is embedded in a horizontal member. A 3/8 in. thick by 3 in. wide strap connects two SPEs. A 10 kip force is transferred. The SPE has a thickness of 0.126 in. The ultimate strength calculations are shown in Figure 4, based on the AISC LRFD requirements. Because the 10 kip force is relatively small for welded connections, minimum size 3/16 in. fillet welds result that are 2 1/2 in. and 3 in. long for the vertical SPE and horizontal SPE, respectively. The extra length weld on the horizontal SPE is needed to avoid stress concentrations per AISC.

If you have any questions, please call me.

Very truly yours,

WISS, JANNEY, ELSTNER ASSOCIATES, INC.

R. H. R. Tide
Senior Consultant and
Licensed Engineer
Illinois No. 4545

RHRT:hs:mk

Enclosure

ltr_magnesio_welding attachment.doc

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[1] Higgins, T.R., and F.R. Preece, "AWS-AISC Fillet Weld Study, Longitudinal and Transverse Shear Tests," Internal Report, Testing Engineers, Inc., Oakland, California, May 31, 1968
[2] Butler, L.J., S. Pal, and G.L. Kulak, "Eccentrically Loaded Welded Connections," Journal of the Structural Division, ASCE, Vol. 98, No. ST5, May 1972

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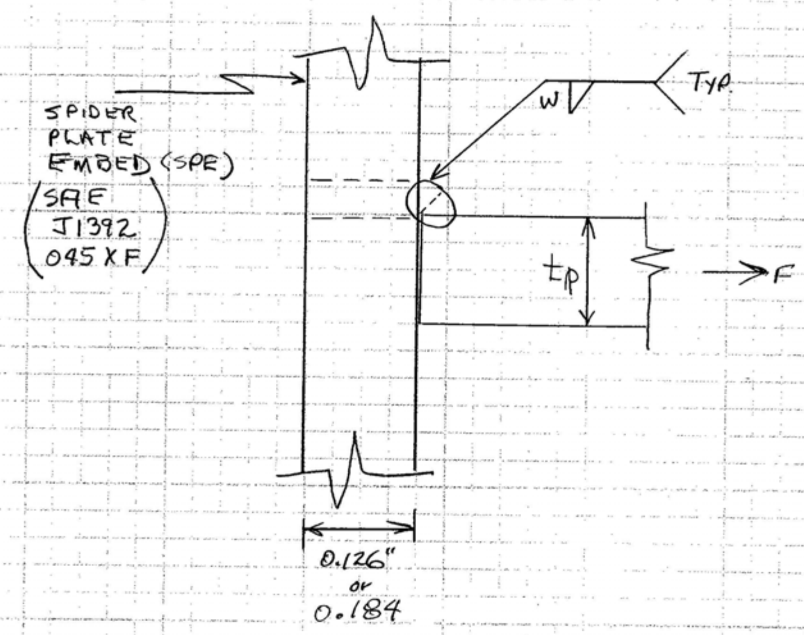
WJE	Wiss, Janney, Elstner Associates, Inc. *330 Pfingsten Road, Northbrook, Illinois 60062*	MADE BY TIDE	SHEET NUMBER 1
	JVI SPIDER PLATE EMBED WELD	CHECKED BY DATE 10/4/06	PROJ. NUMBER 2006. 4386



DASHED LINES INDICATE FAILURE PLANE(S)

FIGURE 1 – STRAP PERPENDICULAR TO SPE

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JVI SPIDER PLATE EMBED	MADE BY: TIDE	SHEET NUMBER: 2
	CHECKED BY:	PROJ. NUMBER: 2006.4386
	DATE: 10/4/06	

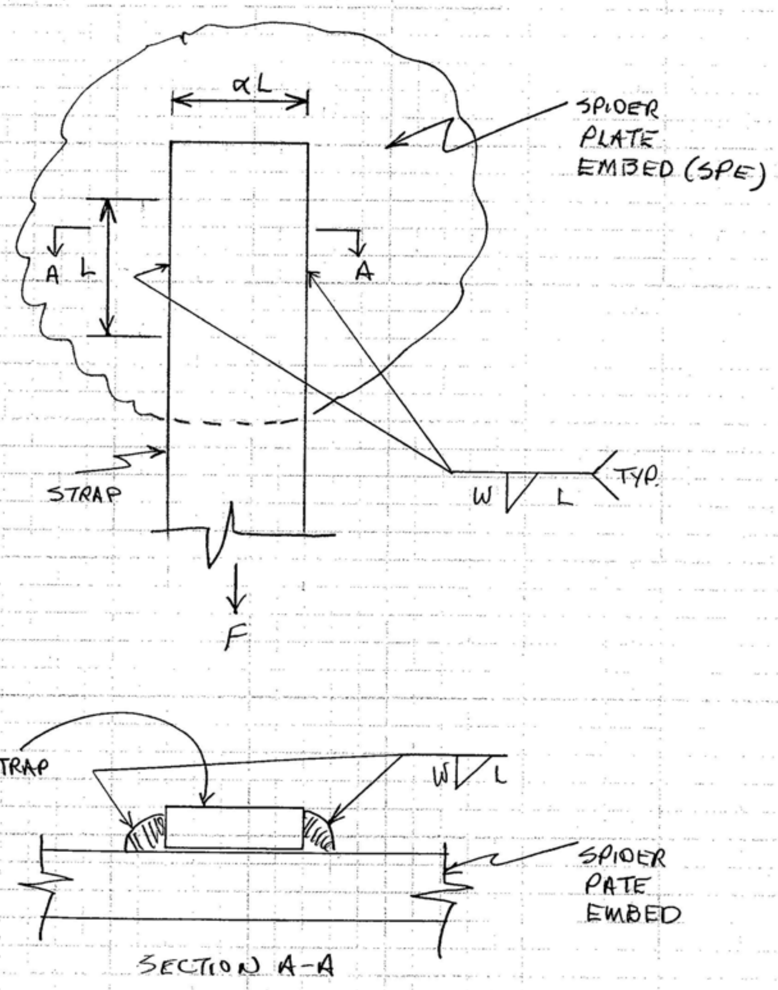

FIGURE 2 – STRAP PARALLEL TO SPE

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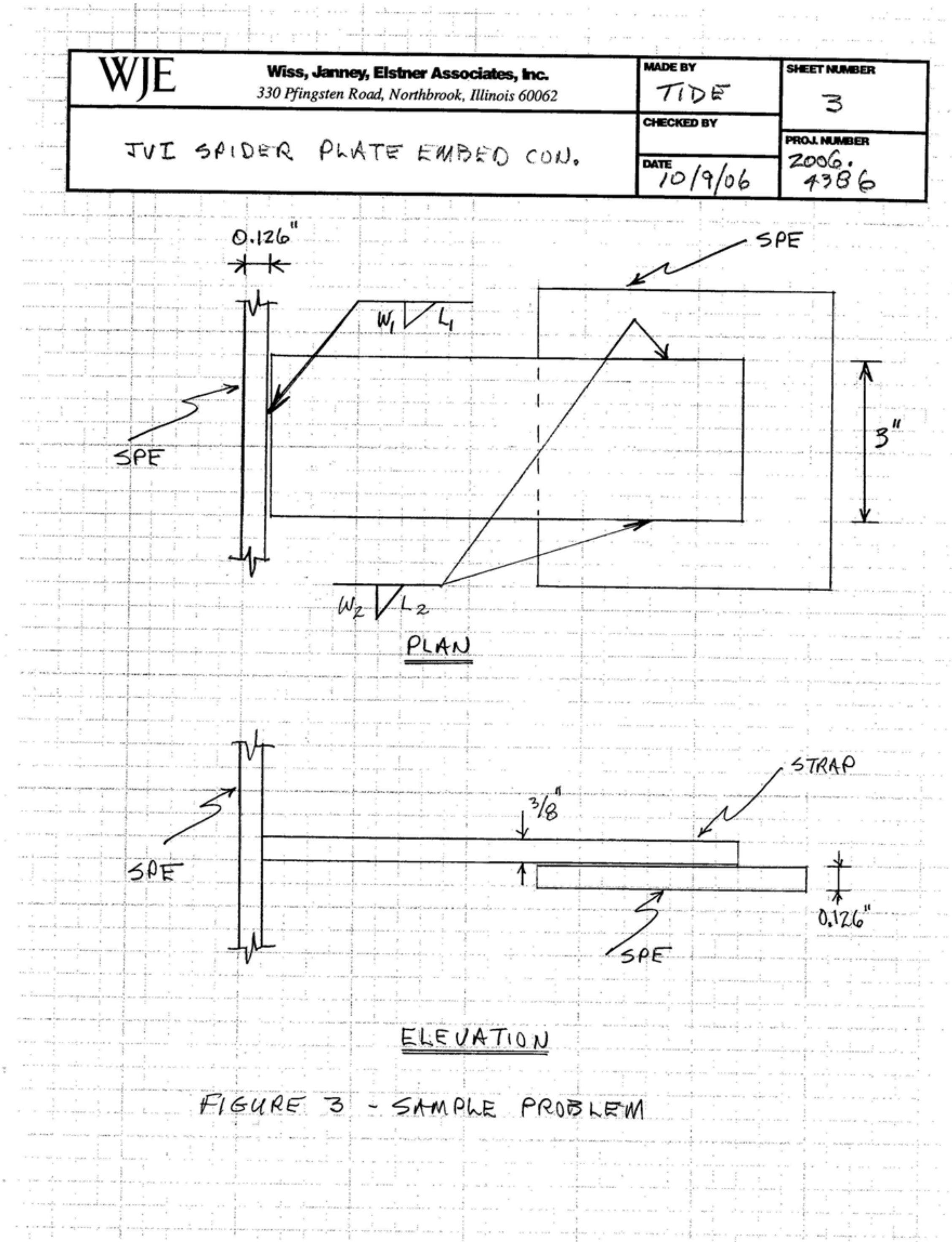

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WJE Wiss, Janney, Elstner Associates, Inc. 330 Pfingsten Road, Northbrook, Illinois 60062	MADE BY TIDE	SHEET NUMBER 4
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BASED OF FIGURE 3 and 10^K force.

AISC SECT. J2.4 (LRFD)

1. Compute ω_1, L_1 and Figure 1

Because of one sided fillet weld transversely loaded, and E70XX electrode or equivalent

$R = \phi R_n = \phi F_w A_w = 10^K$, $\phi = 0.75$

$10 = 0.75(0.60 \times 70)(L_1 \cdot \omega_1 \cdot 0.707)$

$L_1 \omega_1 = 0.449 \text{ in}^2$, with $L_1 = 2\frac{1}{2}''$

$\omega_1 = 0.180'' < 0.275''$

use 3/16" fillet weld, 2½" long. , ω_1 & L_1

2. Compute ω_2, L_2 and Figure 2

$R = \phi R_n = \phi F_w A_w = 10^K$, $\phi = 0.75$

$10 = 0.75(0.60 \times 70)(2 \cdot L_2 \cdot \omega_2 \cdot 0.707)$

$L_2 \omega_2 = 0.225 \text{ in}^2$, with $L_2 = 2''$

$\omega_1 = 0.113'' < 0.275''$

use 3/16" fillet weld, 3" long, ω_2 & L_2

3" long fillet weld required per AISC Section J2.2b.
because strap is 3" wide, this avoids severe stress concentration at weld ends.

FIGURE 4 - SAMPLE CALCULATIONS

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