Flexible Seat Angles

1. BEHAVIOR UNDER LOAD

When designing a flexible seat angle, it is important to understand how it is loaded, and how it reacts to its load. See Figure 1.

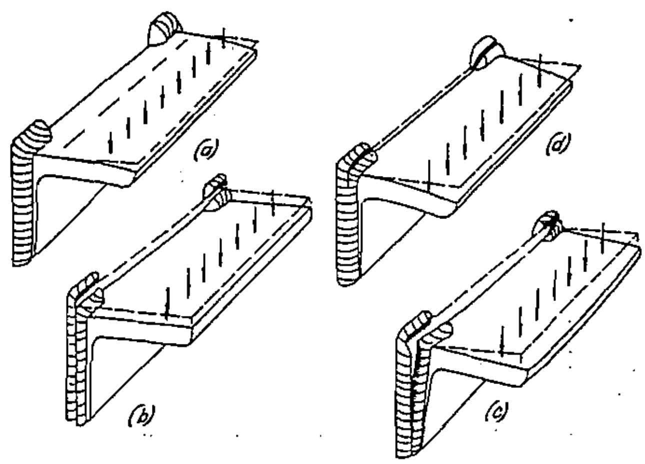


FIGURE 1

The outstanding (top) leg of the seat angle is subject to bending stresses, and will deflect downward (1,a). The vertical reaction (R) on the connecting weld of the angle results in direct shear (1,b) and in bending forces (1,c).

If the seat angle is too thin, the top of the connecting weld tends to tear, because only this portion of the weld resists the bending action. With thicker angles, the whole length of the connecting weld would carry this bending load (Fig. 1,d).

The top leg of the seat angle is stressed in bending by the reaction (R) on the end of the beam which it supports. It is necessary to determine the point at which this force is applied on the leg in order to get the moment arm of the force. See Figure 2.

A simply supported beam is placed on the seat angle (2,a). Because of the loading on the beam, the beam deflects and its ends rotate (2,b). Consequently the point of contact of the reaction (R) tends to move outward. This increase in moment arm increases the bending moment on the seat, causing the leg of the angle to deflect downward. As the deflected leg takes the same slope as the loaded beam, the point of contact moves back (2,c).

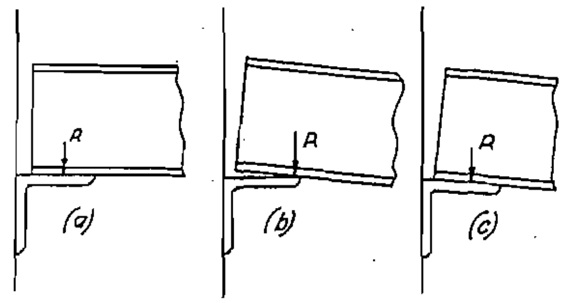


FIGURE 2

If the leg of the angle were made thicker, it would deflect less. Consequently, the point of contact would extend farther out along the leg, thus increasing the bending moment.

If the angle were made too thick, this bearing reaction would be concentrated and might overstress the beam web in bearing.

If the angle were made too thin, it would deflect too easily and the point of contact would shift to the end of the beam, thereby not producing sufficient length of contact for proper support of the beam web.

Definitions of Symbols

ω = leg size of fillet weld, inches
σ_y = yield strength of material used, psi
a = clearance between column and end of beam, usually ½"
b = width of seat angle, inches
e = moment arm of reaction (R) to critical section of horizontal leg of seat angle, inches
e_f = distance of reaction (R) to back of flexible seat angle, inches
t = thickness of seat angle, inches
t_w = thickness of beam web, inches
K = vertical distance from bottom of beam flange to top of fillet of beam web, obtained from steel handbook, inches
L_h = horizontal leg of seat angle, inches
L_v = vertical leg of seat angle, also length of vertical connecting weld, inches
N = minimum bearing length
R = vertical bearing reaction at end of beam, kips

2. ALLOWABLE STRESS IN BEAM

AISC (Sec. 1.10.10) specifies that the compressive stress at the web toe of the fillet of a beam without bearing stiffeners shall not exceed $\sigma = .75\ \sigma_y$ psi. This stress is located at distance K up from bottom face of flange. See Figure 3.

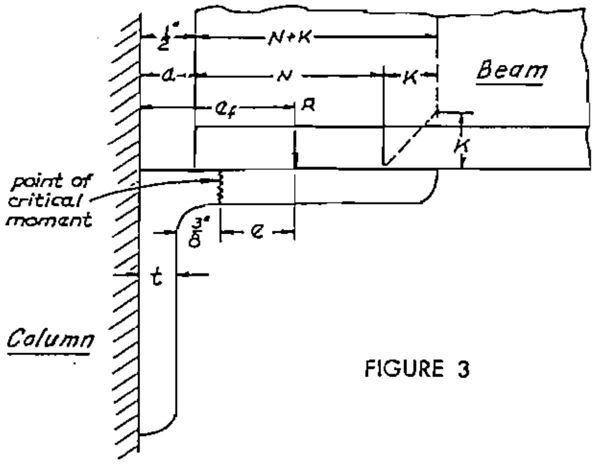


FIGURE 3

For end reactions, the following formula is given:

$$\boxed{\frac{R}{t_w\ (N + K)} = \text{not over } .75\ \sigma_y \text{ psi (AISC Sec 1.10.10)}} \quad \ldots\ldots(1)$$

	A7, A373	A36	A441 or weldable A242		
yield (σ_y)	33,000	36,000	42,000	46,000	50,000
75% allowable	25,000	27,000	31,500	34,500	37,500

This means that the web section (N + K) may be stressed to $\sigma = .75\ \sigma_y$ psi. This plane lies at the top of the toe of the fillet of the beam web, or at height K. This can be projected down at 45° to the base of the beam flange to get the minimum bearing length (N). It is assumed the bearing reaction (R) may be centered midway along this length (N).

3. SEAT ANGLE DIMENSIONS

AISC (Steel Construction Manual), recommends the following method for finding the required size of the seat angle. The point of critical bending moment in the angle leg is assumed to be at the tangent of the fillet of the outstanding leg of the angle. This is approximately ⅜" in from the inside face of the vertical leg, for most angles used as seat angles.

Step 1: Determine the point where the beam reaction is applied to the angle, so that the eccentricity or moment arm (e) of the load may be known.

$$\boxed{N = \frac{R}{t_w\ (.75\ \sigma_y)} - K} \quad \ldots\ldots(2)$$

$$\boxed{e_f = a + \frac{N}{2}} \quad \ldots\ldots(3)$$

$$\boxed{e = e_f - t - \tfrac{3}{8}''} \quad \ldots\ldots(4)$$

Nomograph No. 1 (Fig. 4) for A 36 steel will give the value of e_f for flexible seats or e_s for stiffened seats. (Stiffened seat brackets are discussed further in the following section.) Known values needed for use of this nomograph are the end reaction (R) of the beam in kips, the thickness of the beam web (t_w), and the distance from the bottom of the beam flange to the top of the fillet (K), obtained from any steel handbook.

Step 2: Determine the required thickness of the angle (t) to provide sufficient bending resistance for the given beam reaction (R).

$$\boxed{M = R\ e} \quad \ldots\ldots(5)$$

$$\boxed{M = \sigma\ S} \quad \ldots\ldots(6)$$

$$\boxed{S = \frac{b\ t^2}{6}} \quad \ldots\ldots(7)$$

From this we get—

$$R\ e = M = \sigma\ S = \frac{\sigma\ b\ t^2}{6}$$

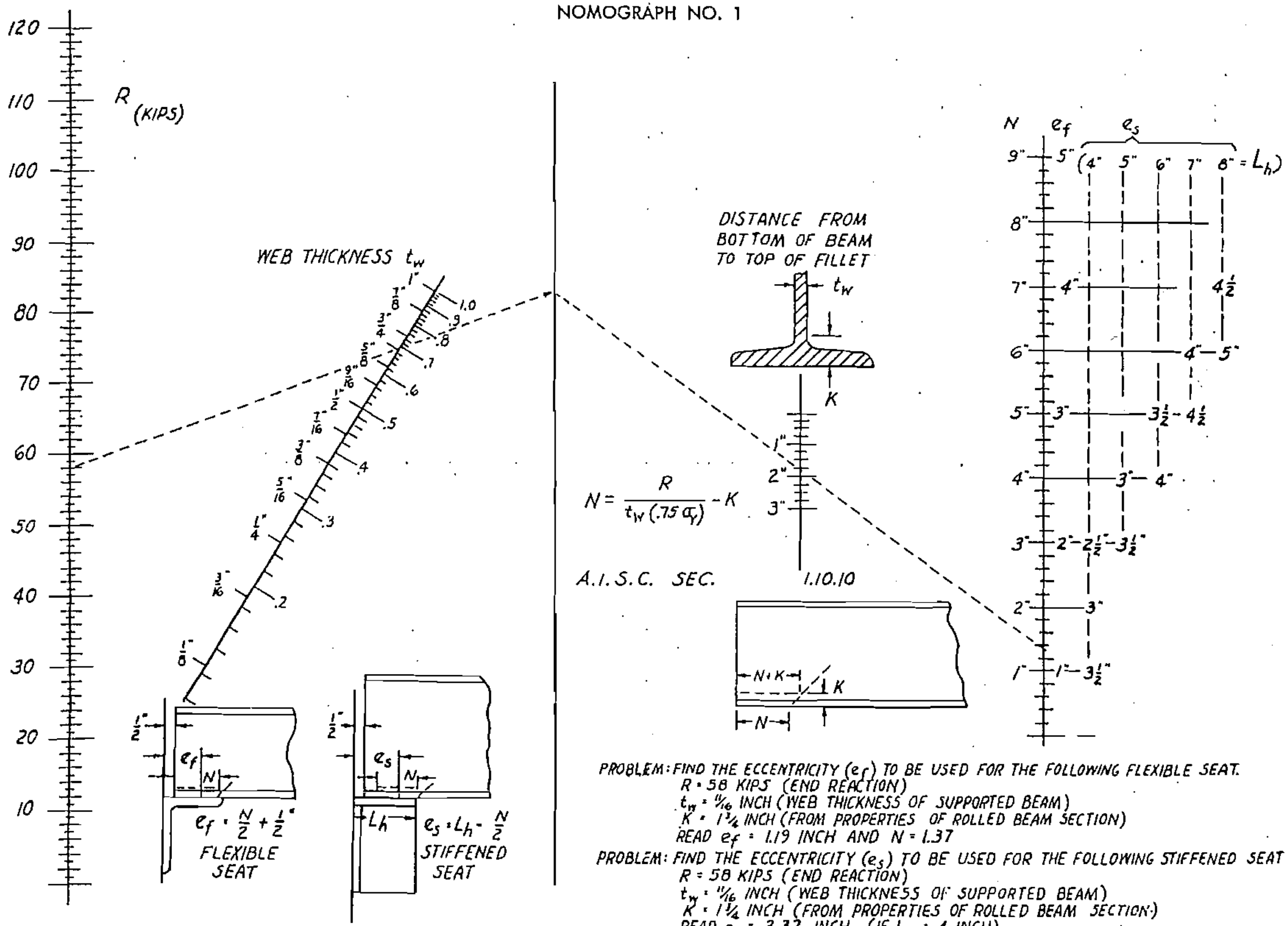
$$\therefore \boxed{\frac{R}{b} = \frac{\sigma\ t^2}{6\ e}} \quad \ldots\ldots(8)$$

Since the outstanding leg of the angle acts as a beam with partially restrained ends, the AISC Manual (1956, p 263) allows a bending stress of $\sigma = 24{,}000$ psi for A7 or A373 steel. For A36 steel, a value of $\sigma = 26{,}000$ psi will be used. This then becomes:

A7 or A373 Steel	A36 Steel	
$\frac{R}{b} = \frac{4.0\ t^2}{e_f - t - ⅜}$	$\frac{R}{b} = \frac{4⅓\ t^2}{e_f - t - ⅜}$	(9)

FIGURE 4—Eccentricity of Load on Flexible or Stiffened Seats For A36 Steel

NOMOGRAPH NO. 1

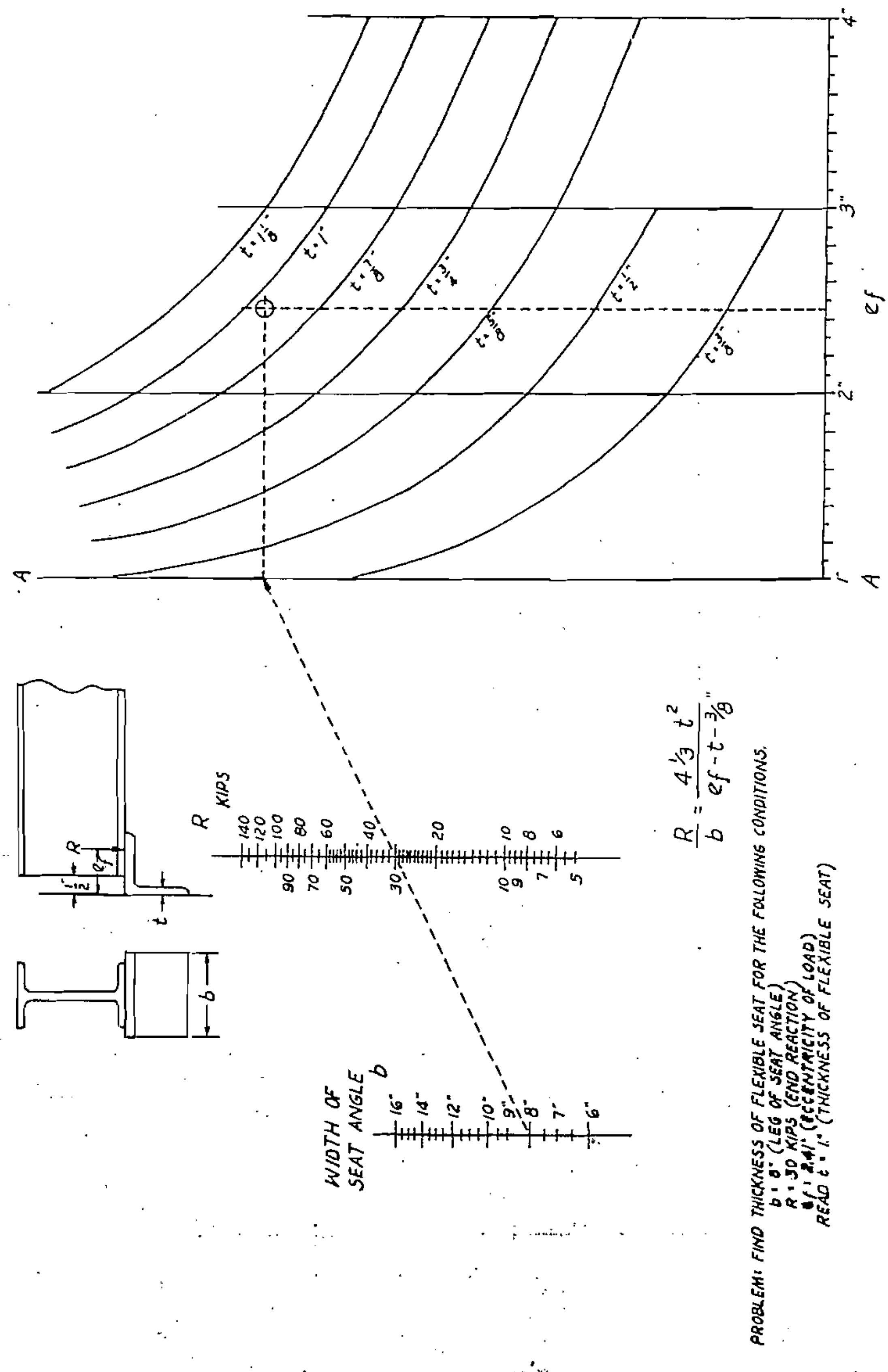


PROBLEM: FIND THE ECCENTRICITY (e_f) TO BE USED FOR THE FOLLOWING FLEXIBLE SEAT.
R = 58 KIPS (END REACTION)
t_w = 11/16 INCH (WEB THICKNESS OF SUPPORTED BEAM)
K = 1 1/4 INCH (FROM PROPERTIES OF ROLLED BEAM SECTION)
READ e_f = 1.19 INCH AND N = 1.37

PROBLEM: FIND THE ECCENTRICITY (e_s) TO BE USED FOR THE FOLLOWING STIFFENED SEAT
R = 58 KIPS (END REACTION)
t_w = 11/16 INCH (WEB THICKNESS OF SUPPORTED BEAM)
K = 1 1/4 INCH (FROM PROPERTIES OF ROLLED BEAM SECTION)
READ e_s = 3.32 INCH (IF L_h = 4 INCH)

FIGURE 5—Thickness of Flexible Seat For A36 Steel

NOMOGRAPH NO. 2



To solve directly for (t), the formula #9 may be put into the following form:

$$\boxed{t = \sqrt{\tfrac{1}{4} A^2 + A\,(e_f - \tfrac{3}{8})} - \tfrac{1}{2} A} \quad \ldots (10)$$

where:

A7 or A373 Steel	A36 Steel
$A = \dfrac{R}{4.0\ b}$	$A = \dfrac{R}{4\frac{1}{3}\ b}$

.....(11)

Knowing the values of A and e_f, the thickness of the seat angle (t) may be found from the above formula.

Nomograph No. 2 (Fig. 5) for A36 steel makes use of formula #9 and will give values of seat angle thickness (t). The width of the seat angle (b) is known since it is usually made to extend at least ½″ on each side of the beam flange. A line is drawn from this value of (b) through the value of (R) to the vertical axis A-A. The required thickness of the angle (t) is found at the intersection of a horizontal line through A-A and a vertical line through the given value of (e_f). In case these lines intersect between two values of angle thickness, the larger value is used as the answer.

Table 1 will give values of R/b in terms of seat angle thickness (t) and eccentricity (e_f). Table 1 is for A36 steel.

Step 3: Determine the horizontal length of the seat angle leg (L_h). This must be sufficient to permit easy erection and provide ample distance for the connecting welds and erection bolts on the bottom flange of the beam.

This minimum length is:

$$\boxed{L_h = a + N} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

Step 4: Determine the vertical length (L_v) of the connecting fillet weld, for a given leg size of weld (ω). This will determine the required length of the seat

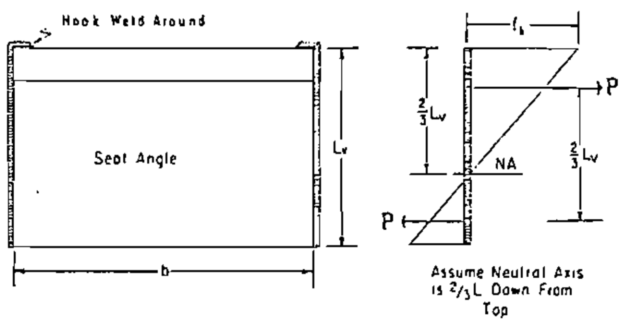


FIGURE 6

TABLE 1—Values of R/b
For A36 Steel

$$\frac{R}{b} = \frac{\text{Reaction, kips}}{\text{Width of seat, inches}} \qquad \boxed{\frac{R}{b} = \frac{4\frac{1}{3}\ t^2}{e_f - t - \frac{3}{8}}}$$

e_f \ t	THICKNESS OF SEAT ANGLE (t) 3/8″	7/16″	1/2″	9/16″	5/8″	3/4″	7/8″	1″	1 1/8″
1.0	2.44	4.41	8.66	21.9					
1.1	1.74	2.88	4.81	8.44					
1.2	1.35	2.13	3.34	5.21	8.45				
1.3	1.10	1.70	2.54	3.78	5.63				
1.4	.937	1.41	2.07	2.97	4.23	7.86			
1.5	.812	1.20	1.73	2.44	3.39	6.50			
1.6	.717	1.05	1.49	2.07	2.82	5.14	9.48		
1.7	.631	.934	1.31	1.80	2.42	4.24	7.37		
1.8	.579	.840	1.17	1.59	2.11	3.62	6.04	10.20	
1.9	.530	.763	1.05	1.42	1.88	3.14	5.10	8.26	
2.0	.487	.697	.964	1.29	1.69	2.78	4.44	6.93	10.96
2.1	.451	.644	.883	1.17	1.54	2.50	3.90	5.98	9.15
2.2	.420	.596	.818	1.08	1.41	2.28	3.47	5.26	7.83
2.3	.393	.557	.761	1.01	1.30	2.08	3.16	4.68	6.85
2.4	.369	.521	.710	.936	1.21	1.92	2.88	4.22	6.09
2.5	.349	.490	.666	.877	1.13	1.78	2.65	3.85	5.47
2.6	.329	.463	.628	.824	1.06	1.66	2.46	3.53	4.98
2.7	.312	.438	.593	.777	.996	1.55	2.30	3.27	4.57
2.8	.297	.416	.562	.736	.940	1.45	2.14	3.04	4.21
2.9	.284	.396	.536	.698	.891	1.37	2.02	2.84	3.91
3.0	.271	.379	.510	.663	.845	1.30	1.89	2.66	3.66
3.1			.486	.631	.806	1.23	1.80	2.52	3.42
3.2			.466	.604	.769	1.17	1.70	2.37	3.23
3.3			.446	.579	.736	1.12	1.62	2.25	3.04
3.4			.428	.555	.705	1.07	1.55	2.14	2.88
3.5			.412	.533	.677	1.03	1.47	2.05	2.74
3.6					.650	.986	1.41	1.95	2.61
3.7					.628	.947	1.35	1.86	2.49
3.8					.604	.912	1.30	1.79	2.38
3.9					.584	.878	1.26	1.71	2.29
4.0					.564	.848	1.20	1.65	2.19

angle's vertical leg, being assumed equal.

horizontal force on weld

$$\text{Moment (each weld)} = \frac{R}{2}\,(e_f) = P\,(\tfrac{2}{3}\,L_v)$$

also:

$$P = \tfrac{1}{2}\,(f_b)\,(\tfrac{2}{3}\,L_v)$$

From this:

$$f_h = \frac{2.25\ R\ e_t}{L_v^2}$$

vertical force on weld

$$f_v = \frac{R}{2\ L_v}$$

resultant force on weld

$$f_r = \sqrt{f_v^2 + f_h^2} = \sqrt{\left(\frac{R}{2\ L_v}\right)^2 + \left(\frac{2.25\ R\ e_t}{L_v^2}\right)^2}$$

or

$$\boxed{f_r = \frac{R}{2\ L_v^2}\sqrt{L_v^2 + 20.25\ e_t^2}} \qquad \dots\dots\dots(13)$$

leg size of fillet weld

$$\omega = \frac{\text{actual force}}{\text{allowable force}}$$

A7, A373 Steel; E60 Welds	A36 Steel; E70 Welds	
$\frac{R}{\omega} = \frac{19.2\ L_v^2}{\sqrt{L_v^2 + 20.25\ e_t^2}}$	$\frac{R}{\omega} = \frac{22.4\ L_v^2}{\sqrt{L_v^2 + 20.25\ e_t^2}}$	....(14)

Since there are a limited number of rolled angles available (for example, L = 9″, 8″, 7″, 6″, 5″, 4″, etc.) it might be well to select a vertical leg length (L_v) = vertical weld length, and solve for the required leg size of fillet weld (ω).

Nomograph No. 3 is based on formula #14 and will give the required length of the vertical connecting weld (L_v) and its leg size (ω) if the other values (R and e_t) are known. (The weld length is assumed equal to the seat's leg length.) Nomograph No. 3 is for A36 steel and E70 welds.

Table 2 will give values of R/ω in terms of vertical leg length of the seat angle (L_v) and eccentricity (e_t). Table 2 is for A36 steel, and E70 welds.

4. APPLYING CONNECTING WELDS

The two vertical fillet welds should be "hooked" around the top portion of the seat angle for a distance of about twice the leg size of the fillet weld, or about ½″, provided the width of column flange exceeds the width of seat angle.

A horizontal fillet weld across the top of the seat angle would greatly increase its strength; however, it might interfere with the end of the beam during erection if the beam were too long or the column too deep in section.

When width of the seat angle exceeds the width of the column flange, connecting fillet welds are placed along the toes of the flange on the back side of the angle.

These seats may line up on opposite sides of a supporting web, either web of column or web of girder, if the leg size of the fillet weld is held to ¾ of the web thickness when determining the length (L_v) of the weld. This will prevent the web within this length of connection from being stressed in shear in excess of a value equivalent to ¾ of the allowable tension.

TABLE 2—Values of R/ω
For A36 Steel & E70 Welds

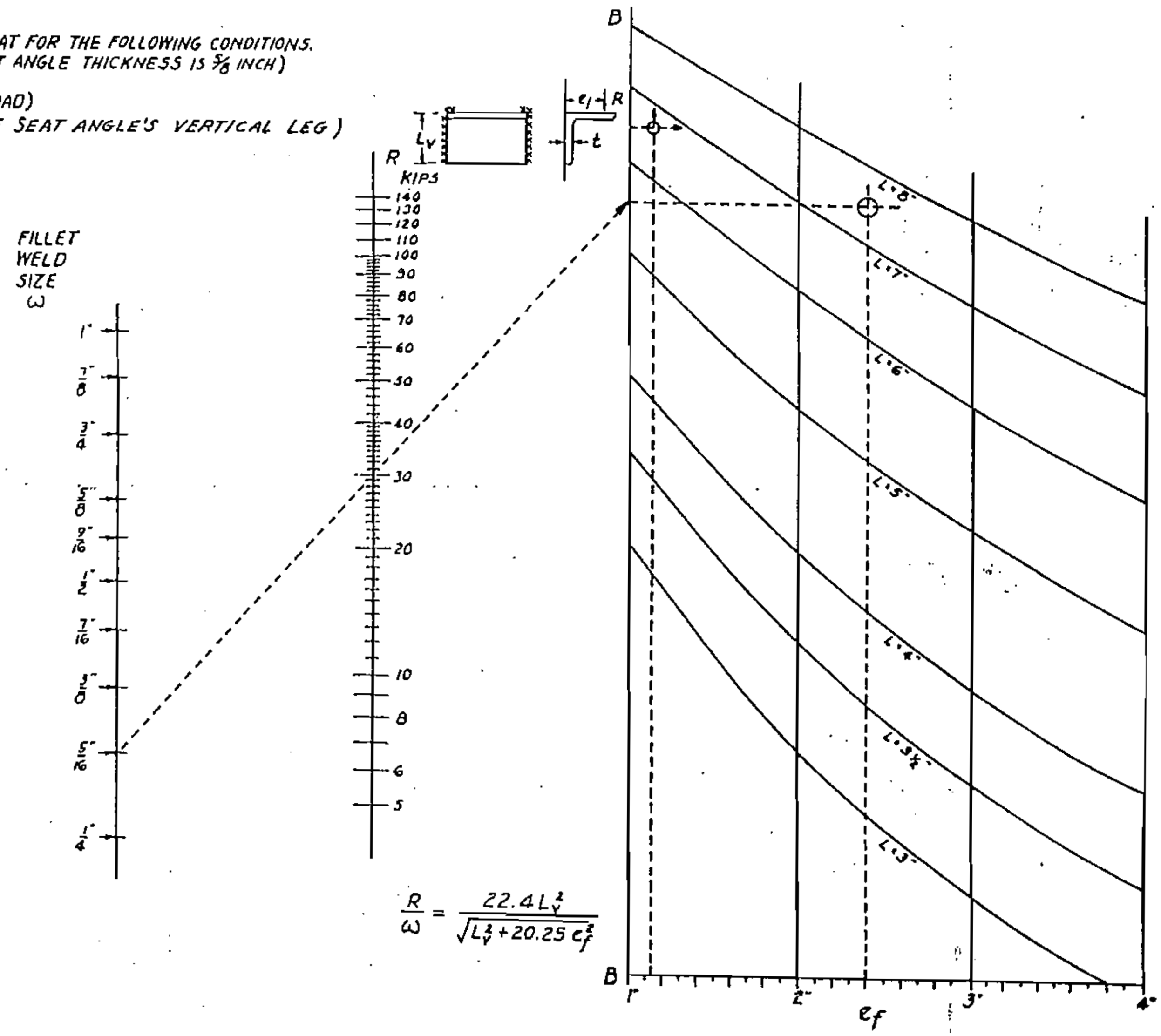
$$\frac{R}{\omega} = \frac{\text{Reaction, kips}}{\text{Leg size fillet weld}} \qquad \boxed{\frac{R}{\omega} = \frac{22.4\ L_v^2}{\sqrt{L_v^2 + 20.25\ e_t^2}}}$$

e_t \ L_v	VERTICAL LEG LENGTH OF SEAT ANGLE (L_v)							
	3″	3½″	4″	5″	6″	7″	8″	9″
1.0	37.3	48.1	59.5	83.3	107.3	137.7	156.2	180.8
1.1	35.0	45.5	56.6	79.3	103.6	128.2	151.7	177.2
1.2	33.0	42.9	53.6	75.8	99.7	124.8	148.2	172.7
1.3	31.2	40.6	51.1	72.4	96.3	120.2	144.7	169.2
1.4	29.2	38.3	48.4	69.2	93.1	116.2	140.0	165.7
1.5	27.6	36.4	45.8	66.3	89.5	112.6	136.5	161.0
1.6	26.0	34.6	43.9	63.6	86.3	109.2	133.0	157.5
1.7	24.7	32.8	41.8	60.7	83.4	105.6	129.5	154.0
1.8	23.4	31.2	39.9	58.3	80.5	102.3	126.0	149.3
1.9	22.4	29.8	38.3	56.2	77.9	99.1	122.5	145.8
2.0	21.2	28.5	36.4	54.3	74.6	96.2	119.0	142.2
2.1	20.4	27.3	35.0	52.2	72.6	93.3	115.8	138.8
2.2	19.5	26.2	33.6	50.4	70.0	90.6	112.8	135.2
2.3	18.7	25.4	32.4	48.7	67.9	87.8	109.7	131.8
2.4	18.0	24.2	31.2	47.0	65.6	85.1	107.0	129.5
2.5	17.3	23.2	30.0	45.5	63.6	82.8	104.2	126.0
2.6	16.7	22.4	28.9	44.1	61.5	80.5	101.5	122.5
2.7	15.9	21.6	28.0	42.6	59.6	78.4	98.8	120.2
2.8	15.5	21.0	27.1	41.4	58.0	76.4	96.2	116.7
2.9	15.0	20.3	26.2	40.2	56.3	74.4	93.6	114.6
3.0	14.6	19.7	25.4	39.0	54.5	72.2	91.3	112.0
3.1	14.2	19.1	24.7	37.9	53.1	70.6	89.2	109.2
3.2	13.8	18.5	24.0	37.0	51.8	68.8	87.2	107.7
3.3	13.3	18.1	23.3	35.9	50.6	67.1	85.2	104.3
3.4	13.1	17.6	22.6	35.0	49.3	65.3	82.2	102.2
3.5	12.6	17.1	22.0	34.1	47.9	63.8	81.4	100.0
3.6	12.4	16.7	21.5	33.2	46.6	62.3	79.6	98.0
3.7	12.0	16.2	21.0	32.3	45.6	60.7	77.8	95.7
3.8	11.7	15.8	20.4	31.5	44.6	59.5	76.3	93.8
3.9	11.3	15.4	19.9	30.7	43.5	58.1	74.6	92.1
4.0	11.1	14.9	19.4	30.0	41.3	56.9	72.8	90.4

FIGURE 7—Leg Length of Flexible Seat and Weld Size For A36 Steel & E70 Welds

NOMOGRAPH NO. 3

PROBLEM: FIND LEG SIZE OF FLEXIBLE SEAT FOR THE FOLLOWING CONDITIONS.
ω = 5/16" (WELD SIZE - SINCE SEAT ANGLE THICKNESS IS 5/8 INCH)
R = 30 KIPS (END REACTION)
e_f = 2.41" (ECCENTRICITY OF LOAD)
READ L = 8 INCH (LENGTH OF SEAT ANGLE'S VERTICAL LEG)



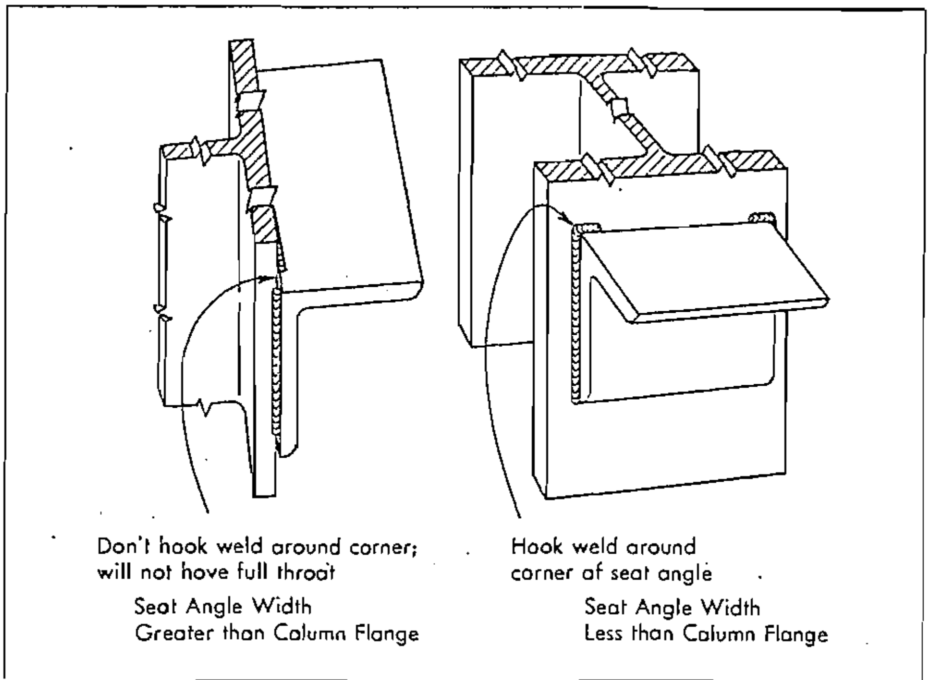


FIGURE 8

5. HORIZONTAL STABILITY

A flexible top angle is usually used to give sufficient horizontal stability to the beam. It is not assumed to carry any of the beam reaction. The most common is a 4" x 4" x ¼" angle, which will not restrain the beam end from rotating under load. After the beam is erected, this top angle is field welded only along its two toes. For beam flanges 4" and less in width, the top angle is usually cut 4" long; for beam flanges over 4" in width, the angle is usually cut 6" long.

In straight tension tests of top connecting angles at Lehigh University, the 4" x 4" x ¼" angle pulled out as much as 1.98" before failure, which is about 20 times greater than usually required under normal load conditions.

Notice in the following figure, that the greatest movement or rotation occurs in the fillet weld connecting the upper leg of the angle to the column. It is important that this weld be made full size.

This test also indicated that a return of the fillet weld around the ends of the angle at the column equal to about ¼ of the leg length resulted in the greatest strength and movement before failure.

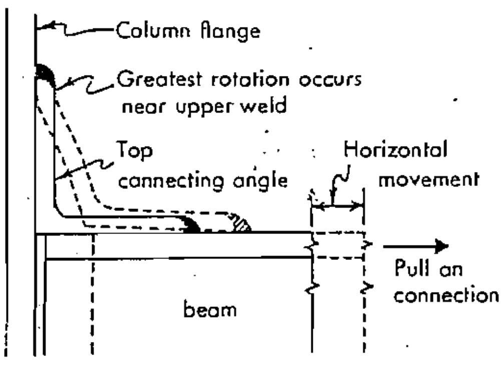


FIGURE 9

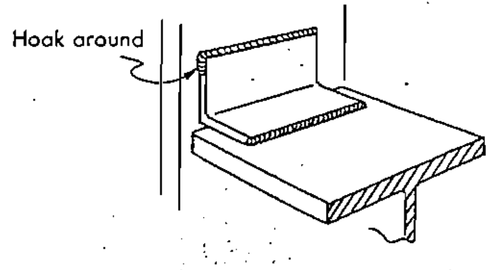


FIGURE 10

Problem 1

Design a flexible seat angle to support a 12" WF 27# beam, having an end reaction of R = 30 kips. Use A36 steel, E70 welds.

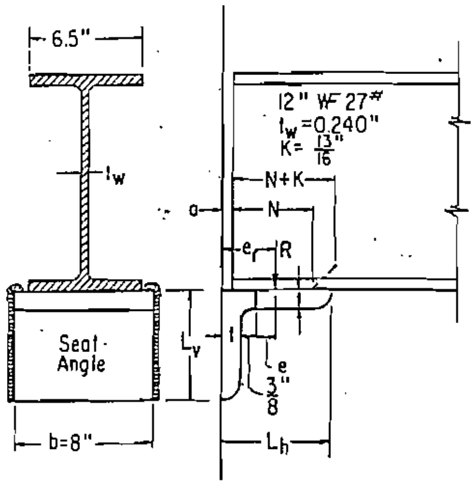


FIGURE 11

thickness of seat angle

$$(2)\quad N = \frac{R}{t_w\ (.75\ \sigma_y)} - K$$

$$= \frac{(30)}{(.240)(27)} - \frac{13}{16}$$

$$= 3.82''$$

$$(3)\quad e_f = a + \frac{N}{2}$$

$$= \tfrac{1}{4} + \frac{3.82}{2}$$

$$= 2.41''$$

$$(10)\quad t = \sqrt{\tfrac{1}{4} A^2 + A(e_f - \tfrac{3}{8})} - \tfrac{1}{2} A$$

$$\text{where } A = \frac{R}{4\tfrac{1}{3} b} = \frac{(30)}{4\tfrac{1}{3}(8)} = .909$$

$$t = \sqrt{\tfrac{1}{4}(.909)^2 + (.909)(2.41 - \tfrac{3}{8})} - \frac{(.909)}{2}$$

$$= .979'' \text{ or } \underline{1''}$$

horizontal leg of seat angle

$$(12)\quad L_h = a + N$$

$$= (\tfrac{1}{2}) + (3.82)$$

$$= 4.32'' \text{ or } \underline{4\tfrac{1}{2}'' \text{ min.}}$$

vertical weld size and length

A 5″ angle, 1″ thick, is not rolled. The only 7″ and 9″ angles rolled have a 4″ horizontal leg which is not sufficient. This leaves just the 6″ and 8″ angles.

a) Using a 6″ x 6″ x 1″ seat angle $L_v = 6''$

$$(14)\quad \omega = \frac{R}{22.4\ L_v^2}\sqrt{L_v^2 + 20.25\ e_f^2}$$

$$= \frac{(30)}{(22.4)(6)^2}\sqrt{(6)^2 + 20.25\ (2.41)^2}$$

$$= .461 \text{ or } \underline{\text{use } \tfrac{1}{2}''}$$

b) Using a 8″ x 6″ x 1″ seat angle $L_v = 8''$

$$(14)\quad \omega = \frac{R}{22.4\ L_v^2}\sqrt{L_v^2 + 20.25\ e_f^2}$$

$$= \frac{(30)}{(22.4)(8)^2}\sqrt{(8)^2 + 20.25\ (2.41)^2}$$

$$= .282'' \text{ or } \underline{\text{use } \tfrac{5}{16}''}$$

The structural designer might be inclined to select the 6″ x 6″ x 1″ angle because of the obvious saving in weight. The shop man knowing that the 5/16″ fillet weld in (b) is a single-pass weld and can be made very fast, whereas the ½″ fillet weld in (a) is a three-pass

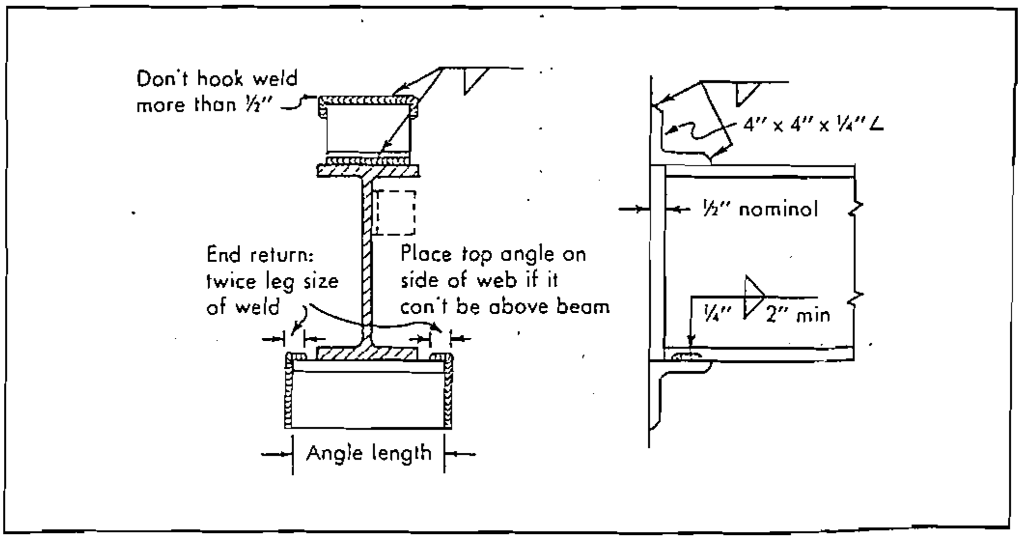


FIGURE 12

weld, would select the 8″ x 6″ x 1″ angle (b). He knows that the cross-sectional area of a fillet weld, and therefore its weight, varies as the square of the leg size. He figures the ratio of the leg sizes for (a) and for (b) to be 8 to 5. This ratio squared produces 64 to 25, or as far as he is concerned 2½ times the amount of weld metal.

Alternate Method Using Tables

From Table 1, $R/b = 30/8 = 3.75$. Using $e_t = 2.4''$ would give this value if $t = 1''$. (Here $R/b = 4.22$)

From Table 2, using $e_t = 2.4''$

a) If $L_v = 6''$, $R/\omega = 65.2$

or leg size of fillet weld,

$$\omega = \frac{30}{65.2} = .460'' \text{ or } \underline{\text{use } \tfrac{1}{2}''}$$

b) If $L_v = 8''$, $R/\omega = 107.0$

or leg size of fillet weld,

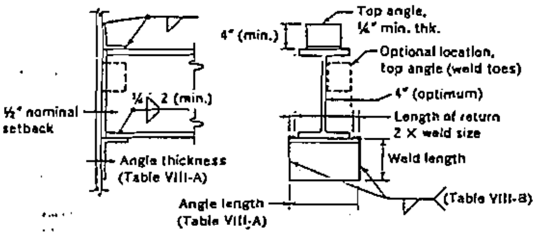
$$\omega = \frac{30}{107.0} = .280 \text{ or } \underline{\text{use } \tfrac{5}{16}''}$$

6. STANDARD SEAT ANGLE CONNECTIONS

(From American Institute of Steel Construction)

SEATED BEAM CONNECTIONS
Welded—E60XX & E70XX electrodes

TABLE VIII



Seated connections are to be used only when the beam is supported by a top angle placed as shown above, or in the optional location as indicated.

Welds attaching beams to seat or top angles may be replaced by bolts or rivets, providing the limitations on the use of ASTM A307 bolts, stipulated in AISC-Specification, Sect. 1.15.12, are observed.

In addition to the welds shown, temporary erection bolts may be used to attach beams to seats (optional).

Nominal beam setback is ½″. Allowable loads in Table VIII-A are based on ¾″ setback, which provides for possible mill underrun in beam length.

Allowable loads in Table VIII-A are based on ASTM A36 material in both beam and seat angle. These values will be conservative when used with beams, or seat angles of ASTM A242 or A441 material.

Weld capacities in Table VIII-B for E60XX and E70XX are applicable when supporting steel is ASTM A36, A242 or A441. When supporting steel is ASTM A7 or A373, use capacities shown for E60XX, regardless of the electrode used.

Should combinations of material thickness and weld size selected from Tables VIII-A and VIII-B, or shown in the sketch above, exceed the limits set by AISC Specification, Sections 1.17.4 and 1.17.5, increase the weld size or material thickness as required.

No reduction of the tabulated weld capacities is required when unstiffened seats line up on opposite sides of a supporting web.

If the reaction values of a beam are not shown on contract drawings, the connections shall be selected to support half the total uniform load capacity shown in the tables for Allowable Loads on Beams for the given shape, span and steel specification of the beam in question. The effect of concentrated loads near an end connection shall also be considered.

TABLE VIII-A Outstanding Leg Capacity, kips (based on OSL = 3½ or 4 inches)

Angle Length		6 Inches						8 Inches					
Angle Thickness		⅜	½	⅝	¾	⅞	1	⅜	½	⅝	¾	⅞	1
Beam Web Thickness	3/16	7.2	10.0	12.8	15.6	18.4	18.4	8.2	11.3	14.4	17.4	18.4	18.4
	¼	9.0	12.4	15.8	19.1	22.5	25.3	10.1	13.8	17.6	21.3	25.0	25.3
	5/16	11.3	15.9	19.8	23.7	27.6	31.5	13.1	17.4	21.7	26.0	30.4	34.0
	⅜	12.4	19.3	24.3	28.7	33.2	37.6	14.3	21.5	26.3	31.2	36.0	40.9
	7/16	13.4	21.1	28.8	33.7	38.7	43.6	15.5	23.8	30.9	36.3	41.7	47.1
	½	14.3	22.8	31.6	39.2	44.6	50.0	16.5	25.7	35.1	41.8	47.7	53.6
	9/16	15.2	24.4	34.0	43.8	51.0	56.9	17.5	27.5	37.8	47.8	54.1	60.5

Note: Values above heavy lines apply only for 4 inch outstanding legs.

TABLE VIII-B Weld Capacity, kips

Weld Size	E60XX Electrodes, Seat angle size (long leg vertical)						E70XX Electrodes, Seat angle size (long leg vertical)						Weld Size
	4 × 3½	5 × 3½	6 × 4	7 × 4	8 × 4	9 × 4	4 × 3½	5 × 3½	6 × 4	7 × 4	8 × 4	9 × 4	
¼	7.4	11.1	14.1	18.4	23.0	27.8	8.6	13.0	16.4	21.5	26.8	32.5	¼
5/16	9.3	13.9	17.6	23.0	28.8	34.8	10.8	16.2	20.6	26.8	33.6	40.6	5/16
⅜	11.1	16.7	21.1	27.6	35.4	41.7	13.0	19.5	24.7	32.2	40.3	48.7	⅜
7/16	13.0	19.5	24.7	32.2	40.3	48.7	15.1	22.7	28.8	37.6	47.0	56.8	7/16
½	14.8	22.2	28.2	36.8	46.0	55.7	17.3	25.9	32.9	43.0	53.7	64.9	½
⅝	...	27.8	35.2	46.0	57.5	69.6	...	32.4	41.1	53.7	67.1	...	⅝
Range of available seat angle thicknesses													
Min.	⅜	⅜	⅜	⅜	½	½	⅜	⅜	⅜	⅜	½	½	Min.
Max.	⅝	¾	⅞	⅞	1	1	⅝	¾	⅞	⅞	1	1	Max.