Review for TABLE D3.1 AISC For shear lag factor-Chapter D –AISC-360-16.

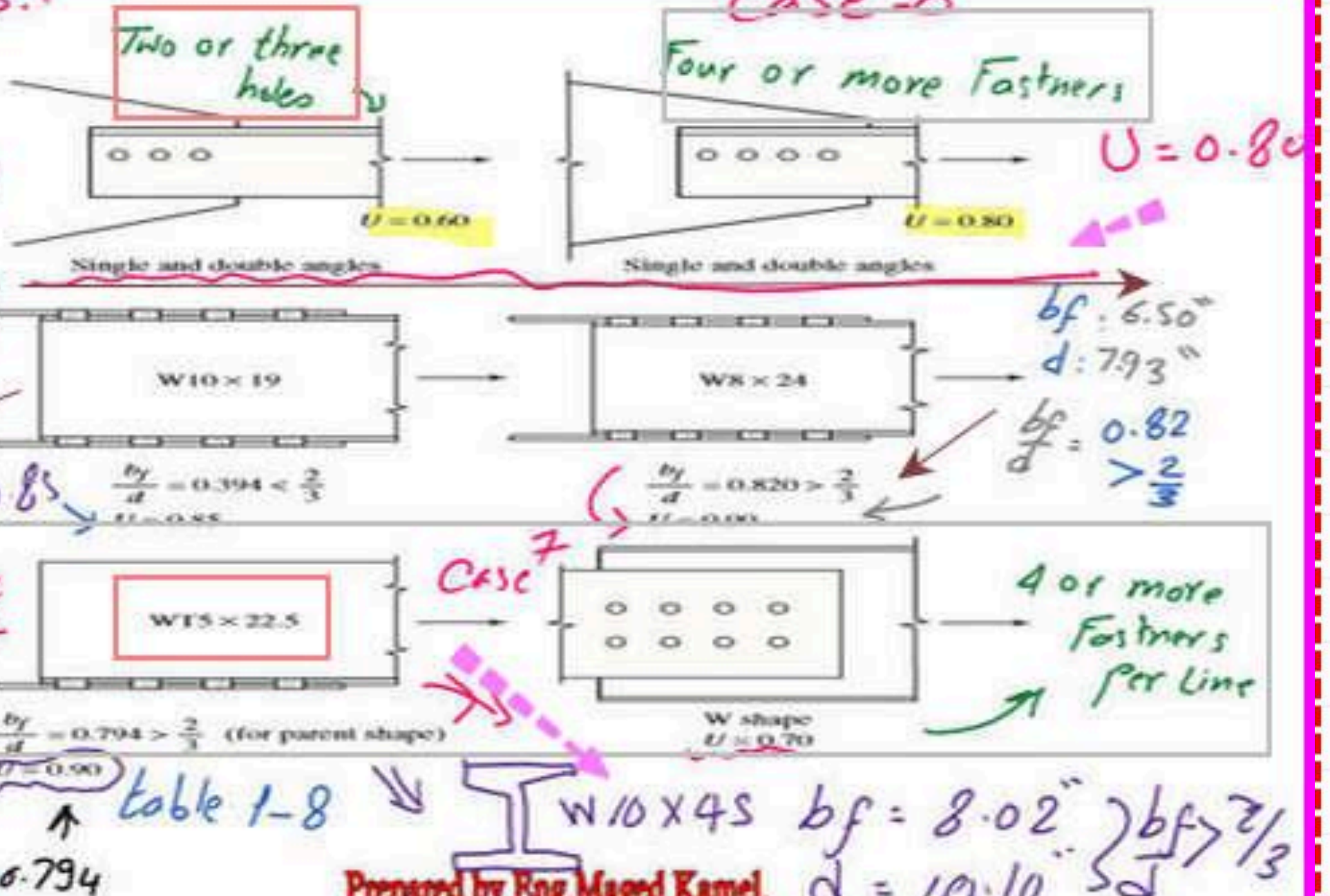
Solved problems 3-4& 3.5.

William T. Segui, 6th edition.

Prepared by Eng.Maged Kamel.

Table D3.1

FIGURE 3.10



STRUCTURAL STEEL DESIGN

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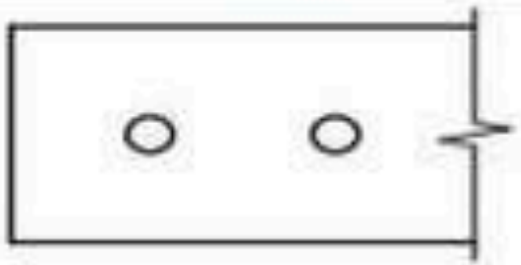
TABLE 4-1 Shear Lag Factor for Common Tension Member Connections

Tension member type	Description	Shear lag factor, U	Example
1a. All tension members where the axial tension load is transmitted directly to all of its component elements	All bolted*	$U = 1.0$	
1b. All tension members where the axial tension load is transmitted directly to all of its component elements	All welded	$U = 1.0$	
*2. All tension members with axial tension load transmitted to some but not all of the elements connected by bolts or a combination of long and transverse welds	Bolts or longitudinal plus transverse welds	$U = 1 - \frac{\bar{x}}{\ell}$ see Figure 4-5 for the definition of $\bar{x}$ and ℓ	

D3.1-cases 1a-1b and 2.

Case No.1 specification

Case 2

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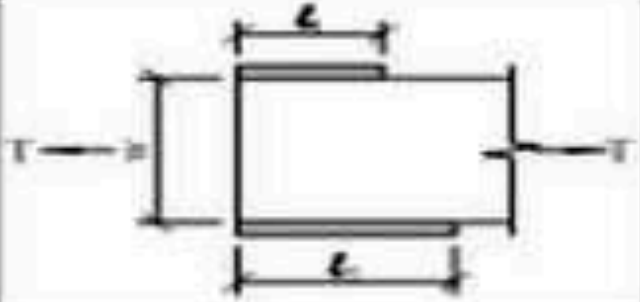
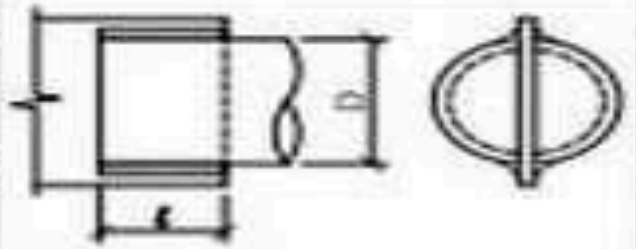
Tension member type	Description	Shear lag factor, U	Example
3. All tension members connected to some but not all the elements of the member	Transverse welds only	$U = 1.0$ A_n = area of directly connected element	
4. Plates, angles, channels with welds at heels, toes, and W-shapes	Longitudinal welds only	$\frac{\bar{x}^2}{\bar{x}^2 + w^2}\left(1 - \frac{\bar{x}}{\ell}\right)$ where $\ell = \frac{\ell_1 + \ell_2}{2}$	
5. Round HSS	Single concentric gusset plate	$\ell \geq 1.3D$, $U = 1.0$ $D \leq \ell < 1.3D$, $U = 1 - \frac{\bar{x}}{\ell}$ $\bar{x} = \frac{D}{\pi}$	

Cases 3-4-5 for U D3.1

Case 3 specifically

PL + L + E

Longitudinal weld

plates-angles and channels U -

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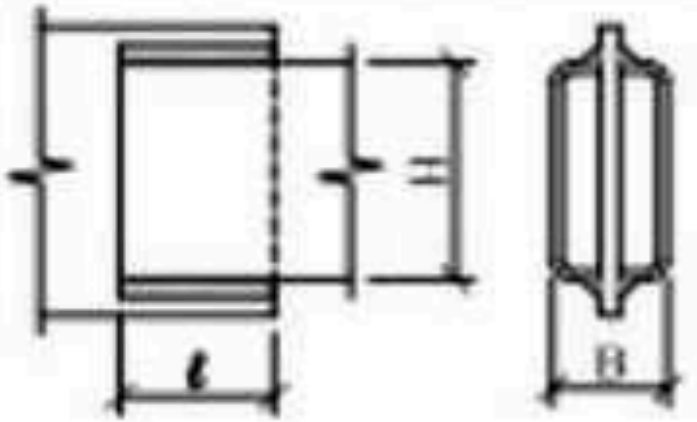
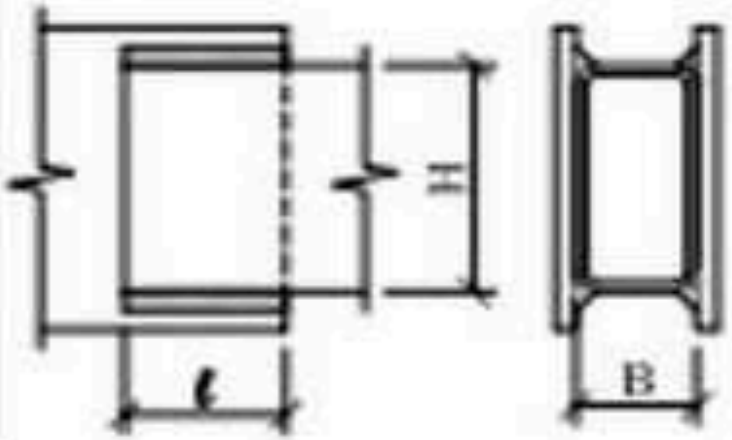
6a. Rectangular HSS	Single concentric gusset plate	$l \geq H,\ U = 1 - \frac{\bar{x}}{l}$ $\bar{x} = \frac{B^2 + 2BH}{4(B+H)}$	
6b. Rectangular HSS	Two-sided gusset plates	$l \geq H,\ U = 1 - \frac{\bar{x}}{l}$ $\bar{x} = \frac{B^2}{4(B+H)}$	

Cases 6a-6b-D3.1

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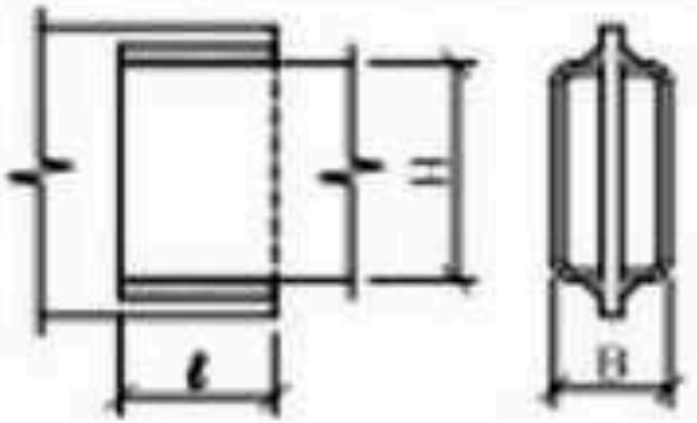
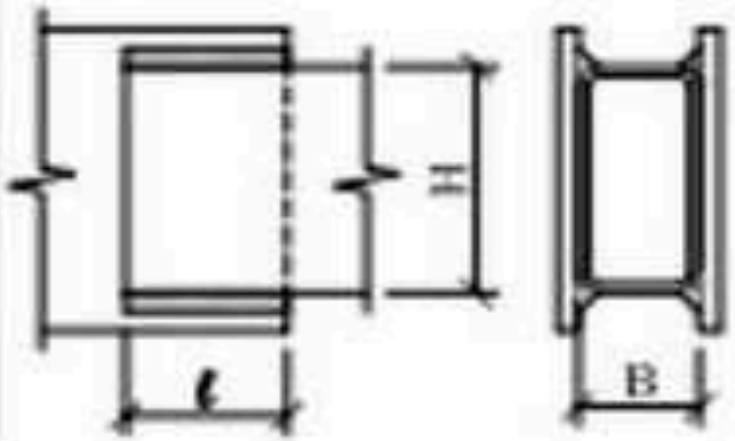
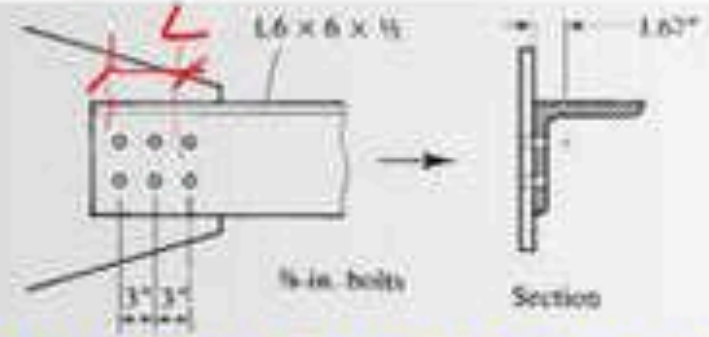
Cases 6a-6b-D3.1

6a. Rectangular HSS	Single concentric gusset plate	$l \geq H,\ U = 1 - \frac{\bar{x}}{l}$ $\bar{x} = \frac{B^2 + 2BH}{4(B+H)}$	
6b. Rectangular HSS	Two-sided gusset plates	$l \geq H,\ U = 1 - \frac{\bar{x}}{l}$ $\bar{x} = \frac{B^2}{4(B+H)}$	

EXAMPLE 3.4

Determine the effective net area for the tension member shown in Figure 3.12.

FIGURE 3.12



Solution

From table U = 0.60

Bolted with 3 Fastners

Find effective area for l6x6x1/2- bolted in two Gauge lines

Single Angle	Four or more fasteners per line in the direction of the load	$U = 0.80$
	Two or three fasteners per line in the direction of the load	$U = 0.60$

Case - 8

U value =0.60, three bolts is a line-case 8

But for angle $6 \times 6 \times \frac{1}{2}$

$\bar{x} \Rightarrow$ from table 1-

$d = \frac{5}{8} + \frac{1}{8} = \frac{6}{8}$"

$\sum d.t = 2\frac{6}{8}\left(\frac{1}{2}\right) = \frac{6}{8}$ inch^2 $\Rightarrow A_n$

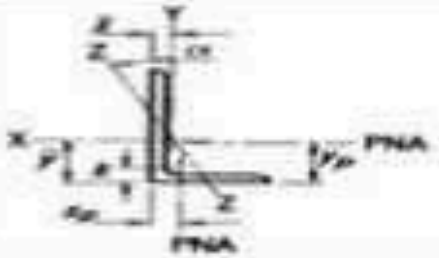


Table 1-7
Angles
Properties

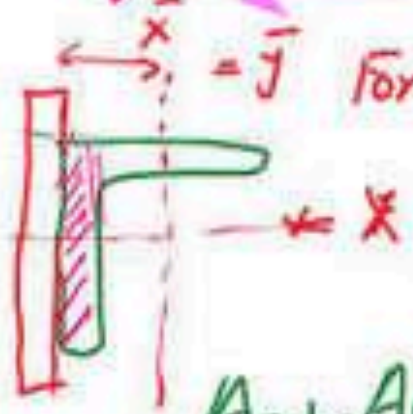
$L 6 \times 6 \times \frac{1}{2}$

Shape	k	Wt.	Area, A	Axis X-X						Flexural-Torsional Properties		
				I	S	r	$\bar{y}$	Z	y_p	J	C_w	$\bar{r}_o$
	in.	lb/ft	$in.^2$	$in.^4$	$in.^3$	in.	in.	$in.^3$	in.	$in.^4$	$in.^6$	in.
6×6×1	1 1/2	37.4	11.0	35.4	8.55	1.79	1.86	15.4	0.917	3.68	9.24	3.18
×7/8	1 3/8	33.1	9.75	31.9	7.61	1.81	1.81	13.7	0.813	2.51	6.41	3.21
×3/4	1 1/4	28.7	8.46	28.1	6.64	1.82	1.77	11.9	0.705	1.61	4.17	3.24
×5/8	1 1/8	24.2	7.13	24.1	5.64	1.84	1.72	10.1	0.594	0.955	2.50	3.28
×9/16	1 1/16	21.9	6.45	22.0	5.12	1.85	1.70	9.18	0.538	0.704	1.85	3.29
×1/2	1	19.6	5.77	19.9	4.59	1.86	1.67	8.22	0.481	0.501	1.32	3.31

Ag = ↑

Case_8 ⇒ 0.60

1



$\bar{x} = \bar{y}$ For an equal angle

$\bar{x} = 1.67$

$L = 3(2) \cdot 6$

Case-2

case 2 gives higher U value.

$U = \left(1 - \frac{\bar{x}}{L}\right) = \left(1 - \frac{1.67}{6}\right) = 0.7217$ maximum

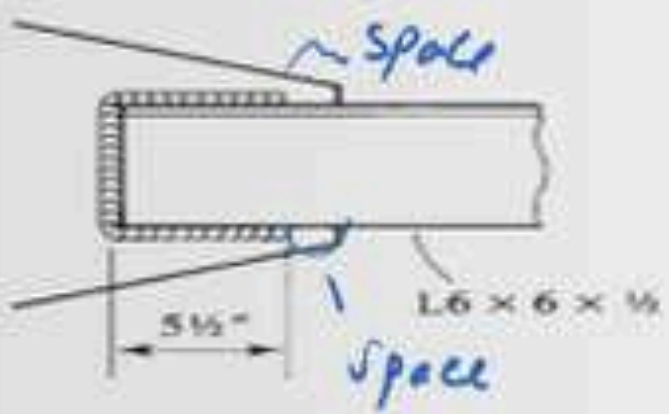
$A_{net} = A_g - \Sigma d.t$

$5.77 - \frac{6}{8} \cdot 5.02 \longrightarrow A_e = A_n(U) = 5.02(0.7217) = 3.623\ in^2$

EXAMPLE 3.5

If the tension member of Example 3.4 is welded as shown in Figure 3.13, determine the effective area.

FIGURE 3.13



X bar in the equation

Solution No value in table $\rightarrow L = 5\frac{1}{2}''$, $\bar{x} = 1.67$

$\left(1 - \frac{\bar{x}}{L}\right) = \left(1 - \frac{1.67}{5\frac{1}{2}}\right) = 0.696$

$= A_g(U) = 5.77(0.696)$

Aeff. No holes $= 4.02 \text{ inch}^2$