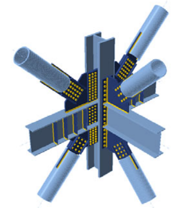
Chapter 3 Tension Members

1

Chapter 3.3 – Effective Area

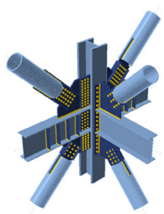
- Of the factors influencing a tension member, the way it is connected is the most important.
- A ***connection*** almost always weakens the member, and the measure of its influence is called the ***joint efficiency***.
- This factor is a function of the ductility of the material, fastener spacing, stress concentrations at holes, fabrication procedure, and a phenomenon known as ***shear lag***.



2

Chapter 3.3 – Effective Area

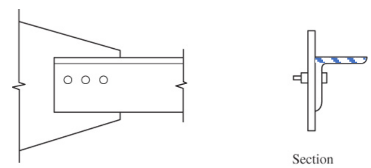
- Of the factors influencing a tension member, the way it is connected is the most important.
- A ***connection*** almost always weakens the member, and the measure of its influence is called the ***joint efficiency***.
- All contribute to reducing the effectiveness of the member, but ***shear lag*** is the most important.



3

Chapter 3.3 – Effective Area

- ***Shear lag*** occurs when some elements of the cross section are not connected, as when only one leg of an angle is bolted to a gusset plate.

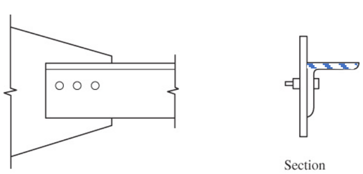


- The consequence of this partial connection is that the connected element becomes ***overloaded***, and the unconnected part is ***not fully stressed***.

4

Chapter 3.3 – Effective Area

- ***Shear lag*** occurs when some elements of the cross section are not connected, as when only one leg of an angle is bolted to a gusset plate.

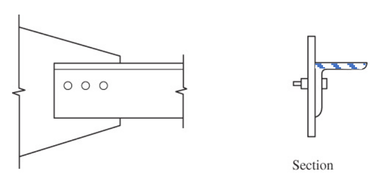


- Lengthening the connected region will reduce this effect.
- Research suggested that ***shear lag*** be accounted for by using a reduced, or ***effective***, net area.

5

Chapter 3.3 – Effective Area

- ***Shear lag*** occurs when some elements of the cross section are not connected, as when only one leg of an angle is bolted to a gusset plate.

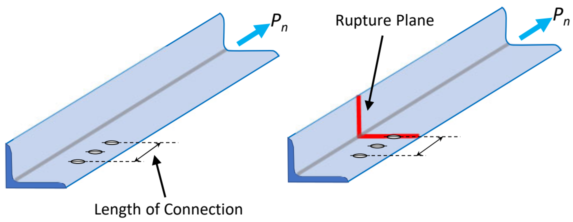


- Because ***shear lag*** affects both bolted and welded connections, the ***effective net area*** concept applies to both types of connections.

6

Chapter 3.3 – Effective Area

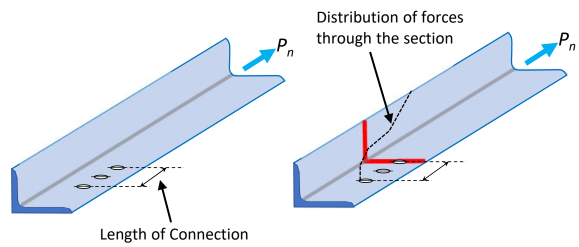
- ***Shear lag*** occurs when some elements of the cross section are not connected, as when only one leg of an angle is bolted to a gusset plate.



7

Chapter 3.3 – Effective Area

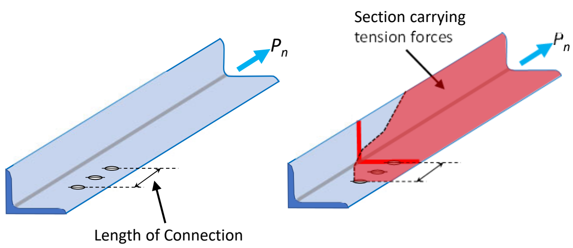
- ***Shear lag*** occurs when some elements of the cross section are not connected, as when only one leg of an angle is bolted to a gusset plate.



8

Chapter 3.3 – Effective Area

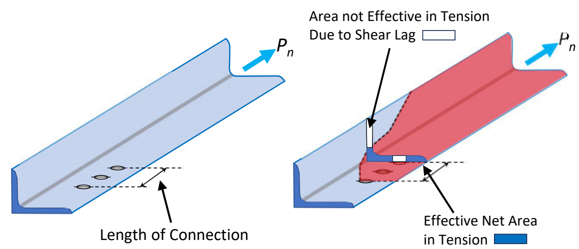
- ***Shear lag*** occurs when some elements of the cross section are not connected, as when only one leg of an angle is bolted to a gusset plate.



9

Chapter 3.3 – Effective Area

- ***Shear lag*** occurs when some elements of the cross section are not connected, as when only one leg of an angle is bolted to a gusset plate.



10

Chapter 3.3 – Effective Area

- For bolted connections, the ***effective net area*** is

$$A_e = A_n U \qquad \textbf{AISC Equation D3-1}$$

- For welded connections, we refer to this reduced area as the ***effective area*** (rather than the effective net area), given by

$$A_e = A_g U$$

where ***U*** is the reduction factor, given in ***AISC D3, Table D3.1***

11

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 1

All tension members where the tension load is transmitted directly to each of the cross-sectional elements by fasteners or welds (except as in Cases 4, 5, and 6).

$$U = 1.0$$

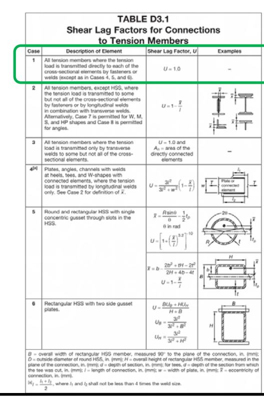


TABLE D3.1
Shear Lag Factors for Connections to Tension Members

Case	Description of Element	Shear Lag Factor, U	Examples
1	All tension members where the tension load is transmitted directly to each of the cross-sectional elements by fasteners or welds (except as in Cases 4, 5, and 6).	$U = 1.0$	–
2	All tension members, except HSS, where the tension load is transmitted to some but not all of the cross-sectional elements by fasteners or by longitudinal welds in combination with transverse welds. Alternatively, Case 7 is permitted for W, M, S, and HP shapes and Case 8 is permitted for angles.	$U = 1 - \frac{\bar{x}}{l}$	
3	All tension members where the tension load is transmitted only by transverse welds to some but not all of the cross-sectional elements.	$U = 1.0$ and A_n = area of the directly connected elements	–
4[a]	Plates, angles, channels with welds at heels, tees, and W-shapes with connected elements, where the tension load is transmitted by longitudinal welds only. See Case 2 for definition of $\bar{x}$.	$U = \frac{3l^2}{3l^2 + w^2}\left(1 - \frac{\bar{x}}{l}\right)$	Plate or connected element
5	Round and rectangular HSS with single concentric gusset through slots in the HSS.	$\bar{x} = \frac{R\sin\theta}{\theta} - \frac{1}{2}t_p$, θ in rad, $U = \left[1 + \left(\frac{\bar{x}}{l}\right)^{3.2}\right]^{-10}$	
		$\bar{x} = b - \frac{2b^2 + tH - 2t^2}{2H + 4b - 4t}$, $U = 1 - \frac{\bar{x}}{l}$	
6	Rectangular HSS with two side gusset plates.	$U = \frac{BU_B + HU_H}{H + B}$, $U_B = \frac{3l^2}{3l^2 + B^2}$, $U_H = \frac{3l^2}{3l^2 + H^2}$	

B = overall width of rectangular HSS member, measured 90° to the plane of the connection, in. (mm); D = outside diameter of round HSS, in. (mm); H = overall height of rectangular HSS member, measured in the plane of the connection, in. (mm); d = depth of section, in. (mm); for tees, d = depth of the section from which the tee was cut, in. (mm); l = length of connection, in. (mm); w = width of plate, in. (mm); $\bar{x}$ = eccentricity of connection, in. (mm).

[a] $l = \frac{l_1 + l_2}{2}$, where l_1 and l_2 shall not be less than 4 times the weld size.

12

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 2

All tension members, except HSS, where the tension load is transmitted to some but not all of the cross-sectional elements by fasteners or by longitudinal welds in combination with transverse welds.

$$U = 1 - \frac{\bar{x}}{l}$$

$\bar{x}$ = eccentricity of connection

l = length of connection

TABLE D3.1
Shear Lag Factors for Connections to Tension Members

Case	Description of Element	Shear Lag Factor, U	Examples
1	All tension members where the tension load is transmitted directly to each of the cross-sectional elements by fasteners or welds (except as in Cases 4, 5, and 6).	$U = 1.0$	–
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3	All tension members where the tension load is transmitted only by transverse welds to some but not all of the cross-sectional elements.	$U = 1.0$ and A_n = area of the directly connected elements	–
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5	Round and rectangular HSS with single concentric gusset through slots in the HSS.	$\bar{x} = \frac{R\sin\theta}{\theta} - \frac{1}{2}t_p$, θ in rad, $U = \left[1 + \left(\frac{\bar{x}}{l}\right)^{3.2}\right]^{-10}$	
		$\bar{x} = b - \frac{2b^2 + tH - 2t^2}{2H + 4b - 4t}$, $U = 1 - \frac{\bar{x}}{l}$	
6	Rectangular HSS with two side gusset plates.	$U = \frac{BU_B + HU_H}{H + B}$, $U_B = \frac{3l^2}{3l^2 + B^2}$, $U_H = \frac{3l^2}{3l^2 + H^2}$	

B = overall width of rectangular HSS member, measured 90° to the plane of the connection, in. (mm); D = outside diameter of round HSS, in. (mm); H = overall height of rectangular HSS member, measured in the plane of the connection, in. (mm); d = depth of section, in. (mm); for tees, d = depth of the section from which the tee was cut, in. (mm); l = length of connection, in. (mm); w = width of plate, in. (mm); $\bar{x}$ = eccentricity of connection, in. (mm).

[a] $l = \frac{l_1 + l_2}{2}$, where l_1 and l_2 shall not be less than 4 times the weld size.

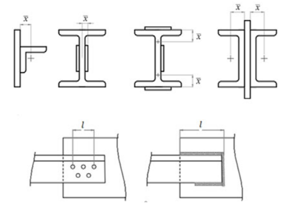
13

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 2

All tension members, except HSS, where the tension load is transmitted to some but not all of the cross-sectional elements by fasteners or by longitudinal welds in combination with transverse welds.



$$U = 1 - \frac{\bar{x}}{l}$$

$\bar{x}$ = eccentricity of connection

l = length of connection

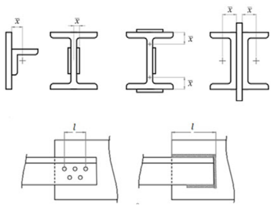
14

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 2

Alternatively, Case 7 is permitted for W, M, S, and HP shapes, and Case 8 is permitted for angles.



$$U = 1 - \frac{\bar{x}}{l}$$

$\bar{x}$ = eccentricity of connection

l = length of connection

15

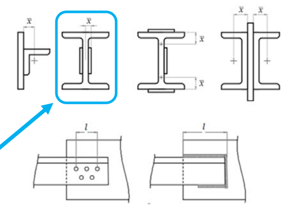
Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 2

If a member has two symmetrically located planes of connection, $\bar{x}$ is measured from the centroid of the nearest one-half of the area.

If the two connecting plates are placed on both sides of one element in a cross-section, the distance is measured from the centroid of the element.



16

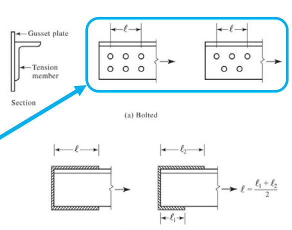
Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 2

The length l is the length of the connection in the direction of the load.

For bolted connections, the measurement is taken from the center of the bolt at one end of the connection to the center of the bolt at the other end.



17

Chapter 3.3 – Effective Area

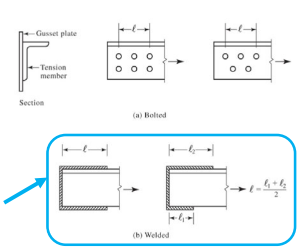
- **AISC Equation D3-1**

Case 2

The length l is the length of the connection in the direction of the load.

For welds, it is measured from one end of the weld to the other.

If there are weld segments of different lengths in the direction of the load, use the average length.



18

Chapter 3.3 – Effective Area

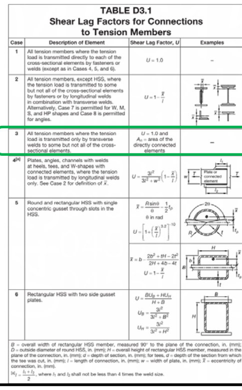
- **AISC Equation D3-1**

Case 3

All tension members where the tension load is transmitted only by transverse welds to some but not all of the cross-sectional elements.

$$U = 1.0$$

A_n = area of the directly connected elements.



19

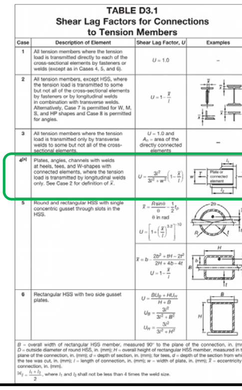
Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 4

Plates, angles, channels with welds at heels, tees, and W-shapes with connected elements, where the tension load is transmitted by longitudinal welds only. See Case 2 for the definition of $\bar{x}$.

$$U = \frac{3l^2}{3l^2 + w^2}\left(1 - \frac{\bar{x}}{l}\right)$$



20

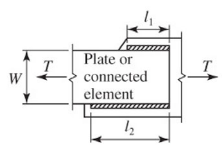
Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 4

Plates, angles, channels with welds at heels, tees, and W-shapes with connected elements, where the tension load is transmitted by longitudinal welds only. See Case 2 for the definition of $\bar{x}$.

$$U = \frac{3l^2}{3l^2 + w^2}\left(1 - \frac{\bar{x}}{l}\right)$$



$$l = \frac{l_1 + l_2}{2}$$ where l_1 and l_2 shall not be less than 4 times the weld size.

21

Chapter 3.3 – Effective Area

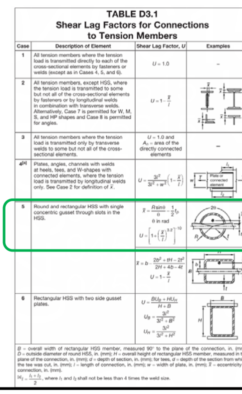
- **AISC Equation D3-1**

Case 5

Round and rectangular HSS with a single concentric gusset through slots in the HSS.

$$U = \left[1 + \left(\frac{\bar{x}}{l}\right)^{3.2}\right]^{-10}$$

$$\bar{x} = \frac{R\sin\theta}{\theta} - \frac{1}{2}t_p\theta \quad \theta \text{ in rad}$$



22

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

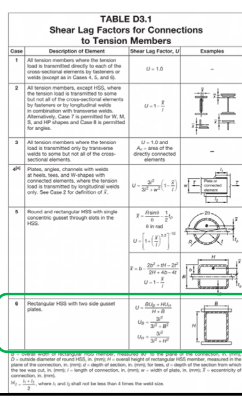
Case 6

Rectangular HSS with two side gusset plates.

$$U = \frac{BU_B + HU_H}{H + B}$$

$$U_B = \frac{3l^2}{3l^2 + B^2}$$

$$U_H = \frac{3l^2}{3l^2 + H^2}$$



23

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 7

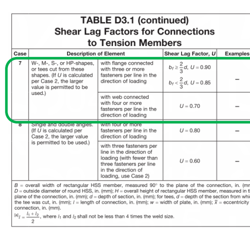
W-, M-, S-, or HP-shapes, or tees cut from these shapes.

(If U is calculated per Case 2, the larger value is permitted to be used.)

*with flange connected with three or more fasteners per line in the direction of loading

$$U = 0.90 \quad \text{if } b_f \geq \tfrac{2}{3}d$$

$$U = 0.85 \quad \text{if } b_f < \tfrac{2}{3}d$$



24

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 7

W-, M-, S-, or HP-shapes, or tees cut from these shapes.

(If U is calculated per Case 2, the larger value is permitted to be used.)

*with web connected with four or more fasteners per line in the direction of loading

$U = 0.70$

TABLE D3.1 (continued)
Shear Lag Factors for Connections to Tension Members

Case	Description of Element		Shear Lag Factor, U	Examples
7	W-, M-, S-, or HP-shapes, or tees cut from these shapes. (If U is calculated per Case 2, the larger value is permitted to be used.)	with flange connected with three or more fasteners per line in the direction of loading	$b_f \geq \frac{2}{3}d$, $U = 0.90$ $b_f < \frac{2}{3}d$, $U = 0.85$	–
		with web connected with four or more fasteners per line in the direction of loading	$U = 0.70$	–
8	Single and double angles. (If U is calculated per Case 2, the larger value is permitted to be used.)	with four or more fasteners per line in the direction of loading	$U = 0.80$	–
		with three fasteners per line in the direction of loading (with fewer than three fasteners per line in the direction of loading, use Case 2)	$U = 0.60$	–

B = overall width of rectangular HSS member, measured 90° to the plane of the connection, in. (mm); D = outside diameter of round HSS, in. (mm); H = overall height of rectangular HSS member, measured in the plane of the connection, in. (mm); d = depth of section, in. (mm); for tees, d = depth of the section from which the tee was cut, in. (mm); l = length of connection, in. (mm); w = width of plate, in. (mm); $\bar{x}$ = eccentricity of connection, in. (mm).
[a] $l = \frac{l_1 + l_2}{2}$, where l_1 and l_2 shall not be less than 4 times the weld size.

25

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 8

Single and double angles.

(If U is calculated per Case 2, the larger value is permitted to be used.)

*with four or more fasteners per line in the direction of loading

$U = 0.80$

TABLE D3.1 (continued)
Shear Lag Factors for Connections to Tension Members

Case	Description of Element		Shear Lag Factor, U	Examples
7	W-, M-, S-, or HP-shapes, or tees cut from these shapes. (If U is calculated per Case 2, the larger value is permitted to be used.)	with flange connected with three or more fasteners per line in the direction of loading	$b_f \geq \frac{2}{3}d$, $U = 0.90$ $b_f < \frac{2}{3}d$, $U = 0.85$	–
		with web connected with four or more fasteners per line in the direction of loading	$U = 0.70$	–
8	Single and double angles. (If U is calculated per Case 2, the larger value is permitted to be used.)	with four or more fasteners per line in the direction of loading	$U = 0.80$	–
		with three fasteners per line in the direction of loading (with fewer than three fasteners per line in the direction of loading, use Case 2)	$U = 0.60$	–

B = overall width of rectangular HSS member, measured 90° to the plane of the connection, in. (mm); D = outside diameter of round HSS, in. (mm); H = overall height of rectangular HSS member, measured in the plane of the connection, in. (mm); d = depth of section, in. (mm); for tees, d = depth of the section from which the tee was cut, in. (mm); l = length of connection, in. (mm); w = width of plate, in. (mm); $\bar{x}$ = eccentricity of connection, in. (mm).
[a] $l = \frac{l_1 + l_2}{2}$, where l_1 and l_2 shall not be less than 4 times the weld size.

26

Chapter 3.3 – Effective Area

- **AISC Equation D3-1**

Case 8

Single and double angles.

(If U is calculated per Case 2, the larger value is permitted to be used.)

*with three fasteners per line in the direction of loading (with fewer than three fasteners per line in the direction of loading, use Case 2)

$U = 0.60$

TABLE D3.1 (continued)
Shear Lag Factors for Connections to Tension Members

Case	Description of Element		Shear Lag Factor, U	Examples
7	W-, M-, S-, or HP-shapes, or tees cut from these shapes. (If U is calculated per Case 2, the larger value is permitted to be used.)	with flange connected with three or more fasteners per line in the direction of loading	$b_f \geq \frac{2}{3}d$, $U = 0.90$ $b_f < \frac{2}{3}d$, $U = 0.85$	–
		with web connected with four or more fasteners per line in the direction of loading	$U = 0.70$	–
8	Single and double angles. (If U is calculated per Case 2, the larger value is permitted to be used.)	with four or more fasteners per line in the direction of loading	$U = 0.80$	–
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B = overall width of rectangular HSS member, measured 90° to the plane of the connection, in. (mm); D = outside diameter of round HSS, in. (mm); H = overall height of rectangular HSS member, measured in the plane of the connection, in. (mm); d = depth of section, in. (mm); for tees, d = depth of the section from which the tee was cut, in. (mm); l = length of connection, in. (mm); w = width of plate, in. (mm); $\bar{x}$ = eccentricity of connection, in. (mm).
[a] $l = \frac{l_1 + l_2}{2}$, where l_1 and l_2 shall not be less than 4 times the weld size.

27

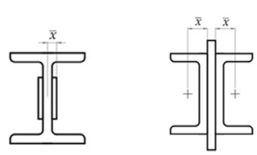
Chapter 3.3 – Effective Area

- The ***Commentary of the AISC Specification*** further illustrates $\bar{x}$ and l.
- ***Figure C-D3.1*** shows some special cases for $\bar{x}$, including channels and I-shaped members connected through their webs.
- For I-shaped members and tees connected through the web, we can also use Case 2 or Case 7 of Table 3.1.

28

Chapter 3.3 – Effective Area

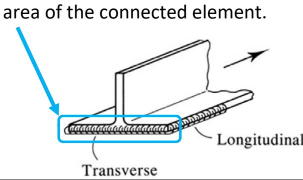
- The ***Commentary of the AISC Specification*** further illustrates $\bar{x}$ and l.
- To compute $\bar{x}$ for these cases, the Commentary uses the concept of the plastic neutral axis to explain the procedure. Since this concept is not covered until Chapter 5, we will use $\bar{x}$ for these cases as shown below.



29

Chapter 3.3 – Effective Area

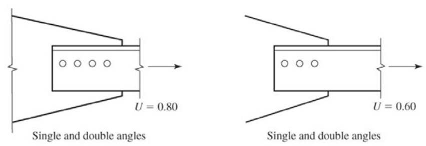
- For bolted plates, $U = 1.0$.
- This is logical, since the cross-section has only one element, and it is connected.
- There are some exceptions for welded plates.
- When the load is transmitted by ***transverse*** welds only (no longitudinal welds), A_n = the area of the connected element.
- This case ***is not common***.



30

Chapter 3.3 – Effective Area

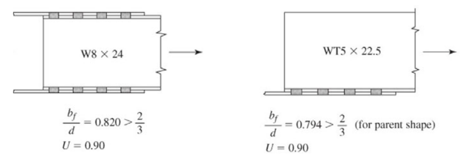
- For round and rectangular ***HSS***, refer to Cases 5 and 6.
- For single and double angles, the following values may be used
  - For ***four or more fasteners*** in the direction of loading, U = 0.80
  - For ***three fasteners*** in the direction of loading, U = 0.60



31

Chapter 3.3 – Effective Area

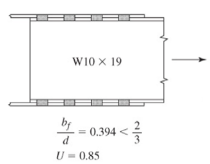
- For ***W, M, S, HP*** shapes or tees cut from these shapes, if the following conditions are satisfied, the corresponding values may be used:
  - Connected through the flange with three or more fasteners in the direction of loading, with a width at least ⅔ of the depth: U = 0.90



32

Chapter 3.3 – Effective Area

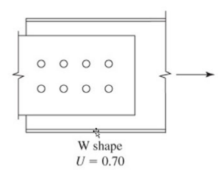
- For ***W, M, S, HP*** shapes or tees cut from these shapes, if the following conditions are satisfied, the corresponding values may be used:
  - Connected through the flange with three or more fasteners in the direction of loading, with a width less than ⅔ of the depth: U = 0.85



33

Chapter 3.3 – Effective Area

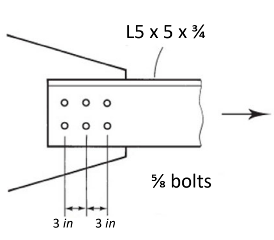
- For ***W, M, S, HP*** shapes or tees cut from these shapes, if the following conditions are satisfied, the corresponding values may be used:
  - Connected through the web with four or more fasteners in the direction of loading: U = 0.70

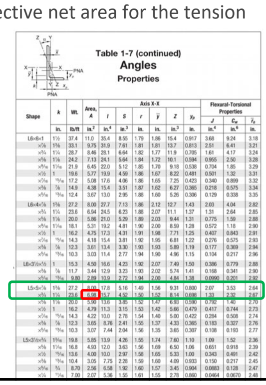


34

Chapter 3.3 – Effective Area

- **Example 3-4**: Determine the effective net area for the tension member shown below.



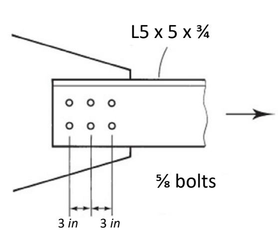


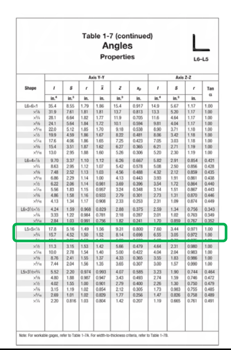
$A_g = 6.98 in^2$

35

Chapter 3.3 – Effective Area

- **Example 3-4**: Determine the effective net area for the tension member shown below.





$A_g = 6.98 in^2$

36

Chapter 3.3 – Effective Area

➢ **Example 3-4**: Determine the effective net area for the tension member shown below.

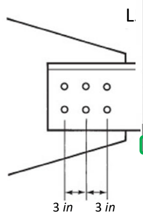


Table 1-7 (continued)
Angles
Properties
L6–L5

Shape	Axis Y-Y I (in.^{4})	S (in.^{3})	r (in.)	$\bar{x}$ (in.)	Z (in.^{3})	x_p (in.)	Axis Z-Z I (in.^{4})	S (in.^{3})	r (in.)	Tan α
L5×5×⅞	17.8	5.16	1.49	1.56	9.31	0.800	7.60	3.44	0.971	1.00
×¾	15.7	4.52	1.50	1.52	8.14	0.698	6.55	3.05	0.972	1.00
×⅜	3.33	1.22	0.984	0.781	2.18	0.287	2.01	1.02	0.763	0.349
×5/16	2.84	1.03	0.991	0.756	1.82	0.241	1.70	0.859	0.767	0.352
L5×5×⅞	17.8	5.16	1.49	1.56	9.31	0.800	7.60	3.44	0.971	1.00
×¾	15.7	4.52	1.50	1.52	8.14	0.698	6.55	3.05	0.972	1.00
×½	11.3	3.15	1.53	1.42	5.66	0.479	4.64	2.31	0.980	1.00
×7/16	10.0	2.78	1.54	1.40	5.00	0.422	4.04	2.04	0.983	1.00
×⅜	8.76	2.41	1.55	1.37	4.33	0.365	3.55	1.83	0.986	1.00
×5/16	7.44	2.04	1.56	1.35	3.65	0.307	3.00	1.57	0.990	1.00
L5×3½×¾	5.52	2.20	0.974	0.993	4.07	0.585	3.23	1.90	0.744	0.464
×⅝	4.80	1.88	0.987	0.947	3.43	0.493	2.74	1.59	0.746	0.472
×½	4.02	1.55	1.00	0.901	2.79	0.400	2.26	1.30	0.750	0.479
×⅜	3.15	1.19	1.02	0.854	2.12	0.305	1.73	0.983	0.755	0.485
×5/16	2.69	1.01	1.02	0.829	1.77	0.256	1.47	0.826	0.758	0.489
×¼	2.20	0.816	1.03	0.804	1.42	0.207	1.19	0.665	0.761	0.491

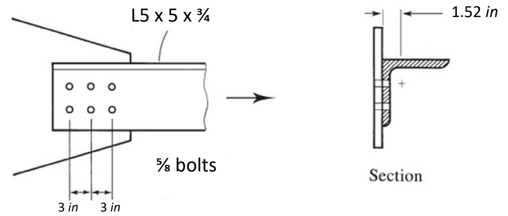
Note: For workable gages, refer to Table 1-7A. For width-to-thickness criteria, refer to Table 1-7B.

$A_g = 6.98 in^2$ $\quad \bar{x} = 1.52\ in$

37

Chapter 3.3 – Effective Area

➢ **Example 3-4**: Determine the effective net area for the tension member shown below.

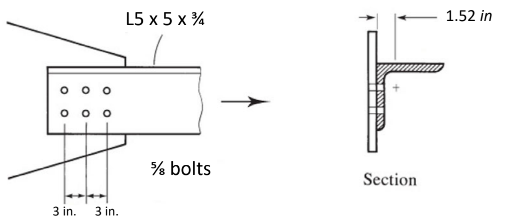


$$A_n = A_g - A_{holes} = 6.98\ in^2 - \frac{3}{4}in\left(\frac{5}{8}in + \frac{1}{8}in\right)(2\ holes) = 5.86\ in^2$$

38

Chapter 3.3 – Effective Area

➢ **Example 3-4**: Determine the effective net area for the tension member shown below.



Only one element (one leg) of the cross-section is connected, so the ***net area must be reduced***.

39

Chapter 3.3 – Effective Area

➢ **Example 3-4**: Determine the effective net area for the tension member shown below.

From the properties tables in **Part 1 of the Manual**, the distance from the centroid to the outside face of the leg of an **L5 x 5 x ¾** is: $\bar{x}$ = 1.52 *in.*

The length of the connection is: $l = 3\ in + 3\ in = 6\ in$

$$U = 1 - \frac{\bar{x}}{l} = 1 - \left(\frac{1.52\ in}{6\ in}\right) = 0.747$$

$$A_e = A_n U = 5.86\ in^2 (0.747) = 4.375\ in^2$$

40

Chapter 3.3 – Effective Area

➢ **Example 3-4**: Determine the effective net area for the tension member shown below.

The alternative value of ***U*** could also be used.

Because this angle has three bolts in the direction of the load, the reduction factor ***U*** can be taken as 0.60, therefore

$$A_e = A_n U = 5.86\ in(0.60) = 3.516\ in^2$$

Either ***U*** value is acceptable, and the ***Specification*** permits the larger one to be used.

However, the results from the equation are more accurate.

41

Chapter 3.3 – Effective Area

➢ **Example 3-4**: Determine the effective net area for the tension member shown below.

The alternative value of ***U*** could also be used.

Because this angle has three bolts in the direction of the load, the reduction factor ***U*** can be taken as 0.60, therefore

$$A_e = A_n U = 5.86\ in(0.60) = 3.516\ in^2$$

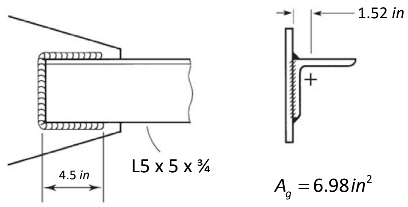
The alternative values of ***U*** can be useful during the preliminary design, when actual section properties and connection details are not known.

For this example: $A_e = 4.375\ in^2$

42

Chapter 3.3 – Effective Area

- **Example 3-5**: If the tension member is welded as shown below, determine the effective area.

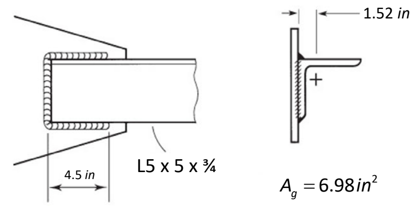


Only part of the cross-section is connected, and a reduced effective area must be used.

43

Chapter 3.3 – Effective Area

- **Example 3-5**: If the tension member is welded as shown below, determine the effective area.

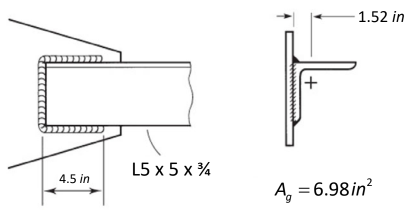


$$U = 1 - \frac{\bar{x}}{l} = 1 - \left(\frac{1.52\ in}{4.5\ in}\right) = 0.662$$

44

Chapter 3.3 – Effective Area

- **Example 3-5**: If the tension member is welded as shown below, determine the effective area.

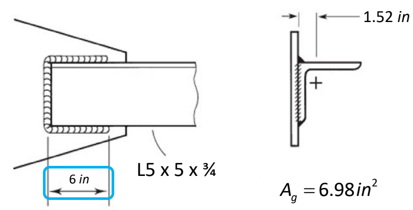


$$A_e = A_n U = 6.98\ in^2 (0.662) = \boxed{4.622 in^2}$$

45

Chapter 3.3 – Effective Area

- **Example 3-5**: If the tension member is welded as shown below, determine the effective area. ***Increasing the weld length.***

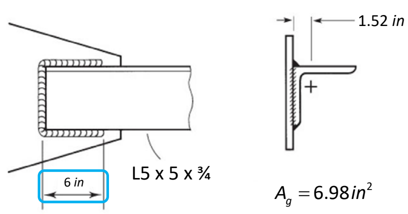


$$U = 1 - \frac{\bar{x}}{l} = 1 - \left(\frac{1.52\ in}{6\ in}\right) = 0.747$$

46

Chapter 3.3 – Effective Area

- **Example 3-5**: If the tension member is welded as shown below, determine the effective area. ***Increasing the weld length.***



$$A_e = A_n U = 6.98\ in^2 (0.747) = \boxed{5.212\ in^2}$$

47

Chapter 3.3 – Effective Area

Let's work on some problems.

48

Chapter 3.3 – Effective Area

Any questions?