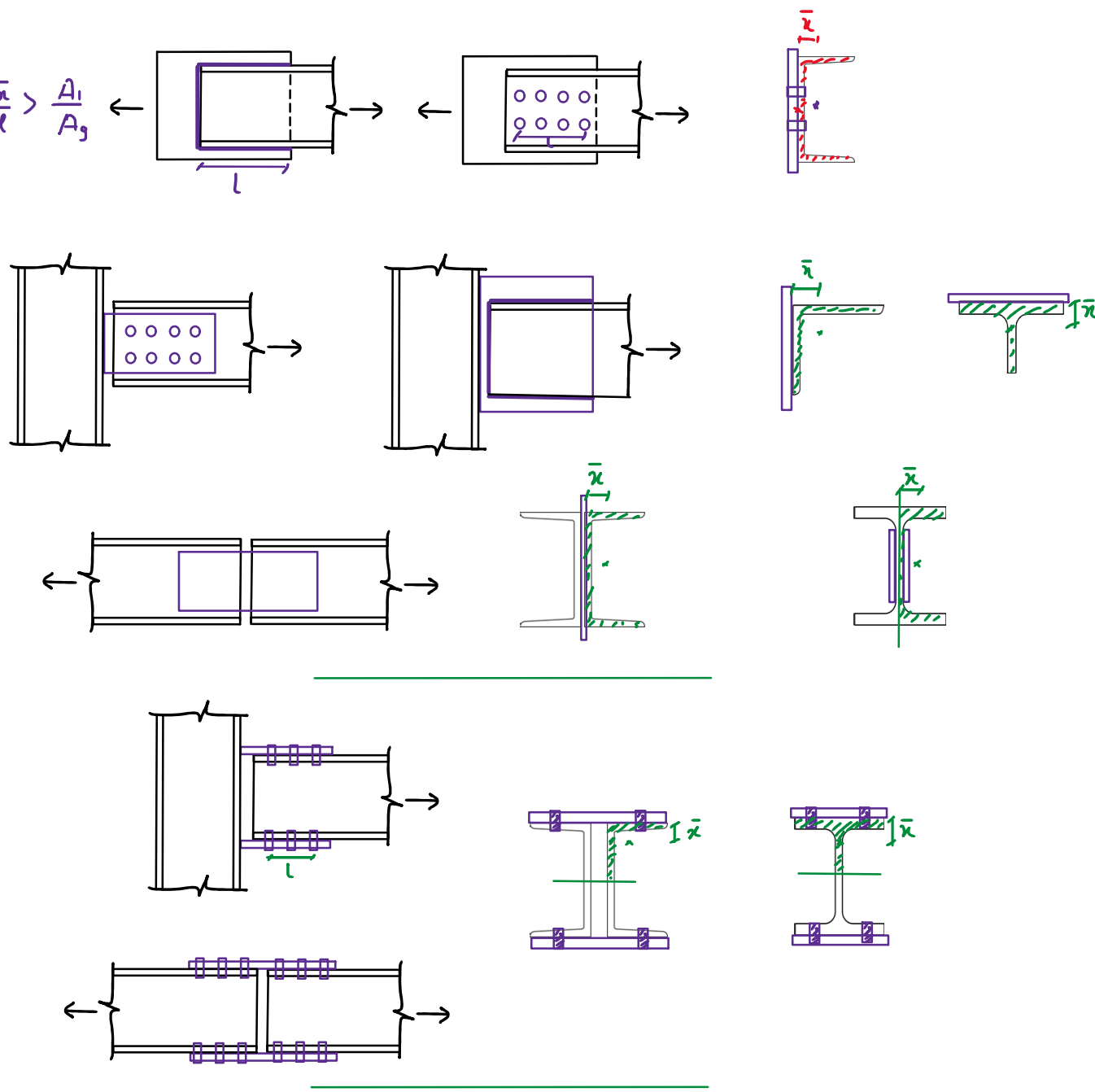


$$A_e = UA_n$$

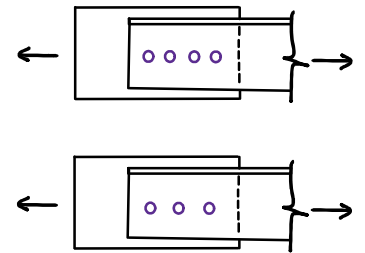
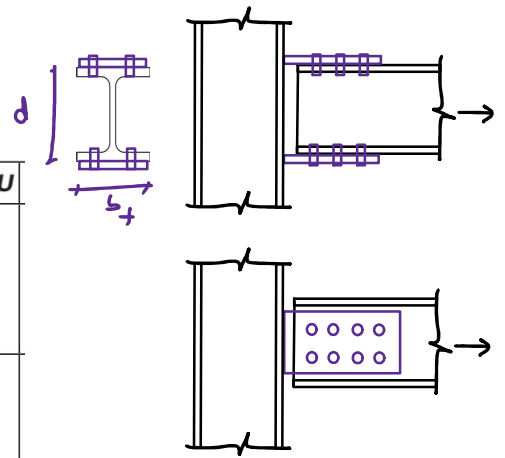
محاسبه ضریب تاخیر پرش U

<p>2</p>	<p>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.</p>	$U = 1 - \frac{\bar{x}}{l}$	
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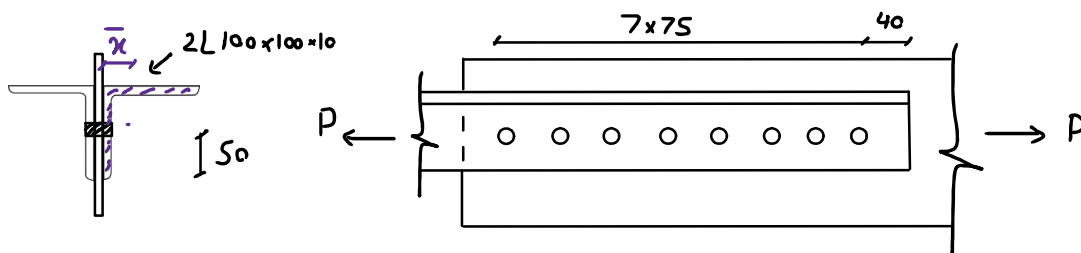
$$U = 1 - \frac{\bar{x}}{l} > \frac{A_1}{A_2}$$



Case	Description of Element	Shear Lag Factor, U
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
		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)



مثال: مقطع کشش ازدوبل نبش $2L100 \times 100 \times 10$ تحت بار مرده 180 kN و بار زنده 530 kN قرار دارد. نوع فولاد نبش ما از S355 بوده و توسط 8 پیچ M20 به ورق اتصال دارد. مقاومت عضو را برای بار داده چک کنید.



S355 : $F_y = 355 \text{ MPa}$, $F_u = 470 \text{ MPa}$ 8 M20 : $d = 24$

$L100 \times 100 \times 10$: $A_g = 19.2 \times 10^2 \text{ mm}^2$, $\bar{x} = 28.2$, $r_x = 30.4 \text{ mm}$, $r_y = 19.5 \text{ mm}$

$P_u = 1.2 P_D + 1.6 P_L = 1.2(180) + 1.6(530) = 1064 \text{ kN}$

$\phi P_n = 0.9 \times 355 \times t_{\text{min}} \times 2 \times 19.2 = 120 \text{ ton}$

① Yield of Gross Section

$\phi P_n = 0.9 F_y A_g = 0.9 \times 355 \times 2 \times 19.2 \times 10^2 = 1227 \text{ kN} \geq P_u = 1064 \checkmark$

② Fracture of Net Section

Case 2 $U = 1 - \frac{\bar{x}}{l} = 1 - \frac{28.2}{525} = \underline{0.946} > \frac{A_1}{A_g} = 0.5$

Case 8 $U = \underline{0.8}$

Case 2 & 8 $U = \max(0.946, 0.8) = \underline{0.946}$

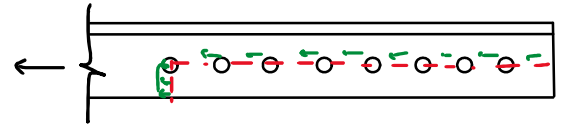
$$A_n = 2 \times [19.2 \times 10^2 - 24 \times 10] = 33.6 \times 10^2$$

$$A_e = U A_n = 0.946 \times 33.6 \times 10^2 = 31.8 \times 10^2 \text{ mm}^2$$

$$\phi P_n = 0.75 F_u A_e = 0.75 \times 470 \times 31.8 \times 10^2 = \underline{1120} \text{ kN} > P_u = 1064 \checkmark$$

③ Block shear Fracture

$$\phi P_n = 0.75 [\min(0.6 F_y A_{gv}, 0.6 F_u A_{nv}) + U_{bs} F_u A_{nt}]$$



$$A_{gv} = 2 \times (565 \times 10) = 113 \times 10^2 \text{ mm}^2 \rightarrow 0.6 F_y A_{gv} = 0.6 \times 355 \times 113 \times 10^2 = \underline{2407} \text{ kN}$$

$$A_{nv} = 2 \times [(565 - 7.5 \times 24) \times 10] = 77 \times 10^2 \rightarrow 0.6 F_u A_{nv} = 0.6 \times 470 \times 77 \times 10^2 = \underline{2171} \text{ kN} \leftarrow$$

$$A_{nt} = 2 \times [(50 - 0.5 \times 24) \times 10] = 7.6 \times 10^2 \rightarrow F_u A_{nt} = 470 \times 7.6 \times 10^2 = 357 \text{ kN}$$

$$\phi P_n = \min(2407, 2171) + 357 = \underline{2528} \text{ kN} \geq P_u = 1064 \checkmark$$

Limit States ϕP_n for 2L100x100x10

yield 1227 kN

fracture 1120 kN \leftarrow Controls

block shear 2528 kN

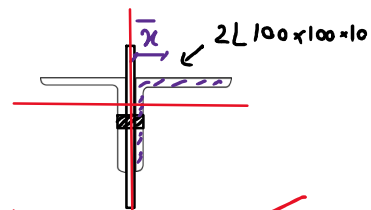
$$D/C = \frac{P_u}{\phi P_n} = \frac{1064}{1120} = \underline{0.95}$$

العرض

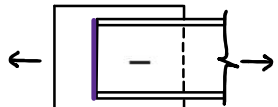
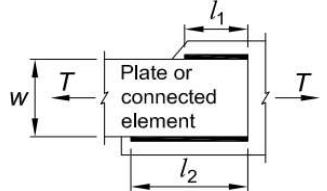
$$r_x = 30.4 \text{ mm} \rightarrow \frac{L}{r_x} \leq 300 \rightarrow L \leq 300 \times 30.4 = 9120 \text{ mm}$$

الارتفاع

$$r_y = 19.5 \text{ mm} \rightarrow \frac{L}{r_y} \leq 300 \rightarrow L \leq 300 \times 19.5 = 5850 \text{ mm}$$



حد اکثر طول عضو کتی حدود ۹ متر است که بر اساس ابعاد بالاتر از عرض است. میانگین است.

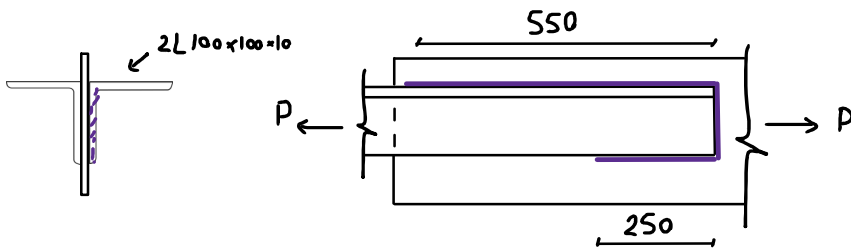
3	All tension members where the tension load is transmitted only by transverse welds to some but not all of the cross-sectional elements.	$U = 1.0$ and $A_n =$ area of the directly connected elements	
4[a]	Plates, angles, channels with welds at heels, tees, and W-shapes with connected elements, where the tension load is transmitted by longitudinal welds only. See Case 2 for definition of \bar{x} .	$U = \frac{3l^2}{3l^2 + w^2} \left(1 - \frac{\bar{x}}{l}\right)$	

مثال: مثال فوق را بررسی حالت زیر حل کنید.

(الف) اتصال با جوش طولی عرض

(ب) فقط جوش عرض

(ج) فقط جوش طولی



$$L = \frac{250 + 550}{2} = 400$$

Case 2 : $U = 1 - \frac{\bar{x}}{l} = 1 - \frac{28.2}{400} = 0.93 \geq \frac{A_1}{A_g} = 0.5$
 $A_e = U A_g = 0.93 \times (2 \times 19.2 \times 10^2) = 35.7 \times 10^2$
 $\phi P_n = 0.75 F_u A_e = 0.75 \times 470 \times 35.7 \times 10^2 = \underline{1258} \text{ kN}$

Case 3 : $U = 1$, $A_n = 2 \times 0.5 \times 19.2 \times 10^2 = 19.2 \times 10^2$
 $\phi P_n = 0.75 F_u A_e = 0.75 \times 470 \times 19.2 = \underline{677} \text{ kN}$

Case 4 : $U = \frac{3l^2}{3l^2 + w^2} \left(1 - \frac{\bar{x}}{l}\right) = \frac{3 \times 400^2}{3 \times 400^2 + 100^2} \left(1 - \frac{28.2}{400}\right) = 0.91$
 $A_e = U A_g = 0.91 \times (2 \times 19.2 \times 10^2) = 35 \times 10^2$
 $\phi P_n = 0.75 F_u A_e = 0.75 \times 470 \times 35 \times 10^2 = \underline{1232} \text{ kN}$

