

د افغانستان اسلامي جمهوریت

د لورو زده کړو وزارت

لنډان پوهنتون

انجنیري پوهنځي



Steel Design  
 Ketabton.com

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حاضرې شمېره : 37

استاد : پوهنځي خيبر (خپلواک)

کال: ۱۳۹۹ هـ ش

# بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

## سریزه

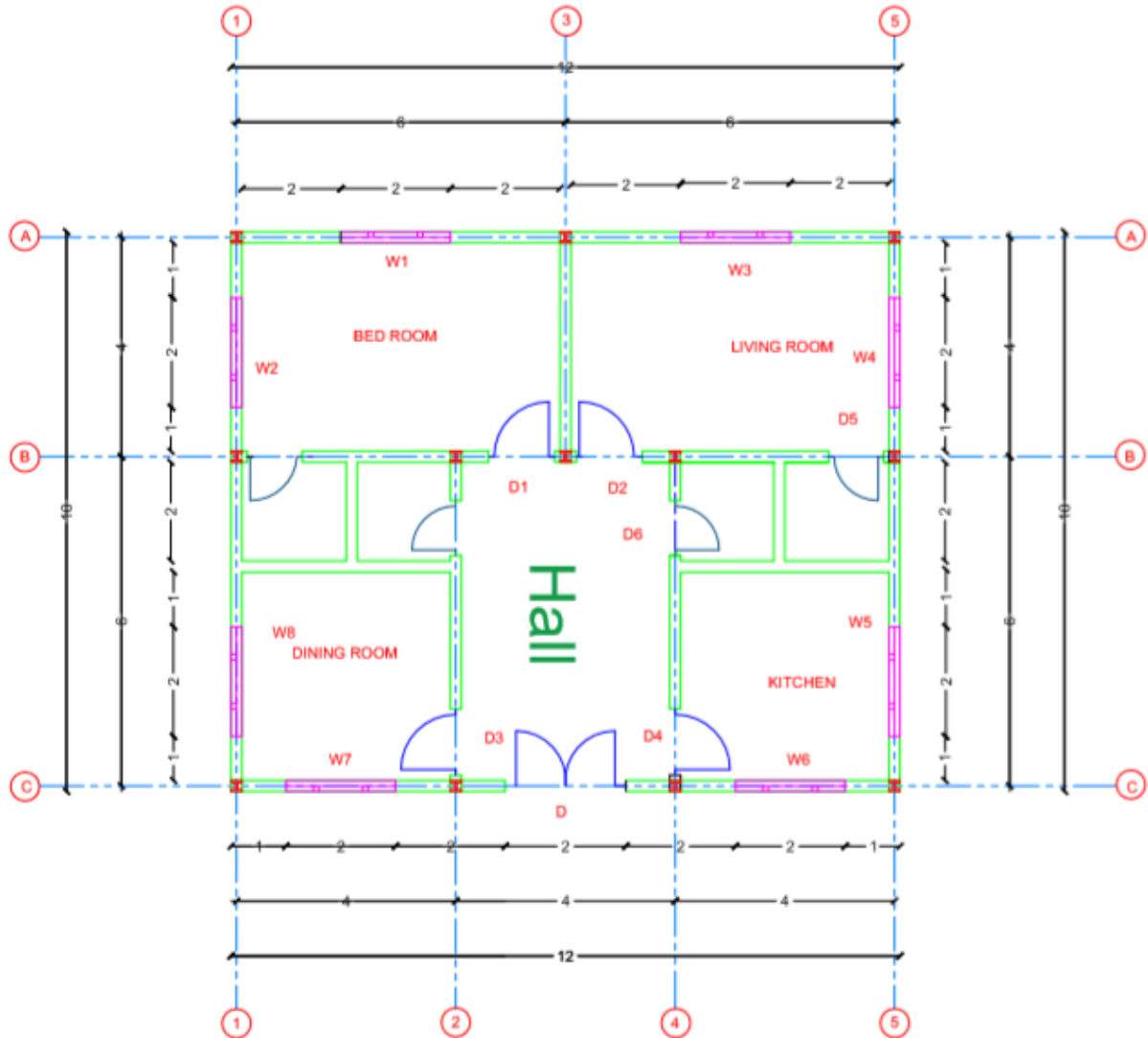
له کله نه چی انسان د خمکی په مخ قدم ایبني نو له همغه پیل نه یی د اوسیدو لپاره ځان ته دیوه سرپناه د پیدا کولو هڅه کړی . دا ځکه چی هر انسان له هوا او اوبو وروسته تر ټولو لمړی اړین عنصر چی د هوسا ژوند تیرولو لپاره ورته اړتیا لری هغه هم سرپنا ده نه یواځی انسانان بلکی الوتونکی هم چی کله په یوه سیمه کی وغواړی دپیر وخت لپاره ووسیری نو لومړی ځان ته له ونو ، بوټو او خابناکو څخه د اوسیدو لپاره ځای برابروی .

په پخوانی وختونو کی کله چی د انسانانو ژوند په مشترک ډول نه و نو په هغه وخت کی خلکوپه غارونو او د لویو ډبرو په اړه خونو او کنجونو کی ژوند تیراوه نو دوی دی ته اړ و چی خپل ځانونه د طبیعت د نا مؤزنه شرایطو او همدارنگه د ځنگلونو ، غرونو او دشتو وحشی حیواناتو څخه ځان په امن وساتی .

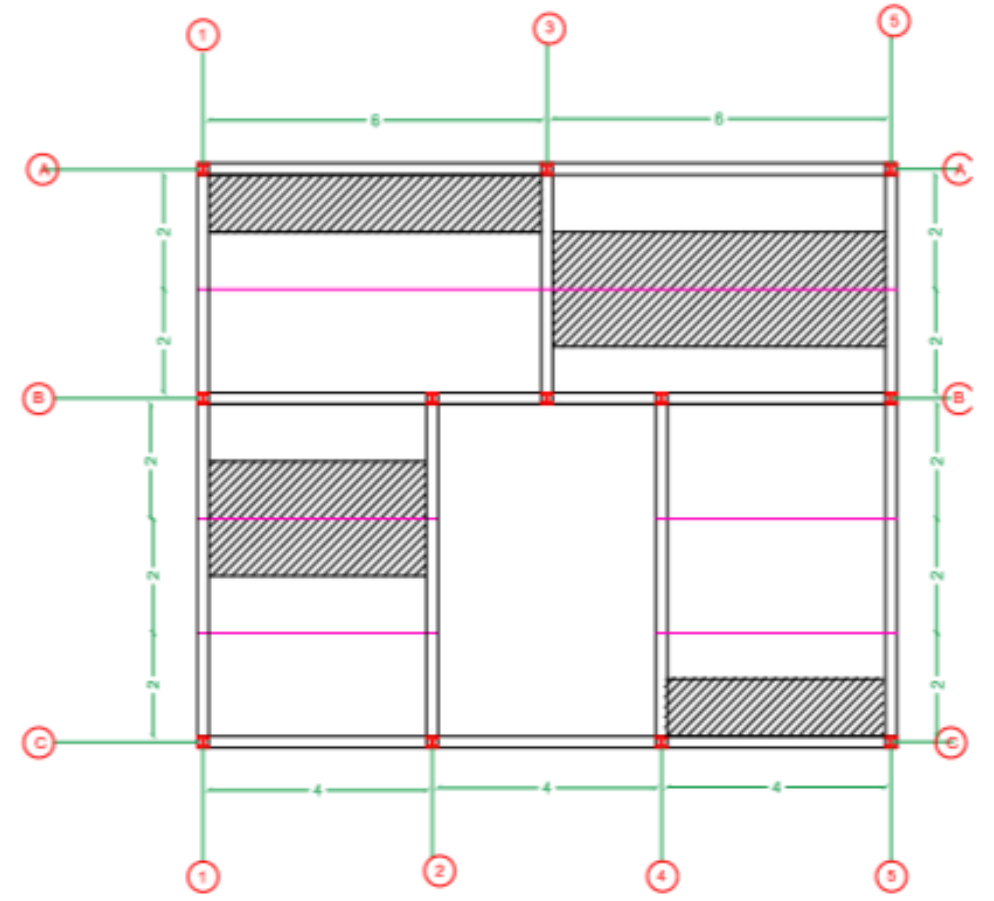
نو له دی څخه څرگندیږی چی انسانانو له همغه پیله ځان ته سرپناه جوړه وی چی د انسان په متمدن کیدو سره د سرپناه په جوړولو کی مختلف بدلونونه راغلل چی اوس وخت عموما چی کوم ساختمانونه جوړیږی هغه د اوسپنیزکانکریت ، لرگیو، او فولادی ساختمانونو څخه عبارت دی چی نظر دی ټولو ته فولادی ساختمانونه ډیر کارول کیږی . او فولاد یو ډیره مهمه ساختمانی ماده ده چی نن سبا په ساختمانی چارو کی په پراخه اندازه ورڅخه استفاده کیږی . لکه په مسکونی ودانیو ، سرکونو ، پلونو، هایدرولیکی ساختمانونو اوداسی نور....

مور چی کوم فولادی ساختمان ډیزاین کوو د هغه پلان په لاندی ډول دی

# پلان



# د ډيمونو او ګاډرو چوکاټ



لومړۍ برخه

د ټولو نه ورومې ددغي ساختمان Roof deck ډيزاين كوو

د Roof د ډيزاين دپاره يوازي live load په نظر كي نيسو.

د مسكوني ودانيو دپاره live load = 192 kg/m<sup>2</sup>

$$W_u = 1.4 * 192 \text{ kg/m}^2 = 268.8 \text{ kg/m}^2$$

د نهايي بار واحد د SI څخه PSF ته اړوو

$Wu = 268.8 * 2.204 / 3,28^2 = 55.06 \text{ PS}$

اوس VULCRAFT MENUAL ته مراجعه ڪوو او دهغه د جدولونو څخه Roof deck انتخابوو . مونږ چي ڪوم Roof deck انتخاب ڪري دي د هغه وايه 2m ده اوس مونږ دغه واحد په Ft بدلوو

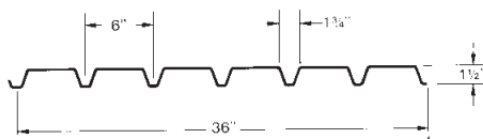
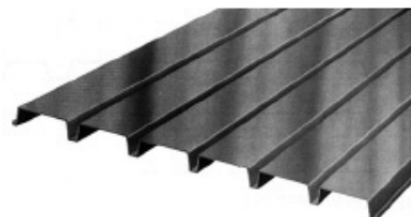
$2m = 2 * 3,28 \text{ Ft} = 6.56 \text{ Ft}$

د VULCRAFT MENUAL په نومري برخه څلورمه صفحه كي DECK F20 1.5F انتخابوو

ڪوم چي 6 Ft - 6in وايه لري او همدارنگه 58 PSF بار د زغملو وړتيا لري او طول يي 6 Ft -6 in دي

### 1.5 F

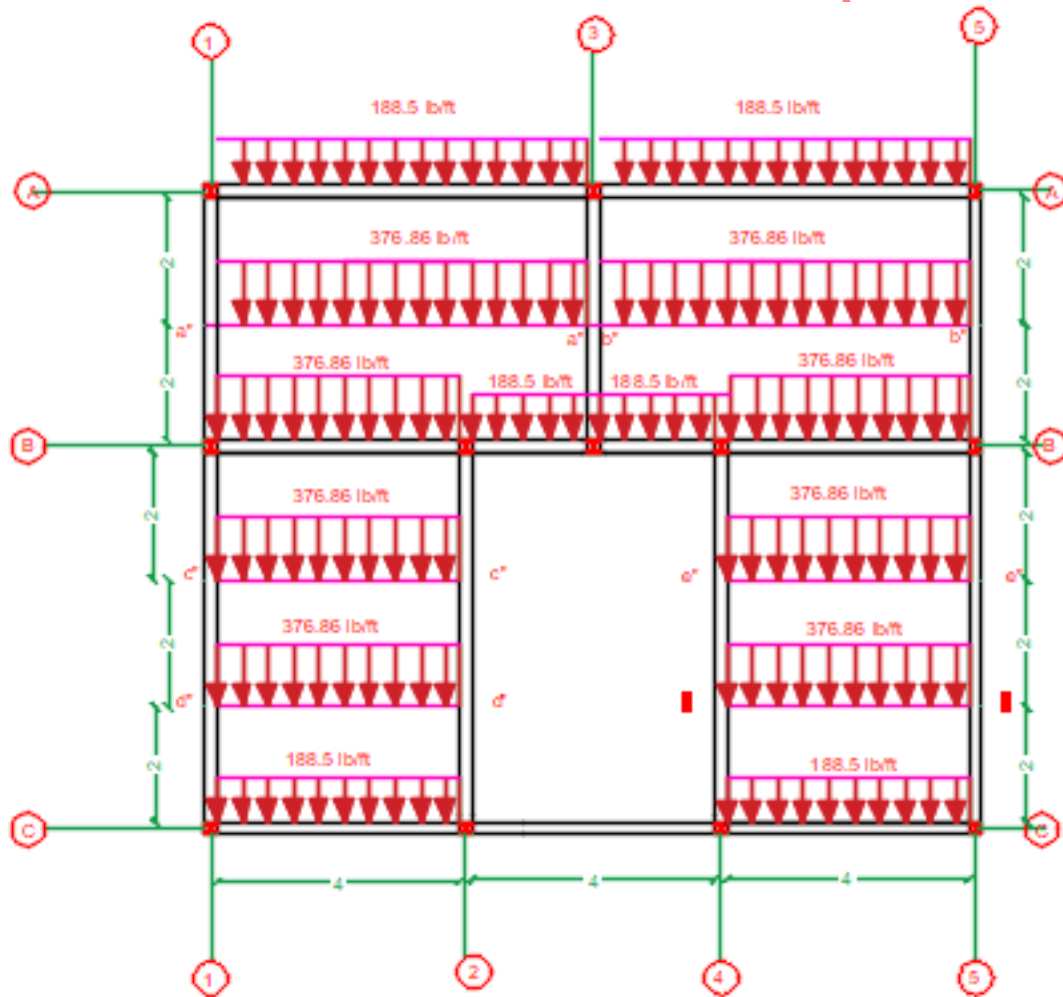
Maximum Sheet Length 42'-0  
Extra Charge for Lengths Under 6'-0  
ICBO Approved (No.3415)  
Factory Mutual Approved  
Deck type & gauge — Max. deck span  
1.5F22..... 4'-11"  
1.5F20..... 5'-5"  
1.5F18..... 6'-3"  
FM Approvals No. 0C8A7.AM



#### VERTICAL LOADS FOR TYPE 1.5F

No. of Spans	Deck Type	Max. SDI Const. Span	Allowable Total (Dead + Live) Uniform Load (PSF)										
			Span (ft.-in.) C. to C. of Support										
1	F22	4'-9"	93	74	60	49	41	35	30	27	23	21	21
	F21	5'-1"	106	84	68	56	47	40	35	30	26	23	21
	F20	5'-5"	116	92	74	61	51	44	38	33	29	25	23
	F19	6'-0"	138	109	89	73	61	52	44	38	33	29	26
	F18	6'-5"	158	125	101	84	70	59	49	42	36	32	29
2	F22	5'-10"	101	80	65	53	45	38	33	29	25	22	20
	F21	6'-2"	113	89	72	60	50	43	37	32	28	25	22
	F20	6'-6"	123	97	79	65	55	47	40	35	31	27	24
	F19	7'-1"	143	113	92	76	64	54	47	41	36	32	28
	F18	7'-8"	163	128	104	86	72	62	53	46	41	36	32
3	F22	5'-10"	126	100	81	67	56	48	41	36	32	28	25
	F21	6'-2"	141	111	90	74	63	53	46	40	35	31	28
	F20	6'-6"	154	122	99	82	69	58	50	44	39	34	30
	F19	7'-1"	179	142	115	95	80	68	59	51	45	40	35
	F18	7'-8"	203	160	130	107	90	77	66	58	51	45	40

### په لاندې چوکاټ کې هرېم ته لوږ په خطي ډول بنودل شوي



په پورته چوکاټ کې ځینې بېمونه د اوږدوالي او پر هغوي د وارده بار له مخې یو ډول دي

$$A_{1-3} = A_{3-5}$$

$$C_{1-2} = C_{4-5}$$

$$B_{1-2} = B_{4-5}$$

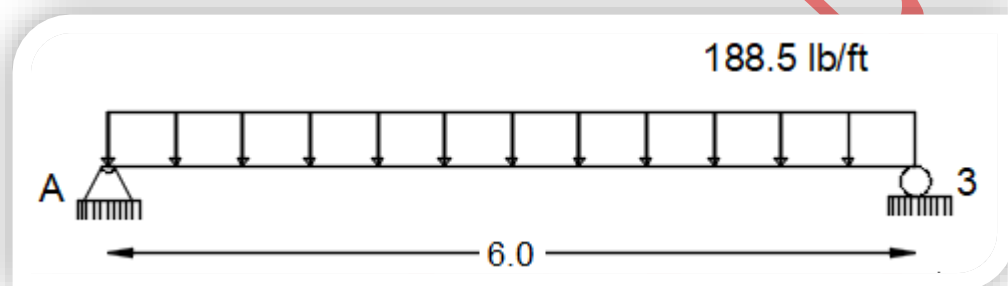
$$B_{2-3} = B_{3-4}$$

$$a'' - a'' = b'' - b'' \quad , \quad c'' - c'' = d'' - d'' = e'' - e'' = f'' - f''$$

## اوس نو لومري A<sub>1-3</sub> بيم ڊيزاين ڪوو

په هر بيم د 1.99 PSF ROOF DECK وزن په نظر ڪي نيول ڪيري

نوٽ : د بيمونو او ڪاڊرو اندازہ گذاري په متر ده چي په محاسبه ڪي په فوٽ اڙول ڪيري



$$W_u = 188.5 \text{ lb/ft}$$

$$M_{\max} = W \cdot L^2 / 8$$

$$M_{\max} = \frac{188.5 \text{ lb/ft} \cdot (19.7 \text{ ft})^2}{8} = 9144.4 \text{ lb} \cdot \text{ft}$$

$$S_{\text{required}} = \frac{M}{\delta_{\text{Allowable}}}$$

$$\delta_{\text{Allowable for steel}} = 29 \text{ ksi}$$

$$ft = 12 \text{ in}$$

$$S_{\text{req}} = \frac{9144.4 \cdot 12 \text{ lb} \cdot \text{in}}{29000 \text{ psi}} = 3.78 \text{ in}^3$$

اوس (28, 29) صفحو ته ڄو او د  $4.9 \text{ in}^3$  ،  $M_{8 \cdot 6.2}$  بيم مقطع انتخابوو

Table 1-2 (continued)  
M Shapes  
Properties



Nom- inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				$r_{ts}$	$h_o$	Torsional Properties		
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	$I$	$S$	$r$	$Z$	$I$	$S$	$r$	$Z$			$\frac{J}{S_x h_o}$	$J$	$C_w$
	lb/ft		in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>			in.	in.	in. <sup>4</sup>
12.4	8.22	74.8	89.3	14.2	4.96	16.5	2.01	1.07	0.744	1.68	0.100	12.3	0.000283	0.0493	76.0
11.6	8.29	74.8	80.3	12.8	4.86	15.0	1.51	0.864	0.667	1.37	0.099	12.3	0.000263	0.0414	57.1
11.8	6.81	62.5	72.2	12.0	4.56	14.3	1.09	0.709	0.559	1.15	0.108	11.8	0.000355	0.0500	37.7
10.8	7.30	69.2	66.7	11.1	4.58	13.2	1.01	0.661	0.564	1.07	0.104	11.8	0.000300	0.0393	35.0
10	9.03	74.7	61.7	10.3	4.57	12.2	1.03	0.636	0.592	1.02	0.098	11.8	0.000240	0.0292	35.9
9	6.53	58.4	39.0	9.8	3.83	9.22	0.672	0.500	0.503	0.809	0.117	9.81	0.000411	0.0314	16.1
8	7.39	65.0	34.0	6.95	3.82	8.20	0.593	0.441	0.500	0.711	0.111	9.81	0.000328	0.0224	14.2
7.5	7.77	71.0	33.0	6.60	3.85	7.77	0.562	0.418	0.503	0.670	0.107	9.81	0.000289	0.0187	13.5
6.5	6.03	53.8	18.5	4.63	3.11	5.43	0.376	0.329	0.443	0.529	0.131	7.81	0.000509	0.0184	5.73
6.2	6.44	56.5	17.6	4.39	3.10	5.15	0.352	0.308	0.439	0.495	0.127	7.81	0.000455	0.0156	5.38
4.4	5.39	47.0	7.23	2.41	2.36	2.80	0.180	0.195	0.372	0.311	0.152	5.81	0.000707	0.00990	1.53
3.7	7.75	54.7	5.96	2.01	2.34	2.33	0.173	0.173	0.398	0.273	0.137	5.75	0.000459	0.00530	1.45

مونبر د AISC MANUAL په 28 صفحه کی M8\*6.2 ډوله مقطع انتخابوو

اوس ياده مقطع د عرضي تشنج دپاره چيک کوو  $V = 1854.15$   $V = w * L / 2$

$A = t_w * d$  ,  $A = 0.129 * 8$  ,  $A = 1.032 \text{ in}^2$  ,

$\tau = V / A$

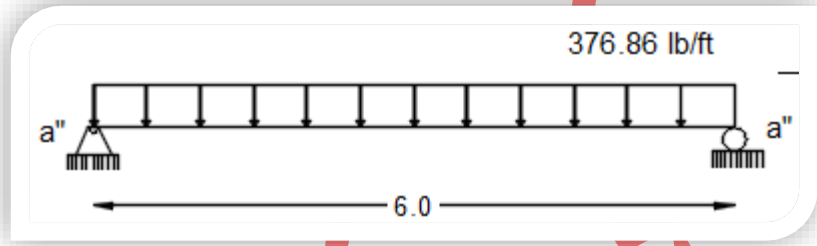
$\tau = 1854.15 / 1.032 = 1.79665 \text{ Ksi}$

$\tau_{\text{allowable}} = 12 \text{ ksi}$

$\tau_{\text{allowable}} > \tau$  ..... ok



## اوس "a"-a" بيم ڊيزاين ڪوو



$$W_u = 376.86 \text{ lb/ft}$$

$$M_{\max} = W \cdot L^2 / 8$$

$$M_{\max} = (376.86 \cdot 19.68^2) / 8 = 18244.8 \text{ lb} \cdot \text{ft}$$

$$S_{\text{required}} = \frac{M}{\delta_{\text{Allowable}}}$$

$$ft = 12 \text{ in}$$

$$S_{\text{req}} = (18244.8 \cdot 12) \text{ lb} \cdot \text{in} / 29000 \text{ psi} = 7.55 \text{ in}^3$$

اوس (28, 29) صفحو ته ڇو او د  $s = 7.79 \text{ in}^3$  بيم مقطع انتخابوو

Table 1-2 (continued)  
M Shapes  
Properties



Nom- inal Wt.  lb/ft	Compact Section Criteria		Axis X-X				Axis Y-Y				$r_{ts}$	$h_o$	$\frac{J}{S_x h_o}$	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	$I$	$S$	$r$	$Z$	$I$	$S$	$r$	$Z$				$J$	$C_w$
			in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>				in.	in.
12.4	8.22	74.8	89.3	14.2	4.96	16.5	2.01	1.07	0.744	1.68	0.100	12.3	0.000283	0.0493	76.0
11.6	8.29	74.8	80.3	12.8	4.86	15.0	1.51	0.864	0.667	1.37	0.099	12.3	0.000263	0.0414	57.1
11.8	6.81	62.5	72.2	12.0	4.56	14.3	1.09	0.709	0.559	1.15	0.108	11.8	0.000355	0.0500	37.7
10.8	7.30	69.2	66.7	11.1	4.58	13.2	1.01	0.661	0.564	1.07	0.104	11.8	0.000300	0.0393	35.0
10	9.03	74.7	61.7	10.3	4.57	12.2	1.03	0.636	0.592	1.02	0.098	11.8	0.000240	0.0292	35.9
9	6.53	58.4	39.0	7.79	3.83	9.22	0.672	0.500	0.503	0.809	0.117	9.81	0.000411	0.0314	16.1
8	7.39	65.0	34.6	6.95	3.82	8.20	0.593	0.441	0.500	0.711	0.111	9.81	0.000328	0.0224	14.2

اوس یی د عرضی تشنج دپاره محاسبه کوو

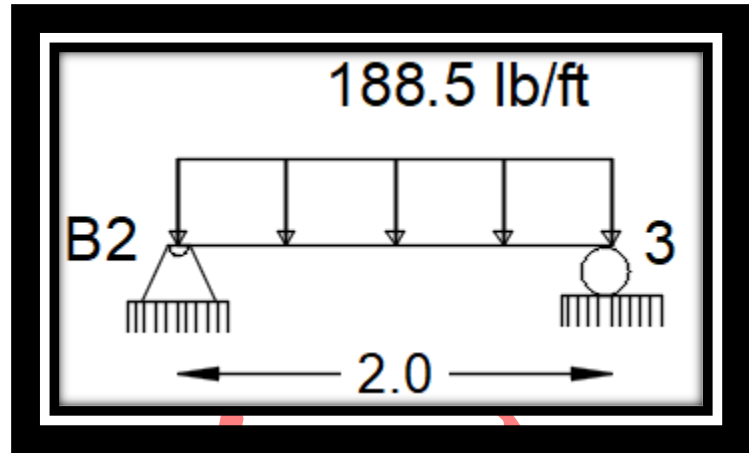
$$\tau = V/A \quad , \quad v = 3708.3 \text{ lb}$$

$$A = t_w * d \quad , \quad A = 0.157 * 10 \quad , \quad A = 1.57 \text{ in}^2$$

$$\tau = 3708.3 / 1.57 = 2.362 \text{ ksi}$$

$$\tau_{\text{allowable}} = 12 \text{ ksi} \quad \tau_{\text{allowable}} > \tau \quad \dots \quad \text{ok}$$

## اوس B<sub>2-3</sub> ڊيزاين ڪوو



$$W_u = 188.5 \text{ lb/ft}$$

$$M_{\text{max}} = (188.5 * 6.56^2) / 8 = 1014 \text{ lb*ft}$$

$$S_{\text{required}} = \frac{M}{\delta_{\text{Allowable}}}$$

$$ft = 12 \text{ in}$$

$$S_{\text{req}} = (1014 \text{ lb*ft} * 12) / 29000 \text{ psi} = 0.42 \text{ in}^3$$

اوس په (28,29) صفحو ڪي  $s = 1 \text{ in}^3$   $M_{3*2.9}$  بيم مقطع انتخابوو

Table 1-2 (continued)  
M Shapes  
Properties



Nom- inal WL	Compact Section Criteria		Axis X-X				Axis Y-Y				$r_x$	$h_o$	$\frac{J}{S_x h_o}$	Torsional Properties	
			$I$	$S$	$r$	$Z$	$I$	$S$	$r$	$Z$				$J$	$C_w$
	lb/ft	$\frac{b_f}{2t_f}$	$\frac{b}{t_w}$	in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in.	in.	in. <sup>4</sup>	in. <sup>6</sup>
12.4	8.22	74.8	89.3	14.2	4.96	16.5	2.01	1.07	0.744	1.68	0.100	12.3	0.000283	0.0493	76.0
11.6	8.29	74.8	80.3	12.8	4.86	15.0	1.51	0.864	0.667	1.37	0.099	12.3	0.000263	0.0414	57.1
11.8	6.81	62.5	72.2	12.0	4.56	14.3	1.09	0.709	0.559	1.15	0.108	11.8	0.000355	0.0500	37.7
10.8	7.30	69.2	66.7	11.1	4.58	13.2	1.01	0.661	0.564	1.07	0.104	11.8	0.000300	0.0393	35.0
10	9.03	74.7	61.7	10.3	4.57	12.2	1.03	0.636	0.592	1.02	0.098	11.8	0.000240	0.0292	35.9
9	6.53	58.4	39.0	9.2	4.22	11.2	0.672	0.500	0.503	0.809	0.117	9.81	0.000411	0.0314	16.1
8	7.39	65.0	34.6	8.5	3.82	8.20	0.593	0.441	0.500	0.711	0.111	9.81	0.000328	0.0224	14.2
7.5	7.77	71.0	33.0	6.60	3.85	7.77	0.562	0.418	0.503	0.670	0.107	9.81	0.000289	0.0187	13.5
6.5	6.03	53.8	18.5	4.63	3.11	5.43	0.376	0.329	0.443	0.529	0.131	7.81	0.000509	0.0184	5.73
6.2	6.44	56.5	17.0	4.30	3.10	5.15	0.352	0.308	0.439	0.495	0.127	7.81	0.000455	0.0156	5.38
4.4	5.39	47.0	7.23	2.41	2.36	2.80	0.180	0.195	0.372	0.311	0.152	5.81	0.000707	0.00990	1.53
3.7	7.75	54.7	5.96	2.01	2.34	2.33	0.173	0.173	0.398	0.273	0.137	5.75	0.000459	0.00530	1.45
18.9	6.01	11.2	24.2	9.67	2.08	11.1	8.70	3.48	1.25	5.33	0.28	4.56	0.00709	0.313	45.7
6	11.9	22.0	4.72	2.48	1.64	2.74	1.47	0.771	0.915	1.18	0.22	3.56	0.00208	0.0184	4.85
4.08	6.62	26.4	3.53	1.77	1.67	2.00	0.325	0.289	0.506	0.453	0.220	3.81	0.00218	0.0147	1.19
3.45	8.65	33.9	2.86	1.43	1.68	1.60	0.248	0.221	0.496	0.346	0.200	3.88	0.00148	0.00820	0.930
3.2	8.65	33.9	2.86	1.43	1.68	1.60	0.248	0.221	0.496	0.346	0.200	3.88	0.00148	0.00820	0.930
2.9	8.65	23.6	1.50	1.00	1.28	1.12	0.248	0.221	0.521	0.344	0.250	2.88	0.00275	0.00790	0.511

اوس يی عرضي تشنج ته محاسبه کوو

$$\tau = V/A$$

$$V = 618.05$$

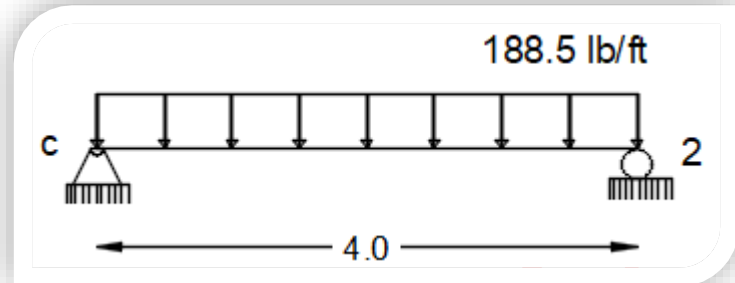
$$A = t_w * d, \quad A = 0.09 * 3, \quad A = 0.27 \text{ in}^2$$

$$\tau = (618.05)/(0.27) = 2289.07 \text{ psi}, \quad \tau_{\text{allowable}} = 12 \text{ ksi}$$

$$\tau = 2.28907 \text{ Ksi}$$

$$\tau_{\text{allowable}} > \tau \quad \text{..... ok}$$

# اوس C1-2 بيم پيزاين کوو



$W_u = 188.5 \text{ lb/ft}$

$M_{\max} = W * L^2 / 8$

$M_{\max} = (188.5 * 13.12^2) / 8 = 4056 \text{ lb*ft}$

$ft = 12 \text{ in}$

$S_{\text{required}} = \frac{M}{\delta_{\text{Allowable}}}$

$S_{\text{req}} = (4056 * 12) / 29000 \text{ psi} = 1.67 \text{ in}^3$

اوس په 31,32 صفحو كي د  $S_3 * 5.7$  ,  $S = 1.67 \text{ in}^3$  مقطع انتخابوو

Table 1-3 (continued)  
**S Shapes**  
Properties



Nominal Wt. lb/ft	Compact Section Criteria		Axis X-X				Axis Y-Y				$r_{ts}$	$h_o$	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	$I$ in. <sup>4</sup>	$S$ in. <sup>3</sup>	$r$ in.	$Z$ in. <sup>3</sup>	$I$ in. <sup>4</sup>	$S$ in. <sup>3</sup>	$r$ in.	$Z$ in. <sup>3</sup>			$J$ in. <sup>4</sup>	$C_w$ in. <sup>6</sup>
121	3.69	25.9	3160	258	9.43	306	83.0	20.6	1.53	36.3	1.94	23.4	12.8	11400

5.7	4.48	11.0	2.50	1.67	1.23	1.94	0.447	0.383	0.518	0.656	0.605	2.74	0.0433	0.838
-----	------	------	------	------	------	------	-------	-------	-------	-------	-------	------	--------	-------

اوس یی عرضی تشنج ته محاسبه کوو

$$\tau = V/A$$

$$V = 1236.1 \text{ lb}$$

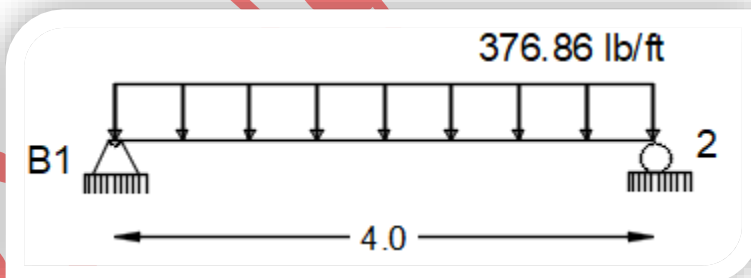
$$A = tw * d \quad , \quad A = 0.17 * 3 = 0.51 \text{ in}^2$$

$$\tau = 1236.1 \text{ lb} / 0.51 \text{ in}^2 = 2423.7 \text{ psi} \quad , \quad \tau_{\text{allowable}} = 12 \text{ ksi}$$

$$\tau = 2.4237 \text{ Ksi}$$

$$\tau_{\text{allowable}} > \tau \quad \dots\dots\dots \text{ ok}$$

## اوس د B1-2 بیم دیزاین کوو



$$W_u = 376.86 \text{ lb/ft}$$

$$M_{\text{max}} = W * L^2 / 8$$

$$M_{\text{max}} = (376.86 \text{ lb/ft} * 13.12^2 \text{ ft}^2) / 8 = 8108.8 \text{ lb*ft}$$

$$F_t = 12 \text{ in}$$

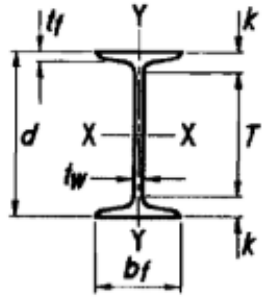
$$S_{\text{required}} = \frac{M}{\delta_{\text{Allowable}}}$$

$$S_{\text{req}} = (8108.8 * 12) / 29000 \text{ psi} = 3.365 \text{ in}^3$$

اوس د مينول په (31,30) صفحه كي  $S_{4 \times 9.5}$  ,  $S=38 \text{ in}^3$  بيم مقطع انتخابوو

S SHAPES															
Nom-inal WL	Compact Section Criteria		Axis X-X				Axis Y-Y				$r_{ts}$	$h_o$	Torsional Properties		
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	$I$	$S$	$r$	$Z$	$I$	$S$	$r$	$Z$			$J$	$C_w$	
lb/ft			in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in.	in.	in. <sup>4</sup>	in. <sup>6</sup>	
121	3.69	25.9	3160	258	9.43	306	83.0	20.6	1.53	36.3	1.94	23.4	12.8	11400	
	9.5	4.77	8.33	6.76	3.38	1.56	4.04	0.887	0.635	0.564	1.13	0.698	3.71	0.120	3.05

اوس يی عرضي تشنج ته محاسبه کوو



**Table 1-3**  
**S Shapes**  
**Dimensions**

Shape	Area, A	Depth, d	Web			Flange				Distance			
			Thickness, t <sub>w</sub>	t <sub>w</sub> /2	Width, b <sub>f</sub>	Thickness, t <sub>f</sub>	k	T	Workable Gage				
										in. <sup>2</sup>	in.	in.	in.
S24x121	35.5	24.5	24 1/2	0.800	13/16	7/16	8.05	8	1.09	1 1/16	2	20 1/2	4
S4x9.5	2.79	4.00	4	0.326	5/16	3/16	2.80	2 3/4	0.293	5/16	3/4	2 1/2	—

$\tau = V/A$

$V = 2472.2 \text{ lb}$

$A = t_w \cdot d$  ,  $A = 0.326 \cdot 4 = 1.304 \text{ in}^2$

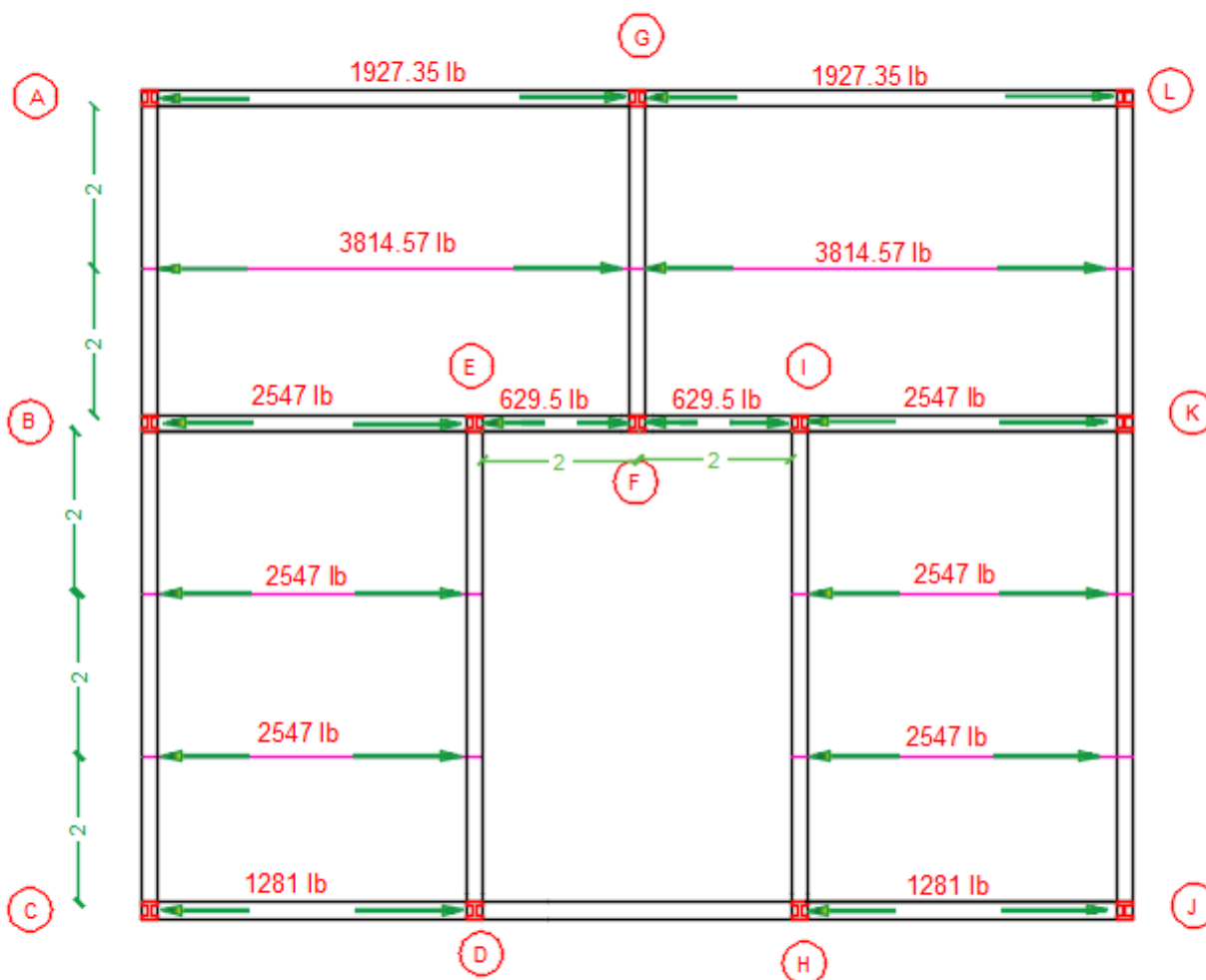
$\tau = 2472.2 \text{ lb} / 1.304 \text{ in}^2 = 1895.86 \text{ psi}$  ,  $\tau_{\text{allowable}} = 12 \text{ ksi}$

$\tau = 1.89586 \text{ Ksi}$

$\tau_{\text{allowable}} > \tau$  ..... ok

## د ګاډرو ډیزاین محاسبه

په لاندې چوکاټ کې مجموعي لوډ د بیمونو څخه ګاډروته د انتقال په حالت کې بنودل شوي. کوم چې د بیمونو او Roof د ډیډلوډ اولایف لوډڅخه ترلاسه شوي.



په پورته چوکاټ کې ځینې ګاډرونه د اوږدوالي او پر هغوي د وارده بار له مخې یو ډول دي. لکه :

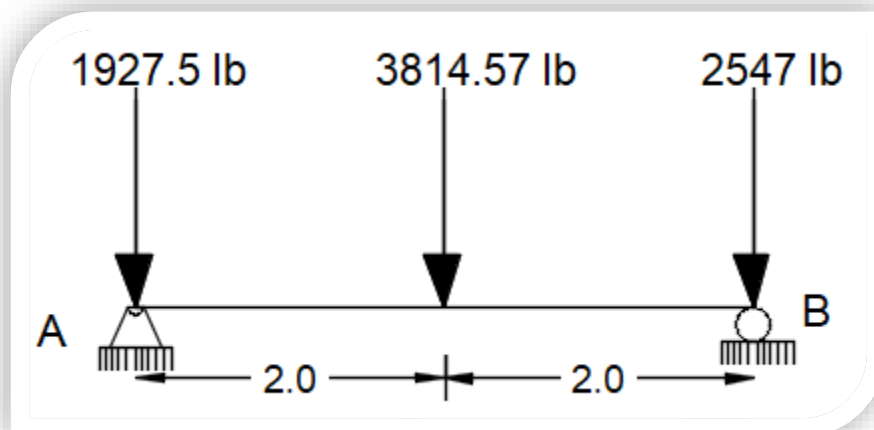
$$A-B = L-K$$

$$B-C = K-J \quad , \quad E-D = I-H$$

$$G-F$$



## د A-B گادر ډيزاين



$$W=3814.57 \text{ lb} , L=4\text{m}$$

$$M_{\max}=w \cdot l/4$$

$$M_{\max} = 12511.79 \text{ lb} \cdot \text{ft}$$

$$S_{\text{required}} = \frac{M}{\delta_{\text{Allowable}}}$$

$$S_{\text{req}} = 12511.79 \text{ lb} \cdot 12 \text{ in} / 29000 \text{ psi} = 5.18 \text{ in}^3$$

اوس په 27 صفحه كې  $w_6 \cdot 9$  مقطع د گادر لپاره انتخابوو  $S=5.56 \text{ in}^3$ .

Nom- inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				$r_{ts}$	$h_o$	Torsional Properties	
			$I$	$S$	$r$	$Z$	$I$	$S$	$r$	$Z$			$J$	$C_w$
	$\frac{b_f}{2t}$	$\frac{h}{t_w}$	in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in.	in.	in. <sup>4</sup>	in. <sup>6</sup>
67	4.43	11.1	272	60.4	3.72	70.1	88.6	21.4	2.12	32.7	2.43	8.07	5.05	1440
9	9.16	29.2	16.4	5.56	2.47	6.23	2.20	1.11	0.905	1.72	1.06	5.69	0.0405	17.7

اوس يی عرضي تشنج ته محاسبه کوو

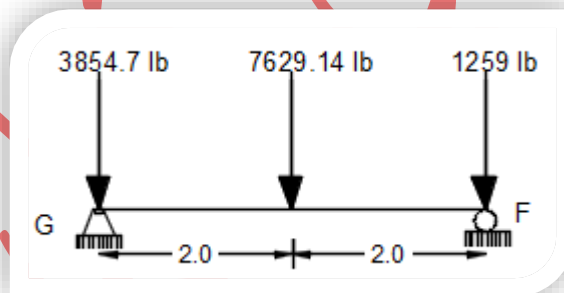
$\tau = V/A$  ,  $v = 1907.28 \text{ lb}$  ,

$A = tw * d$      $A = 0.17 * 5.9$  ,     $A = 1.003 \text{ in}^2$

$\tau = 1907.28 \text{ lb} / 1.003 \text{ in}^2 = 1796.6 \text{ psi}$  ,     $\tau_{\text{allowable}} = 12 \text{ ksi}$

$1.7966 \text{ ksi} < \tau_{\text{allowable}}$  ..... ok

# اوس د G-F د گادر ډیزاین کوو



$W = 7629.14 \text{ lb}$  ,  $L = 4 \text{ m}$

$M_{\text{max}} = w * l / 4 = 25023.58 \text{ lb} * \text{ft}$

$S_{\text{required}} = \frac{M}{\sigma_{\text{allowable}}}$  ,

$1 \text{ m} = 3.28 \text{ ft}$  ,     $1 \text{ ft} = 12 \text{ in}$

$S_{\text{req}} = 25023.58 * 12 / 29000 \text{ psi} = 10.35 \text{ in}^3$

اوس په 25 صفحه کې  $W_{10*12}$  د بيم مقطع انتخابوو چې عبارت ده له  $S = 10.9$

W12 - W10														
Nominal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				$r_{ts}$	$h_o$	Torsional Properties	
	$b_f$ 2 $t_f$	$h$ $t_w$	$I$ in. <sup>4</sup>	$S$ in. <sup>3</sup>	$r$ in.	$Z$ in. <sup>3</sup>	$I$ in. <sup>4</sup>	$S$ in. <sup>3</sup>	$r$ in.	$Z$ in. <sup>3</sup>			$J$ in. <sup>4</sup>	$C_w$ in. <sup>6</sup>
58	7.82	27.0	475	78.0	5.28	86.4	107	21.4	251	32.5	2.82	11.6	2.10	3570
10	7.41	30.5	66.9	13.0	3.90	10.0	2.09	1.40	0.610	2.30	1.01	9.72	0.104	66.3
12	9.43	46.6	53.8	10.9	3.90	12.6	2.18	1.10	0.785	1.74	0.983	9.66	0.0547	50.9

اوس يی عرضي تشنج ته محاسبه کوو

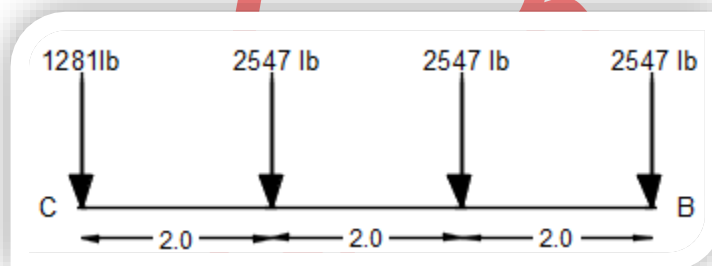
$$\tau = V/A, v = 3814.57 \text{ lb}, A = 1.87 \text{ in}^2$$

$$\tau = 3814.57 \text{ lb} / 1.87 \text{ in}^2 = 2039 \text{ psi}, \tau_{\text{allowable}} = 12 \text{ ksi}$$

$$\tau = 2.039 \text{ ksi}$$

$$\tau < \tau_{\text{allowable}} \dots \dots \text{ ok}$$

## اوس C-B گارڊ ڊيزاين کوو



$$A_y = 3828 \text{ lb}, B_y = 5094 \text{ lb}$$

$$M_{\text{max}} = 16708.32 \text{ lb} \cdot \text{ft}$$

$$S_{\text{required}} = \frac{M}{\delta_{\text{allowable}}}$$

$$S_{\text{req}} = 16708.32 \cdot 12 \text{ in} / 29000 \text{ psi} = 6.91 \text{ in}^3$$

اوس په 27 صفحه کي  $W_{6 \times 12}$  د بيم مقطع انتخابوو چي عبارت ده له:

$$S = 7.31 \text{ in}^3$$

Nom- inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				$r_{ts}$	$h_o$	Torsional Properties	
	$\frac{b_f}{2t}$	$\frac{h}{t_w}$	$I$	$S$	$r$	$Z$	$I$	$S$	$r$	$Z$			$J$	$C_w$
lb/ft			in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in. <sup>4</sup>	in. <sup>3</sup>	in.	in. <sup>3</sup>	in.	in.	in. <sup>4</sup>	in. <sup>6</sup>
67	4.43	11.1	272	60.4	3.72	70.1	88.6	21.4	2.12	32.7	2.43	8.07	5.05	1440

12	7.14	21.6	22.1	7.31	2.49	8.30	2.99	1.50	0.918	2.32	1.08	5.75	0.0903	24.7
----	------	------	------	------	------	------	------	------	-------	------	------	------	--------	------

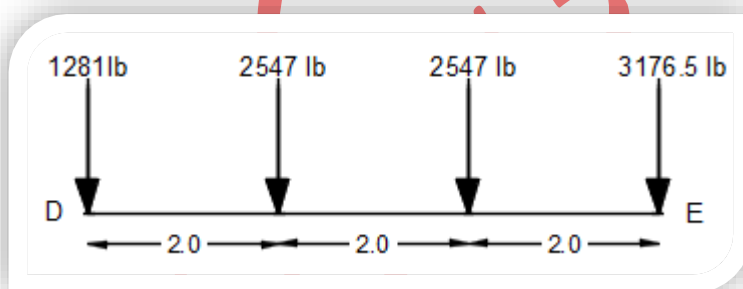
اوس يی عرضي تشنج ته محاسبه کوو

$$\tau = V/A \quad , \quad V = 2547 \text{ lb} \quad , \quad A = 1.4 \text{ in}^2$$

$$\tau = 2547/1.4 = 1819.3 \text{ psi} \quad , \quad \tau_{\text{allowable}} = 12 \text{ ksi}$$

$$1.8193 \text{ ksi} < 12 \text{ ksi} \quad \dots\dots\dots \text{ ok}$$

## E-D گادر ډيزاين



$$D_y = 3828 \text{ lb} \quad , \quad E_y = 5723.5 \text{ lb} \quad , \quad 1 \text{ ft} = 12 \text{ in}$$

$$S_{\text{required}} = \frac{M}{\delta_{\text{Allowable}}}$$

$$M_{\text{max}} = 16708.32 \text{ lb} \cdot \text{ft}$$

$$S_{\text{req}} = 16708.32 \text{ lb} \cdot 12 / 29000 \text{ psi} = 6.91 \text{ in}^3$$

د مينول په ۲۷ صفحه کي ۱۲\*۶ w د بيم مقطع انتخاب وکمه چي د C-B گادر لپاره  
انتخاب شوي چي عبارت له:  $S = 7.31 \text{ in}^3$

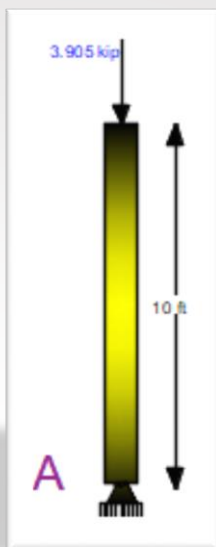
اوس يی عرضي تشنج ته محاسبه کوو

$$\tau = V/A \quad , \quad V = 2547 \text{ lb} \quad , \quad A = Tw \cdot d = 0.23 \cdot 6.03 = 1.4 \text{ in}^2 \quad , \quad A = 1.4 \text{ in}^2$$

$$\tau = 2547/1.4 = 1819.3 \text{ psi} \quad , \quad \tau_{\text{allowable}} = 12 \text{ ksi} \quad , \quad 1.8193 \text{ ksi} < 12 \text{ ksi} \dots\dots \text{ ok}$$

# A = L پایو ډیزاین

Wu = 3.905 kip



اوس د manual په 468 صفحه کې د  
 HSS2\*2\*1/8 مقطع انتخابوو

R= 0.761 in

SR= AL/R ≤ 200

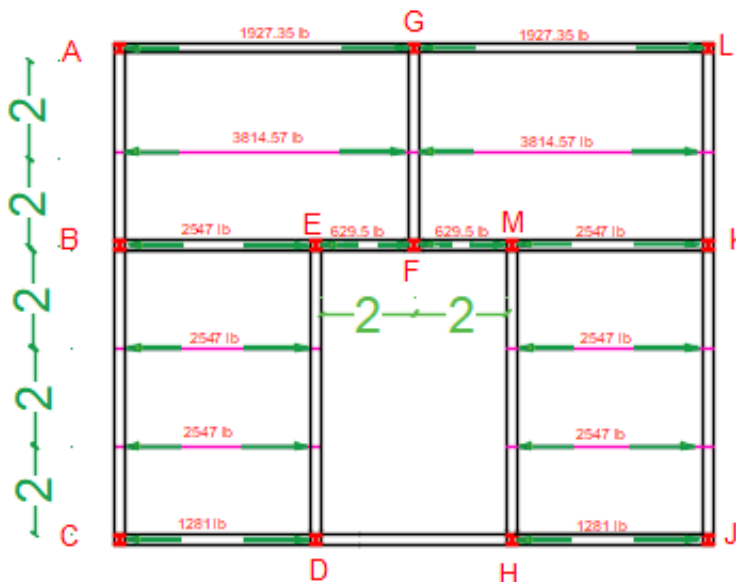
A=10 ft کالم ارتفاع

SR=( 10\*12) in/0.76in

SR=157.7

157.7 < 200 .... ok

# د پایو ډیزاین



د هري پایو اوږدوالي 10 ft دي

د ټولو پایو اتکاو په دواړو خواوو کې PIN دي  
 په دې پلان کې ځینې پای پر هغوي د واردیدو قوو له مخي یو ډول دي

A=L , B=K , E=M , C=D=H=J , F , G

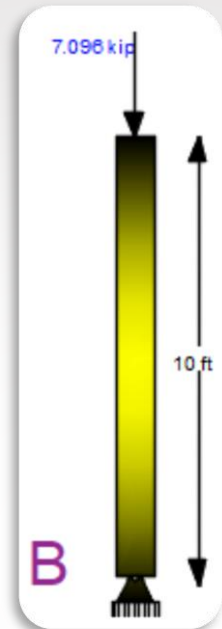
Shape	HSS2 1/4 × 2 1/4 ×						HSS2 × 2 ×					
	3/16		1/8		1/4		3/16		1/8			
	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD		
$t_{design} \text{ in.}$	0.174		0.116		0.233		0.174		0.116			
WU/R	4.94		3.47		5.38		4.30		3.04			
Design	$P_u/\Omega_c$	$\phi_c P_n$	$P_u/\Omega_c$	$\phi_c P_n$	$P_u/\Omega_c$	$\phi_c P_n$	$P_u/\Omega_c$	$\phi_c P_n$	$P_u/\Omega_c$	$\phi_c P_n$		
	0	37.7	56.6	26.3	39.6	41.5	62.4	32.9	49.4	23.1	34.8	
	1	37.1	55.8	26.0	39.0	40.7	61.2	32.3	48.5	22.7	34.2	
	2	35.6	53.5	25.0	37.6	38.4	57.7	30.6	45.9	21.6	32.5	
	3	33.2	49.9	23.4	35.2	34.8	52.3	27.9	42.0	19.9	29.9	
	4	30.1	45.3	21.4	32.1	30.4	45.6	24.6	37.0	17.7	26.6	
	5	26.6	40.0	19.0	28.6	25.5	38.3	20.9	31.5	15.2	22.9	
	6	22.8	34.3	16.5	24.8	20.5	30.9	17.2	25.8	12.7	19.0	
	7	19.1	28.6	13.9	20.9	15.9	23.9	13.6	20.4	10.2	15.3	
	8	15.5	23.3	11.5	17.2	12.2	18.3	10.4	15.7	7.93	11.9	
	9	12.3	18.5	9.17	13.8	9.63	14.5	8.26	12.4	6.26	9.42	
10	9.95	15.0	7.43	11.2	7.80	11.7	6.68	10.1	5.07	7.63		

نوموړي ډیزاین د C=D=H=J لپاره هم کفایت کوي ځکه  
 چې 4.08 kip/ft ظرفیت لرونکي دي او په C,D,H,J کالمونو باندې لږې کمه قوه موجوده ده.

Shape	HSS2 1/4 x 2 1/4 x				HSS2 x 2 x							
	3/16		1/8		1/4		3/16		1/2			
$L_{design}$ in.	0.174		0.116		0.233		0.174		0.116			
Wt/ft	4.94		3.47		5.38		4.30		3.04			
Design	$P_n/\Omega_c$		$\phi_c P_n$		$P_n/\Omega_c$		$\phi_c P_n$		$P_n/\Omega_c$		$\phi_c P_n$	
	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
$r$ radius of gyration	0	37.7	56.6	26.3	39.6	41.5	62.4	32.9	49.4	23.1	34.8	
	1	37.1	55.8	26.0	39.0	40.7	61.2	32.3	48.5	22.7	34.2	
	2	35.6	53.5	25.0	37.6	38.4	57.7	30.6	45.9	21.6	32.5	
	3	33.2	49.9	23.4	35.2	34.8	52.3	27.9	42.0	19.9	29.9	
	4	30.1	45.3	21.4	32.1	30.4	45.6	24.6	37.0	17.7	26.6	
	5	26.6	40.0	19.0	28.6	25.5	38.3	20.9	31.5	15.2	22.9	
	6	22.8	34.3	16.5	24.8	20.5	30.9	17.2	25.8	12.7	19.0	
	7	19.1	28.6	13.9	20.9	15.9	23.9	13.6	20.4	10.2	15.3	
	8	15.5	23.3	11.5	17.2	12.2	18.3	10.4	15.7	7.93	11.9	
	9	12.3	18.5	9.17	13.8	9.63	14.5	8.26	12.4	6.26	9.42	
	10	9.95	15.0	7.43	11.2	7.80	11.7	6.66	10.1	5.07	7.63	

B=K پای دیزاین

$W_u = 7.096$   
kip



اوس د manual په 468  
صفحه كي د  
انتخابوو  
HSS2\*2\*1/8 مقطع

$R = 0.761$  in

$SR = AL/R \leq 200$

$B = 10$  ft كالم ارتفاع

$SR = (10 * 12) \text{ in} / 0.761 \text{ in}$

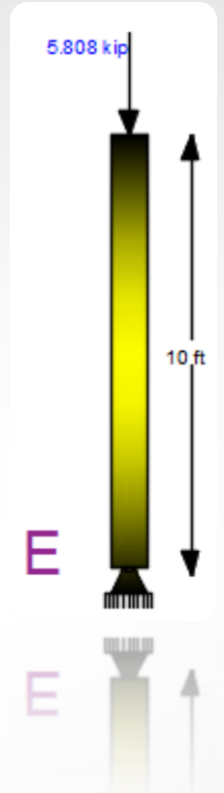
$SR = 157.69$

$157.69 < 200$  .... ok

کول منع دی!

### E=M پای دیزاین

Wu = 5.808 kip



Shape	HSS2 1/4 x 2 1/8 x				HSS2 x 2 x							
	3/16		1/8		1/4		3/16		1/8			
t <sub>design</sub> in.	0.174		0.116		0.233		0.174		0.116			
Wt/ft	4.94		3.47		5.38		4.30		3.04			
Design	P <sub>n</sub> /Ω <sub>c</sub>		φ <sub>c</sub> P <sub>n</sub>		P <sub>n</sub> /Ω <sub>c</sub>		φ <sub>c</sub> P <sub>n</sub>		P <sub>n</sub> /Ω <sub>c</sub>		φ <sub>c</sub> P <sub>n</sub>	
	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Radius of gyration r <sub>y</sub>	0	37.7	56.6	26.3	39.6	41.5	62.4	32.9	49.4	23.1	34.8	
	1	37.1	55.8	26.0	39.0	40.7	61.2	32.3	48.5	22.7	34.2	
	2	35.6	53.5	25.0	37.6	38.4	57.7	30.6	45.9	21.6	32.5	
	3	33.2	49.9	23.4	35.2	34.8	52.3	27.9	42.0	19.9	29.9	
	4	30.1	45.3	21.4	32.1	30.4	45.6	24.6	37.0	17.7	26.6	
	5	26.6	40.0	19.0	28.6	25.5	38.3	20.9	31.5	15.2	22.9	
	6	22.8	34.3	16.5	24.8	20.5	30.9	17.2	25.8	12.7	19.0	
	7	19.1	28.6	13.9	20.9	15.9	23.9	13.6	20.4	10.2	15.3	
	8	15.5	23.3	11.5	17.2	12.2	18.3	10.4	15.7	7.93	11.9	
	9	12.3	18.5	9.17	13.8	9.63	14.5	8.26	12.4	6.26	9.42	
	10	9.95	15.0	7.43	11.2	7.80	11.7	6.69	10.1	5.07	7.63	

انتخابی دی!

اوس د manual په 468 صفحه كي د HSS2\*2\*1/8 مقطع انتخابوو

R=0.761 in

SR= AL/R ≤ 200

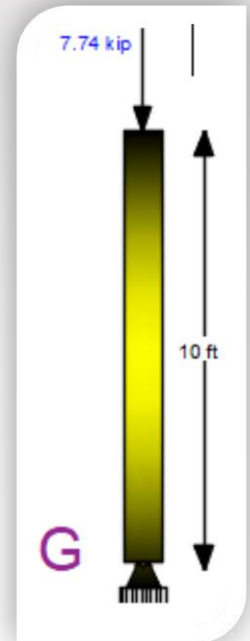
B=10 ft كالم ارتفاع

SR=( 10\*12) in/0.761in

SR=157.69

## G پای دیزاین

$$W_u = 7.74 \text{ kip}$$



Shape	HSS2 1/4 x 2 1/4 x				HSS2 x 2 x							
	3/16		1/8		1/4		3/16		1/2			
$t_{design}$ in.	0.174		0.116		0.233		0.174		0.116			
Wt/lft	4.94		3.47		5.38		4.30		3.04			
Design	$P_n/\Omega_c$		$\phi_c P_n$		$P_n/\Omega_c$		$\phi_c P_n$		$P_n/\Omega_c$		$\phi_c P_n$	
	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
0	37.7	56.6	26.3	39.6	41.5	62.4	32.9	49.4	23.1	34.8		
1	37.1	55.8	26.0	39.0	40.7	61.2	32.3	48.5	22.7	34.2		
2	35.6	53.5	25.0	37.6	38.4	57.7	30.6	45.9	21.6	32.5		
3	33.2	49.9	23.4	35.2	34.8	52.3	27.9	42.0	19.9	29.9		
4	30.1	45.3	21.4	32.1	30.4	45.6	24.6	37.0	17.7	26.6		
5	26.6	40.0	19.0	28.6	25.5	38.3	20.9	31.5	15.2	22.9		
6	22.8	34.3	16.5	24.8	20.5	30.9	17.2	25.8	12.7	19.0		
7	19.1	28.6	13.9	20.9	15.9	23.9	13.6	20.4	10.2	15.3		
8	15.5	23.3	11.5	17.2	12.2	18.3	10.4	15.7	7.93	11.9		
9	12.3	18.5	9.17	13.8	9.63	14.5	8.26	12.4	6.26	9.42		
10	9.95	15.0	7.43	11.2	7.80	11.7	6.69	10.1	5.07	7.63		
11	8.22	12.4	6.14	9.23	6.44	9.68	5.53	8.31	4.19	6.30		
12	6.91	10.4	5.16	7.75			4.64	6.98	3.52	5.30		
13	5.89	8.85	4.40	6.61								
14			3.79	5.70								

اوس د manual په 468  
صفحه كي د  
انتخابوو  
HSS2\*2\*3/16 مقطع

$$R=0.733 \text{ in}$$

$$SR= AL/R \leq 200$$

$$B=10 \text{ ft كالم ارتفاع}$$

$$SR=(10*12) \text{ in}/0.733 \text{ in}$$

$$SR=163.7$$

$$163.7 < 200 \dots \text{ok}$$



### F پای پی دیزاین

Wu = 5.1445

kip

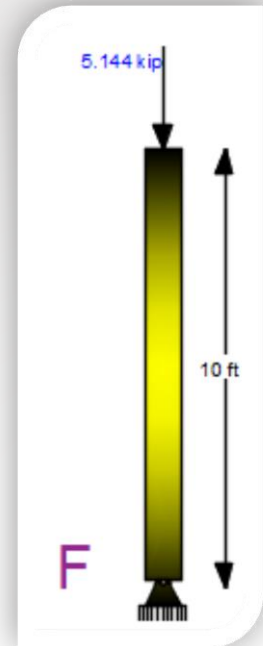


Table 4-4 (continued)  
Available Strength in Axial Compression, kips  
Square HSS

$F_y = 46 \text{ ksi}$

HSS2 1/4-HSS2

Shape	HSS2 1/4 x 2 1/4 x				HSS2 x 2 x					
	3/16		1/8		1/4		3/16		1/8	
$t_{design}$ in.	0.174		0.116		0.233		0.174		0.116	
W/R	4.94		3.47		5.38		4.30		3.04	
Design	$P_u/\Omega_c$	$\phi_c P_n$	$P_u/\Omega_c$	$\phi_c P_n$	$P_u/\Omega_c$	$\phi_c P_n$	$P_u/\Omega_c$	$\phi_c P_n$	$P_u/\Omega_c$	$\phi_c P_n$
	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
0	37.7	56.6	26.3	39.6	41.5	62.4	32.9	49.4	23.1	34.8
1	37.1	55.8	26.0	39.0	40.7	61.2	32.3	48.5	22.7	34.2
2	35.6	53.5	25.0	37.6	38.4	57.7	30.6	45.9	21.6	32.5
3	33.2	49.9	23.4	35.2	34.8	52.3	27.9	42.0	19.9	29.9
4	30.1	45.3	21.4	32.1	30.4	45.6	24.6	37.0	17.7	26.6
5	26.6	40.0	19.0	28.6	25.5	38.3	20.9	31.5	15.2	22.9
6	22.8	34.3	16.5	24.8	20.5	30.9	17.2	25.8	12.7	19.0
7	19.1	28.6	13.9	20.9	15.9	23.9	13.6	20.4	10.2	15.3
8	15.5	23.3	11.5	17.2	12.2	18.3	10.4	15.7	7.93	11.9
9	12.3	18.5	9.17	13.8	9.63	14.5	8.2 <sup>a</sup>	12.2	6.26	9.42
10	9.95	15.0	7.43	11.2	7.80	11.7	6.44	9.68	5.07	7.63
11	8.22	12.4	6.14	9.23	6.44	9.68	5.53	8.31	4.19	6.30
12	6.91	10.4	5.16	7.75			4.64	6.98	3.52	5.30
13	5.69	8.85	4.40	6.61						
14			3.79	5.70						

اوس د manual په  
468 صفحه كي د W8\*58  
مقطع انتخابوو

R=0.761

in

SR= AL/R ≤ 200

B=10 ft كالم ارتفاع

SR=( 10\*12)

in/0.761in

SR=157.69

157.69 < 200 .... ok

ومن الله توفيق

اختتام

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