SPREADER BAR

I.D. Nº 2 COLOR OF BAR : Yellow

LOAD CAPACITY PAINTED ON BAR 33 TONS.

DATE CAP. & I.D. Nº PAINTED ON BAR July 1986

DATE OF LAST LOAD TEST. August 8, 1986

TEST LOAD WEIGHT 41.16 TONS

TEST LOAD % 124.7%

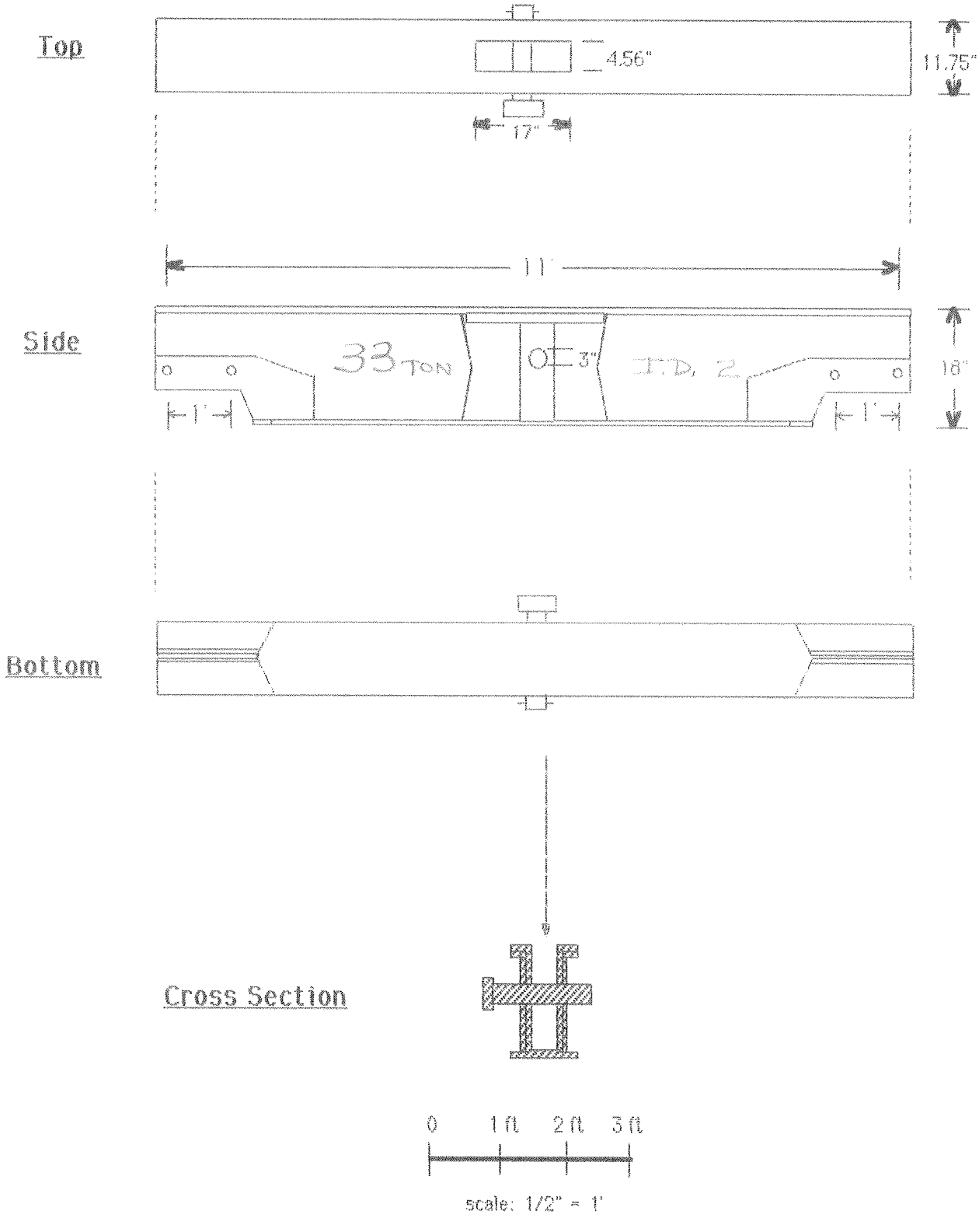
STRESS CALCULATIONS :

DONE BY Bosek + Miranda

DATE June 1986

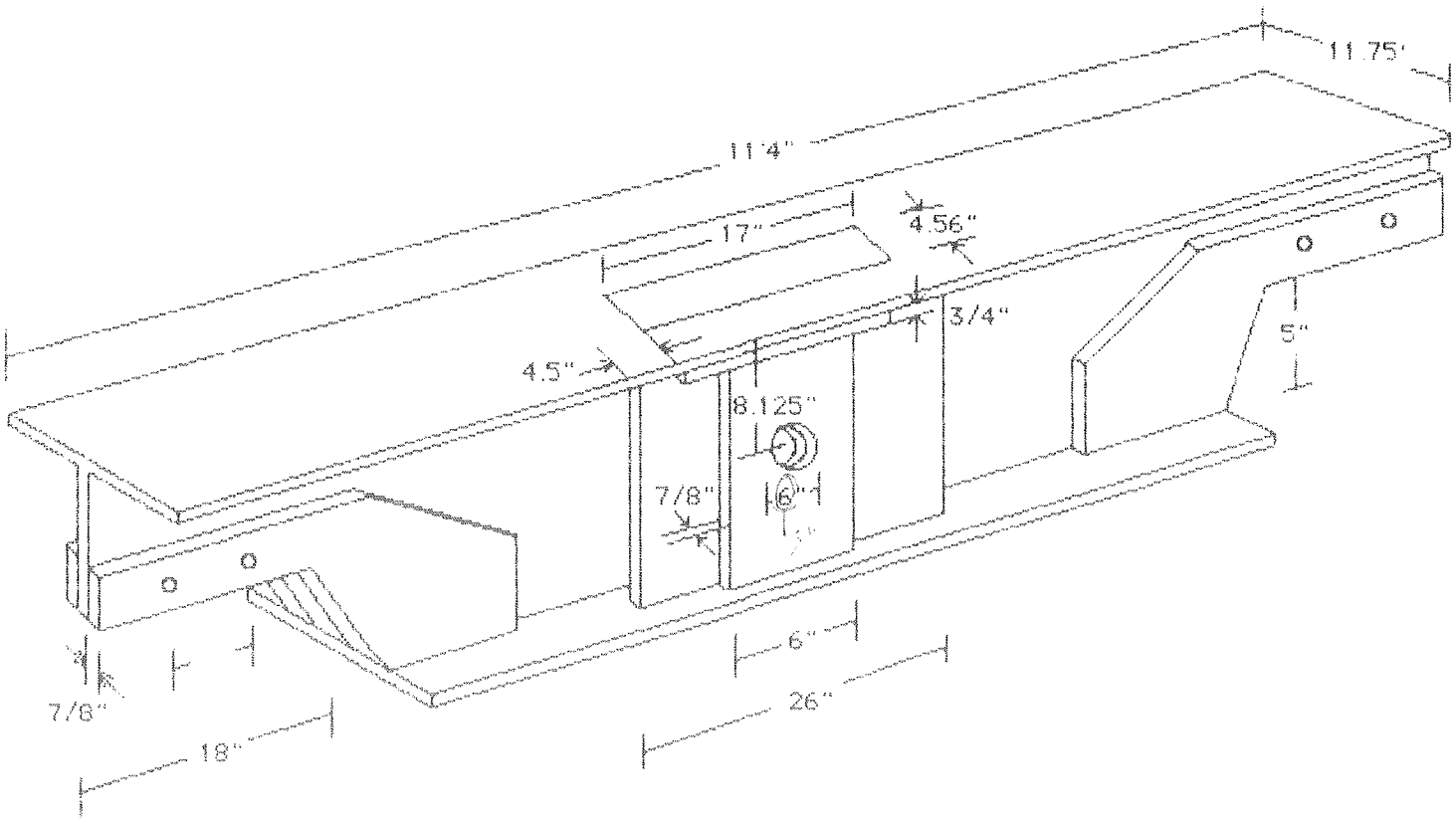
REMARKS : Test was perfect

Yellow #2


Top
4.56"
11.75"
17"
11'
Side
33 TON
3"
I.D. 2
18"
1'
1'
Bottom
Cross Section
0
1 ft.
2 ft.
3 ft.
scale: 1/2" = 1'

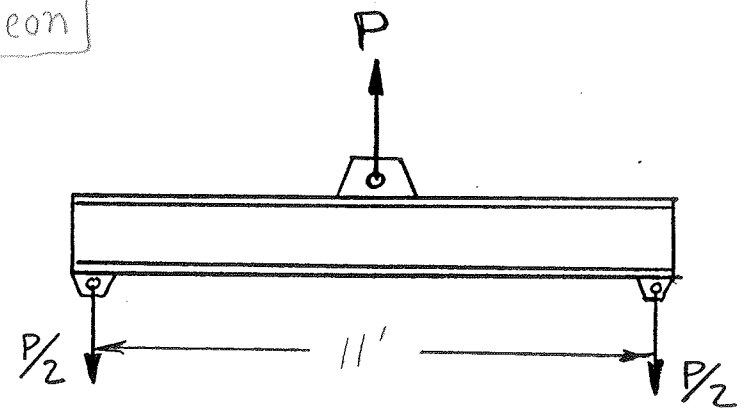
~ 1 hr 30 min

not to scale



SPREADER BAR Nº 2 PAINT COLOR Yellow

Leon



BEAM SIZE W18 X 96

d = 18 in

L = 132 in

d/A_f = 1.86

S_x = 185 in³

t_w = .512 in

$A_w = d \cdot t_w$ = 9.216 in²

$M = \frac{PL}{4}$ = 33P

$V = \frac{P}{2}$

BENDING STRESS:

$F_{b\ ALLOW}$ = 12,000 psi

OR $F_{b\ ALLOW} = \frac{12 \times 10^6}{L \cdot d/A_f} = \frac{12 \times 10^6}{(132)(1.86)}$ = 48,876 psi } USE THE LEAST

$\therefore f_{b\ MAX} = \frac{M}{S_x} = \frac{33P}{185} = .1784P = 12{,}000$ psi

$\therefore P = 67{,}265$ lb = 33.6 tons

SHEAR STRESS:

$F_{V\ ALLOW} = \frac{.4 F_y}{3}$ = 4800 psi

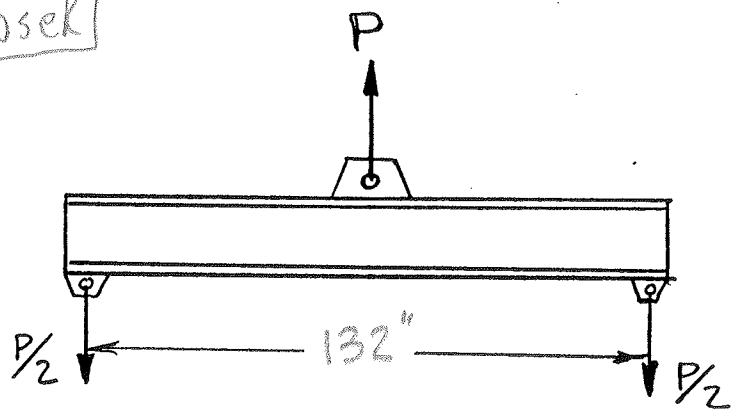
$\therefore f_{V\ MAX} = \frac{V}{A_w} = \frac{P}{2(9.216)} = \frac{P}{18.432} = 4{,}800$ psi

$\therefore P = 88{,}473$ lb = 44.2 tons

SUMMARY: $\therefore P$ = 33.6 TONS

SPREADER BAR Nº 2 PAINT COLOR YELLOW

BOSEK



PAINTED ON "33 TONS"

BEAM SIZE W 18 x 96

$d = 18.16$ $\quad A_w = d \cdot t_w = 9.30$

$L = 132$

$d/A_f = 1.86$ $\quad M = \frac{PL}{4} = 33P$

$S_x = 185$

$t_w = .512$ $\quad V = \frac{P}{2}$

BENDING STRESS:

$F_{b\ ALLOW} = 12{,}000$ psi

OR $F_{b\ ALLOW} = \frac{12 \times 10^6}{L \cdot d/A_f} = \frac{12 \times 10^6}{132 \times 1.86} = 48876$ psi } USE THE LEAST

$\therefore f_{b\ MAX} = \frac{M}{S_x} = \frac{33P}{185} = 12000 \quad P = 67273$ lb $= 33.6$ TONS

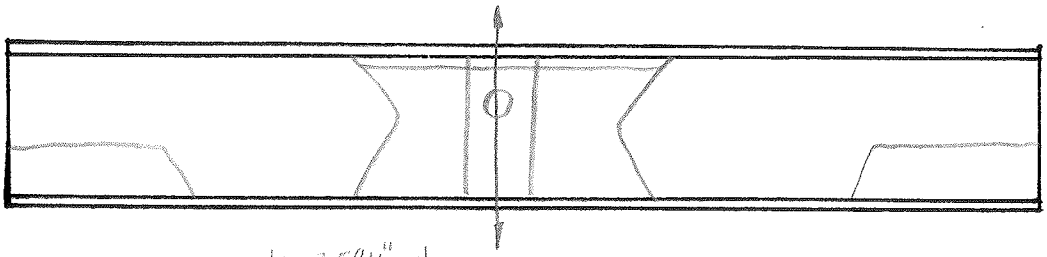
SHEAR STRESS:

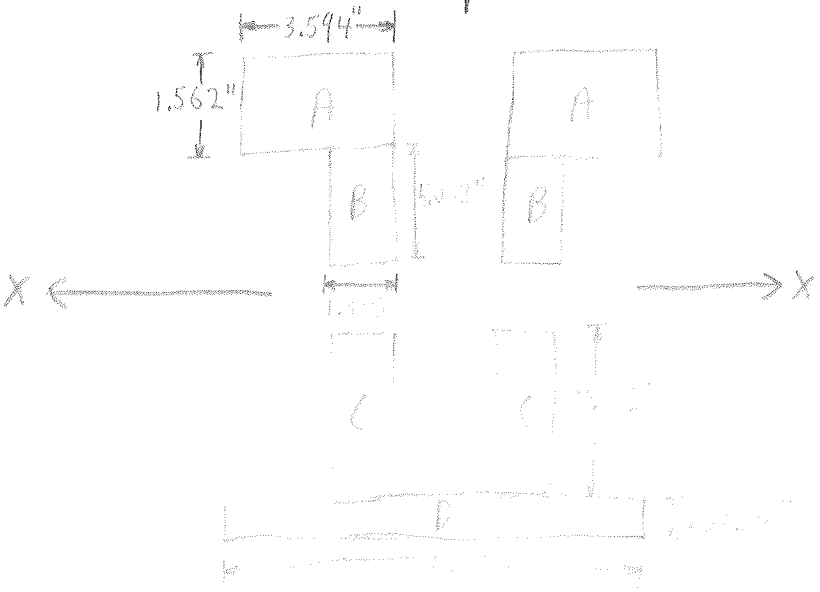
$F_{V\ ALLOW} = \frac{.4\ F_y}{3} = 4800$ psi

$\therefore f_{V\ MAX} = \frac{V}{A_w} = \frac{P}{2 \times 9.3} = 4800 \quad P = 89280$ lbs. $= 44.6$ TONS

SUMMARY: $\therefore P = 33.6$ TONS

SPREADER BAR Nº 2	Lean	Paint Color Yellow	I





in

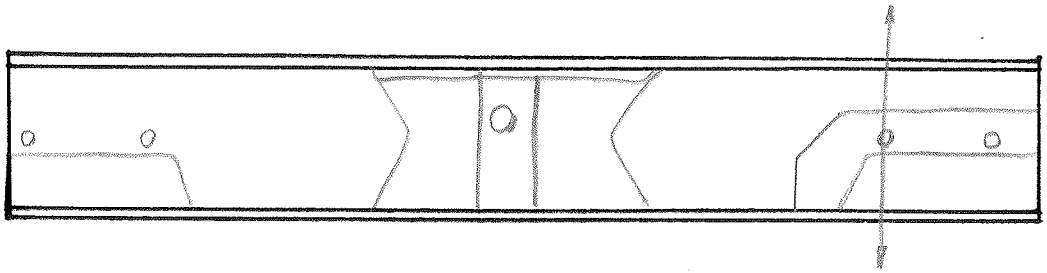
Section	Base (in)	Height (in)	I (in⁴)	Area (in²)	r (in)	r' (in)	Ar'² (in²)
A							
B							
C						4.109	
D		.845	0.12				

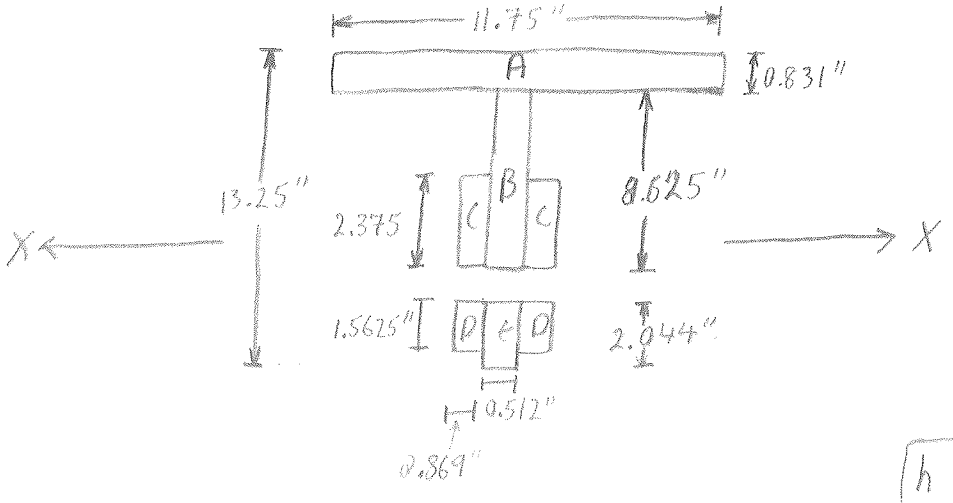
c = 4.712

I_{xx} = 2704.79 in⁴

S_{xx} = 287.327 in³ ~ 185 in³

SPREADER BAR Nº 2	Leon	Paint Color Yellow	II





h = 8.433 in

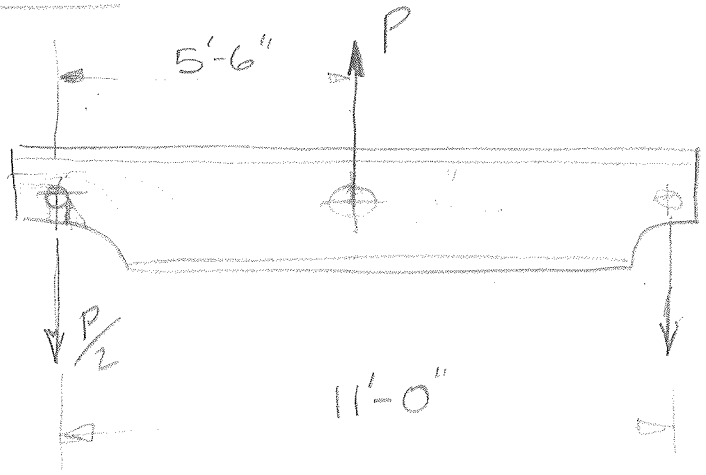
Section	Base (in)	Height (in)	I (in⁴)	Area (in²)	r (in)	r' (in)	Ar'² (in²)
A	11.75	0.831	0.562	9.764	12.835	4.402	189.203
B	0.512	8.625	27.376	4.416	8.107	0.326	0.469
C	1.738	2.375	1.940	4.128	4.982	3.451	49.162
D	1.738	1.563	0.553	2.716	1.236	7.197	140.680
E	0.512	2.044	0.364	1.047	1.022	7.411	57.504

c = 8.433 in

I_{xx} = 467.813 in⁴

S_{xx} = 55.474 in³ < 185 in³ → see back

BENDING:



I-BEAM

W-18×96

(STEEL MAN. PP 1-32)

$S_{Nx} = 185 in^3$

$\frac{d}{A_f} = 1.86$

$r_T = 3.19$

$\ell = 132"$

STEEL MAN PP 5-19 $F_{b\ ALLOWABLE} = \frac{12 \times 10^6}{\ell d / A_f}$

$F_{b\ allow} = \frac{12 \times 10^6}{132 \times 1.86} = 48876 psi$

OR

STEEL MAN PP 5-19 $F_{b\ allow} = \frac{170 \times 10^6}{\left(\frac{\ell}{r_T}\right)^2} = 99285 psi.$

OR

$F_{b\ max} = 21,600 psi.$ 12,000 psi MAX.

$F_b = \frac{M}{S}$ $\frac{12,000}{21,600} = \frac{M}{185}$ $M = 3996,000$ in. lb.

STEEL MAN PP. 2-200 CASE 7. $M_{MAX} = \frac{P}{2} \times 66" = 3996,000$

$P = 121,091$ lb. $\approx$ 60 TONS

67273 lb 33.6

BEARING ON CENTER PIN:

Steel Manual pp. 5-19

$F_{ALLOWABLE} = .9(36{,}000) = 32{,}400$ psi

3" DIA. $\frac{1}{2}\left(\frac{7}{8}" + 1" + 1" \times \frac{7}{8}"\right) = 3\frac{3}{4}"$ lgth of contact

LOAD = ~~60 TONS~~ 34.6 tons

$$P = \frac{lb}{IN} = \frac{60 \times 2000}{3.75} = 32{,}000\ lb/IN.$$

Roark pp 320 case 6

$$S_c = .591\sqrt{p E \frac{(D_1 - D_2)}{D_1 \times D_2}}$$

$E = 29 \times 10^6$

$D_1 = 3.062$

$D_2 = 3.000$

$S_c = 46773$ psi $< 32{,}400$ psi

TRY LOAD = 40 TONS

$$P = \frac{40 \times 2000}{3.75} = 21333\ lb/IN.$$

$$S_c = .591\sqrt{p E \frac{(D_1 - D_2)}{D_1 D_2}}$$

$S_c = 38190$ psi < 32400 psi

TRY LOAD = 25 TONS

$$P = \frac{25 \times 2000}{3.75} = 13333\ lb/IN.$$

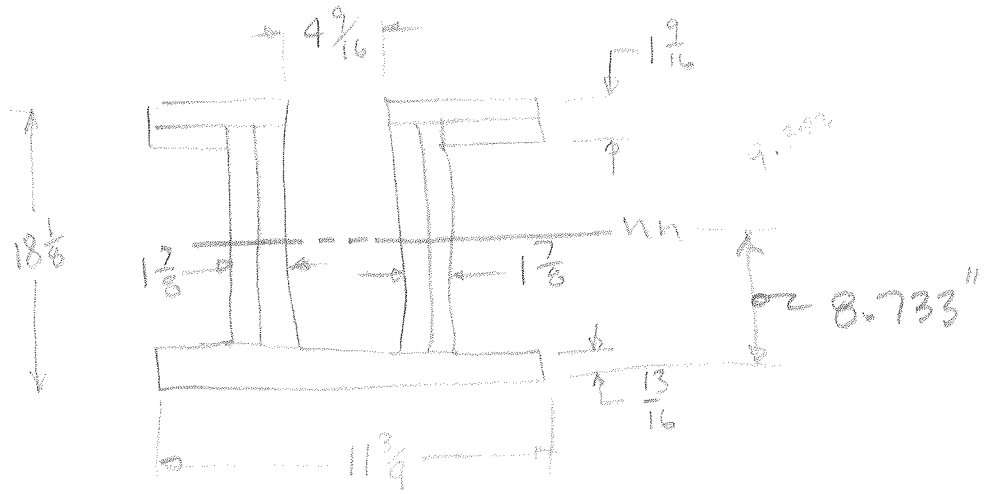
$$S_c = .591\sqrt{p E \frac{(D_1 - D_2)}{D_1 \times D_2}}$$

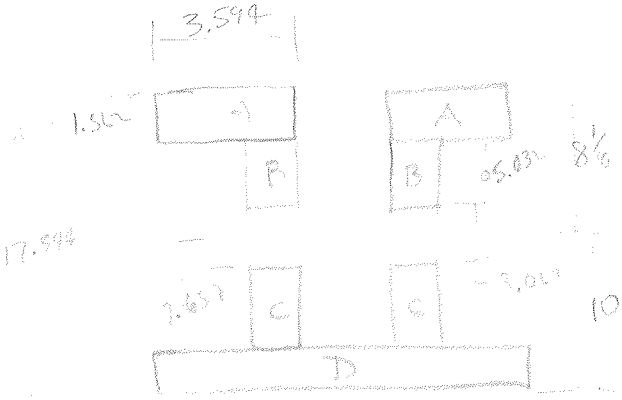
$S_c = 30192$ psi < 32400 psi

$\therefore \approx 26$ TON IS MAX BEARING LOAD ON CENTER PIN.

Section Modulas at Center

S for W18×96 = 185 in³ ≤ S at Beam Center





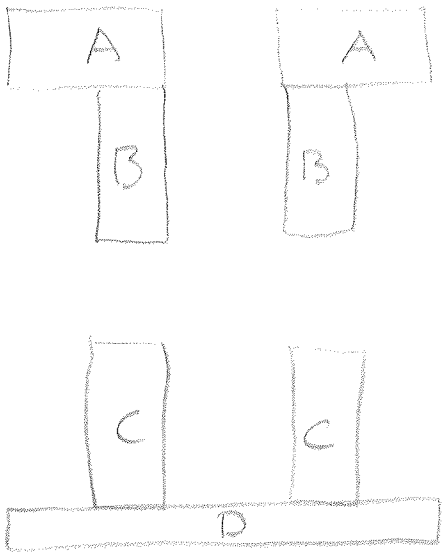
$$h = \frac{\Sigma M}{\Sigma A} - 8.733''$$

Design Welding pp 2.3-2

$$h = \frac{300.8959}{38.9467} - 8.733''$$

Section	Area in²	Dist. to Ref. Line	M
A	5.6138 x(2)	17.344	97.3457 x(2)
B	9.435 x(2)	14.097	132.5334 x(2)
C	14.3569 x(2)	4.6905	66.6232 x(2)
D	9.541	.406	3.8736

$\Sigma A = 68.3524$ $\Sigma M = 596.9182$



$$I_{nn} = \sum I_a + \sum r^2 A_a$$

$$I_c = \frac{bh^3}{12}$$

SECTION	$I_{a,b,c,d}$	r	A in^2	r^2A
A	1.1919 × 2	8.611	11.2276	832.5189
B	19.9087 × 2	5.314	18.87	532.8623
C	70.1499 × 1	4.0925	28.7138	480.9147
D	.5242	8.327	9.541	661.5627
				$\sum r^2A = 2507.8586$

$\sum I_{a,b,c,d} = 182.9142$

$I_{nn} = 2690.7728\ in^4$

$$S = \frac{I}{c} = 308.1155\ in^3 \geq 185\ in^3$$

Horizontal Shear at Neutral Axis:

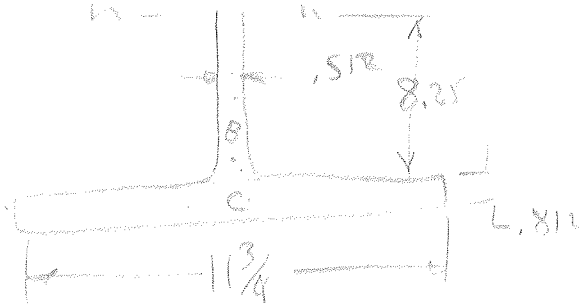
$$f_s = \frac{VAy}{It}$$

$V = 33600$ lb.

$A = \frac{28.2}{2} = 14.1$ in^2

$I = 1680$ in^4

$t = .512$ in

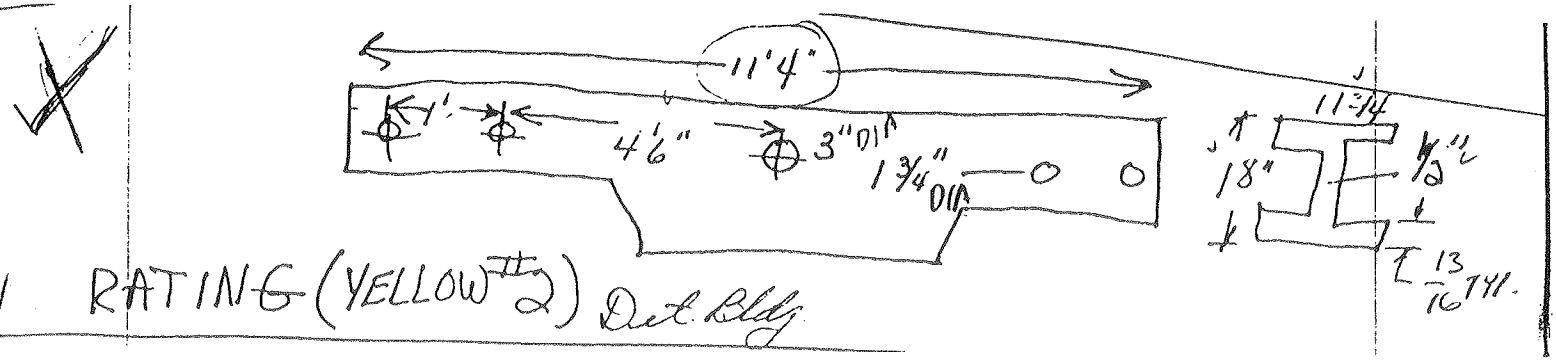


Section	Area	dist to c.g.	Area × dist
B	4.224	4.05	17.107
C	9.541	2.656	82.582
$\Sigma A =$	13.765	$\Sigma My =$	100.0109

$$Y = \frac{\Sigma My}{\Sigma A} = 7.265$$

$$f_s = \frac{33600 \times 14.1 \times 7.265}{1680 \times .512} \approx 4003 \text{ psi}$$

Field Data



RATING (YELLOW #2) Dist. Bldg

Yellow #2	Field Data	Leon	7-18-88