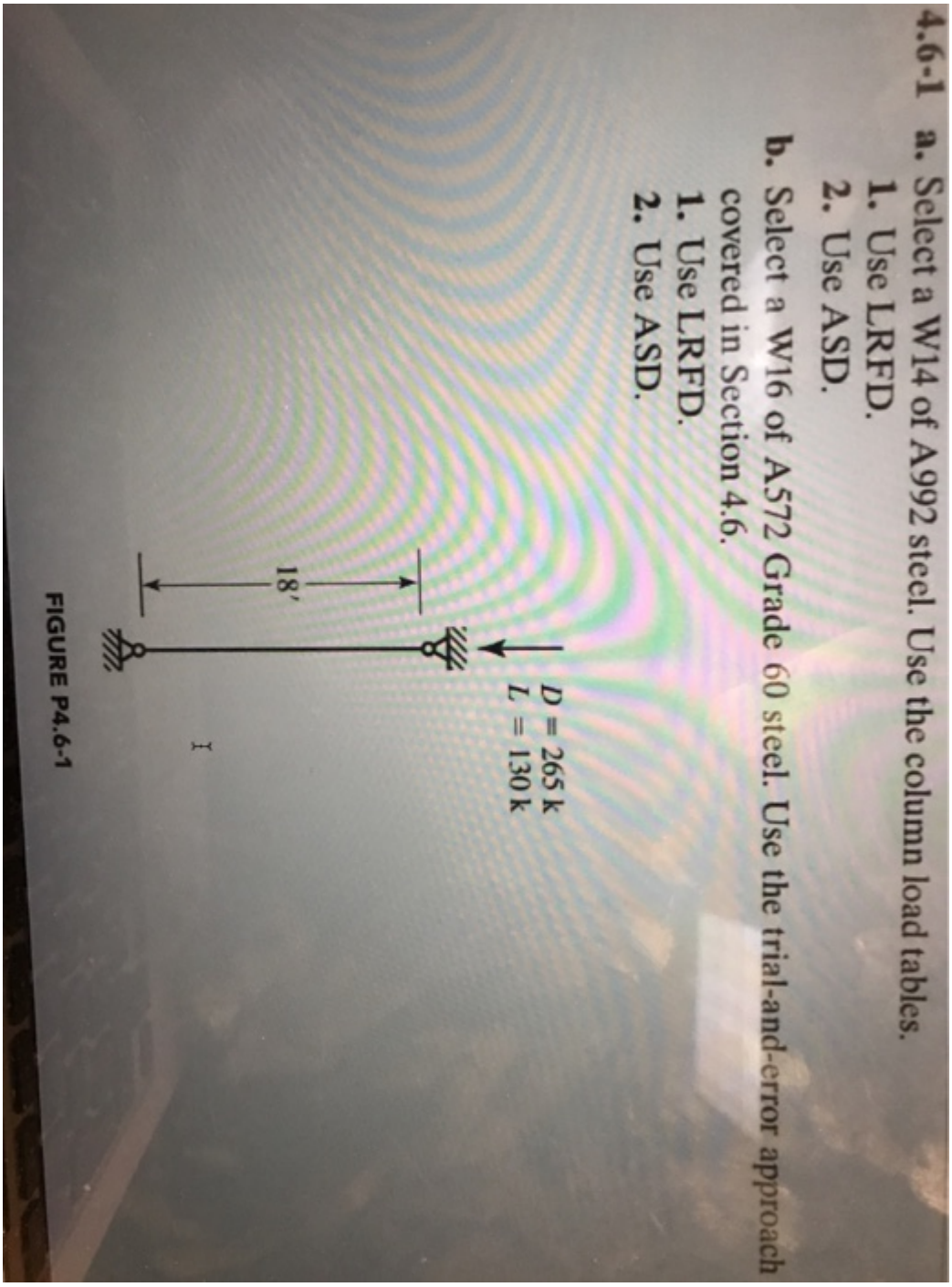
Question: 4.6-1 a. Select a W14 of A992 steel. Use the column load tables. 1. Use LRFD 2. Use ASD b. Select...



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Expert Answer

Expert Answer

Sishira Pattan Chegg expert
answered this

a1) Load $P_u = 1.2D + 1.6L$
$= 1.2 \times 265 + 1.6 \times 130$
$= 526$ kips

$KL = 18$ ft
From column load tables,
W14 X 74 = 563 kips > P_u
Section selected using LRFD is W14 X 74

a2) ASD :-
Load $P_a = D + L = 265 + 130$
$= 395$ kips

From column load tables,
$KL = 18$ ft
W14 X 82 = 413 kips > P_a
Section selected using ASD is W14 X 82

b1) LRFD :-
Assume $F_{cr} = 25$ ksi , $\phi_c = 0.90$
Gross area $A_g > \frac{P_u}{\phi_c F_{cr}}$

$\therefore A_g = \frac{526}{0.9 \times 25} = 23.4 \text{ in}^2$

Try W16 X 77
$A_g = 22.6 \text{ in}^2$
$r_y = 2.47$ in
$\frac{KL}{r_y} = \frac{18 \text{ ft} \times 12 \text{ inch}}{2.47}$
$= 87.45 < 200$
Hence ok.

$F_e = \frac{\pi^2 E}{(KL/r)^2} = \frac{\pi^2 \times 29000}{87.45^2}$
$= 37.43$ ksi

$4.71\sqrt{\frac{E}{F_y}} = 4.71\sqrt{\frac{29000}{50}}$
$= 113.43 > \frac{KL}{r_y}$
(F_y/F_e)

$F_{cr} = 0.658^{(50/37.43)} \times F_y$
$= 0.658^{(50/37.43)} \times 50$
$= 28.59$ ksi

Load $P_n = F_{cr} \cdot A_g$
$= 28.59 \times 22.6$
$= 646.13$ kips

$\phi_c P_n = 0.9 \times 646.13$
$= 581.5$ kips > P_u
Hence Safe.

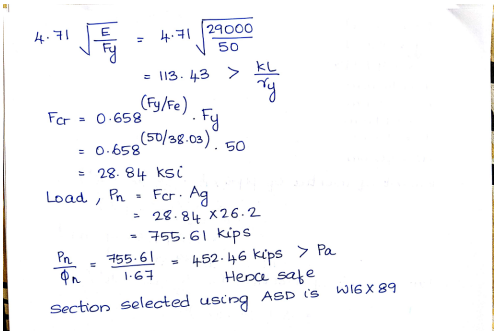
Section selected using LRFD is W16 X 77

b2) ASD :-
Assume $F_{cr} = 25$ ksi
Gross area, $A_g > \frac{P_a}{0.6 F_{cr}}$

$A_g = \frac{395}{0.6 \times 25} = 26.3 \text{ in}^2$

Try W16 X 89
$A_g = 26.2 \text{ in}^2$
$r_y = 2.49$ in
$\frac{KL}{r_y} = \frac{18 \text{ ft} \times 12 \text{ inch}}{2.49} = 86.75 < 200$
Hence ok

$F_e = \frac{\pi^2 E}{(KL/r)^2} = \frac{\pi^2 \times 29000}{86.75^2}$
$= 38.03$ ksi



2 Comments

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Practice with similar questions

Design a. Select a W14 of A992 steel. Use the column load tables. 4.6-1 1. Use LRFD 2. Use ASD b. Select a W16 of A572 Grade 60 steel. Use the trial-and-error approach covered in Section 4.6 1. Use LRFD 2. Use ASD D 265 k L 130 k 18'

See answer

Design 4.6-1 a. Select a W14 of A992 steel. Use the column load tables. 1. Use LRFD 2. Use ASD b. Select a W16 of A572 Grade 60 steel. Use the trial-and-error approach covered in Section 4.6 1. Use LRFD 2. Use ASD D 265 k L 130 k 18'

See answer 100% (1 rating)

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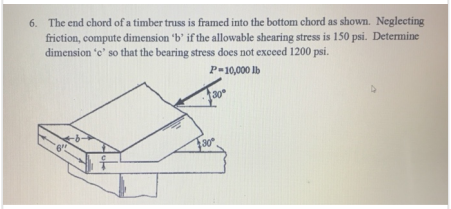
Up next for you in Civil Engineering

A water tank, 22 ft in diameter, is made from steel plates that are ½ in. thick. Find the maximum height to which the tank may be filled if the circumferential stress is limited to 6000 psi. The

See answer

The end chord of a timber truss is framed into the bottom chord as shown. Neglecting fricti…



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