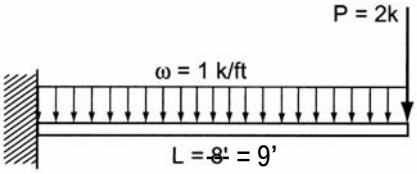
ENDS 231. Assignment #10

Date: 4/5/07, *due 4/12/07* *Pass-fail work*

Problems: from Onouye, Chapters 9 & 10.
*Note: Problems marked with a * have been altered with respect to the problem stated in the text. Multiframe2D may be used.*

***Use A992 steel. Also use LRFD design method and the beam diagram to select a W10 (fully braced) knowing the distributed load is dead load and the point load is a live load. F_y = 50 ksi, F_{yw} = 50 ksi, E = 30,000 ksi, γ_L = 1.6, γ_D = 1.2, ϕ_b = 0.9, ϕ_v = 0.9, *and* L = 9'.**

9.1.21 Assuming ~~A36~~ steel, select the most economical ~~W8~~ W10 section. Check the shear stress and determine the deflection at the free end.



Problem 9.1.21

F_b = ~~22 ksi~~ **= 33 ksi**

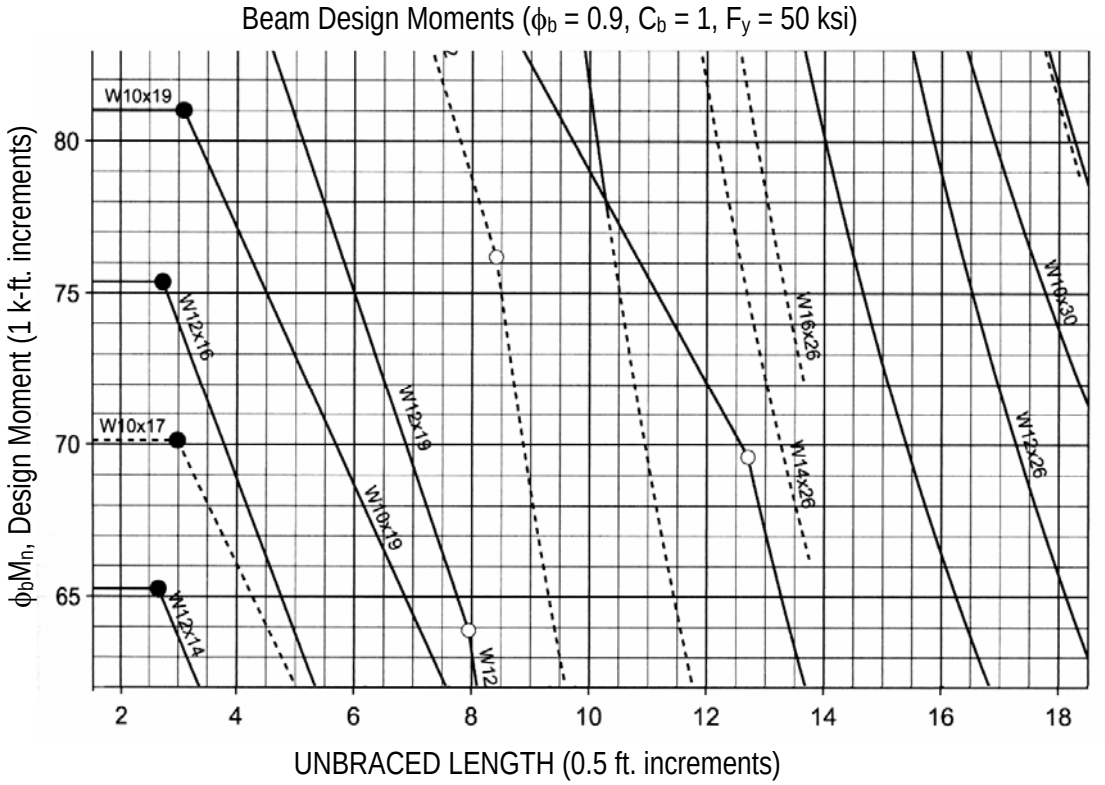
F_v = ~~14.5 ksi~~ **= 20 ksi**

E = ~~29 × 10³ ksi~~ **= 30 x 10³ ksi**

Partial answers to check with:

ASD design: f_b =30.7 ksi , f_v = 4.6 ksi, Δ = 0.65 in.

LRFD design: M_u = 77.4 k-ft, V_u = 14 k, ϕV_n =69.1 k, Δ =0.79 in



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***Use US customary units.**

No picture for 10.2.3

10.2.3 Determine the maximum critical length of a W10×54 (*W250x80*) column supporting an axial load of 250 kips (*1.112.x 10³ MN*). $E = 29 \times 10^3$ ksi ($E = 200 \times 10^3$ *MPa*).

Partial answers to check with:

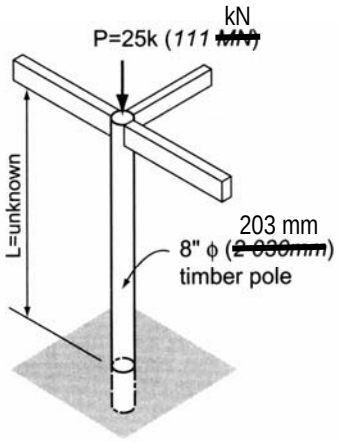
L_x = 49 ft, L_y = 28.6 ft *(make choice)*

10.2.4 An 8"-diameter timber pole is fixed into a large concrete footing at grade and is completely pin connected at its upper end. How high can the pole be and still just support a load of 25 kips? $E = 1.0 \times 10^6$ psi. Solve this problem assuming the diameter is 203 mm and the load to be supported is ~~111 MN~~ **kN** ($E = 6.895 \times 10^3$ *MPa*). ***(The SI values are wrong.)**

Partial answers to check with:

I_x = 201 in^4, K=0.7, L = 33.6 ft

I_x =83.4 x 10^6 mm^4, L = 10.2 m



Problem 10.2.4

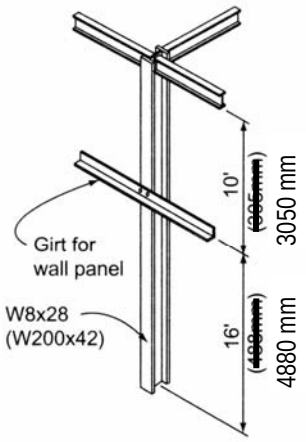
***Use metric units.**

10.2.6 Determine the critical buckling load and stress for the W8×28 (*W200x42*) column shown. $E = 29 \times 10^3$ ksi ($E = 200 \times 10^3$ *MPa*). ***1 MPa = N/mm²**

Partial answers to check with:

L_e/r_x = 90.5 and L_e/r_y = 118.7, $P_{cr\text{-}x}$ = 1281 kN,

$P_{cr\text{-}y}$ = 748 kN, f_{cr} = 141 MPa



Problem 10.2.6