ENDS 231. Assignment #10

Date: 11/8/07, *due 11/15/07* *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.*
Multiframe4D may be used.

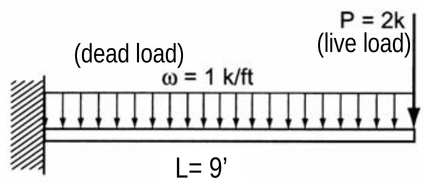
(15%) ***Use A992 steel. The length has been changed to 9 ft.**
Also use LRFD design method and the beam diagram to select a W10 (fully braced) knowing the distributed load is dead load and the point load is a live load. Check the shear stress and determine the deflection at the free end.
(F_y = 50 ksi, F_{yw} = 50 ksi, E = 30,000 ksi, γ_L = 1.6, γ_D = 1.2, ϕ_b = 0.9, ϕ_v = 0.9) *(LRFD)*

(25%) ***9.1.21** Assuming **A992** steel, select the most economical **W10** section. Check the shear stress and determine the deflection at the free end. *(allowable stress design and deflection)*

F_b = **33 ksi**

F_v = **20 ksi**

E = **30 x 10^3 ksi**



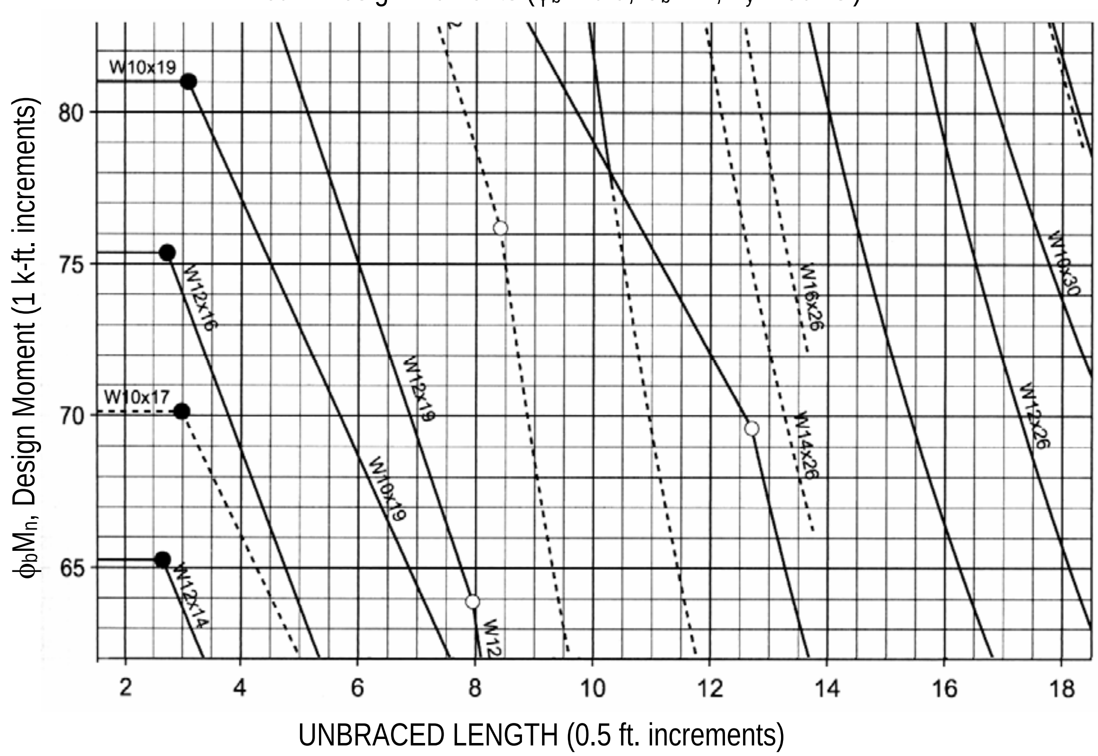
Problem 9.1.21

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

Beam Design Moments (ϕ_b = 0.9, C_b = 1, F_y = 50 ksi)



MORE NEXT PAGE

(15%) ***Use US customary units.**

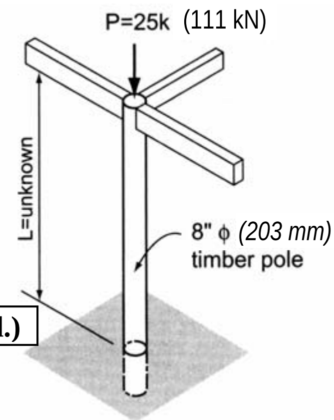
10.2.3 Determine the maximum critical length of a W10×54 (*W250x80*) column supporting an axial load of 250 kips (*1.112.x 10^3 MN*). $E = 29 \times 10^3$ ksi ($E = 200 \times 10^3$ *MPa*).
(*Euler buckling formula)*

Partial answers to check with:
$L_x = 49$ *ft*, $L_y = 28.6$ *ft (make choice)*

No picture for 10.2.3

(25%)* **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 kN** $E = 6.895 \times 10^3$ *MPa*). ***(The SI values have been corrected.)**
(*Euler buckling formula)*

Partial answers to check with:
$I_x = 201\ in^4$, *K=0.7*, $L = 33.6$ *ft*
$I_x = 83.4 \times 10^6\ mm^4$, $L = 10.2$ *m*

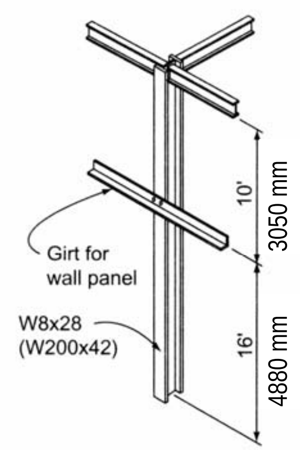


Problem 10.2.4

(20%) ***Use metric units. (The SI values have been corrected.)**

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)**
(*Euler buckling formula)*

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