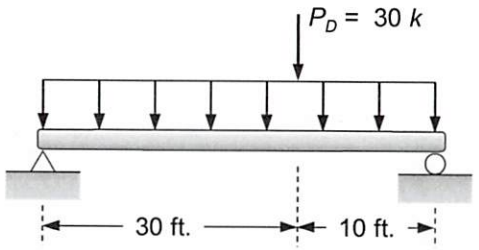
Classroom Problem 5.5-2: The beam shown is a **W30 x 108** of **A992** steel with F_y = 50 *ksi*; F_u = 65 *ksi*. It supports a reinforced concrete floor slab that provides continuous lateral support of the compression flange. The service dead load is 1 *k/ft*. This load is superimposed on the beam; it does not include the beam's weight. The service live load is 2.5 *k/ft*.



FROM TABLE 1-1 (1-16) $A = 31.7 in^2$ $Z_x = 346 in^3$ $b/2t = 6.89$ $h/t = 49.2$

CHECK FLANGE $b/2t < 0.38\sqrt{E/F_y} = 0.38\sqrt{\frac{29{,}000 ksi}{50 ksi}} = 9.15$ COMPACT

CHECK WEB $h/t < 3.76\sqrt{E/F_y} = 3.76\sqrt{\frac{29{,}000 ksi}{50 ksi}} = 90.55$ COMPACT

$$M_n = M_p = F_y Z_x = 50 ksi (346 in^3) = 17{,}300 k\cdot in = 1{,}441.67 k\,ft$$

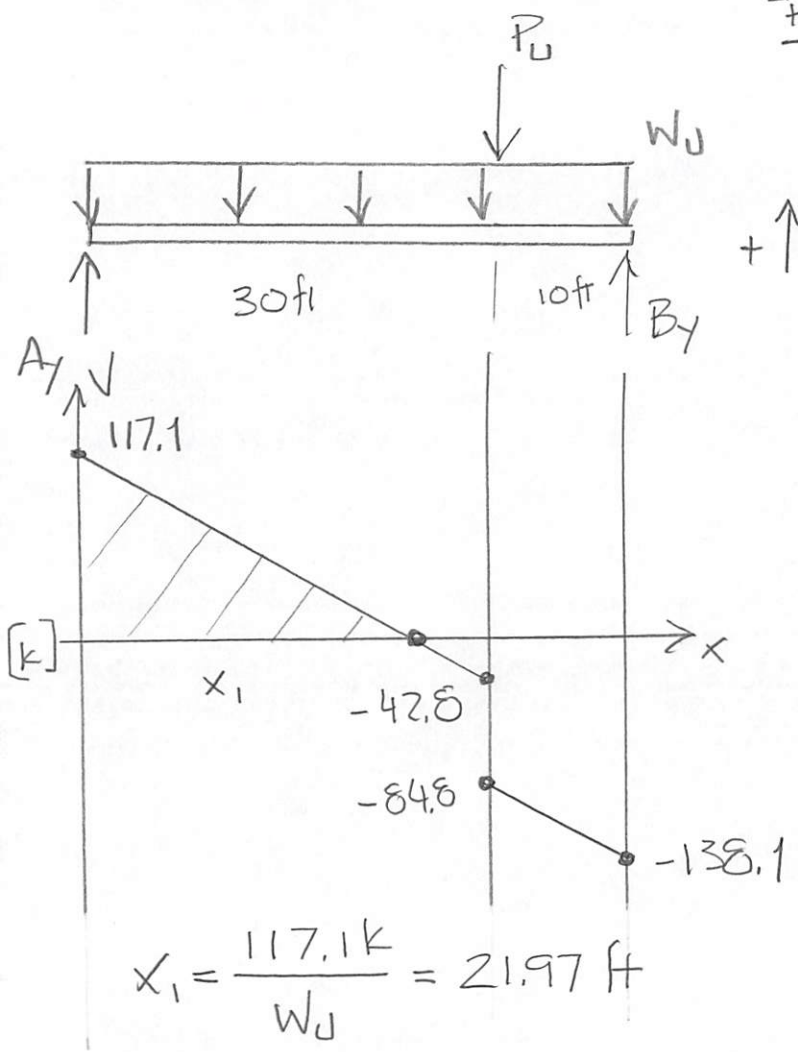
← BEAM WT

$$w_D = 1 k/ft + 0.108 k/ft = 1.108 k/ft$$

$$w_U = 1.2 w_D + 1.6 w_L = 1.2(1.108 k/ft) + 1.6(2.5 k/ft) = 5.33 k/ft$$

$$P_U = 1.4 P_D = 1.4(30^k) = 42^k$$

CR PROBLEM 5.2-2



$$\circlearrowleft + \sum M_B = 0 = W_U(40\text{ft})(20\text{ft}) + P_U(10\text{ft}) - A_Y(40\text{ft})$$

$$A_Y = 117.1\text{k}$$

$$+\uparrow \sum F_Y = 0 = A_Y + B_Y - P_U - W_U(40\text{ft})$$

$$B_Y = 138.1^{\text{k}}$$

M_{MAX} @ $V = 0$

$$\therefore M_{MAX} = \tfrac{1}{2}(21.97\text{ft})\,117.1\text{k} = \underline{1{,}286.3\text{k-ft}}$$

$$\phi_b M_n > M_u$$

$0.90(1{,}441.67\text{k-f}) = 1{,}297.5^{\text{k-ft}} > M_u$ <u>O.K.</u>