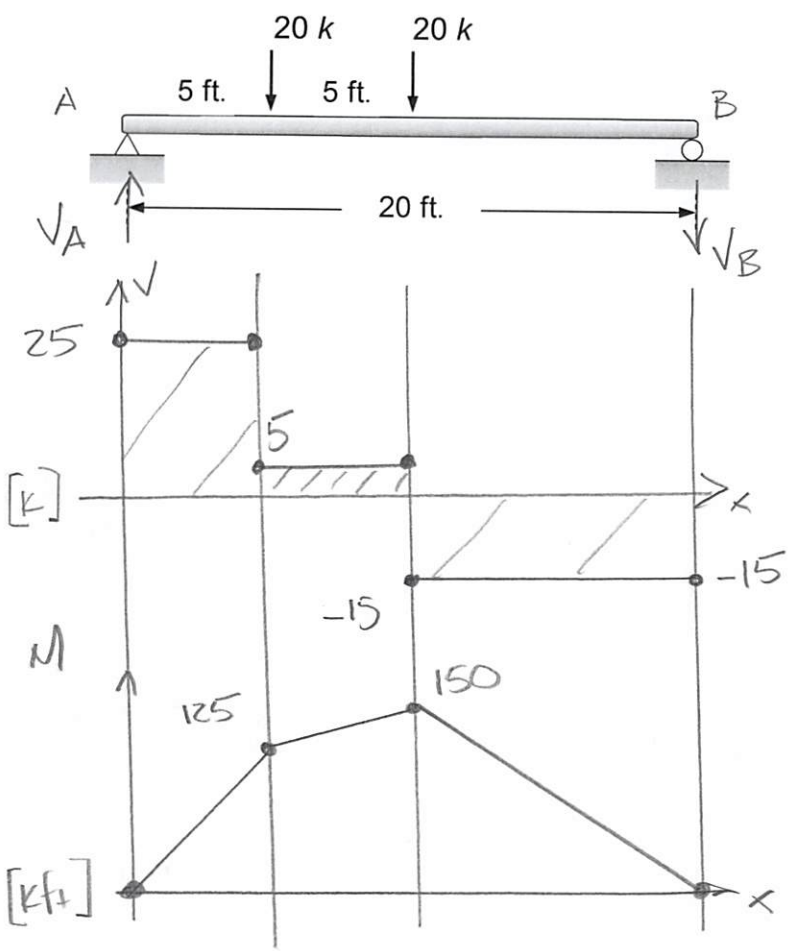
Classroom Problem 5.8-2: A **W12 x 45** of **A992** steel with F_y = 50 *ksi*; F_u = 65 *ksi*, and has continuous lateral support. The two concentrated loads are service live loads. Neglect the beam's weight and determine if the beam is adequate.



* FROM TABLE 1-1 (1-26)

$A = 13.1\ in^2$ $\quad d = 12.1\ in$ $\quad t_w = 0.335\ in$

$h/t_w = 29.6$ $\quad Z_x = 64.2\ in^3$

$\circlearrowleft + \Sigma M_B = 0 = 20^k(10\,ft + 15\,ft) - V_A(20\,ft)$

$V_A = 25^k$

$+\uparrow \Sigma F_y = 0 = V_A - V_B - 20^k - 20^k$ $\quad V_B = -15^k$

$V_u = 1.6(25k) = 40^k$

$M_u = 1.6(150k\,ft) = 240k\,ft$

$M_n = M_p = F_y Z_x = 50ksi(64.2\,in^3) = 3{,}210\,k\cdot in = 267.5k\,ft$

$\therefore\ \phi M_n = 0.90(267.5k\,ft) = 240.75k\,ft > M_u = 240.0k\,ft$ $\quad$ O.K.

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$$\frac{h}{t_w} = 29.6 \qquad 2.24\sqrt{\frac{E}{F_y}} = 2.24\sqrt{\frac{29{,}000\,ksi}{50\,ksi}} = 53.94 > {}^{h}/_{t_N}$$

$\therefore\ C_{V_1} = 1.0 \qquad \phi_v = 1.0$

$$V_n = 0.6F_yA_wC_{V_1} = 0.6(50ksi)12.1in(0.335in)(1.0) = 121.6^k$$

$$\phi V_n = 121.6^k > V_u = 40^k \quad \underline{\text{o.k.}}$$