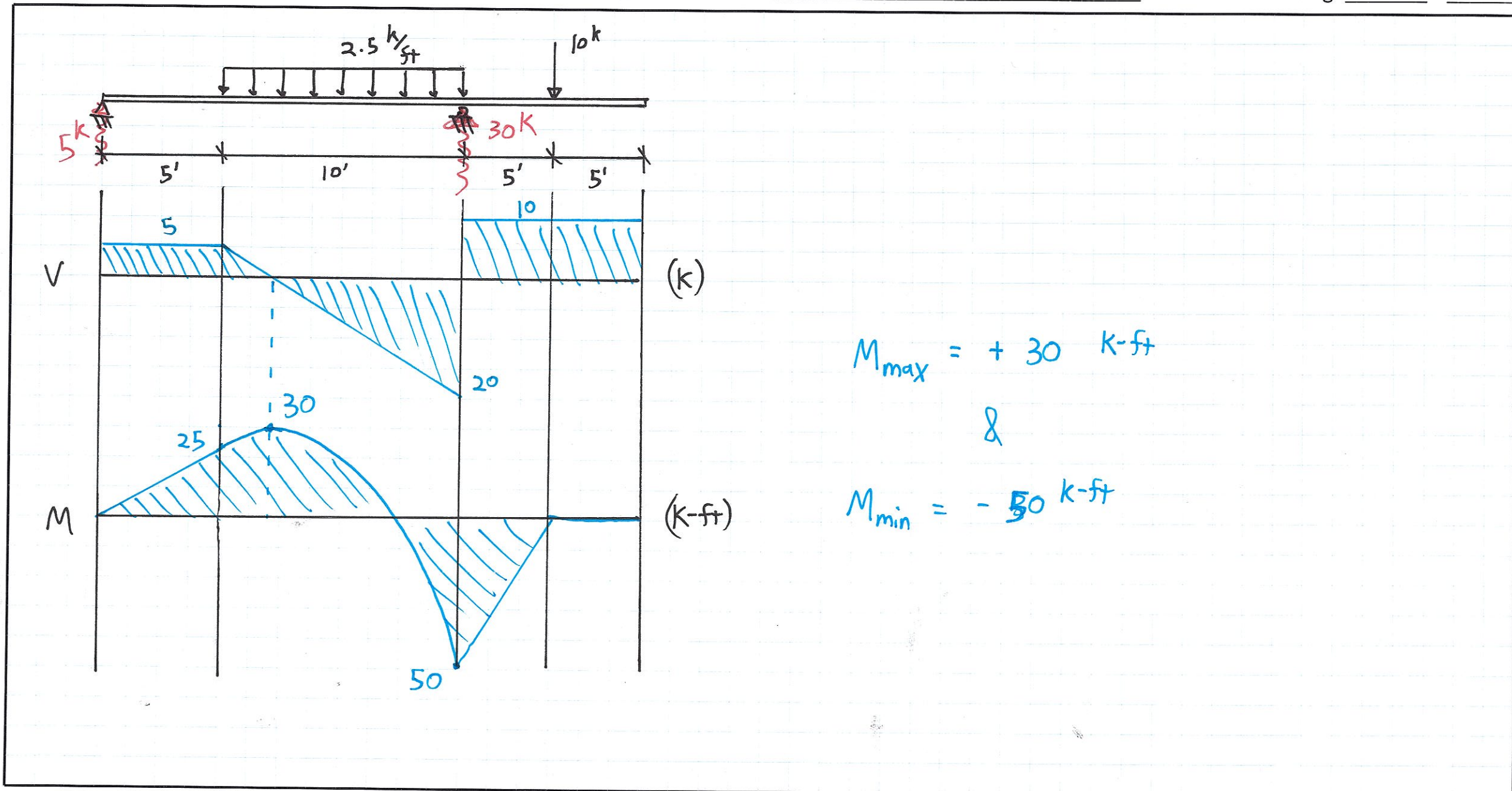


The diagram shows a T-beam cross-section. The top flange is 5 inches wide and 2 inches high. The web is 1 inch wide and 6 inches high. The centroidal axis is located 5.5 inches from the bottom edge. The distance from the top edge to the centroidal axis is 2.5 inches. The distance from the top edge to the centroid of the flange is 1.5 inches. The distance from the centroid of the flange to the centroidal axis is 2.5 inches. The centroidal axis is labeled  $\bar{y} = 5.5''$ . The top and bottom edges are labeled  $C_{top}$  and  $C_{btm}$  respectively. The top and bottom edges are also labeled ① and ②.

$$\bar{y} = \frac{(2'')(5'')(7'') + (6'')(1'')(3'')}{(5'')(2'') + (6'')(1'')} = 5.5''$$
$$I = \frac{1}{12} (5'')(2'')^3 + (5'')(2'')(1.5'')^2 + \frac{1}{12} (1'')(6'')^3 + (1'')(6'')(2.5'')^2 = 81.33 \text{ in}^4$$
$$C_{top} = 2.5'' ; C_{btm} = 5.5''$$
$$S_{top} = \frac{81.33 \text{ in}^4}{2.5''} = 32.53 \text{ in}^3 ; S_{btm} = \frac{81.33 \text{ in}^4}{5.5''} = 14.79 \text{ in}^3$$



$$M_{max} = + 30 \text{ k-ft}$$

&

$$M_{min} = - 50 \text{ k-ft}$$

$$\sigma_{max} = \frac{|M_{max}|}{S} \Rightarrow$$

POS. MOMENT;  
top  $\rightarrow$  comp.  
btm  $\rightarrow$  ten.

$$\sigma_{top} = \frac{(30 \text{ k-ft})(12 \frac{\text{in}}{\text{ft}})}{(32.53 \text{ in}^3)} = -11.07 \text{ ksi}$$

$\leftarrow S_{top}$

$$\sigma_{btm} = \frac{(30 \text{ k-ft})(12 \frac{\text{in}}{\text{ft}})}{(14.79 \text{ in}^3)} = +24.34 \text{ ksi}$$

$\leftarrow S_{btm}$

controls in tensile stress

NEG. MOMENT;  
top  $\rightarrow$  ten.  
btm  $\rightarrow$  comp.

$$\sigma_{top} = \frac{(50 \text{ k-ft})(12)}{(32.53)} = +18.44 \text{ ksi}$$

$$\sigma_{btm} = \frac{(50)(12)}{(14.79)} = -40.57 \text{ ksi}$$

controls in compression stress