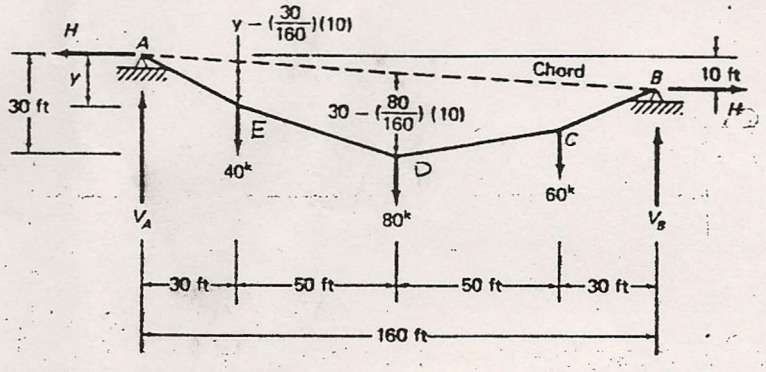
ENCE 3356 SOLN HW#9

NAME EXAMPLE DATE

COURSE ~~ENCE~~ ENCE 3356 SHEET 1 OF 2

Problem: Determine the sag at points C and E on the cable (O given) and determine the tension in each segment.

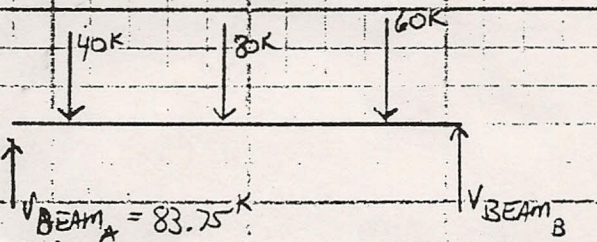


Solution:

Calculate the horizontal tension in the cable H using the beam analogy

Hy_p = Bending Moment at point P in a similarly loaded simple beam

where y_p is the distance from point P to the chord.



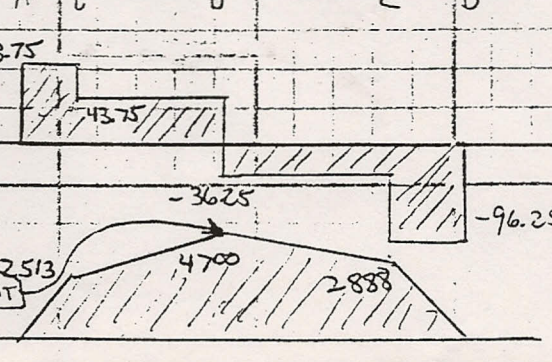
$$\circlearrowright \Sigma M_B = V_{BEAM_A}(160) - 40(130) - 80(80) - 60(30) = 0$$

$V_{BEAM_A} = 83.75^K$ ← Note, this is not equal to reaction V_A in top sketch. It is only used for calculation of Moments in beam analogy

$$\Sigma F_y^{\uparrow} = 83.75 - 40 - 80 - 60 - V_{BEAM_B} = 0$$

$V_{BEAM_B} = 96.25^K$

Draw Moment diagram for beam (k) X



OR CREATE TABLE

POINT	MOMENT ON BEAM
C'	$83.75^K[30'] = 2512.5^{IK}$
D'	$83.75^K[80'] - 40^K[50'] = 4700^{IK}$ ← MAX MOMENT
E'	$83.75^K[130'] - 40^K[100'] - 80^K[50'] = 2887.5^{IK}$ (A+)

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COURSE SHEET 2 OF 2

At point D

Sag $y_D = 25$ ft (from initial diagram)

Beam Moment $M_D = 4700$ ft-K, so

$$H = \frac{M_D}{y_D} = \frac{4700 \text{ ft-K}}{25 \text{ ft}}$$

$H = 188$ Kips

Knowing H, the sags y_E and y_C may be determined

$$y_C = \frac{M_C}{H} = \frac{2888 \text{ ft-K}}{188 \text{ K}} \qquad y_E = \frac{M_E}{H} = \frac{2513}{188}$$

$y_C = 15.36$ ft $\qquad y_E = 13.37$ ft

The vertical reactions V_A and V_B can be solved using ΣF_y and ΣM_B knowing $H = 188^K$

$$\curvearrowright \Sigma M_B = -H(10) + V_A(160) - 40(130) - 80(80) - 60(30) = 0$$

$V_A = 95.5^K$

$$\uparrow \Sigma F_y = 95.5 - 40 - 80 - 60 + V_B = 0$$

$V_B = 84.5$

The tension in each of the segments can be calculated by

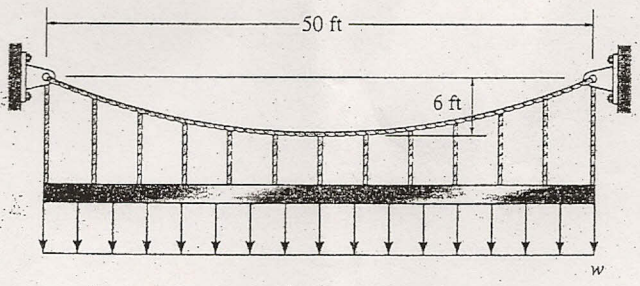
$T = \sqrt{H^2 + V^2}$ where H and V are ~~Horizontal/Vertical~~ Components of force in each segment

Segment	Horizontal Component (K)	Vertical Component (K)	Resultant Tension (K)
AE	188	95.5	$\sqrt{188^2 + 95.5^2} = 210.9$
ED	188	$95.5 - 40 = 55.5$	$\sqrt{188^2 + 55.5^2} = 196.0$
DC	188	$95.5 - 40 - 80 = -24.5$	$\sqrt{188^2 + (-24.5)^2} = 189.6$
CB	188	$95.5 - 40 - 80 - 60 = -84.5$	$\sqrt{188^2 + (-84.5)^2} = 206.1$

SOLN HW # 9

ENCE 3356
Homework 10

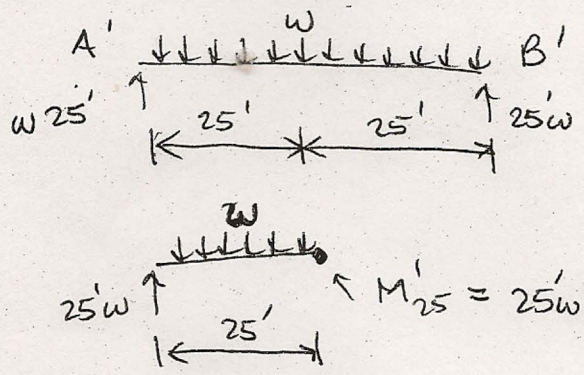
Determine the maximum uniform loading w that the cable can support if it is capable of sustaining a maximum tension of 3000 lb before it will break.



CALCULATIONS :

SAG KNOWN AT MIDSPAN $y_{25'} = 6'$

ANALOGOUS BEAM :



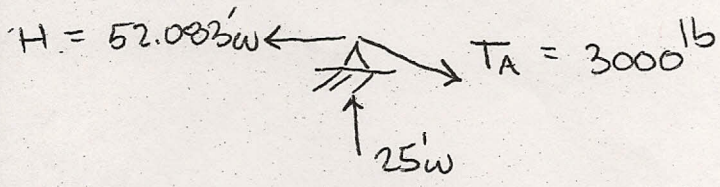
$$H y_{25'} = M'_{25'}$$

$$H(6') = \frac{1}{8} w (25')^2$$

$$H = 52.083' w$$

$$M'_{25} = 25'w[25'] - 25'w[12.5'] = \frac{1}{8} w [25']^2$$

CABLE :



$$T = \sqrt{H^2 + A_y^2}$$

$$3000^{lb} = \sqrt{(52.083'w)^2 + (25'w)^2}$$

$$w^2 = 2696.5\ lb^2/Ft$$

$$w = 51.93\ lb/Ft$$

$$w = 51.9\ lb/Ft$$