- A baseline was measured using 100m tape which is standardized $15^{o}C$ with a standard pull of 10kg. The recorded distance was found out to be 430.6m. At the time of measurement the temperature was $20^{o}C$ and the pull exerted was 16kg.

Determine the true length of the base if the weight of one cu. cm. of steel is 7.86 gr. Weight of tape is 2.67 kg. $E=2x10^{6}kg/cm^{2}$, $K=7x10^{-7}m/\ ^{o}C$.

- Solution:

  Given:

  LT = 100 m T_1 = 15°C

  T_2 = 20°C P_1 = 10 kg

  TD = 430.60 m P_2 = 20 kg

  W = 2.67 kg E = $2x10^6$ kg/cm^2

  k = $7x10^{-7}$ m/°C A = ?

  Unit weight of steel = 7.86 gr. per cu. Cm

- Temperature correction

$$C_T = k\, L_1 (T_2 - T_1)$$

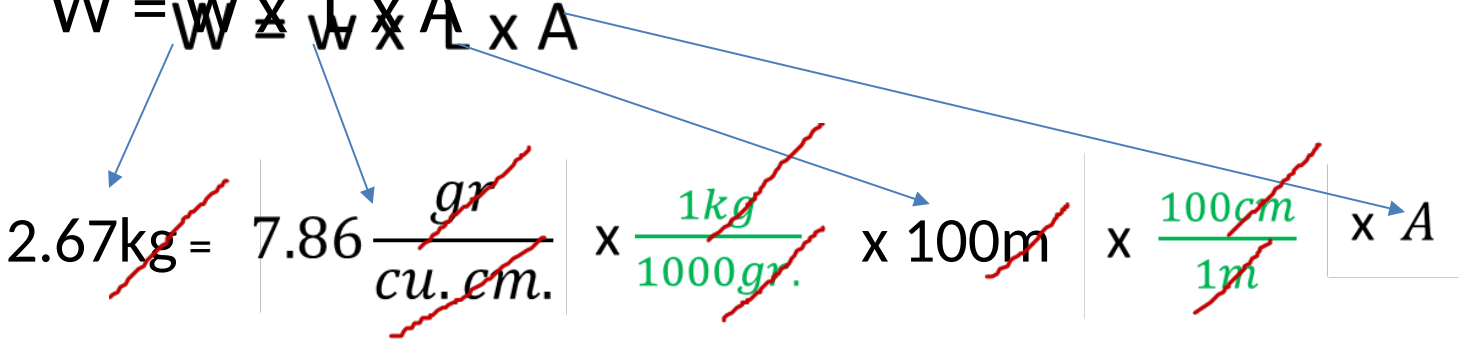
$$Ct = 7x10^{-7}\,(430.6)(20 - 15) = +0.0015 \text{ m}$$

- Pull correction =

Solving for the cross sectional area of tape

Total weight = unit weight x Volume

W = w x L x A



A = 0.0340 cm^2

$$C_P = \frac{(20-10)kg(430.6)m}{(0.034)cm^2(2x10^6)kg/cm^2} = +0.0633\ m$$

- Sag correction –

2. Sag Correction: (To be subtracted only)

$$Cs = \frac{w^2 L^3}{24P^2} = \frac{W^2 L}{24P^2}$$

$$Cs = \frac{W^2 \text{ x L}}{24P^2} \qquad Cs1 = \frac{(2.67\ kg)^2 \text{ x } 100\text{m}}{24(20kg)^2} = 0.0743\text{m}$$

$$W_2 = 7.86 \text{ x } \frac{1}{1000} \text{ x } 30.6 \text{ x } \frac{100}{1} \text{ x } 0.034cm^2 = 0.8178\text{kg}$$

$$W_2 = 2.67 \text{ x } \frac{30.6}{100} = 0.8170 \text{ kg}$$

Solving for the value of Cs_2 (To be subtracted only)

$$Cs2 = \frac{(0.8170\ kg)^2}{24(20kg)^2} \text{ x } 30.60\text{m} = 0.0021\text{ m}$$

Solving for the value of correction due to sag

$$Cs = 0.0743 \text{ x } 4 + 0.0021 = 0.2993\text{ m}$$

Solving for the true length of the base

$$L_{True} = L_M + C_T + C_P + C_S$$

$$L_{True} = 430.60 + 0.0030 + 0.0633 + (-0.2993)$$

$$L_{True} = 430.367\text{m}$$