

TAPE CORRECTION EXAMPLES

#1. A DISTANCE WAS MEASURED AT A TEMPERATURE OF 8°F AND WAS FOUND TO BE 2166.68'. IF THE TAPE HAS A STANDARDIZED LENGTH OF 99.96 FT. AT 68°F, WHAT IS THE CORRECT DISTANCE MEASURED?

KNOW: $t = 8^\circ F$
 $l = 2166.68'$
 $L_s = 99.96'$
 $t_0 = 68^\circ F$

FIND: C_t, C_f, T

STANDARD LENGTH: $C_t = L_s - 100'$
 $= 99.96' - 100.00'$
 $= -0.04'$ PER TAPE LENGTH

TOTAL $C_t = (-0.04')(21.67)$
 $= -0.867'$

WHERE 21.67 IS THE NUMBER OF TAPE LENGTHS

TEMPERATURE: $C_f = l \alpha (t - t_0)$ $\alpha = 0.00000645$ PER $1^\circ F$
 $= (2166.68')(0.00000645)(8^\circ - 68^\circ)$
 $= -0.839'$

TOTAL CORRECTION: $C = C_t + C_f$
 $= (-0.867') + (-0.839')$
 $= -1.71'$

$T = R + C$
 $= 2166.68' + (-1.71')$
 $= 2164.97'$

#2. A 100.00ft TAPE IS USED TO MEASURE AN INCLINED DISTANCE AND THE VALUE DETERMINED IS 3106.34ft. IF THE SLOPE IS 6%, WHAT IS THE CORRECT HORIZONTAL DISTANCE?

KNOW: $L_s = 100.00'$
 $l = 3106.34'$ (Δ)
 SLOPE = 6%

FIND C_h , T OR H

FIND THE CHANGE IN HEIGHT BETWEEN THE POINTS:

$$h = (3106.34')(0.06)$$

$$= 186.38'$$

COMPUTE HORIZONTAL DISTANCE

$$H = \sqrt{\Delta^2 - h^2}$$

$$= \sqrt{(3106.34)^2 - (186.38)^2}$$

$$= 3100.74'$$

OR BY USING CORRECTION:

$$C_h = -\frac{h^2}{2\Delta} = -\frac{186.38^2}{2(3106.34')}$$

$$= -5.59'$$

$$T = R + C$$

$$= 3106.34' + (-5.59')$$

$$= 3100.75'$$

#3 A 30.00 m TAPE IS USED TO MEASURE AN INCLINED DISTANCE AND THE VALUE DETERMINED IS 1642.32 m. IF THE SLOPE IS 6%, WHAT IS THE CORRECT HORIZONTAL DISTANCE?

KNOW: $L_s = 30.00 \text{ m}$
 $l = 1642.32 \text{ m (s)}$
SLOPE = 6%

FIND C_h & T OR H

FIND THE CHANGE IN HEIGHT BETWEEN BOTH POINTS
 $h = (1642.36 \text{ m})(0.06)$
 $= 98.54 \text{ m}$

then $H = \sqrt{l^2 - h^2}$
 $= \sqrt{(1642.32)^2 - (98.54)^2}$
 $= 1639.36 \text{ m}$

OR BY USING CORRECTION:

$$C_h = -\frac{h^2}{2l} = -\frac{98.54^2}{2(1642.32)}$$
$$= -2.96 \text{ m}$$

$$T = l + C$$
$$= 1642.32 + (-2.96)$$
$$= 1639.36 \text{ m}$$

#A A TAPE WEIGHING 2LB. ($A = 0.006 \text{ sq. in.}$; $E = 29,000,000 \text{ psi}$) HAS A LENGTH OF 100.00 FT UNDER A PULL OF 10 LB WHEN SUPPORTED FOR ITS FULL LENGTH. THE TAPE IS USED TO MEASURE A LINE HOLDING THE TAPE ON THE GROUND WITH A PULL OF 35 LB. IF THE VALUE OBTAINED IS 2686.45 FT., WHAT SHOULD THE CORRECT DISTANCE BE?

KNOW: $W = 2 \text{ lb.}$ $P_3 = 10 \text{ lb}$ FIND: C_p, T
 $A = 0.006 \text{ sq. in.}$ $P = 35 \text{ lb}$
 $E = 29,000,000 \text{ psi}$ $l = 2686.45'$
 $L_s = 100.00'$

$$\begin{aligned} \text{TENSION: } C_p &= \frac{(P - P_3) l}{AE} \\ &= \frac{(35 - 10)(2686.45')}{(0.006)(29,000,000)} \\ &= 0.39' \end{aligned}$$

$$\begin{aligned} T &= R + C \\ &= 2686.45' + 0.39' \\ &= 2686.84' \end{aligned}$$

#5 A TAPE WEIGHING 2 lb (A = 0.006 sq. in.); E = 29,000,000 psi) HAS A LENGTH OF 100.00 FT UNDER A PULL OF 10 lb WHEN SUPPORTED FOR ITS FULL LENGTH. THE TAPE IS USED TO MEASURE A LINE WITH THE TAPE SUPPORTED AT ITS ENDS AND IN THE CENTER WITH A PULL OF 35 lb. IF THE VALUE OBTAINED IS 2686.45 FT., WHAT SHOULD THE CORRECT DISTANCE BE?

KNOW: $W = 2 \text{ lb}$ $P_3 = 10 \text{ lb}$ FIND: C_s, C_p, T
 $A = 0.006 \text{ sq. in.}$ TAPE SUPPORTED EVERY 50'
 $E = 29,000,000 \text{ psi}$ $P = 35 \text{ lb}$
 $L_s = 100.00'$ $L_{\text{TOTAL}} = 2686.45'$

SAG: SINCE TAPE SUPPORTED EVERY 50', CONSIDER ONLY HALF OF TAPE
 $W = 2 \text{ lb} / 2 = 1 \text{ lb}$ FOR 50' SEGMENT
 $l = 50'$
 NO. OF UNSUPPORTED SPANS = $\frac{2686.45'}{50'} = 53.729$

$$C_{s \text{ for } 50' \text{ SPANS}} = -\frac{W^2 l}{24 P^2} = -\frac{(1^2) 50}{24 (35^2)} = -0.0017' \text{ PER } 50' \text{ SPAN}$$

$$C_{s \text{ for } 2600'} = (53) (-0.0017') = -0.090'$$

$$C_{s \text{ for } 36.45' \text{ SPAN}} = -\frac{W^2 l}{24 P^2} = -\frac{(1^2) 36.45'}{24 (35^2)} = -0.001'$$

$$C_{s \text{ TOTAL}} = (-0.090') + (-0.001') = -0.091'$$

$$\text{TENSION: } C_p = \frac{(P - P_3) L}{AE} = \frac{(35 - 10) (2686.45')}{(0.006) (29,000,000)} = 0.386'$$

$$\text{TOTAL CORRECTION: } C = C_s + C_p \\ = (-0.091') + 0.386' \\ = 0.295'$$

$$T = R + C \\ = 2686.45' + 0.295' \\ = 2686.75'$$

#6 A TAPE WEIGHING 0.910 kg AND WITH A CROSS-SECTIONAL AREA OF 3.87 mm² HAS A LENGTH OF 30.00 m UNDER A PULL OF 5 kg WHEN SUPPORTED FOR ITS FULL LENGTH. THIS TAPE IS USED TO MEASURE A DISTANCE WITH ITS ENDS ONLY SUPPORTED AND E = 2050000 kg/cm² WITH A PULL OF 10 kg. IF THE VALUE OBTAINED IS 1168.32 m, WHAT SHOULD THE CORRECT DISTANCE BE?

KNOW: W = 0.910 kg
 A = 3.87 mm²
 L_s = 30.00 m
 P_s = 5 kg

p = 10 kg
 l = 1168.32 m
 E = 2050000 kg/cm² = 20500 kg/mm²
 SUPPORTED ONLY AT ENDS

FINID: C_s, C_p, T

$$\text{SAG: } C_{s_{30m \text{ span}}} = -\frac{W^2 l}{24 p^2} = -\frac{(0.910)^2 (30)}{24 (10)^2} = -0.0104 \text{ m PER 30 m SPAN}$$

$$\text{No. OF SPANS} = \frac{1168.32 \text{ m}}{30 \text{ m}} = 38.944$$

$$C_{s_{1140m}} = (-0.0104)(38) = -0.395 \text{ m}$$

$$C_{s_{28.32m \text{ span}}} = -\frac{W^2 l}{24 p^2} = -\frac{(0.910)^2 (28.32)}{24 (10)^2} = -0.010 \text{ m}$$

$$C_{s_{TOTAL}} = (-0.395 \text{ m}) + (-0.010 \text{ m}) = -0.405 \text{ m}$$

$$\text{TENSION: } C_p = \frac{(p - p_s) l}{AE} = \frac{(10 - 5)(1168.32)}{(3.87)(20500)} = 0.074 \text{ m}$$

$$\text{TOTAL CORRECTION } C = C_s + C_p = (-0.405 \text{ m}) + 0.074 \text{ m} = -0.33 \text{ m}$$

$$T = R + C = 1168.32 \text{ m} + (-0.33 \text{ m}) = 1167.99 \text{ m}$$

