

2.4. Errors in Chaining

Errors will be introduced in chaining due to the following reasons.

a). Instrumental errors: these are due to defective conditions of instrument. E.g. a chain may be either too long or too short.

b). Natural errors: These are due to variations in the natural phenomena e.g. changes in length due to temperature.

2.5. Correction Due to Incorrect Length of the Chain or Tape

If a chain has been damaged and it may be too short or too long of the true length of the chain, and all the measurements taken will be too long or too short, conversely a contracted or stretched chain will give incorrect measurements of the true lengths.

The correct lengths of a measured distance is found from

$$\text{Correct Length} = \text{Measured Length} \times \frac{\text{Incorrect length of chain}}{\text{Correct length of chain}}$$

$$\text{Or Correct Length} = \text{Measured Length} \times \frac{L'}{L}$$

where L' = Incorrect length of chain or tape

L = Correct length of chain or tape

If an area has been calculated then,

$$\text{Correct area} = \text{Calculated area} \times \left[\frac{\text{Incorrect length of chain}}{\text{Correct length of chain}} \right]^2$$

If an volume has been calculated then,

$$\text{Correct volume} = \text{Calculated volume} \times \left[\frac{\text{Incorrect length of chain}}{\text{Correct length of chain}} \right]^3$$

Example 2.1: A 30m chain was found to be 10cm too long after chaining a distance of 1360m. Find the true distance.

Correct length of the chain = 30m

Incorrect length of the chain = 30 + 0.10 = 30.10

Measured distance = 1360m

True distance = Measured distance x $\frac{\text{Incorrect length of chain}}{\text{Correct length of chain}}$

$$1360 \times \frac{30.10}{30.00} = 1364.53 \text{ m}$$

Example 2.2 : A road actually 1330 m long was found to be 1326 m when measured with a defective 30 m chain. How much correction does the chain need. ?

Solution :

True length = Measured length x $\frac{\text{Incorrect length of chain}}{\text{Correct length of chain}}$

True length = Measured length x L' / L

True length = 1330 m

Measured Length = 1326 m

Length of the chain = 30 m.

$1330 = 1326 \times L' / 30$

$$L' = \frac{1330 \times 30}{1326} = 30.09 \text{ m}$$

The chain is 0.09 m (9cm) too long

Correction = -9 cm (Ans).

Example 2.3 : A 20 m chain was found to be 6 cm too long at the end of the days work after measuring 6000 m. If the chain was correct before the commencement of the work, find the correct length of the line.

Solution : The increase of 6 cm should be taken as gradually.

mean in correct length of the chain $L' = 20 + (20.06/2) = 20.03 \text{ m}$.

Correct length of the chain , $L = 20\text{m}$. Measured Distance = 6000 m

True distance = $6000 \times 20.03 / 20 = 6009 \text{ m(Ans)}$.

Example : 2.4 : A 30 m chain was found to be 6 cm too long after chaining a distance of 4000 m. It was tested again at the end of day's work and found to be 8 cm too long after changing a total distance of 7800 m. If the chain was correct before the commencement of the work, find the true distance.

Solution : Chain length before commencement of the work = 30 m

Chain length after measuring 4000 m = 30.06 m.

Mean incorrect length of the chain (L') = $(30 + 30.06) / 2 = 30.03 \text{ m}$.

True distance = Measured distance $\times L' / L$

True distance = $4000 \times (30.03) / 30 = 4004 \text{ m} \dots\dots\dots (i)$

Remaining distance measured after measuring 4000 m

= $7800 - 4000 = 3800 \text{ m}$

The distance of 3800 m was measured with the chain which was 6 cm too long in the beginning and 8 cm too long at the end of the chaining.

$L' = (30.06 + 30.08) / 2 = 30.07 \text{ m}$

True distance = $3800 \times (30.07) / 30 = 3808.9 \text{ m} \dots\dots\dots (ii)$

Total True distance = (i) + (ii)

= $4004 + 3808.9 = 7812.9 \text{ m (Ans)}$

Example : 2.5 : A metallic tape originally 20 m is now found to be 20.2 m long. A house 40 m x 30 m is to be laid out. What measurement must be made using this tape ? What should the diagonal read ?

Solution : True distance = distance to be measured $\times L' / L$

$L' = 20.2 \text{ m}$

$L = 20 \text{ m}$

$40 = \text{Length to be measured} \times (20.2 / 20)$

Length to be measured = $40 \times (20 / 20.2) = 39.6 \text{ m}$

Similarly, breadth to be measured = $30 \times (20 / 20.2) = 29.7 \text{ m}$