SURVEY ENGINEERING

Topic : Measurement of Area and Volume

Notes

Measurement of Area

Component and use of Digital Planimeter :

A digital Planimeter is a table-top instrument that measures areas by tracing the outline of an object. It has several components that work together to provide accurate measurements.

Components are : Measuring wheel, Encoders, Display, Buttons and controls, Battery.

To Uses of Digital Planimeter :

Place the drawing sheet on a level surface
Press the ‘ON’ key to start the measurement
Trace the outline of the figure in a clockwise direction with the tracing lens
Read the result from the scales.

The planimeter comprises three parts: the tracing arm, the roller housing, the polearm and the pole plate.

Use : Planimeter is use to measure irregular shape area.

Measurement of Area & Volume :

Measurement method are depends on the - a) Accuracy req. and b) Shape or Geometry of area.

1. Field Measurement.
2. Plan Measurement.

If plan is of irregular shape area is found using ‘ Planimeter’
If it is regular shape : Is divided into no. of geometric shape.

Always known the Area of various Geometrical Figure :
Rectangule, Squar,Circle,Triangle,Parallelogram,Trapezium

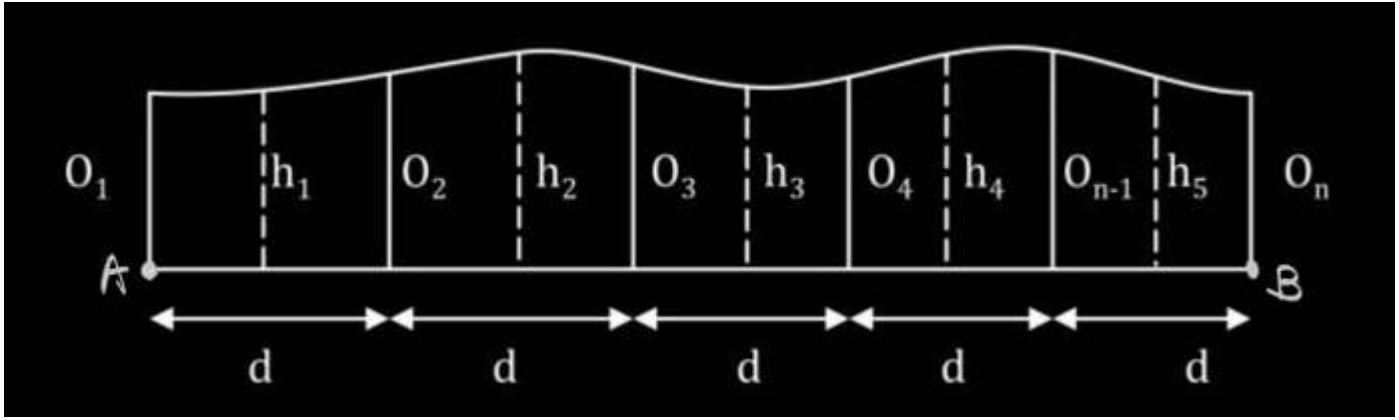
1. Mid Ordinate Rule :

Area = { Average of all mid ordinate } x Length

= (h1 x d) + (h2 x d) + (h3 x d) + ……. + { h(n-1) x d}

n is the total no. of offset/ordinate and L = (n-1)x d

In this picture here 5 nos of segment and 6 offset. D is distance between two consecutive offset.



2. Average Ordinate Method :

Area = {(O1 +O2+O3 +……+On) /n} x L

3. Trapezoidal Rule :

If land boundary b/w any two consecutive offset is more or less straight then this rule is preferred.

More accurate than mid ordinate & average ordinate.

Area = d [{ first offset + last offset }/2 + Sum of all other offset]

4. Simpson's one third Rule :

If irregular boundaries are curved, Simpson rule is preferred over trapezoid rule.

In this case curved boundary is considered to be parabolic.

This Rule is applicable only for Odd number of Offset it's the limitations of the method.

Area = d/3 {(first offset + last offset)+ 4(Sum of even offset) + 2(Sum of odd offset)}

Simpson's Rule also known as Prismoidal Formula.

Measurement of Volume :

Volume measurement is required for computation of earthwork in cutting and filling quantity of concrete etc
Example : Volumn of reserviour capacity.

Method of Measurement volumn : Trapezoidal method and Prismoidal/Simpson Rule.

1. Trapezoidal method :

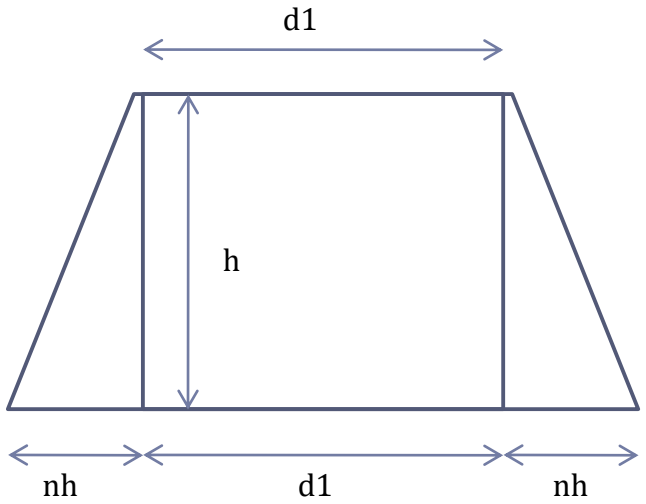
$$\text{Volumn} = d\,[\,\{\,(a1+an)/2\} + a2 + a3 + a4 + \ldots\ldots + a(n-1)\,]$$

2. Simpson's Rule :

$$\text{Volumn} = d/3\,\{(a1+an) + 4(\text{even area}) + 2(\text{odd area})\}$$

Calculation of Earthwork :

Area = (h x d1) + nh^2



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