

Lecture 31

Earthwork: Trapezoidal & Prismoidal Formulas

Estimation & Costing

Agenda

- 1. Introduction to Volume Calculation Rules
- 2. Trapezoidal Formula
- 3. Prismoidal Formula
- 4. Comparison
- 5. Summary

Trapezoidal Rule (Average End Area Method)

The Trapezoidal rule assumes that the volume is made up of a series of trapezoidal prisms.

Formula

$$V = \frac{D}{2} [(A_1 + A_n) + 2(A_2 + A_3 + \cdots + A_{n-1})]$$

Where:

- D = distance between sections
- $A_1, A_2, \dots, A_n$ = cross-sectional areas

It tends to slightly overestimate the actual volume.

Prismoidal Formula

The Prismoidal formula is more accurate and assumes the shape is a prismoid.

Condition: This rule is strictly applicable only when there is an **odd number** of cross-sections (i.e., n is odd).

Formula

$$V = \frac{D}{3} [(A_1 + A_n) + 4(A_2 + A_4 + \dots) + 2(A_3 + A_5 + \dots)]$$

In words: $V = \frac{D}{3} [(First + Last) + 4(\Sigma Even) + 2(\Sigma Odd)]$

Comparison Table

Feature	Trapezoidal Rule	Prismoidal Rule
Accuracy	Approximate (overestimates)	Highly Accurate
No. of Sections	Any number	Must be Odd
Shape Assumption	Straight lines between sections	Parabolic curves

Summary

Trapezoidal rule is simpler but less accurate.

Prismoidal rule requires an odd number of sections but provides true volume.

Next: Application to Canals and Lead/Lift.