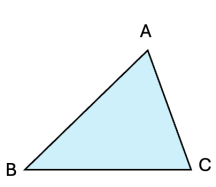

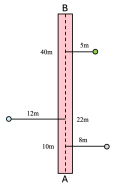

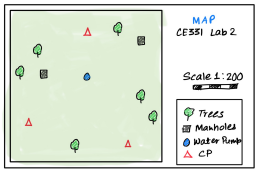

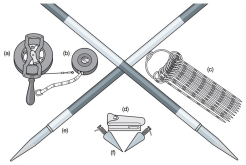


CE331 Lab 2 : Distance Measurement using Tape

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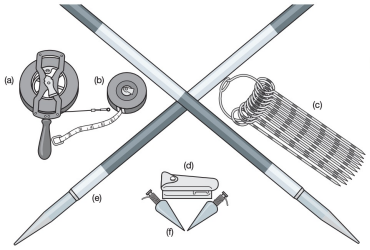
Indian Institute of Technology Kanpur

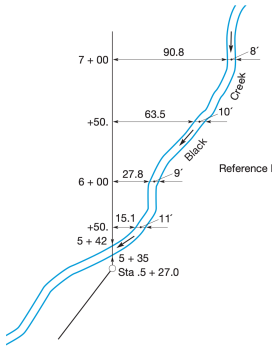
Objective

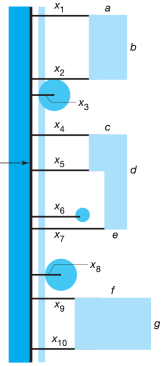
Lab Exercise 2 : Distance Measurement using Tape

- Measure distances between two points using tape
- Record chain line details in a field book
- Plot features on a map from field data









Courtesy: Wolf and Ghilani

Linear Measurement

- Tape
- Chain
- Electronic Distance Measurement (EDM)



For this lab, we'll use only Tape

Equipment for the lab

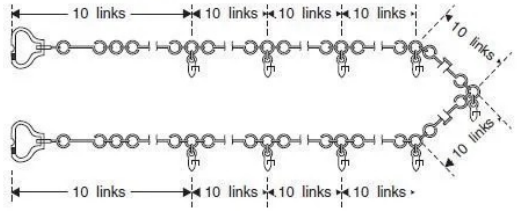
- Measuring Tape (30 m) x 2
- Ranging Rods x 3
- Peg
- Hammer



(Strictly for students registered in CE331, IIT Kanpur, 2024)

Metric Chain (30m)

- Total Length: **30 meters** (indicated on handle or tally)
- Material: Mild Steel
- Links: Provide intermediate distance information within the chain
- Link Length: 20 cm per link
- Brass Rings: Placed at every 1-meter interval along the chain
- Distinct Features: At 3m, 6m, 9m, 12m & 15m



Link provided at 3 m and 27 m

Link provided at 6 m and 24 m

Link provided at 9 m and 21 m

Link provided at 12 m and 18 m

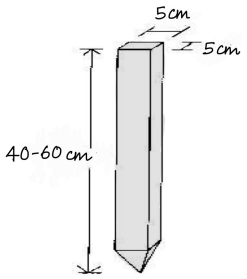
Link provided at 15 m

Tape (30m)

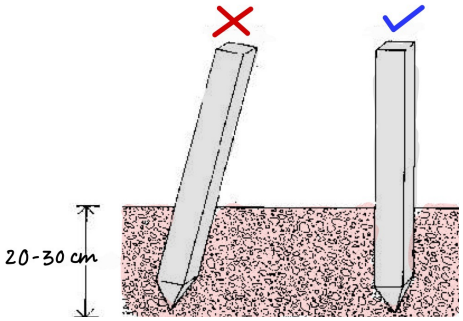
- Material: Typically made of fiberglass, steel, or cloth
- Total Length: **30 meters** (varies)
- Least Count: 1 mm

Pegs

- Used to mark the position of a point, line or feature on the ground
- Also known as surveyors' pins or surveyors' stakes



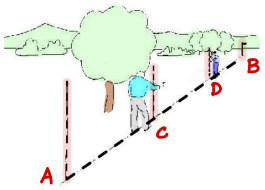
Pegs



Ranging Rod

- Used to mark positions and align sightlines during surveying
- Essential for chain surveying to ensure straight lines during distance measurement
- Pointed end to facilitates easy insertion into the ground for stability
- Markings painted in alternating bands of orange, usually for visibility

Ranging!!



Ranging

Why?

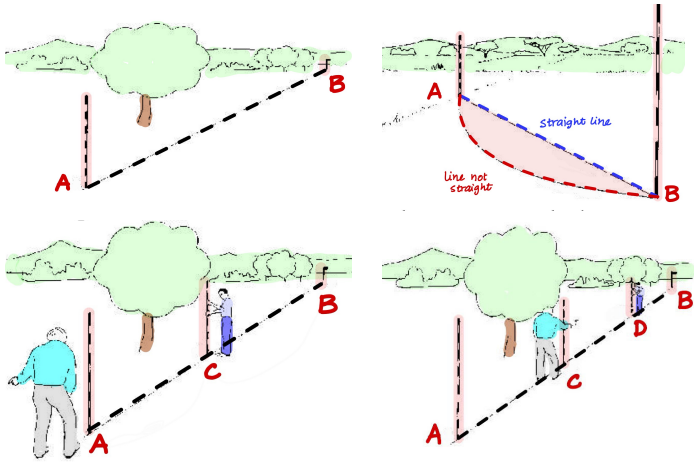
- Essential for distances greater than the length of the chain or tape

What?

- Aligning intermediate points to ensure measurements are in a straight line

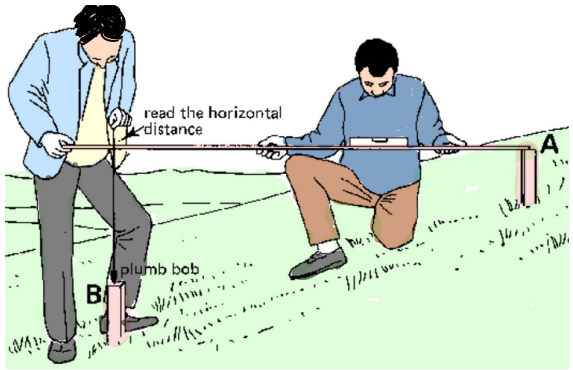
How?

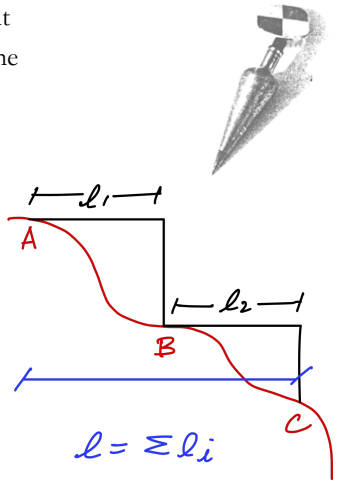
- Ranging Rods



Plumb Bob

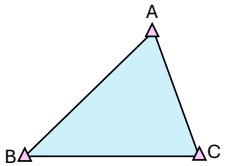
- Ensures accurate vertical alignment for distance measurement
- Suspended from a string or wire to establish a true vertical line





Methodology

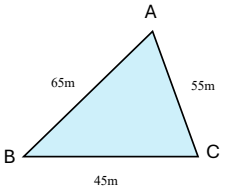
- Choose control points A, B, and C, ensuring each side (AB, BC, CA) is > 30 meters
- Measure distances between each control point (AB, BC, CA) called tie
- Draw individual lines for AB, BC, CA in the field book
- Take offsets along each line not more than 15-20 meters for this lab
- Minimize control points while maximizing important observations
- Ensure clear and accurate recording in the field book

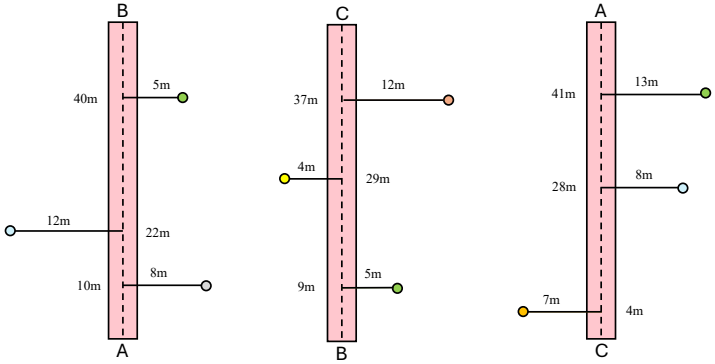


AB > 30 m
BC > 30 m
CA > 30 m

Offsetting

- Measure perpendicular distances from AB, BC, CA to mark features
- Keep offsets within 15-20 meters for precision
- Record data accurately in a field book

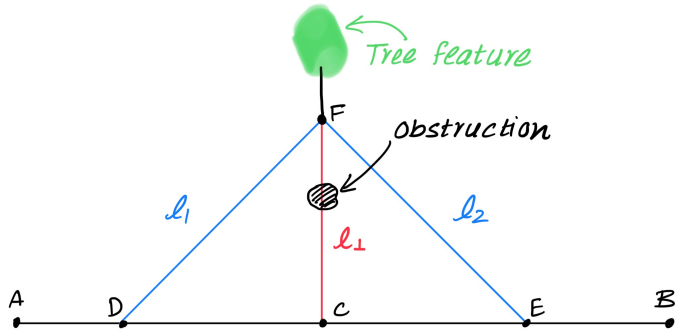




Offsetting

What to do when there is obstruction to measure perpendicular distance for features?

- Measure the distance from two distinct points lying on baseline to the feature
- Ensure these points are on opposite sides of the obstruction



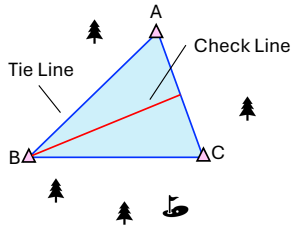
Tie Lines and Check Lines

Tie Lines:

- Lines to connect two known points and establish their relative positions
- For example, measure distances between A-B, B-C, and C-A. These lines (AB, BC, CA) are the tie lines. They help to relate your survey to the control points and ensure consistency

Check Lines:

- Lines to verify the accuracy of your measurements and survey work
- For instance, measure additional lines that were not initially part of your tie lines to cross-check the distances and ensure reliability of your survey



Accuracy of Map

How to check the accuracy of the map?

- Measure distances between features not used in the original survey (e.g., tree to building, pole to building)
- Measure corresponding distances on the map
- Multiply map distance by the scale to get the equivalent ground distance
- Error = Field Distance (measured) - Scaled Map Distance

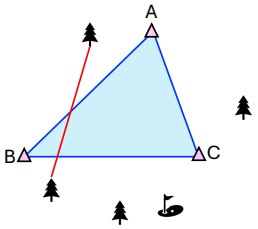
$$\Delta D = D_f - (D_m \times \text{Scale})$$

D_f: *Field Distance (measured independently)*
D_m: *Map Distance (measured on the map)*

- Relative Error indicates the accuracy of the map

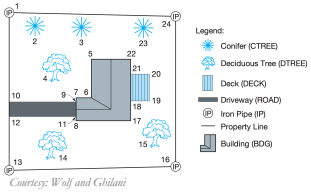
$$\text{Relative Error} = \frac{\Delta D}{D_f}$$

- The smaller the relative error, the more accurate the map

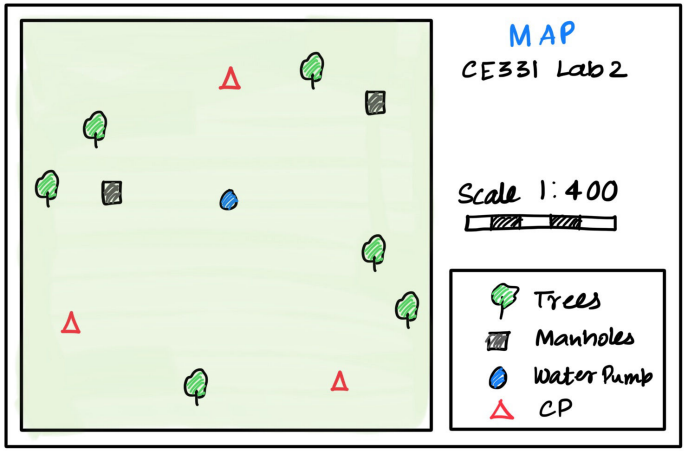


Map

- Include a Map Legend:
- Keep map neat and clean
- Show a Map Scale for real-world distance
- Round off the scale for ease of conversion

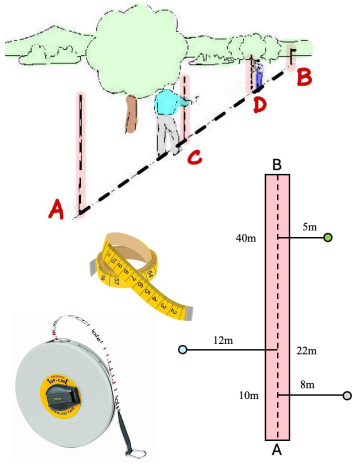


Courtesy: Wolf and Ghilani



Common Errors in Distance Measurement Using Tape

- Erroneous Length of the Chain or Tape
  - Cumulative error due to incorrect tape length.
- Errors due to Inefficient Ranging
  - Misalignment causes positive cumulative errors.
- Errors due to Inefficient Straightening
  - Incorrect tape alignment on slopes or irregular grounds.
- Errors due to Careless Holding and Markings
  - Errors from improper handling by the chainman.
- Error due to Sag in Tape
  - Sagging affects accuracy, especially over long distances.
- Personal Mistakes
  - Human errors during measurement.
- Errors due to Variation in Pull
  - Inconsistent tension causes length discrepancies.
- Errors due to Variation in Temperature
  - Temperature changes alter tape length.
- Errors due to Non-Horizontality
  - Non-horizontal measurements lead to inaccurate results.



Courtesy: Dr. Salil Goel, Geoinformatics Lab, IIT Kanpur

Thank you

Comments and Questions?
Email: amanks20@iitk.ac.in