Surveying

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Lectures
Spring
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Lecture 3:

Chain Surveying

Chaining: It is the method of measuring distance with a chain or tape. Of the various methods of determining distance, chaining is the most accurate and common method. For work of ordinary precision, a chain is used. But, where great accuracy is required, a steel tape is invariably used.

Instruments used in Chain survey

Instruments used for measuring distances:

1. Chain

2. Tape

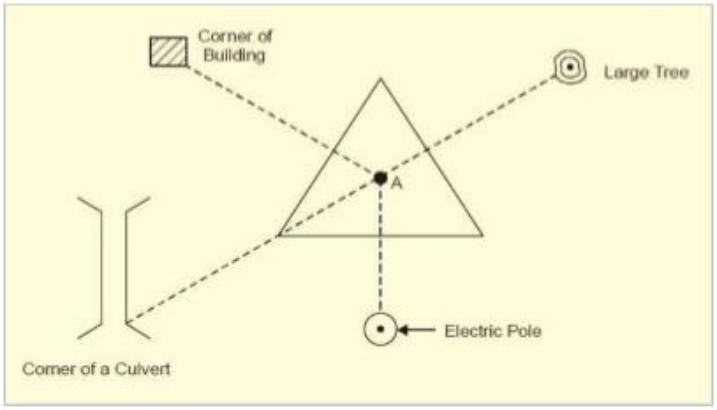
Instruments used for marking survey stations:

1. Ranging rod; 2. Offset rod; 3. Laths and whites; 4. Pegs

Instruments used for setting right angles: 1. Cross staff; 2. Optical square

Other instruments: 1. Arrow; 2. Plumb bob

1- Chain surveying: it is that type of surveying in which only linear measurements are made in the field. In planning and carrying out chain survey for a particular plot of land, the operations needed are reconnaissance, selection of station, running survey lines, recording field data (field book) and plotting the survey work.



Survey station: It's the beginning or end of the survey lines; they locate by pegs or marked by points.

Survey lines: The lines joining the main survey station are called main survey line. **Check line**: Is this line which is run in the field to check the accuracy of the work. The length of the check line is measured in the field must agree with it is length on the plan.

Tools and Equipment

1.Tape (preferably 20 m long)

2.Field book and a pencil

3.Ranging rods

4.Arrows

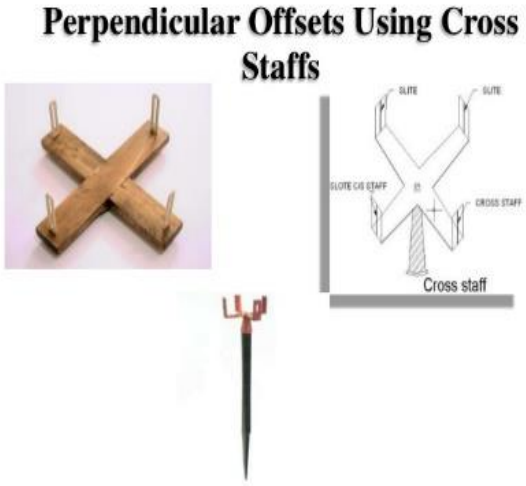
5.Chain (preferably 20 m long)

6.Plumb bob,

7.Pegs and hummer

8.An instrument for setting right angles to the chain line from the object:

a. Cross staff; b. Optical square; c. Prism square



Metric chain

IS 1492-1956 covers requirement of chains in metric units. The chains are made in length of 20 and 30 meters. To enable the reading of fractions of a chain without much difficulty, tallies are fixed at every five-meter length and small brass rings are provided at every meter length, except where tallies are attached. Connecting links between two large links are oval in shape, the central one being a circular ring. The length of the chain is marked over the handle to indicate the length and also to distinguish from non-metallic chains. The length of each link is 0.2 m (20cm) in 20m chain is provided with 100 links and 30 m chain divided into 150 links (Fig. 1).

The advantages of the chain are:

(i) it is very suitable for rough usage

(ii) it can be easily repaired in the field

(iii) it can be easily read.

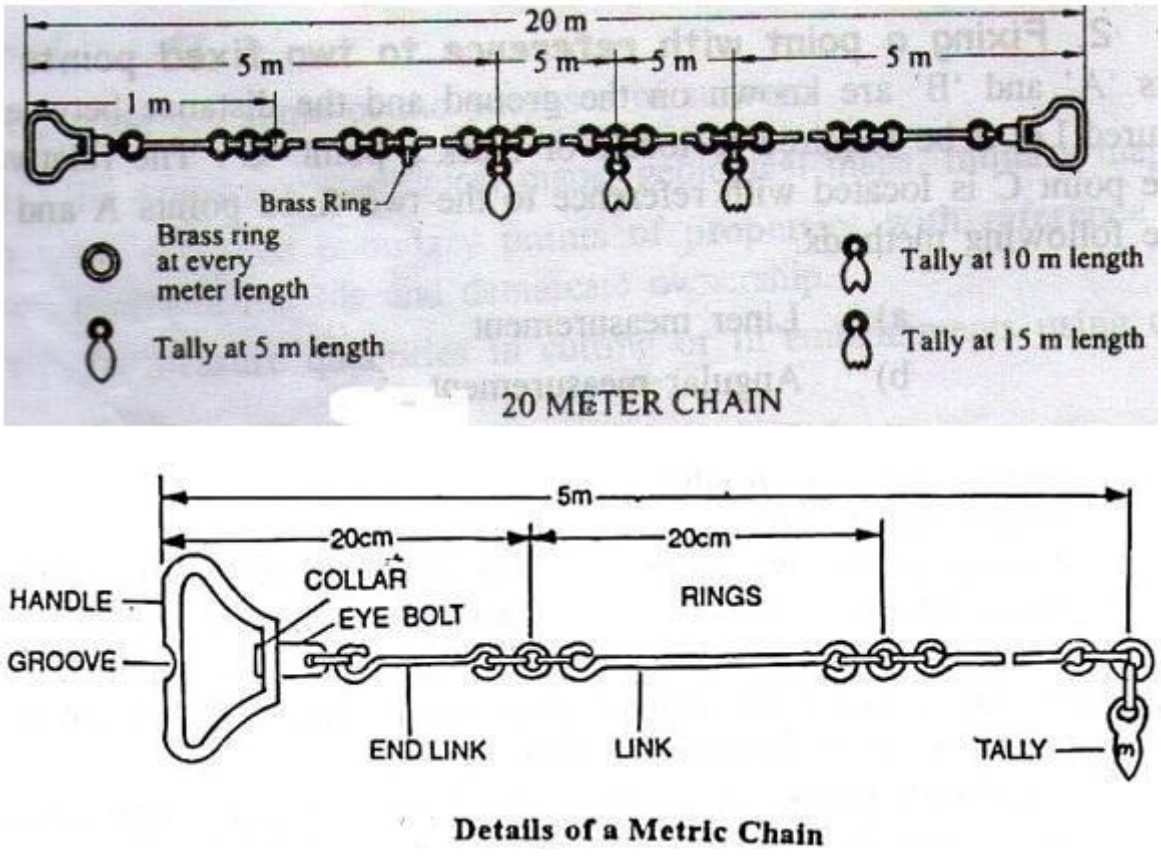


Fig. 1. Metric chain

Chain surveying is recommended when:

1. The ground surface is more or less level
2. A small area is to be surveyed
3. A small-scale map is to be prepared and
4. The formation of well-conditioned triangles is easy

Chain surveying is unsuitable when:

1. The area is crowded with many details
2. The area consists of too many undulations
3. The area is very large and
4. The formation of well-conditioned triangles becomes difficult due to obstacles

Large-Scale and Small-Scale Maps

When 1 cm of a map represents a small distance, it is said to be a large-scale map.

For example, 1 cm= 1m i.e. RF= 1/100

When 1 cm of the map represents a large distance, it is called a small-scale map.

For example, 1 cm= 100 m i.e. RF= 1/10000

A map having an RF of less than 1/500 is considered to be large-scale. A map of RF more than 1/500 is said to be small-scale.

2- TAPING

Introduction:

Measurement of horizontal distance by taping consists of applying the known length of a graduated tape directly to a line a number of times.

Two problems:

1. Measuring an unknown distance between fixed points.
2. Laying out a known or required distance with only the staking mark in place.

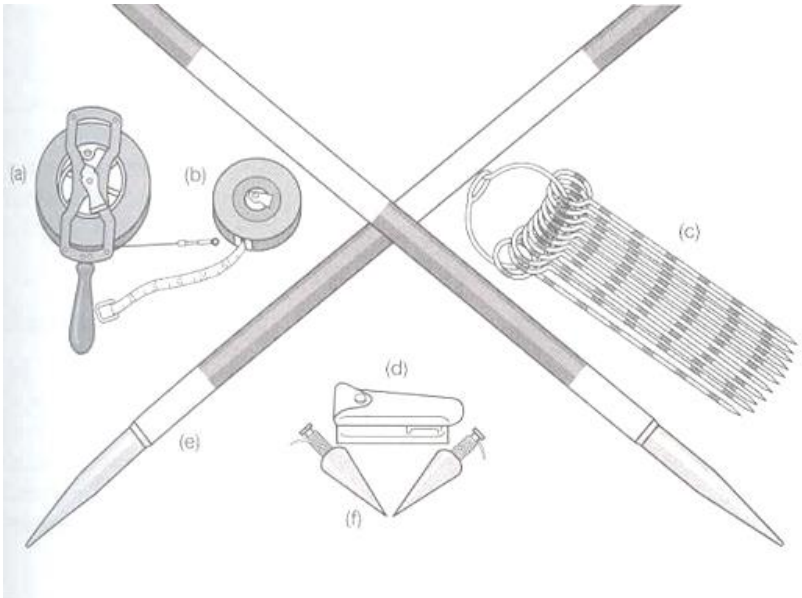
Taping is performed in six steps:

1. Lining in
2. Applying tension
3. Plumbing
4. Marking tape lengths
5. Reading the tape
6. Recording the distance

TAPING EQUIPMENT AND ACCESORIES

Metric tapes have standard lengths of 10, 20, 30, 50 and 100 meters.

- All can be wound on a reel (a) or an enclosed reel (b)
- Invar tapes are special tapes made up of special steel in order to prevent length variations caused by differences in temperature.
- Chaining pins (taping pins) are used to mark tape lengths. Taping pins are made of sharply pointed at one end, have a round loop at the other end, and are painted with alternate red and white bands (c) sets of 11 pins carried on a steel ring are standard.



laping equipment for field party. (Courtesy W. & L.E. Gurley.)

The hand level is a simple instrument used to keep the tape ends at equal elevations when measuring over rough terrain (d).

Tension handles facilitate the application of a desired known tension.

Pocket thermometer

Range poles (lining rods) (e)

Plumb bobs (f)

TAPING ON LEVEL GROUND

1. Lining in:

- Use range poles, mark the line at both ends.

- Taping requires a minimum of two people (a forwarded tape person and a rear tape person)

2. Applying tension: For accurate results, the tape must be straight and at same elevations.

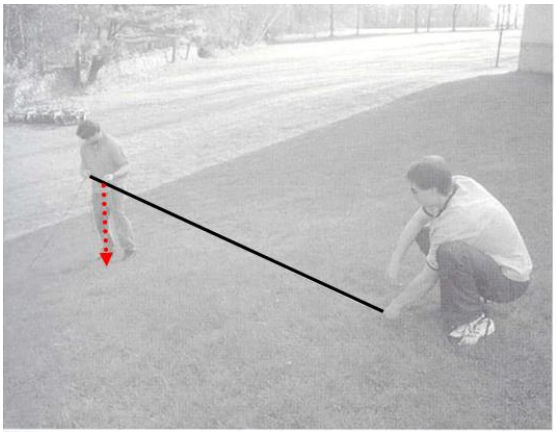
3. Plumbing: weeds, brush, obstacles and surface irregularities give difficulties by laying a tape on the ground. Then hold the tape above the ground in a horizontal position.

4. Marking tape lengths: rear person calls out = stick forward tape person answer = stuck when one length of a tape is properly applied in line on ground.

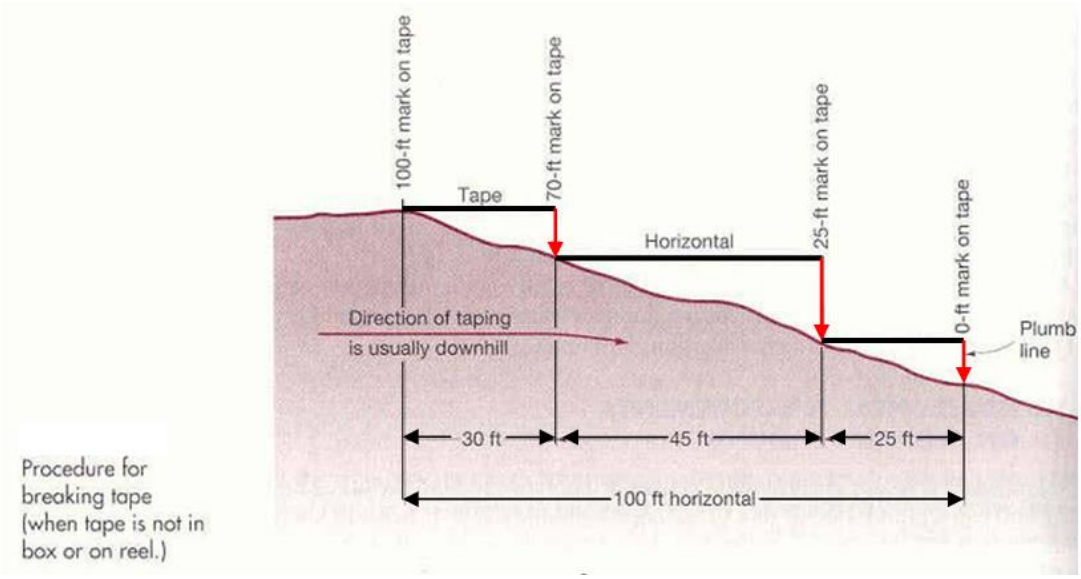
5. Reading the tape

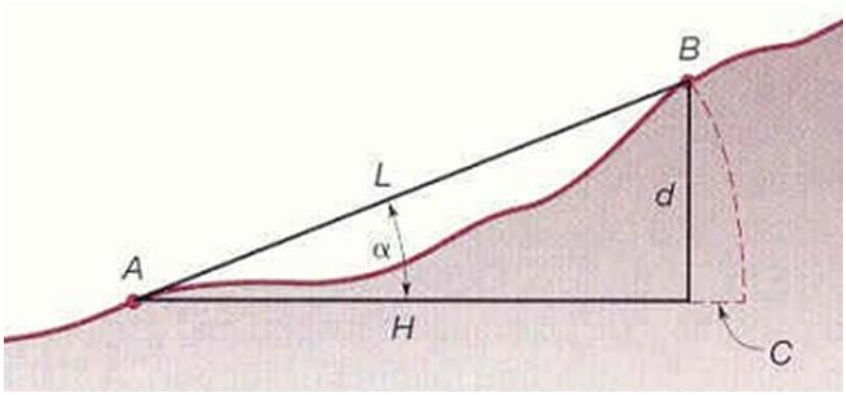
6. Recording the distance

HORIZONTAL MEASUREMENTS ON SLOPING GROUND



Breaking tape.





Slope measurement

$$H = L \cdot \cos \alpha$$

$$H = \sqrt{L^2 - d^2}$$

SOURCES OF ERROR IN TAPING;

Three fundamental errors:

1. **Instrumental errors**: actual length can be different from nominal length because of a defect in manufacture or repair on as a result of kinks.

2. **Natural errors**: the horizontal distance of a tape varies because of effects of temperature, wind and weight of tape itself.

3. **Personal errors**: Tape persons may be careless in setting pins, reading tape or manipulating equipment.

Some error types produce systematic errors others random errors.

SOURCES OF ERROR IN TAPING IN DETAIL

1. Incorrect length of tape
2. Temperature other than standard

$$C_T = k\,(T_1 - T)\,L$$

CT: correction because of temperature

K: coefficient of thermal expansion and contraction of tape

L: measured length of line

T_1: temperature at time of measurement

T: tape temperature when it has standard length