LECTURE # 3

In this lecture you will learn about:

- Land Surveying
- Method of Land Surveying
- Chain Surveying
- Survey Station
- Selection Of Survey Station
- Base Line
- Check Line
- Tie Line
- Offsets
- Taking Offset
- Short offset
- Long offset
- How to take Offsets to different object
- Locating Building
- Booking Field Notes
- Field Work

Course Name:

"Surveying I"

Course Code: CT-123

Credit Hours: 2

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Prepared By: Engr. Khurshid Alam

Land Surveying

Purpose of Land Surveying

- To secure data for exact description of the boundary.

- To determine its area.

- To Secure Necessary data for making a plan.

- To reestablish the bounders.

- To divide a piece of land into a number of units.

Method of Land Surveying

Two general methods

Triangulation

- The lines of survey form a network of triangles.

- Denotes a system of surveying in which the sides of the various triangles are computed from:

- (1) A single line measured directly called BASE LINE.

- (2) The three angles of triangle measured accurately with theodolite. Basis for Geodetic or Triangulation Survey.

Method of Land Surveying

2. Traversing

- In Traverse Surveying the direction of survey line are fixed by angular measurement and not by forming a network of triangles as done in chain survey.

- Framework consists of Series of connected lines Length measured by chain or tape

- Angle measured by an angular instrument

Chain Triangulation Or Chain Surveying

- It is a system of surveying in which sides of various triangles are measured directly in the field and NO angular measurement are Taken.

- The simplest kind of Surveying

- When Level of accuracy required is not high.

Chain Triangulation Or Chain Surveying

Suitable when

- Ground is fairly level and simple
- Plans are required on large scale e.g fields
- Area is small in extent.

Not Suitable

- For Large Area.
- Too many details.
- Wooded countries
- Undulating areas

Chain Triangulation

- Principle of chain survey is Triangulation

- Since the triangle is a simple plane geometrical figure, it can be plotted from the measured length of its sides alone.

- In chain surveying, a NETWORK of TRIANGLES is preferred.

Chain Triangulation

- Preferably all the sides of a triangle should be nearly equal having each angle nearly 60 to ensure minimum distortion due to errors in measurement of sides and plotting.

- Generally such an **ideal condition** is not practical always. Usually attempt should be made to have **WELLCONDITIONED TRIANGLES** in which no angle is smaller than 30 and no angle is greater than 120.

Measurement of Area by Chain Triangulation

PROCEDURE:

- Let ABCDE be the given field whose area is to be measured, fix the pegs at A, B, C, D & E.

- Divide area into three triangles ADE, ABD and BCD by joining AD and BD.

- Measure the lengths AB, BC, CD, DE, EA, AD and BD.

- Calculate the area of the triangles.

- The sum of the areas of the three triangles is the area of the given field.

- RESULT:

- The area of the given field = ___

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Measurement of Area by Chain Triangulation
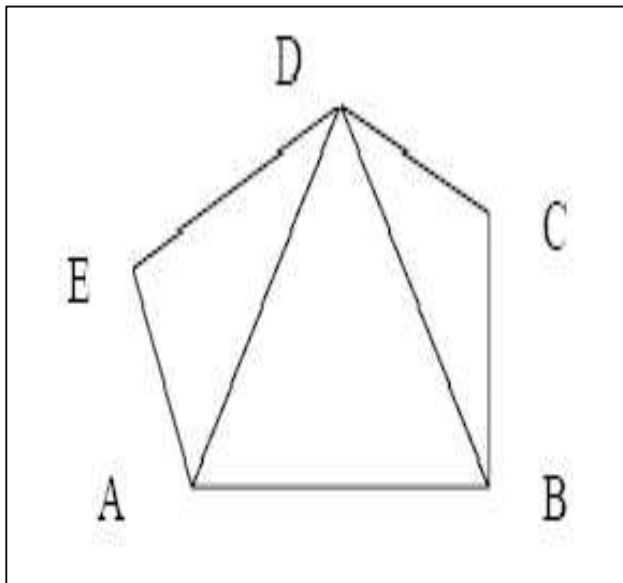
FORMULA:

Area of the triangle Δ = $\sqrt{s(s-a)(s-b)(s-c)}$

Where $S = (a+b+c)/2$

A, b, c, are the sides of the triangle.

Survey Station

- Survey Stations is a point of importance at the beginning and end of chain line.

- Two kinds

Main Station

- These are the end of survey line i.e. which connect boundaries.

- Line joining Main stations is called Main survey line or chain line.

- Represented by Circle, Capital letters A B... or number 1 2... Or (A).

Survey Station

2. Subsidiary or Tie Station

- These are the points selected on main line, where it is necessary to run axillary lines to locate interior details such corner, tree, building etc.

- Line joining tie station are called tie lines or subsidiary lines

- Represented by Small letters a, b.

Building

Main Station

Tie Line

Main Station

A

B

a

b

Main Survey Line

Tie Station
(on Main survey line)
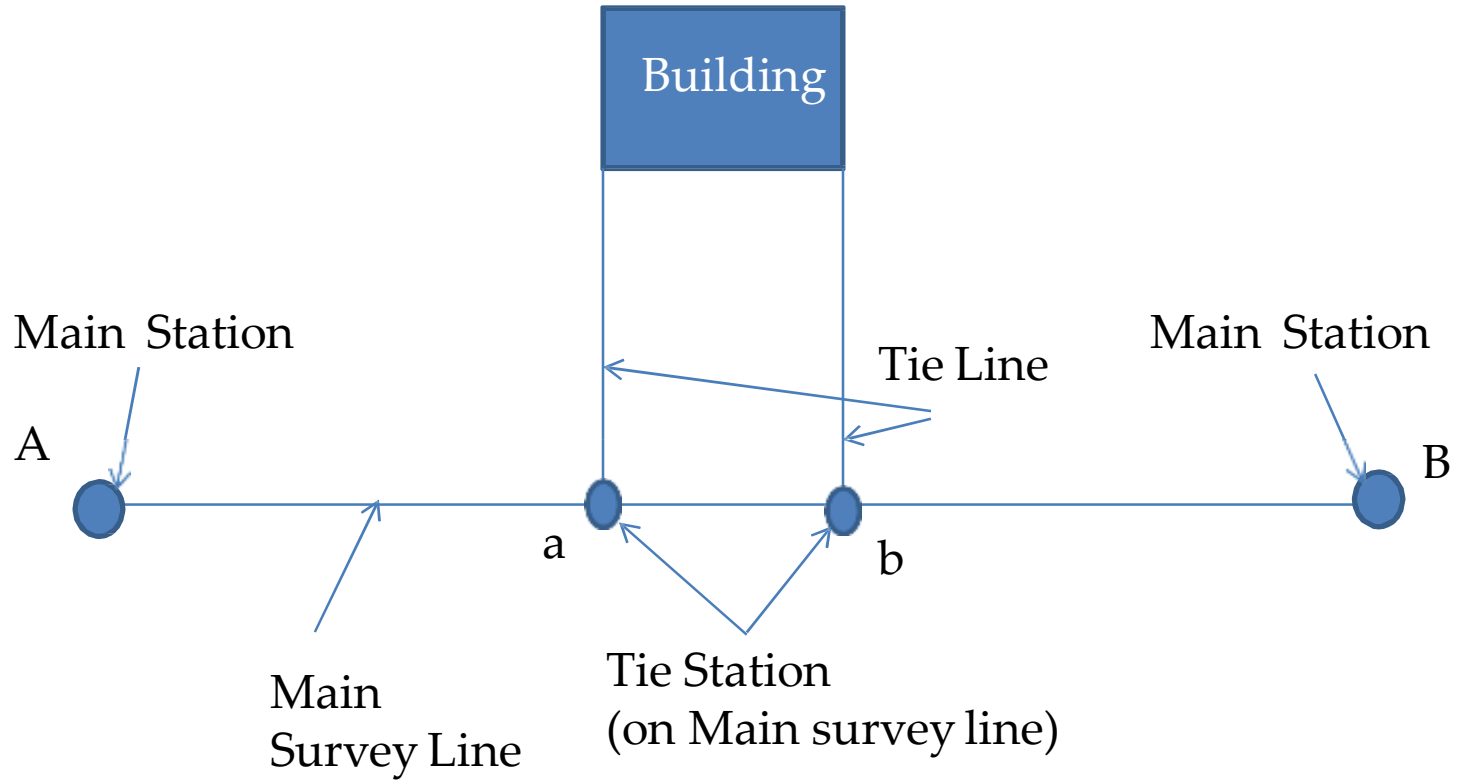
Selection Of Survey Station

- Should be mutually visible.

- Main principle should be strictly observed

- If possible, line through the whole length of area should be drawn

- All triangles well defined

- A check line should provide for each triangle

Selection Of Survey Station

- Survey lines should be as few as possible.

- A number of tie lines should be drawn

- Position of survey lines should be such that to avoid obstacles to chaining and ranging

- It should be on level ground

- The sides of triangle should pass as close to the boundary as possible

Base Line, Check Line, Tie Line
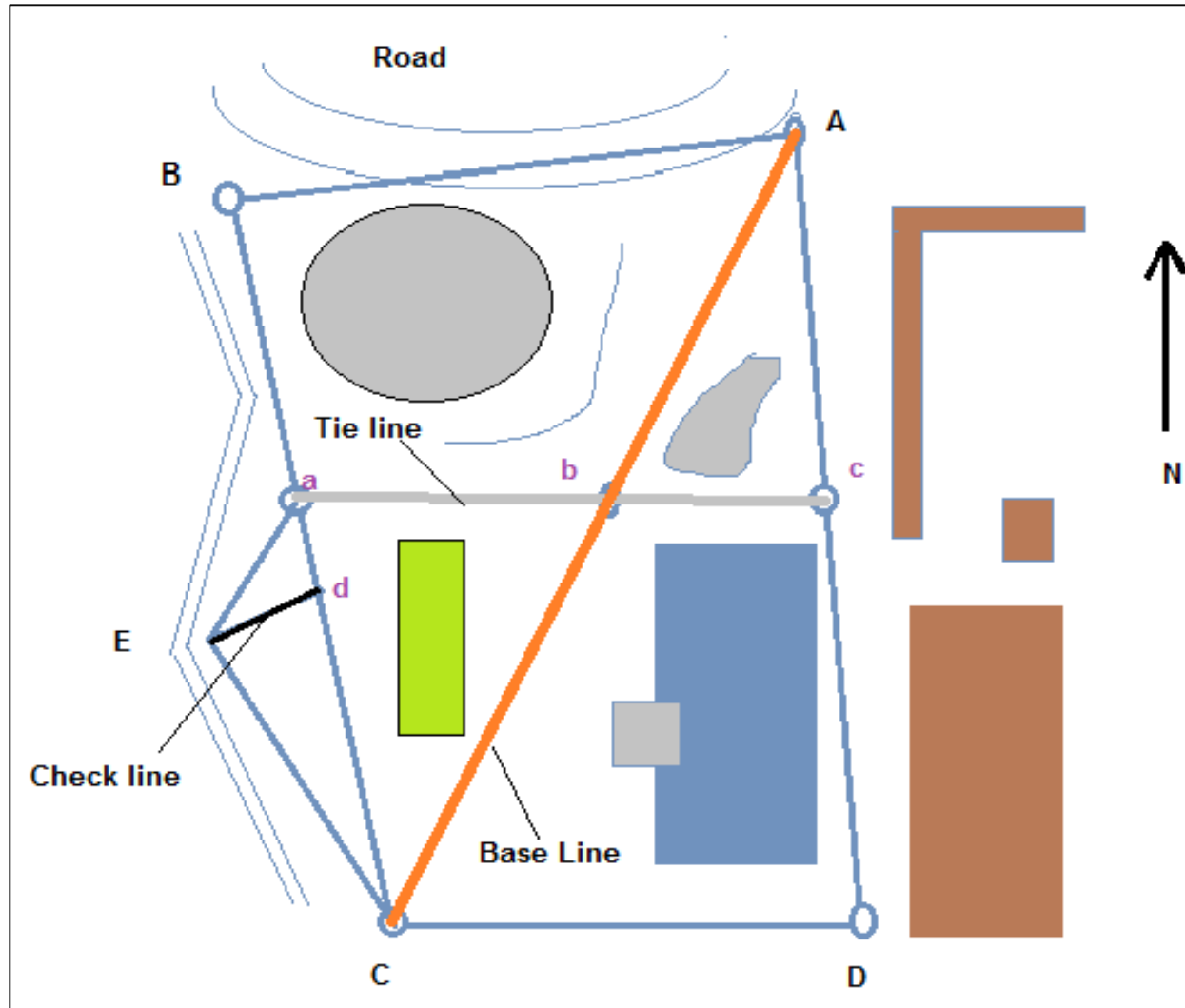
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Base Line

- The longest of the chain lines used in making a survey is generally regarded as Base line.

- Most important line.

- It fixes up direction of all other lines, as on base line, is built framework of a survey.

- Should be laid on level ground, as possible through the center and length of the area.

- Should be correctly measured and should be measured twice or thrice.

Check Line

- A check line also called proof line is a line joining the apex of a triangle to some fixed point on the opposite side.

- A check line is measured to check the accuracy of the framework.

- Thus there is a complete check on the field measurement as well as on the accuracy of the plotting work.

Tie Line

- A tie line is a line joining fixed points termed as Tie station on the main survey lines.

- A tie line usually fulfill a dual purpose i.e. it checks the accuracy of the framework and enables the surveyor to locate the interior details which are far away from the main chain line

Operation in Chain Surveying

The following operations are involved in chain surveying.

- Chaining
- Ranging
- Offsetting

These three operations are done simultaneously during chain surveying.

Offset

- The Lateral Distance to locate the object / detail to left or right of the Main survey line is known as Offset.

- To Locate Position of details such as boundary, building tree, river etc.

There are two kinds of Offsets

- Perpendicular / Right angled Offset
- Oblique Offset/ Tie-line Offset
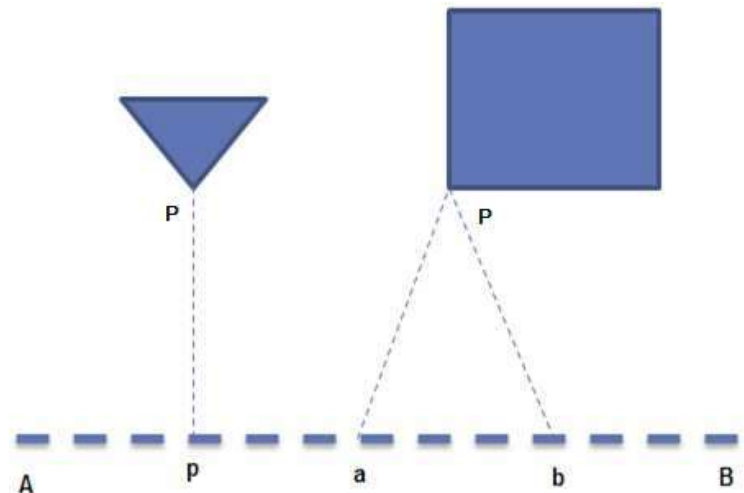
Taking Offset

For every offset we need two measurements

- 1. Distance along the chain line is called Chainage (Ap)

- 2. The length of Offset (pP).

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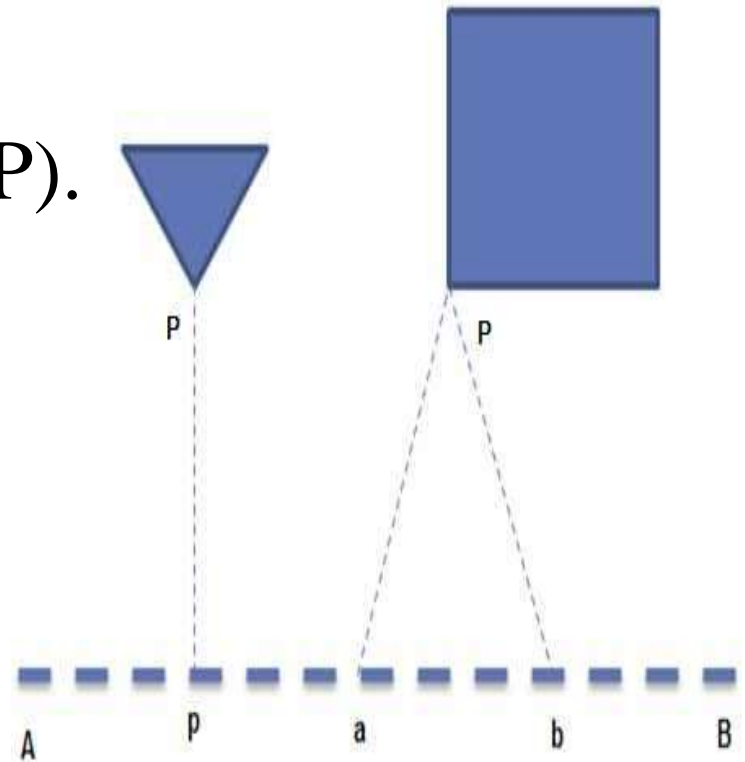
Offsets

Offset may also be classified as Perpendicular Offsets and oblique offset.

Perpendicular Offsets

- The offsets which are taken perpendicular to the chain line are termed as perpendicular offsets. These offsets are taken

(a) By holding zero end of the tape at the object and swinging the tape on the chain line. The shortest distance measured from object to the chain line is usually the perpendicular offset.

(b) By setting right angle in 3:4:5

(c) By cross-staff or optical square.

- Perpendicular offset usually preferred than oblique.

Perpendicular Offsets
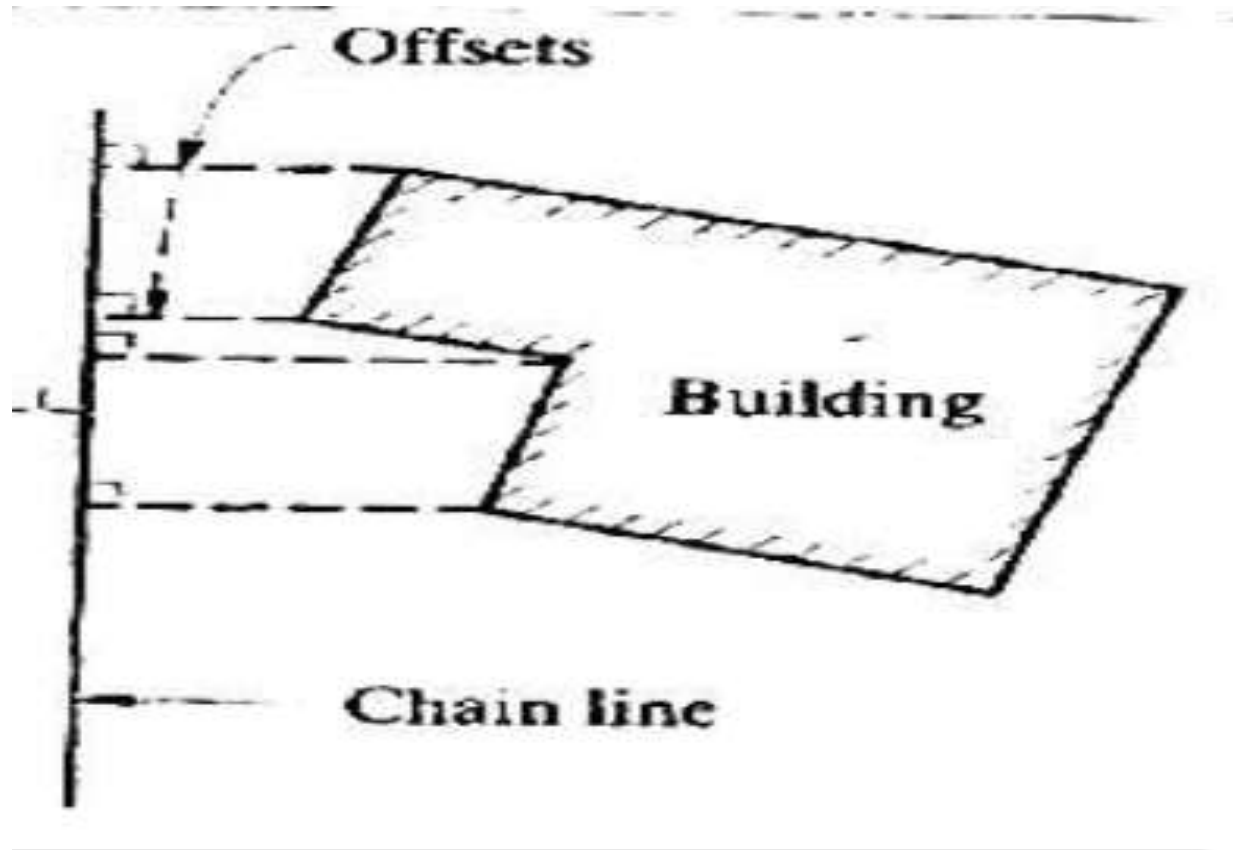
Perpendicular Offsets By Swinging

Perpendicular offset

Chain line

Foot of perpendicular

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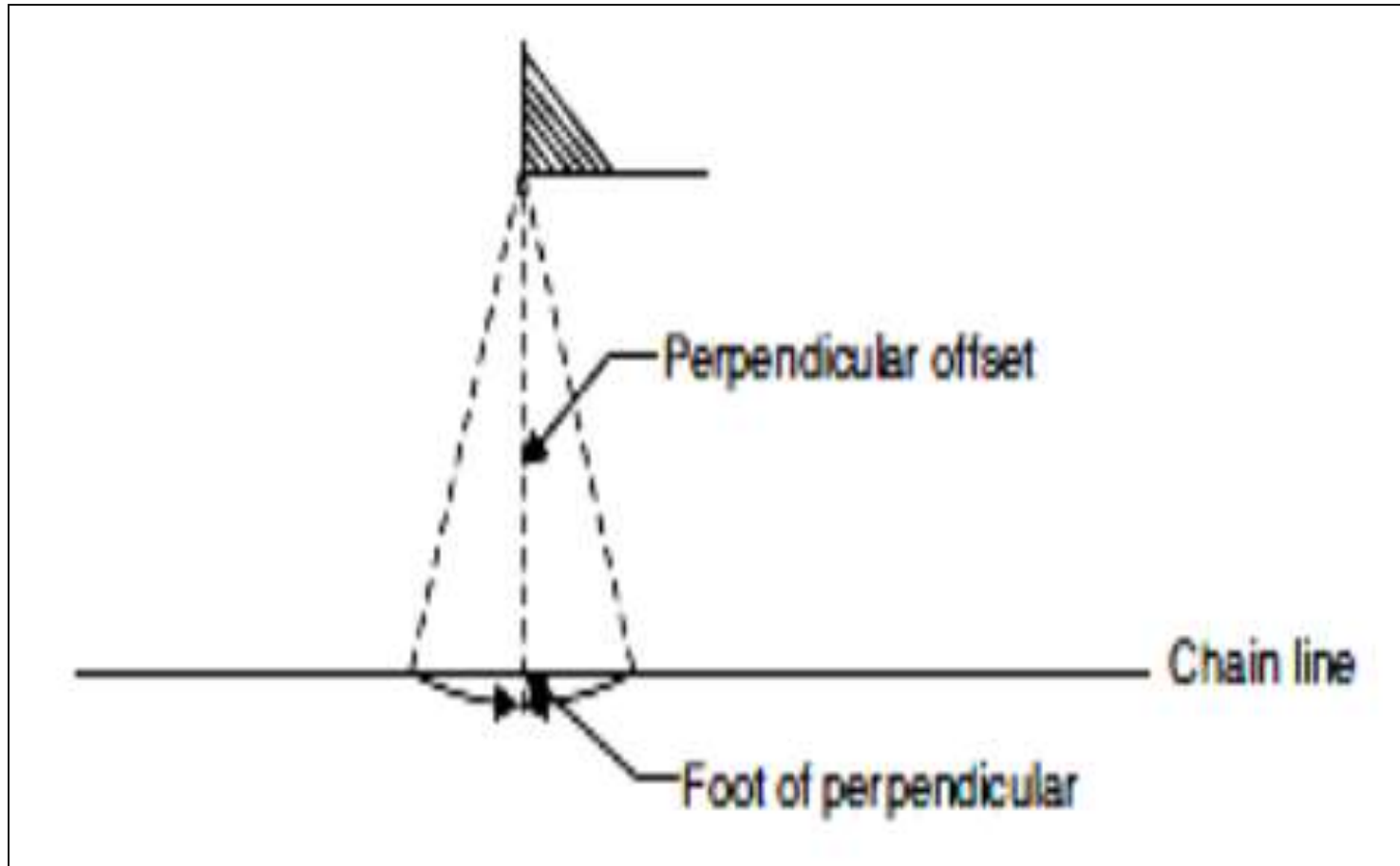
3-4-5 Method
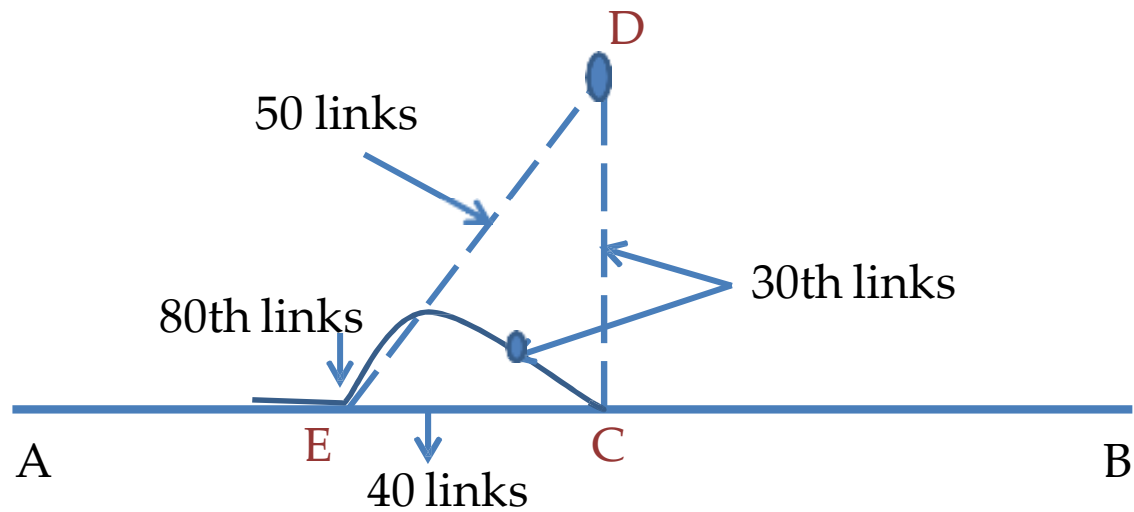
Instruments for Setting-Out Right Angles

The following instruments may be used for

1. Finding the foot of perpendicular from a given point to a line

2. Setting out a right angle at a given point on a line.
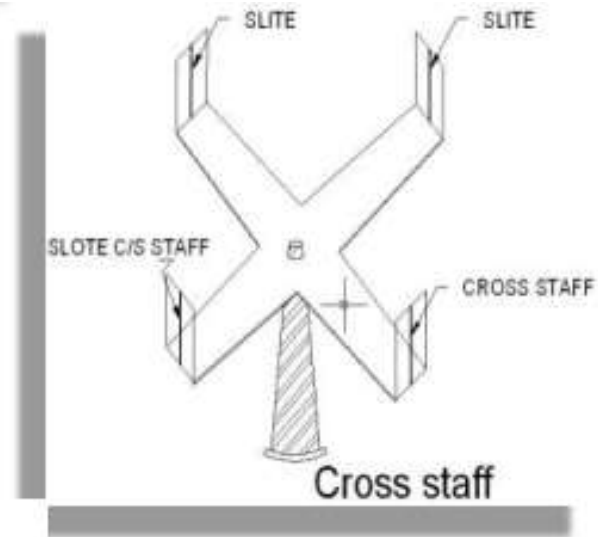
- Cross Staff

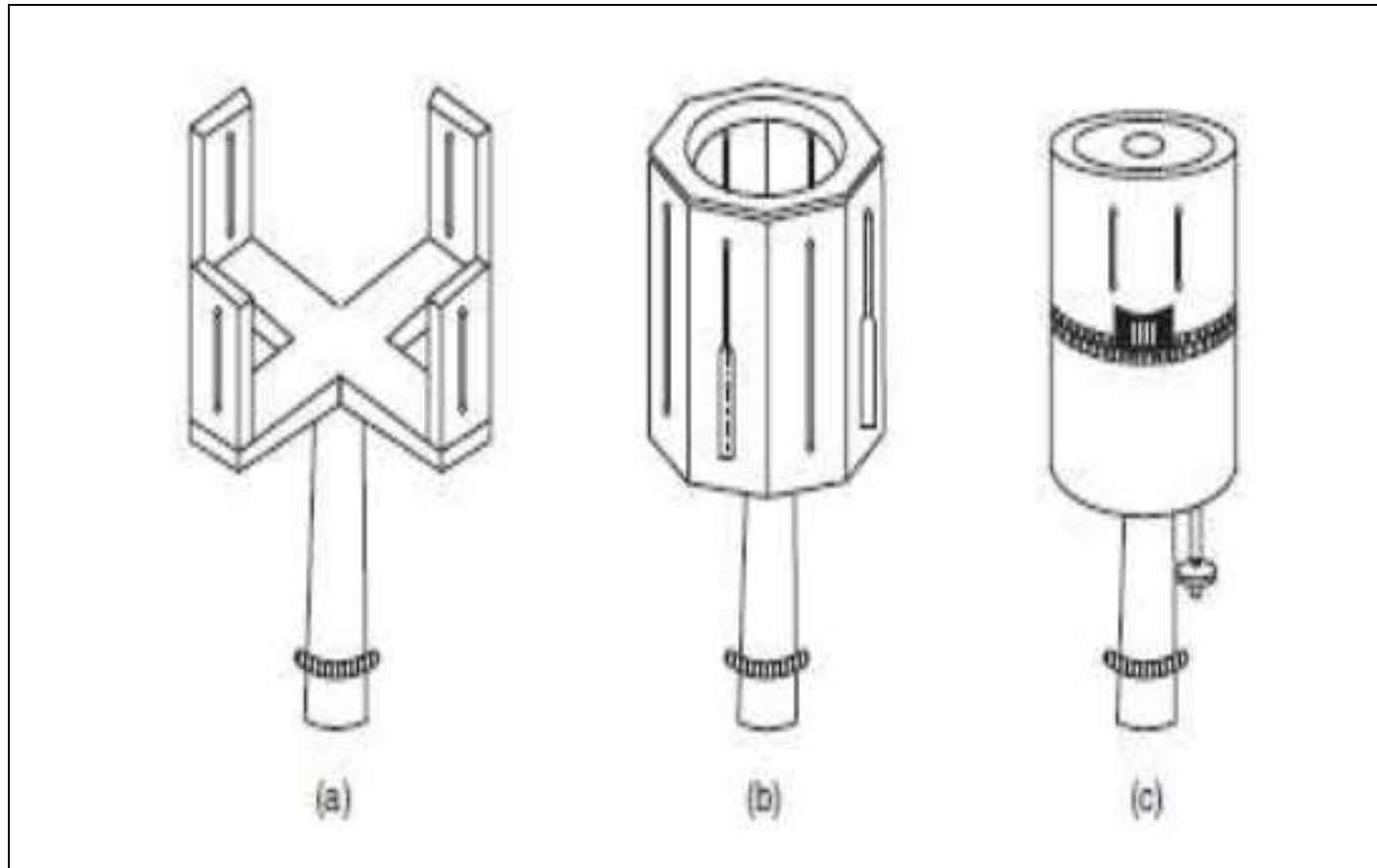1) The French

2) The Adjustable

3) The Open

- Optical square

- With chain or tape

Perpendicular Offsets Using Cross Staff

SLITE

SLITE

SLOTE C/S STAFF

CROSS STAFF

Cross staff

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Perpendicular Offsets Using Cross Staff

(a)   (b)   (c)

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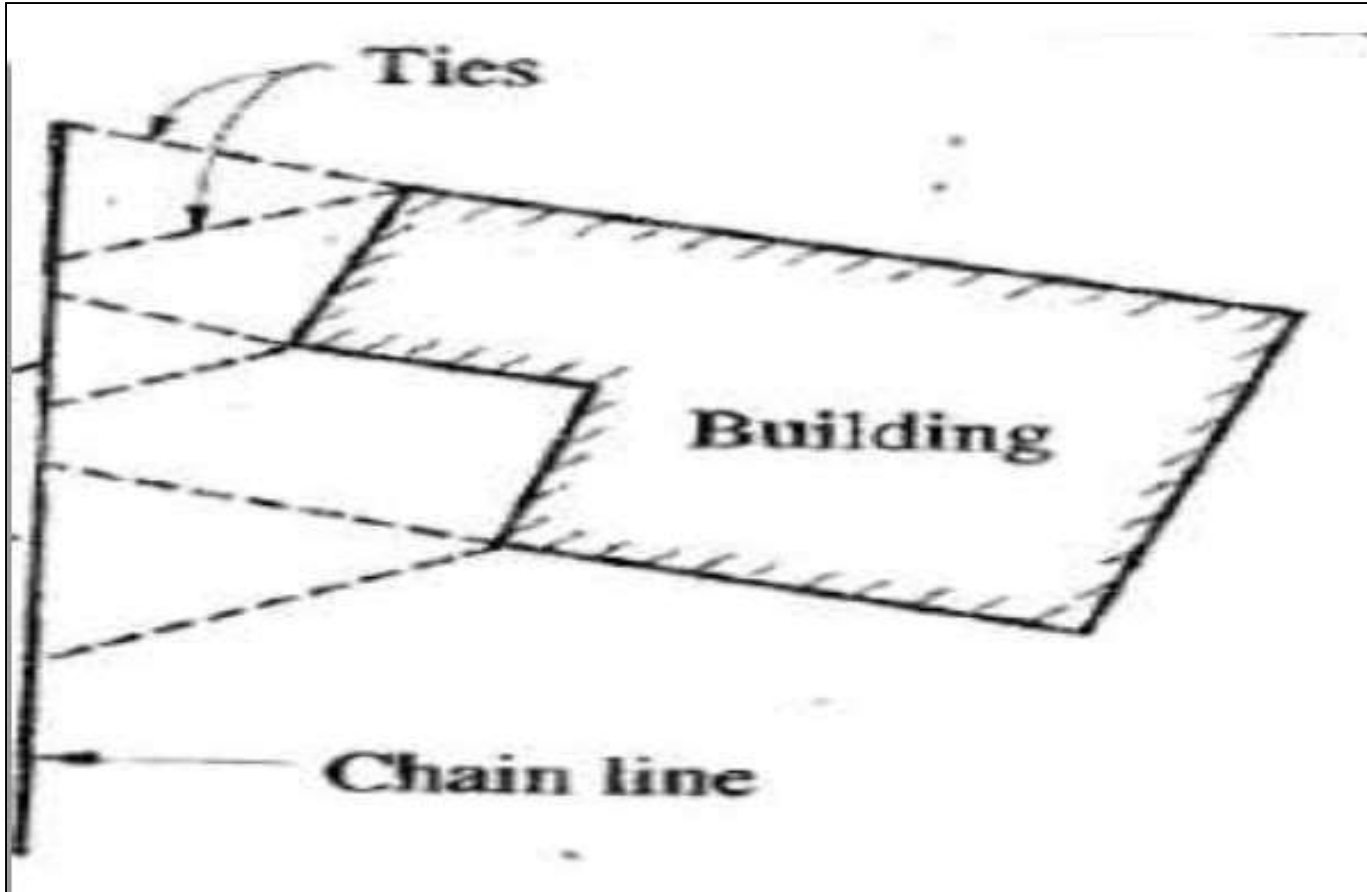# Double Prism Optical Square

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Oblique Offsets

Oblique distance is always greater than perpendicular distance. All the offsets which are not taken at the right angle to chain line are known as oblique offsets.

Oblique Offset

Short Offset

- The offset are called short when they are less than 15m in length and long when their length exceeds 15m.

- Offset should be as short as possible because they are less liable to error due to incorrect length of tape or incorrect direction.

- Short offset can be measured quickly and accurate.

Long Offset

Where much accuracy is desired the long offset should be as far as possible be avoided.

They can be avoided by arranging the main survey line or by running subsidiary lines from the main lines.

Example Nala.

- CE and DE are subsidiary lines
- eE is check line
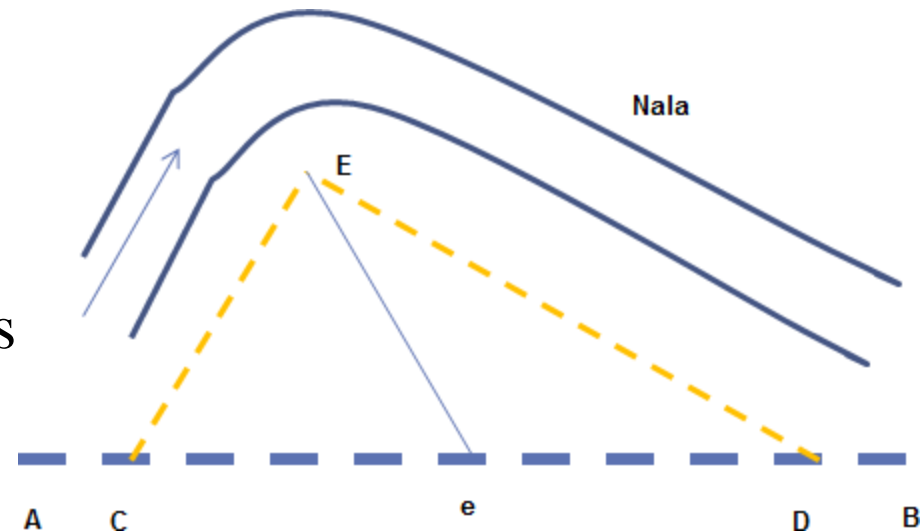
How to Take Offsets to Different Objects

- Round object

- If the boundary is straight

- When object changing direction

- For irregular boundary

- If boundary is fair curve

How to Take Offsets to Different Objects

- When the object such as road crossing the survey line

- To locate a gate

- Locating positions of corners and intersections.
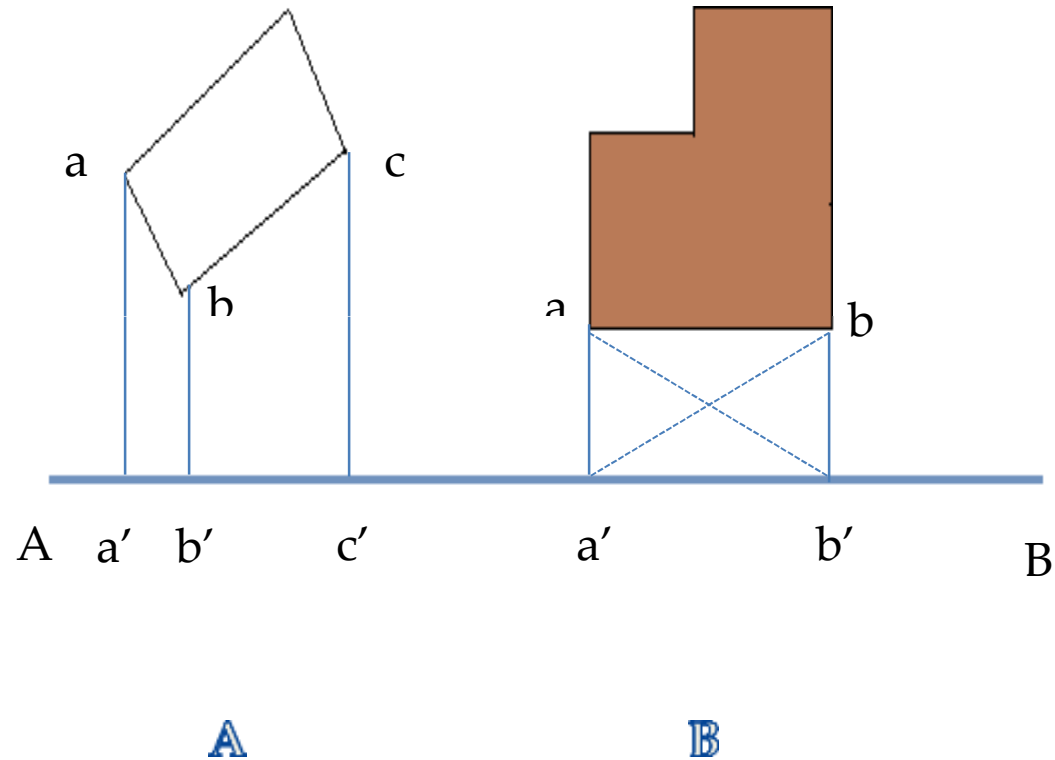
- Locating of building

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Locating Building

- **A**. In locating buildings offset are taken to the corners only and in addition the dimension of the building are also measured and recorded.
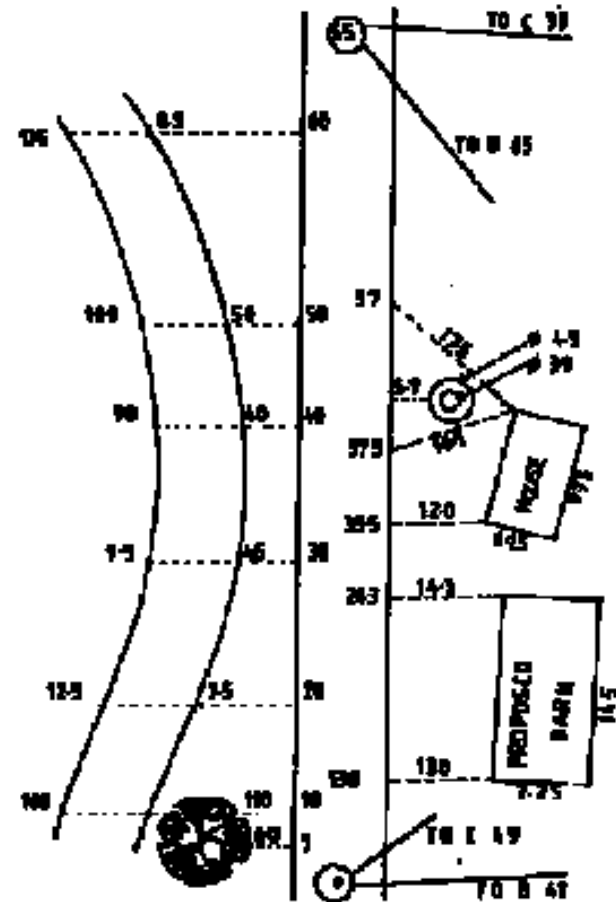- **B**. another method when building near to chain line (aa' bb', a'b, b'a ar measured)

Locating Building

A   a′   b′   c′   a′   b′   B

A   B

Booking Field Notes

- The book in which survey work is recorded by measurement and sketches is called field book.

- Oblong book convenient size

- There are two forms of field book

1) Single Line
2) Double Line

Field Work

Equipment

The equipment required for a chain survey should include

- A chain and 10 arrows.

- 20 m metallic tape.

- Ranging rods.

- Offset rods.

- Optical square or cross staff.

Field Work

- Plumb bob
- Survey field book
- Pegs
- Pencils
- Hammer nail, chalk etc.

Field Work

A Chain survey may be executed in the following steps:

1) Reconnaissance

- Walk the whole area and thoroughly examine the ground, note position of boundaries

- ,road ,river etc., various difficulties to chain lines, select stations, prepare a neat sketches called index sketches or key plan.

2) Marking stations

- With ranging rod, or wooden peg. Driving a nail or spikes if hard surface, embedding stone with a cross mark.

Field Work

3) Reference sketches

- After marking station they should be referenced i.e. located by measurement called ties taken from 3 permanent points which are easily identified such corner of building

4) Running survey line

- After the preliminary work chaining start from base line and carried throughout all the line of the framework continuously. Chaining and locating nearby detail. So chain is laid and kept lying , offset are taken 24