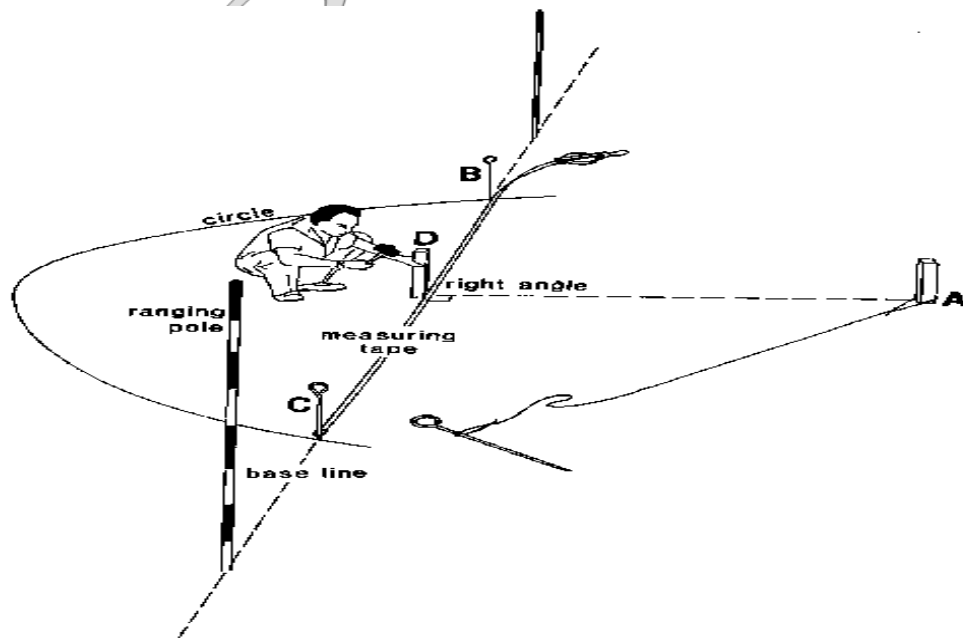
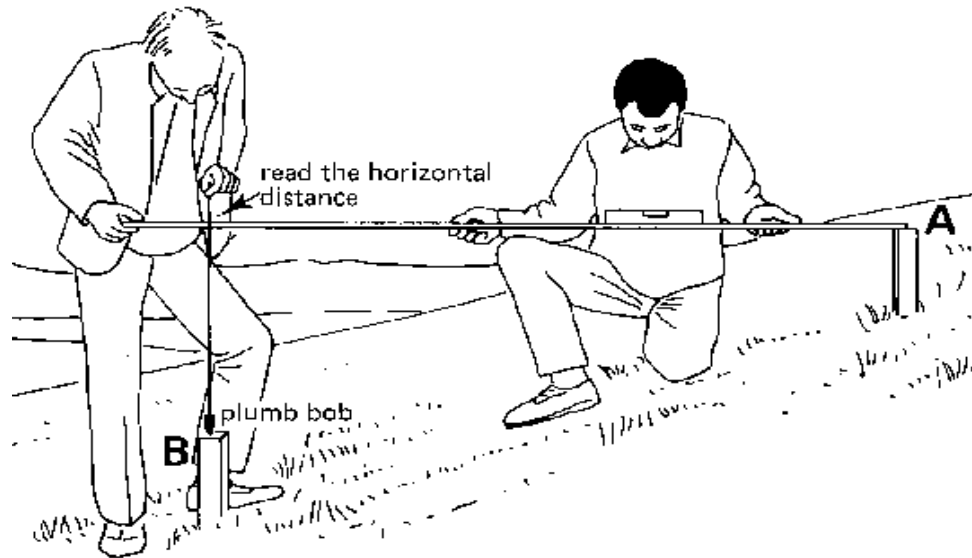




Land Survey



THE ELEMENTARY SURVEY

THE LAND SURVEY

- Surveying is the science of measuring and recording ***distance, angles*** and ***height*** on the Earth's surface by using electronic measuring devices to obtain data from which accurate plans and maps are made.
- Refers to an art of making measurement of natural and man-made features on the Earth's surface.

PURPOSES OF SURVEYING

- To determine horizontal distance between points on the Earth's surface.
- To determine vertical distance (height) between points on the Earth's surface.
- To determine the area on the given piece of land.
- To determine the direction of various features on the Earth's surface.
- To determine the location of physical and non-physical features on the Earth's surface.

STAGES OF SURVEYING PROCESSES

- Surveying processes involve the following stages:
 - Reconnaissance
 - Actual Surveying
 - Presentation

RECONNAISSANCE

- This is the process of taking general view of the land to be surveyed.
- It is done in order to get a real picture of the work to be done.

- It is done by visual observation of the area.
- The Surveyor does this by walking around the area and taking general view and noting down the dominant features of the area, for example:
 - i. Boundaries of the area.
 - ii. Corners of the boundaries of the area, etc.

IMPORTANCE OF RECONNAISSANCE SURVEYING

- i. It helps to get the real picture of the survey work to be done.
- ii. It helps in choosing the scale for map making.
- iii. It makes coordination of new and old surveys easier.
- iv. It shows the existing situation of the area on piece of paper.

ACTUAL SURVEYING (SECONDARY SURVEYING)

- This involves observation, measuring and recording direction, angles, distance and elevation by using surveying equipments.

PRESENTATION

- This involves presentation of data/information collected/recorded.
- Presentation can be in form of writing or drawing.

BRANCHES OF SURVEYING

- The land surveying is divided into various branches. These are:-
 - a) Geodetic Surveying
 - b) Plane Surveying
 - c) Topographical Surveying
 - d) Engineering Surveying
 - e) Cadastral Surveying
 - f) Geological Surveying
 - g) Hydrographical Surveying

a) THE GEODETIC SURVEYING

- It is a kind of survey which is used for a large area, for example at National level.
- Its purpose is to lay the foundations for other types of surveying, hence it needs high accuracy.

b) THE PLANE SURVEYING

- This is the type of surveying in which the area measured is considered to be flat/plane.
- It is used only on a small area of the land, such as *building sites, schools, dispensary, villages, and ward.*

c) CADASTRAL SURVEYING

- This is the branch of surveying that defines and reads the boundaries of properties such as plots, estates, villages and countries.
- It also facilitates the collection of taxes by the Government from the property owners.

d) ENGINEERING SURVEYING

- This is the branch of surveying that deals with the construction activities, example roads, railways, airports, dams, harbors, mining centers, etc.
- This is the kind of survey which collects the data needed to plan and design engineering projects.

e) GEOLOGICAL SURVEY

- It's a type of survey which is conducted for the purpose of recording the geological (rock) significant features of the area.

f) TOPOGRAPHICAL SURVEY

- It's a kind of survey which is performed to gather data necessary to prepare topographical maps.

- This is the branch of surveying that deals with the measurements of natural and man-made features.
- These are multicolor contour maps portraying terrain and rivers; highways; railways; bridges and other man-made features.

g) HYDROGRAPHIC SURVEY

- This is the kind of survey which maps the shorelines of water bodies; chart the bottom of streams; lakes; harbors and coastal water.
- It measures the flow of water.
- It also assesses other factors affecting navigation and water resources.

Importance of surveying

1. It helps to prepare a topographical map which shows the hills, valleys, rivers, villages, towns, forests, etc. of a country.
2. It helps to prepare a cadastral map showing the boundaries of the fields, houses and other properties.
3. It helps to prepare an engineering map which shows the details of engineering works such as roads, railways, reservoirs, irrigation canals, etc.
4. It helps to prepare a military map showing the road and railway communications with different parts of a country.
5. It helps to prepare a geological map showing areas including underground resources.
6. It helps to prepare an archaeological map including places where ancient relics exist.

MAJOR ELEMENTS (TYPES) OF LAND SURVEYING

1. Chain and Tape Survey
2. Plane Table Survey
3. Prismatic Compass Survey
4. Techniques of Leveling

CHAIN & TAPE SURVEY

Meaning Of Chain And Tape Survey:

- Simple chain and Tape survey refers to the type of survey which deals with the linear measurements (Horizontal distance) on the ground such as length, width and height using a chain and a tape measure as the main instruments.
- Simple Chain and Tape survey is the simplest and commonest method of making linear or horizontal measurement for small areas.
- Simple chain and Tape survey involves the measurements of series of straight lines on the ground with chain or tape measures and to fix points.

Common Terms that are normally used in the Simple Chain and Tape Survey:

1) LINES OF TRAVERSE (SURVEY LINE):

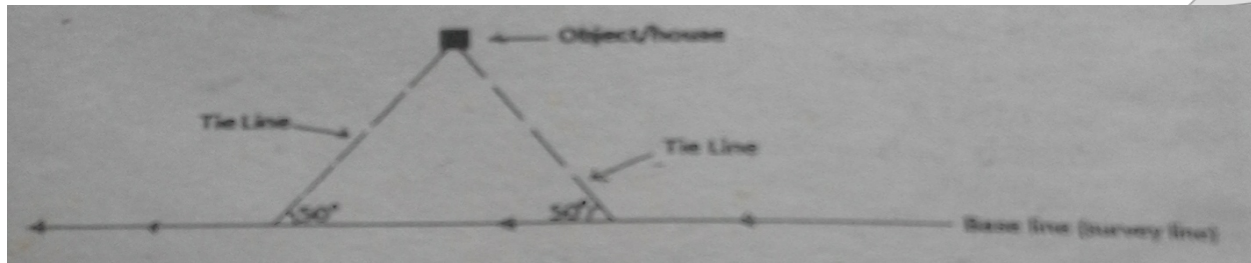
- These are routes or ways which are followed by the Survey team when surveying.
- They are the series of straight lines on the ground measured and marked by a chain or tape from which the fixed points in the field of survey are referred to by using ties and off-sets.

2) TRAVERSING:

- This is the movement done by the Survey Team when measuring and recording distance and fixing object's position.

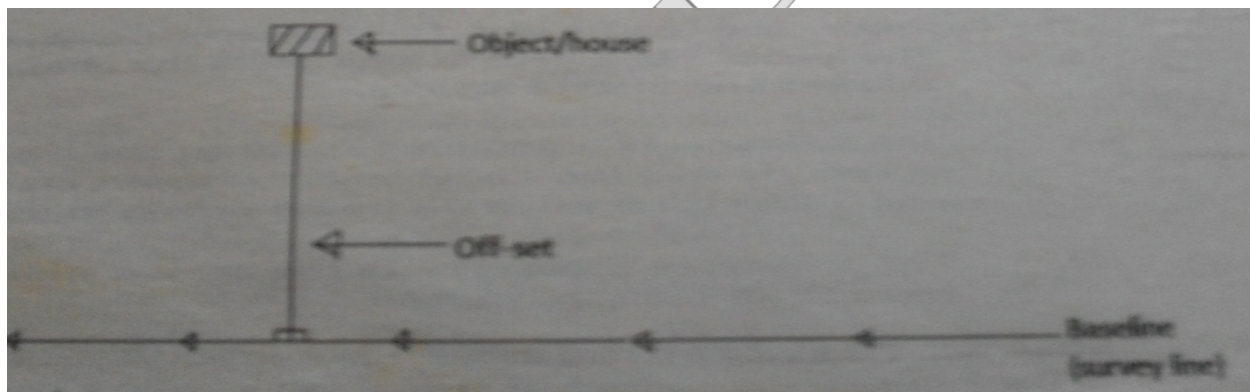
3) TIE LINES:

- These are lines drawn from the line of traverse (Base Line) to the Object (i.e. fixed point) and join the base line at an acute or obtuse angles.

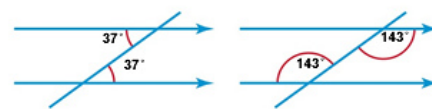
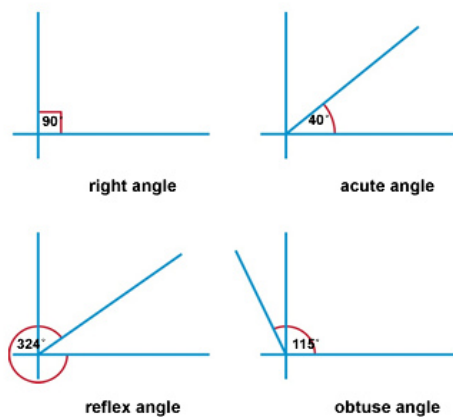


4) OFF-SETS:

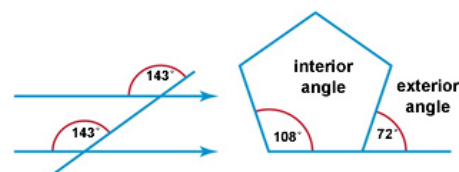
- These are lines of short distance measured from the base line to the object and join the base line at right angle.
- It is a perpendicular line measured from the base line to the object.



Angles



alternate angles (also Z angles)



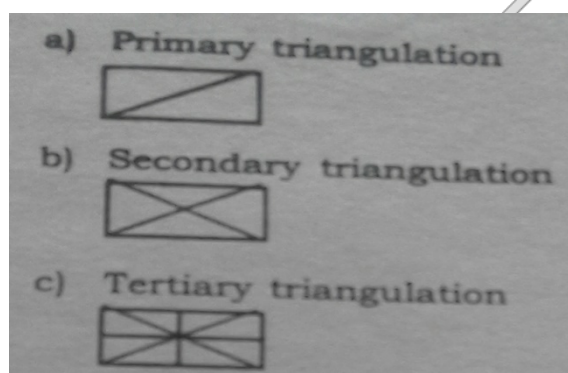
corresponding angles
(also F angles)

5) TRIANGULATION:

- This is the process of finding an area to be surveyed into many triangles.
- It is divided into:
 - a) Primary Triangulation

b) Secondary Triangulation

c) Tertiary Triangulation

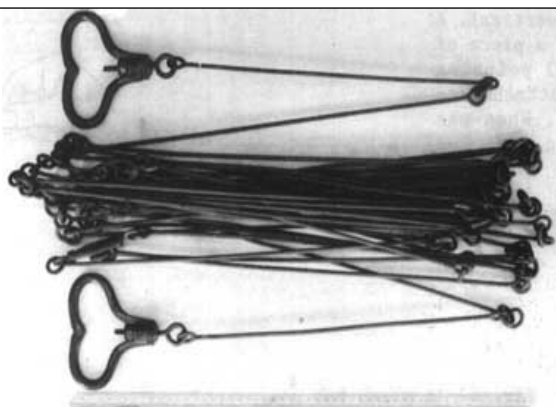


EQUIPMENTS USED IN CHAIN AND TAPE SURVEYING

- The equipments used by Surveyors when conducting tape or chain surveying include the following:-
 - i. The chain
 - ii. The tape
 - iii. Surveyor's band
 - iv. Ranging poles
 - v. Arrows
 - vi. Pegs
 - vii. Optical square
 - viii. Note book
 - ix. Cross staff

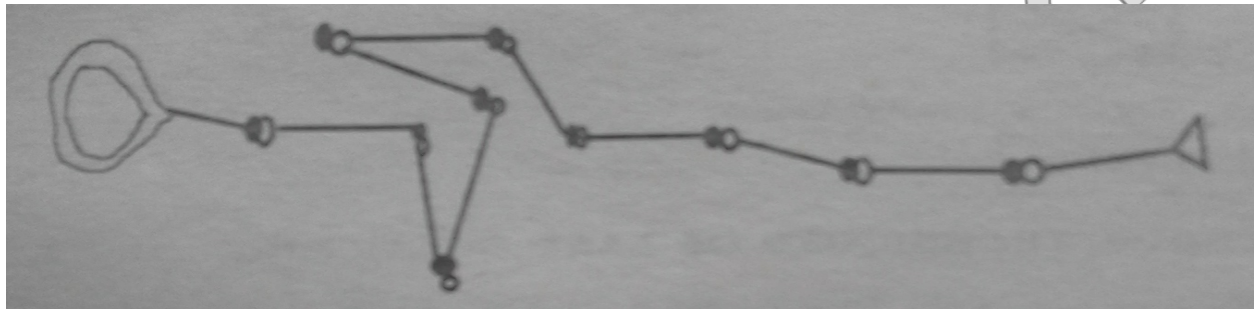
THE CHAIN

- A chain has a length of 20 meter or 30 meter made up of steel wire.
- Links are connected by small rings.



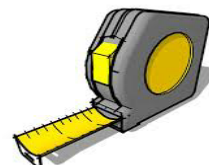
FUNCTION OF THE CHAIN

- The main function is to measure a short and straight distance.



THE TAPE

- The tape is made up from steel or plastic materials having lengths 10m, 20m and 30m.
- It is marked in meters, feet or centimeters.



FUNCTION OF THE TAPE

- The tape is used to measure

short horizontal distance on the ground.

SURVEYOR'S BAND

- The surveyor's band is made up from steel materials and is rolled into a metal frame with a handle.
- The length of the band ranges from 30m, 50m to 100m.
- It is much longer than the Tape.



SURVEYOR'S BAND

THE MAJOR FUNCTION:

- The major function is to measure straight long distance.

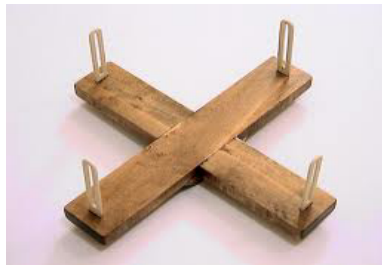
CROSS STAFF

- The surveyor's cross staff is made up of metal or wood with the eye slots for sighting an object.

- It has four end members in each of which are slits, the line of sight between each cross at right angles (see the diagrams below).



Cross staff made of wood



Cross staff made of wood



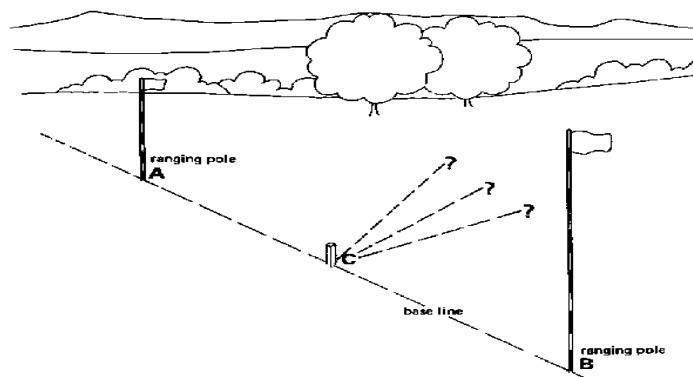
Cross staff made of metal

FUNCTION OF CROSS STAFF

The cross staff is used to set a perpendicular line or measure right angles from the line of traverse (**to make off-set**)

RANGING POLES (RANGING RODS)

- These are made up of wood or light metal with length of 2m, 2.5m or 3m (or 6 – 10 feet) long.
- They are made of wood or metal. Ranging poles can also be home made from strong straight bamboo or tree branches.
- They are painted alternatively in red and white or white and black



bands each 500mm long so that they can be seen easily from distance.

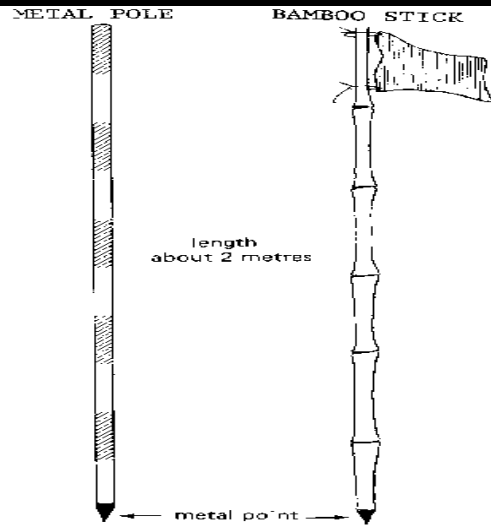
- They are pointed with a ***steel shod*** so as to stick (or for driving into) in the ground.

FUNCTION OF RANGING POLES

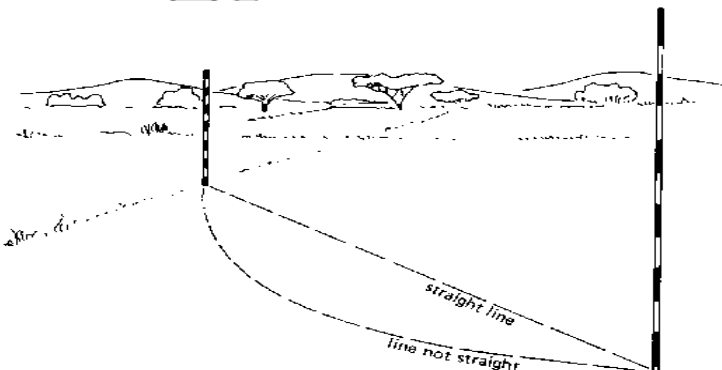
- Ranging poles are used to mark or locate ***temporary*** position of a place.
- They are also used to mark points which must be seen from a distance, in which case a flag may be attached to improve the visibility.

REMEMBER:

- Ranging poles may never be curved.
- Ranging poles are usually painted with alternate red-white or black-white bands.



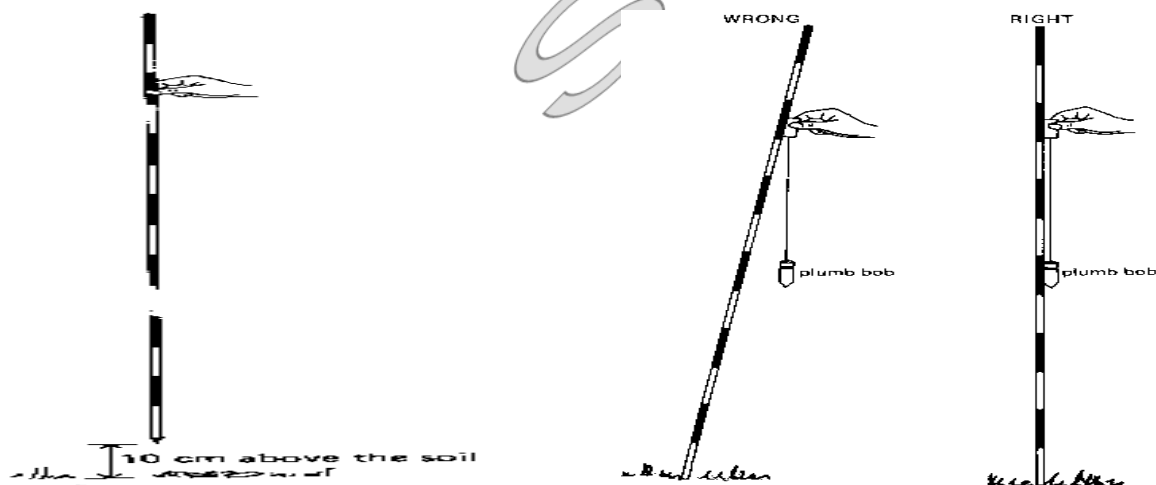
Ranging poles



- If possible, wooden ranging poles are reinforced at the bottom end by metal points.

PLACING OF RANGING POLES

- The correct way to hold a ranging pole is to keep it loosely between thumb and index finger; about 10 cm above the soil.
- When the observer indicates that the ranging pole is in the right position, the assistant loosens the pole. The sharp bottom point of the ranging pole leaves a mark on the soil exactly where the pole has to be placed. Once in place, it should be checked if the ranging pole is vertical, e.g. with a plumb bob, or a carpenter level (see Figure below)



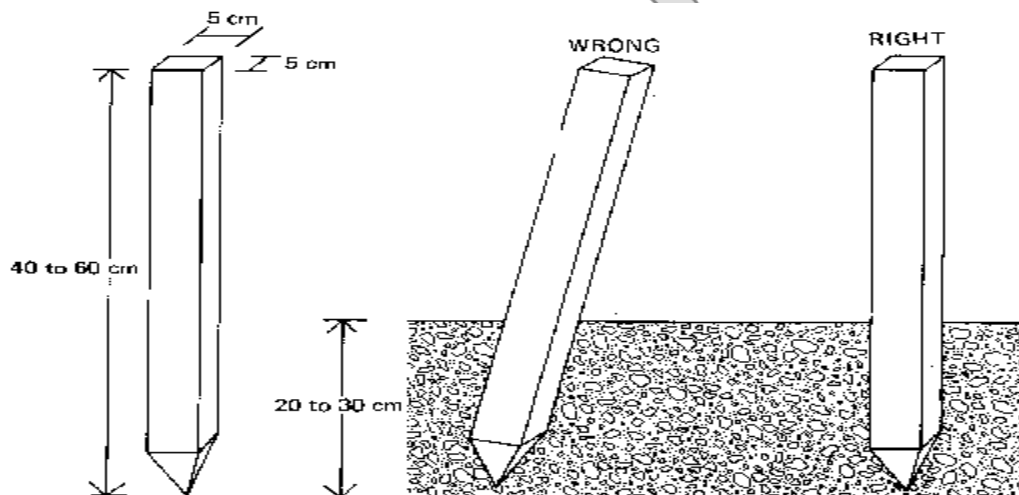
PEGS

- Pegs are generally made of wood; sometimes pieces of tree-branches and properly sharpened.

- The size of the pegs (40 to 60 cm) depends on the type of survey work they are used for and the type of soil they have to be driven in.
- The pegs should be driven vertically into the soil and the top should be clearly visible.
- It is also painted in alternative bands of colors like a ranging pole.
- Pegs (see Figure below) are used when certain points on the field require more permanent marking.

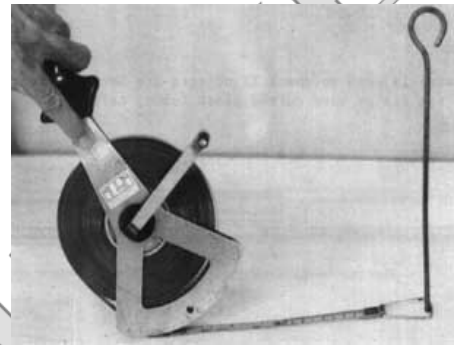
FUNCTION OF PEGS

- It is used to mark points *permanently* on the ground.



ARROWS

- These are made up of steel wire materials which have two ends in which one is pointed so as to be driven into the ground easily, while another point is bent with colored rag so as to be seen far from a distant place.
- They are pointed metal (steel) markers which can be stuck into the ground for marking points (stations).
- They are about 50cm long, bent at the top into a circle to which *rag* can be tied to make them seen easier.
- **RAG** is a colored piece of cloth or plastic).



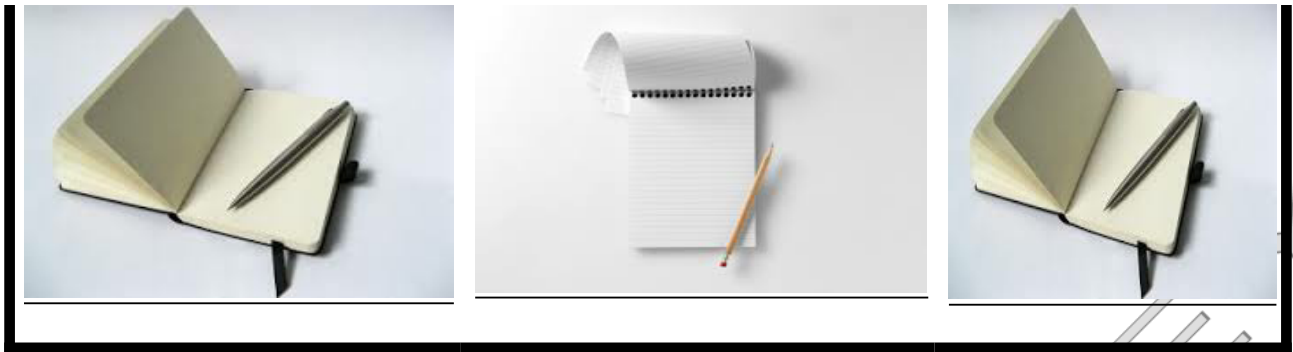
**SURVEYOR'S BAND AND
AN ARROW**

FUNCTION OF ARROWS

- Arrows are used to mark temporary position (stations).

A NOTE BOOK AND A PENCIL:

These are used by the Surveyor to record all measurements and data collected during the chaining processes.



OPTICAL SQUARE

- This is an instrument for setting out angles from Survey line

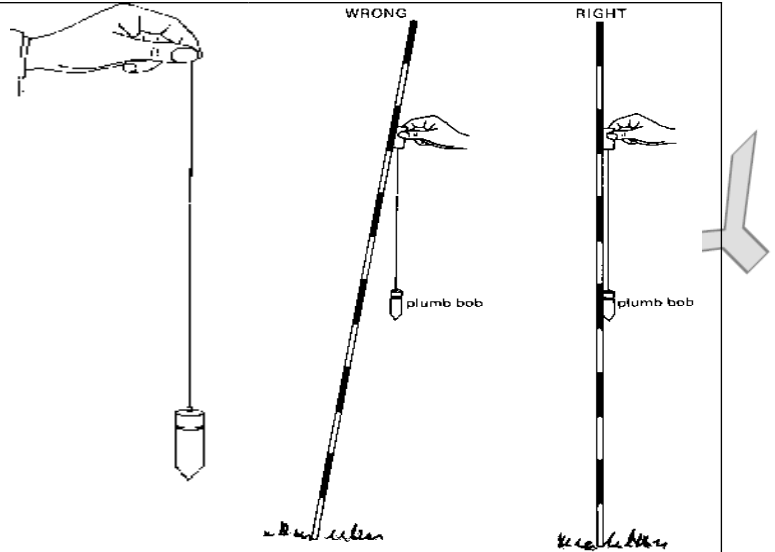


FUNCTION OF AN OPTICAL SQUARE:

- It is used for making Off-Sets from the survey line.

PLUMB BOB

- This refers to the instrument which is made up of solid piece of metal with one pointed end and string fixed to flat base.



FUNCTION OF PLUMB BOB:

- It is used to indicate the position of the point exactly, example when chaining long slope.

THE SURVEY TEAM

- Survey team that may be used in surveying processes is categorized into two types:
 1. *Two Men Team*
 2. *Three Men Team*

TWO MEN TEAM:

- This is the minimum team used in chain survey.
- These are:
 - I. The Chain man or Leader.
 - II. The Booker or Surveyor.



THREE MEN TEAM:

- This involves the following the following people:
 - I. The Chain Man or Leader
 - The leader is the forerunner along the chain line.
 - He starts from the beginning of the line holding the front end of the chain and arrows.
 - II. The Follower
 - The follower is the back runner along the line.
 - He holds the back ends of the chain.
 - He gives signals to the Leader to ensure that the line is in a direct sight from a far station.
 - III. The Booker or Surveyor
 - The booker records all information.
 - He has to be aware with all mistakes when listening.

CHAINING STAGES/PROCESSES

- The following are the steps used in conducting a chain and tape

survey

- a) Select the straight point.
- b) Dividing an area by triangulation method.
- c) Erecting Ranging poles (Rods).
- d) Extending the chain.
- e) Measuring the distance.
- f) Erecting the Ranging poles at another point.
- g) Fixing the object's positions from the survey line.

The Tie lines and Off-sets are used.

ERRORS OR DISCREPANCIES IN CHAIN SURVEY

- Errors Or Discrepancies:

These are mistakes or shortcomings that happen during the survey process leading to taking wrong measurements.

SOURCES OF ERROR IN CHAIN SURVEY

- Errors in chain survey may be caused by several factors:

- i. Mistakes in reading from the chain:

This means that a single measurement error may be transferred to other measurements.

- ii. Fault in the equipment (chain):

This is like failure of the links to stretch properly.

- iii. The uses of too many chain lines:

The uses of too many chain lines or uses of too long chain lines may also cause error in chain survey.

- iv. Incorrect positioning of arrows along the chain lines.

TYPES OF ERRORS IN CHAIN SURVEY

1. *Mistakes (Personal Errors):*

- These occur due to the carelessness of the operator of the chain

survey.

- They can be corrected by extensive care, example listening very careful to the leader before writing in the notebook.

2. *Accidental errors (Instrumental errors):*

- These errors occur without noting the effect instantly.
- Example, a chain is normally expands during very hot weather condition and contract when it's very cold weather condition.
- Accidental errors can be corrected by taking note of the weather condition and checking out the chain.

WAYS OF AVOIDING ERRORS/DISCREPANCIES IN CHAIN SURVEY

- Avoid steep slopes and major obstacles.
- Keep chain lines short and measure them accurately.
- Checking that all lines are included and none is missed out.
- Read markers on chain carefully.
- Calling measurements to the booker as clearly as possible and asking him to repeat.
- Checking the length of the chain that is accurate by lying it against an accurate tape' if there is an error, then adjust all readings.
- Ensure correct position of arrow. They must touch the outer edge of brass handle of measuring tape and perfectly upright.
- Do not allow the tape or chain to sag.
- Avoid chaining during the hot time, this avoid expansion of instruments, example a chain.
- Use the trained Survey Team.
- Use high quality note book and making net sketch.

✓ THINGS TO CONSIDER WHEN ONE WANTS TO CONDUCT SURVEY

- i. Organize a survey team.
- ii. Preparation of equipments to be used. This will depend on the type of

survey.

- iii. Reconnaissance (i.e. visit the area or pre-survey).
- iv. Estimating the costs.
- v. Study the weather of the area.

BOOKING

- Booking is the process whereby all measurements done in the field are entered in the field note book for map making.
- In Booking:
 - ✓ Spiral bond note book is used
 - ✓ The note book must have a single column
 - ✓ Booking is done from the bottom to the top of the note book

OBSTACLES IN CHAIN SURVEY

Obstacles

- Refer to the physical features along the line of traverse that prevent the measurements by the Surveyors.
- The obstacles across a chain line include:

✓ <i>Ponds</i> ✓ <i>Mounds</i> ✓ <i>Buildings</i> ✓ <i>Bend of a river</i> ✓ <i>Forests</i>	✓ <i>Tall Buildings</i> ✓ <i>Thick Jungles</i> ✓ <i>High Compound Wall</i> ✓ Also <i>a wide river</i> can't be chained through.
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METHODS OF OVERCOMING OBSTACLES IN CHAIN SURVEY

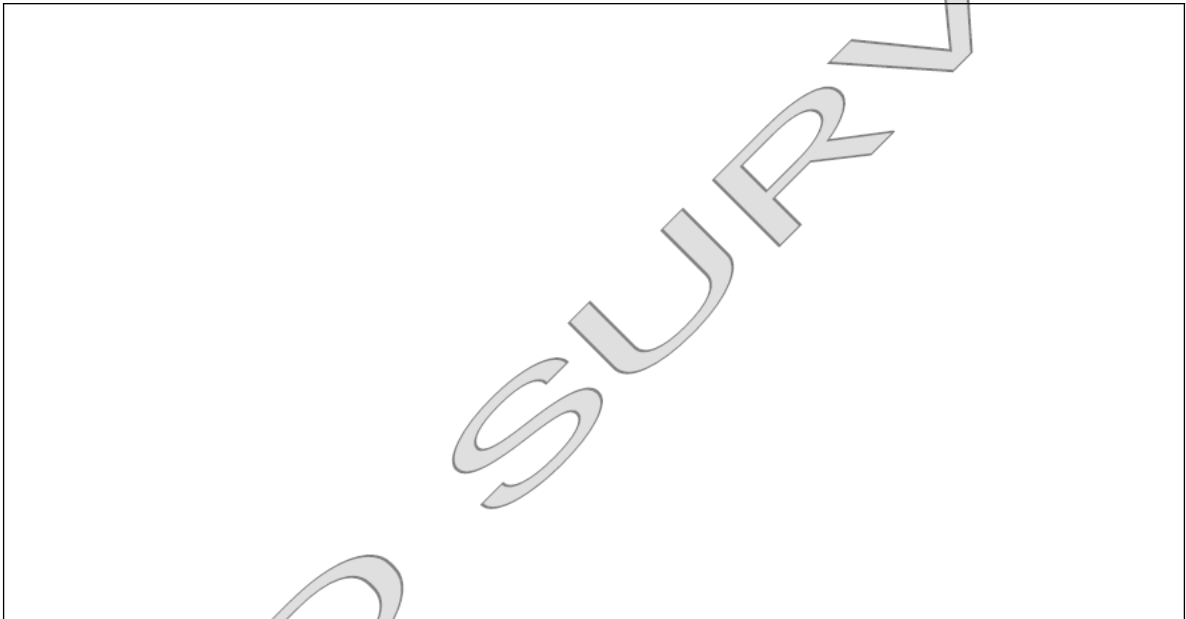
- The following are methods of overcoming obstacles in chain

surveying.

- These are:-
 - a) Rectangulation
 - b) Triangulation

RECTANGULATION

- Consider the diagram below which shows how an obstacle can be overcome by Rectangulation.
- A Pond is found across a chain line (Line of Traverse).



- **Required** is to get a linear measurement (distance) from point **A** to point **F**.
- Draw perpendiculars at **B** and **E** to **C** and **D** respectively.
- Line **BE = CD**, therefore; measure the distance $\overline{CD}$
- Therefore: $\overline{AD} = \overline{AB} + \overline{CD} + \overline{EF}$

TRIANGULATION

a) Across pond

- BoE and CoD are proved for similarly
- $CoD = BoE$
- $\therefore AF = AB + CD + EF$
- The distance **CD** is measured to get distance **BE** across which lies an irregular pond

b) Across a winding river

- AYO and PQO are proved for similarly.
- $POQ = AOY$
- $AY = PQ$
- Then PQ is measured to get the distance AY interrupted by a winding river, surveying team can't cross while measuring and recording

NB: similar triangles helps to find the distances between BE and AY

ADVANTAGES (SIGNIFICANCE) OF A CHAIN SURVEY

A. It is used with other types of Survey

The method can be used with other methods of surveying, for example Prismatic Compass Surveying

B. It is cheap

This is another merit of chain survey whereby, in terms of equipments and human resources: simple chain survey is cheap.

C. It doesn't need high mathematical calculations

D. It is suitable method in surveying the small, flat & open area like houses, roads, rivers, etc.

E. It uses less number of people

It needs only few people to form up the survey team (i.e. leader, follower and booker).

F. It does not need high technology

This is because it uses normal and locally available equipments, e.g. Pegs.

G. It adds details to large scale area

H. It's used in house planning the site for building.

I. It helps in construction of transport and communication system example roads, railways, telephone lines, etc.

J. It's used in dams' construction.

K. It is the only method in surveying using for measuring distance. Others measure angles and heights.

L. It's applicable in another method of survey like in Compass Survey.

M. It does not require a lot of mathematical calculations like in Leveling.

DISADVANTAGES OF A CHAIN SURVEY

1. It is time consuming since it's manually conducted.
2. It's limited to flat or near flat areas.
3. It's subjected to errors over long distance which is due to faults in the equipments or single measurement error.
4. It's easy affected by weather condition, for example to conduct chain survey during the rainy seasons.
5. It's laborious since it needs more than two people (the survey team).

LIMITATIONS (PROBLEMS) FACING SURVEYING PROCESSES

- ✓ Climatic problems: for example heavy rainfall, snowfall.
- ✓ Poor tools: these leads to wrong data.
- ✓ Poor knowledge: this is on how to conduct surveying.
- ✓ Presence of wild animals in the jungle.
- ✓ Poor transport and communication.
- ✓ Social problems: for instant some areas are traditionally restricted.

PRISMATIC SURVEY

PRISMATIC COMPASS SURVEY

- This is the simple land survey that deals with measuring and recording angles of bearings by using magnetic compass.

EQUIPMENTS USED IN PRISMATIC COMPASS SURVEY

- The Instruments used in Prismatic Compass survey include:
 - Prismatic Compass.
 - All instruments used in chain and tape survey.
- THE PRISMATIC COMPASS
 - A Prismatic compass is a *Prism-like in shape* with a hinged lid, sight slit of glass prism.
 - It is also called **A MAGNETIC COMPASS** because it has magnetic materials which make the surveyor to be careful when using it.
 - This equipment is very sophisticate and therefore, it should be handled properly.

Its function:

- Prismatic Compass **is used to take an angle of bearing of an object** to the line of sight from the Observer to the Object.
- RANGING POLES
 - These are used to mark temporary stations during the surveying.
 - After surveying, they are removed and being replaced by *Wooden Pegs*.
- WOODEN PEGS
 - These are made of wood, 50 cm long and they are in square form.
 - Pegs are used to mark permanent stations after removing the ranging poles.

- SPIRAL-BOUND NOTE BOOK

- This note-book is for booking purposes and drawing of the traverse, tie lines and off-sets.



***SPIRAL-BOUND NOTE
BOOK***

- CROSS-STAFF

- This equipment is used to set right angles when marking off-sets of the line of traverse to objects in the field of survey.

SOURCES OF ERRORS DURING THE PRISMATIC COMPASS SURVEY

1. Human errors:

This is occurs especially when the prismatic compass is not held absolutely stead due to carelessness.

2. Local attraction:

This is the distortion in reading which occurs when magnetic needle of a compass is disturbed by metallic objects. This may affect the reading of the compass.

3. Errors due to parallax (vision):

This is when reading the compass and drawing.

4. Using inaccurate equipments:

Using inaccurate equipments example faulty prismatic compass may lead to wrong records due to errors of equipments.

PRECAUTIONS TO AVOID ERRORS DURING A COMPASS SURVEY

- Avoid metallic objects (i.e. be aware of metallic objects).
- The compass should be held steadily.
- Using accurate equipments.
- Using trained staffs (experts).
- Ensure that the Booker takes readings correctly, and asking him/her to repeat all figures verbally.
- It is always best to contact the geological map but the presence of large metal ore would necessitate using another method.

ADVANTAGES OF PRISMATIC COMPASS SURVEY

- ✓ It reduces accumulation of errors.
- ✓ It can be used with other methods like chain and plane table survey.
- ✓ It covers a large area.

DISADVANTAGES OF PRISMATIC COMPASS SURVEY

- o It's costly.
- o It involves long calculations.
- o It needs high trained staffs
- o It can take wrong readings: this is when the compass is not well handled.
- o Human error is involved in taking observations as it is difficult to hold compass absolutely steady.
- o The presence of metallic bodies may not be known to the Surveyor and this would affect readings.

THE PLANE TABLE SURVEY

- ✓ The plane table survey is an accurate and rapid way of fixing position of distance objects by intersection under the help of Plane Table.
- ✓ A complete map can be produced and filling in details on the plane table.



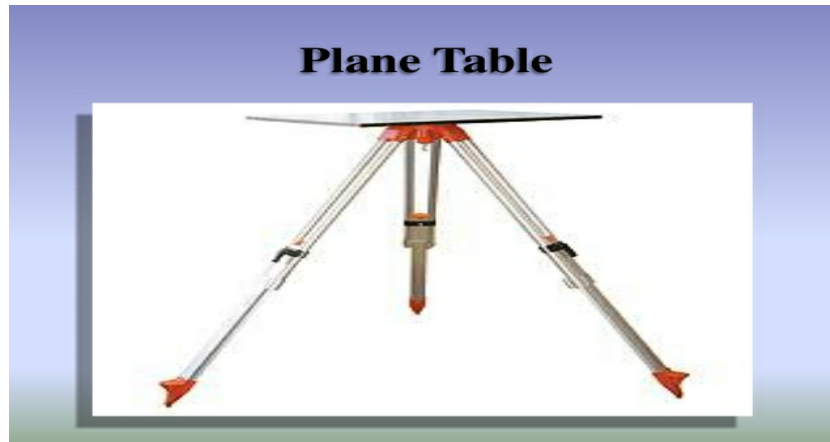
EQUIPMENTS USED IN PLANE TABLE SURVEY

1. THE PLANE TABLE

- This is a simple drawing wooden board covered with paper and placed on a tripod stand.
- This is a wooden board about 70cm by 60cm by 1cm, with a wood brass screw flanged on it underside mounted on tripod stand.
- The table can be turned in any direction and then clamped into position.
- The table is fixed on a tripod stand whose height can be adjusted using its metal or wood legs.

FUNCTION OF PLANE TABLE

- The plane table is used to put on it drawing paper, alidade (Clinometers), plumb bob and the trough compass.



2. TRIPOD STAND

This is the wooden stand with three legs which can be easily moved and adjusted

FUNCTION OF THE TRIPOD STAND

- It is used to support the Plane Table



3. ALIDADE

- An Alidade is a brass ruler with graduated measurements with an observation slit.
- An improved Alidade is fixed with a *Telescope* is known as

CLINOMETER and capable of taking **angle of elevation** and **angle of depression**.



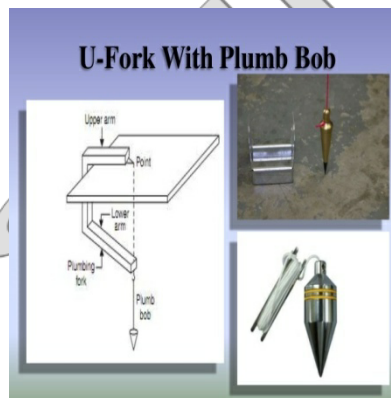
FUNCTION OF ALIDADE

- An alidade (Clinometers) is used to sight distant objects and fix them on a drawing paper on the plane table.

AN ALIDADE

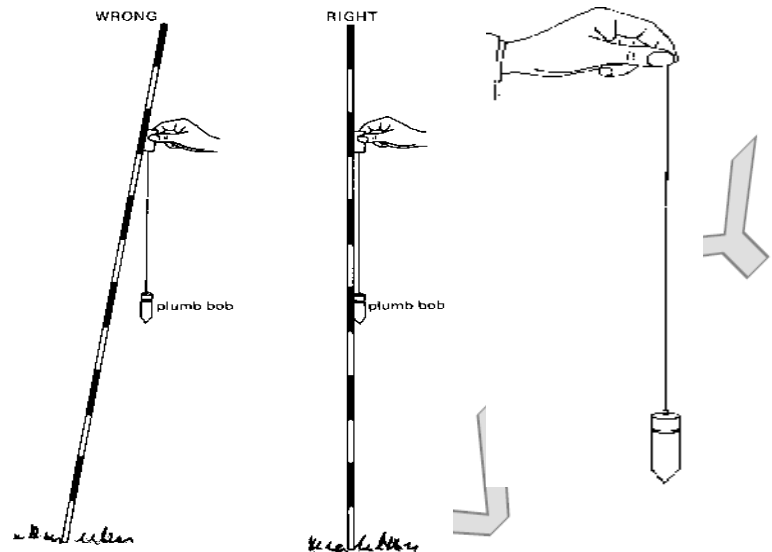
4. PLUMB BOB (*PLUMBING FORK*)

- A plumb bob is used to check if objects are vertical.
- A plumb bob consists of a piece of metal (called a bob) pointing downwards, which is attached to a cord (see the figure).
- When the plumb bob is hanging free and not moving, the cord is



vertical.

- It is a metal weight attached to the edge of the table (board) hanging directly over the ground station point marked by the wooden peg.



FUNCTION OF PLUMB BOB

- A plumb bob is used to check if objects are vertical.
- It is used to fix position exactly.

5. THE TROUGH COMPASS

- It is a wooden box containing a magnetic needle about 120 mm long.
- The needle is left to point a magnetic North and is parallel to the side of the box.



FUNCTION OF THE TROUGH COMPASS

- The trough compass is used to determine an angle from magnetic north to the line of sight.

6. WOODEN PEG

- A wooden peg is used to mark permanent stations during surveying.

ADVANTAGES OF THE PLANE TABLE SURVEY

- ✓ A map or plan can be produced immediately:
No booking is required. This reduces errors.
- ✓ The method is quick and accurate:
It is also permits rapid sketching of details.
- ✓ Personal observation can be made by the Map Maker:
A Map Maker can rely on his/her own information, i.e. he/she does not have to rely on another team member for data.
- ✓ Low task:
That is, the map is produced directly and office work is cut to a minimum

DISADVANTAGES OF THE PLANE TABLE SURVEY

- o The method cannot be used during rainy or wet conditions:
This is due to the drawing paper covering the table can get wet and destroyed.
- o It is difficult to note errors:
Therefore, simple error in the ground base line measurement could throw out all angle measurements.
- o It is tiresome to survey a large area:

LEVELLING TECHNIQUES

♦ **Leveling can be defined as the science of determining height differences on the ground for the purpose of obtaining a level land or reducing slopes by removal or additional of land.**

♦ Heights are determined by the aid of reference known as BENCH MARK (BM)

BENCH MARK (BM)

- This is the stable references points from mean sea level for heights.

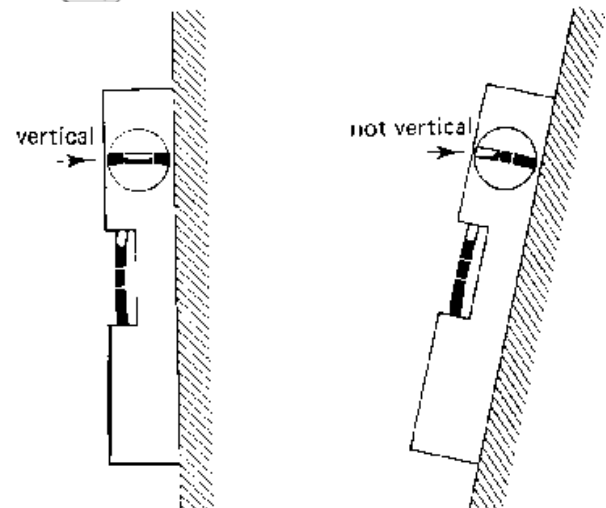
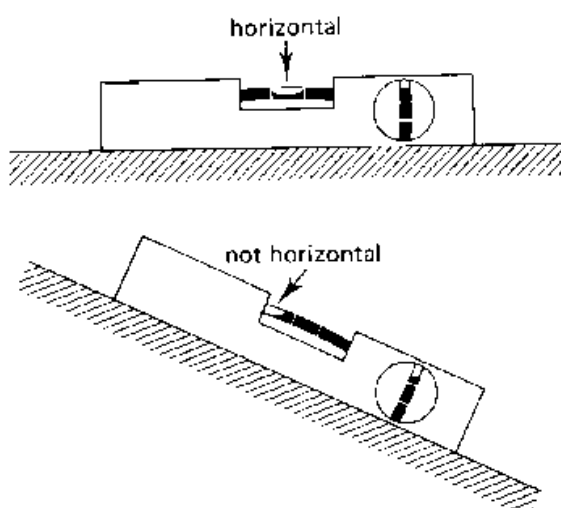
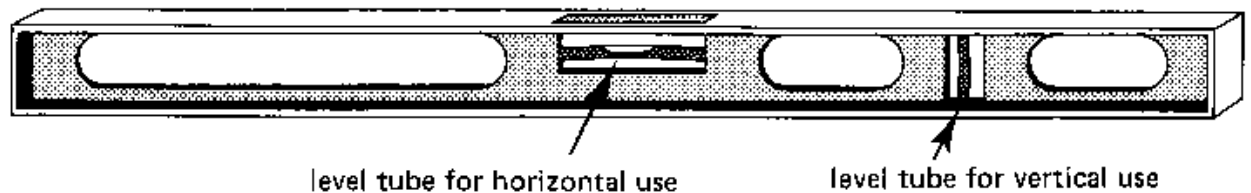
USEFULNESS OF LEVELLING

- It is used to determine and locate construction sites, example roads, railways, etc.

EQUIPMENTS USED IN LEVELLING

a) THE SURVEYOR'S LEVEL (ENGINEER'S LEVEL)

- This consists of a long spirit level or bubble tube about 50mm to 125mm long mounted on the telescope



IT'S FUNCTION

- It is used to read height of object by using a graduated telescopic staff from his position whose height is known.

b) THE LEVELLING (TELESCOPIC) STAFF

- This equipment is made up of metal or wood and can be extended to 3m, 4m or 5m.
- The staff is graduated in 10mm intervals and 1m interval is numbered in black, red and white for easy reading

FUNCTION OF LEVELING STAFF

- It is used to determine height.

c) TRIPOD STAND

- It is equipment used in leveling on which the *Engineer's level* is mounted.

FUNCTION OF TRIPOD STAND

- It is used to support Surveyor's level

METHODS USED IN LEVELLING

- There are two methods used in leveling namely,

a) The Rise and Fall Method.

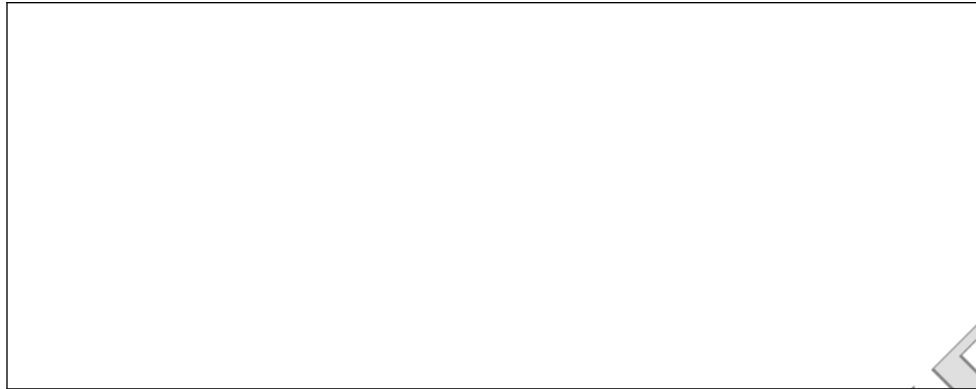
b) The Height of Collimation Method.

RISE AND FALL METHOD

- The basic objective of leveling is to determine the difference in height (level) between two points, while the height of one of which is known.
- Therefore, the method is used to determine the difference in level of two point and the height of one of which is known.

Example I





PROCEDURES:

- 1ST: Telescopic Staff is erected at A and the reading is taken, say 3.561m.
- 2ND: The level is swung around in horizontal at a telescopic staff set at B, and then the second reading is taken as 1.352m.
- 3RD: The difference in level between A and B is obtained by $3.561\text{m} - 1.352\text{m} \equiv 2.209\text{m}$.
- 4TH: Since the height of A is known; 635.562m, and then the height of B is obtained by:-

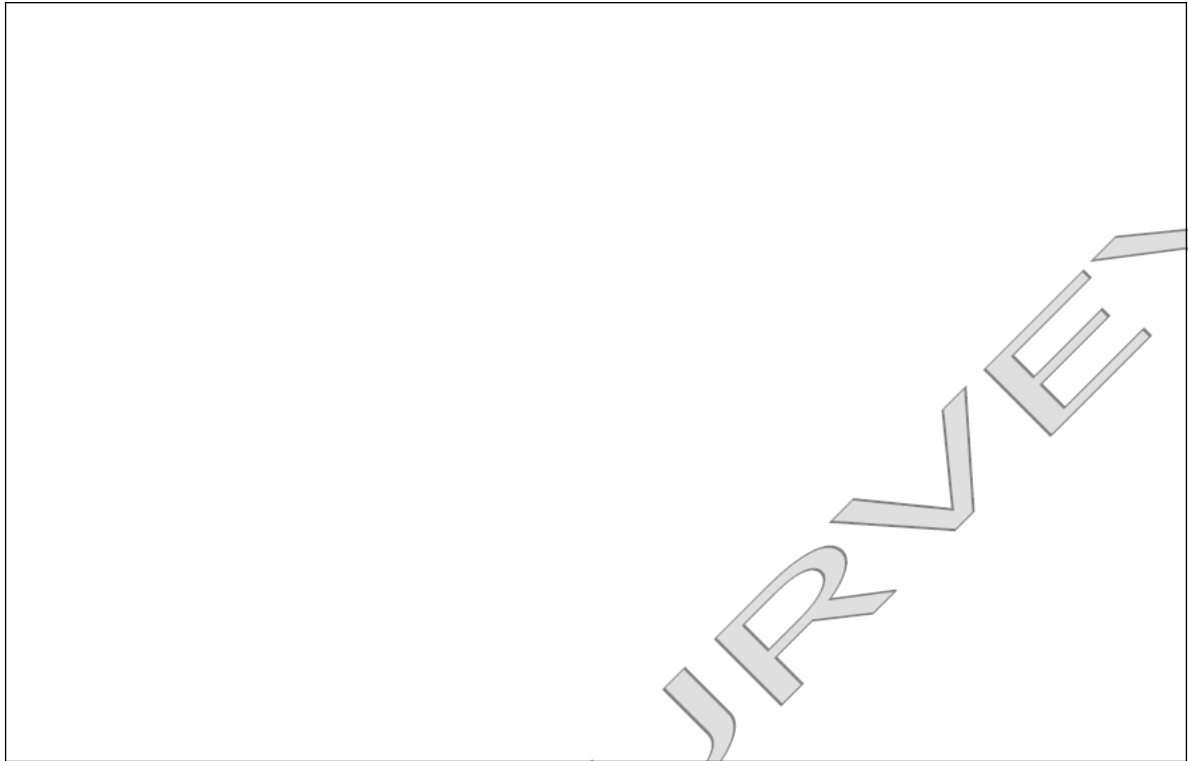
$$635.562 + 2.209\text{m} = 637.771\text{m}$$

Example II

THE RISE METHOD

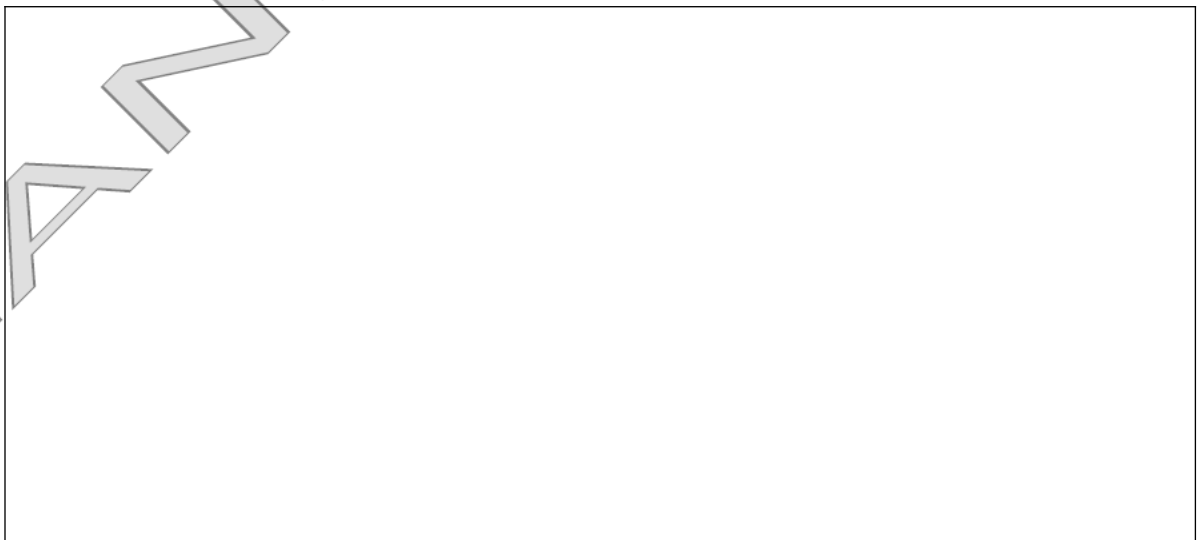
- The Surveyor's level is set at 'X'.
- The Telescopic Staff (Leveling Staff) is erected at 'A' and reading (back sight) is 3.561m.
- The Staff is moved at point 'B' and therefore sight is 1.352m.
- The difference = $3.561\text{m} - 1.352\text{m} = 2.209\text{m}$
- As height is known (i.e. 635.562m), height of B will be:

$$635.562\text{m} + 2.209\text{m} = 637.771\text{m}$$



THE FALL METHOD

- o The reading to 'A' is 1.56.m
- o The reading to 'B' is 2.034m
- o The difference in level between A and B will be:
$$2.034\text{m} - 1.56.\text{m} = 0.473\text{m}$$
- o As height is known as 635.562m, then the height of B is:
$$635.562\text{m} - 0.473\text{m} = 635.089\text{m}$$



HEIGHT OF COLLIMATION METHOD

- Height of Collimation is the method of determining unknown height of a point by taking the sum of the staff height of a point and the ground height of the same point minus the staff height of the point with unknown height.

$$4\text{m} + 600\text{m} = 604\text{m}$$

$$604\text{m} - 2\text{m} = 602\text{m H'' Height of Collimation}$$

SIGNIFICANCE (IMPORTANCE) OF LEVELLING

- a) It is suitable to prepare Contour maps.
- b) It is used to determine and locate construction sites, example buildings, industrial sites, communication routes, etc.
- c) It helps water Engineers
During the construction of dams and houses (i.e. buildings) as they have to start with base level.
- d) It helps to determine the height/elevation of the land surface, example hills, valleys, etc.
- e) It helps Engineers during building and construction
Example: roads and railway lines on banking and to reduce slope and attain the one that can be overcome by vehicles and locomotives.
- f) It helps civil Engineers during building and construction
Example airports; play grounds to end up with perfect level.

*****the end*****

REFERENCE:

- ✓ www.fao.org
- ✓ www.slideshare.com
- ✓ www.shuledirect.com

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