Chain Surveying

Khondokar Al Momin

Department of Civil Engineering, BUET

** Most of the geometrical shape have —
i) Length &
ii) Angle

** Only square & triangles need only length.

** For surveying we can do —
1) Only Linear Measurement
2) " Angular "
3) Both Linear & Angular "

**Q. Compare chain surveying with traverse surveying.

Basis	Chain Surv.	Traverse Surv.
(1) Suitability	For small projects.	For large projects
(2) Measurement	Only Linear measurement.	Both linear & angular measurement.
(3) Accuracy	Less accurate	More accurate
(4) Instrument	Chain or tape	
(5) Classification	No classification	Classified in two groups

** Advantages, Disadvantages & Limitations of Chain Surveying.

** Disadvantages are not Limitations.

** In surveying two things are imp. —
(1) Mistake — unintentionally done
(2) Error — intentionally done / we know about it / it is predicted to be happened.

e.g. Chain is metallic. Suppose — a chain is 20 long at 20°C. But with the increase or decrease in temp., the length of the chain will be more or less. This is called error.

** Using mathematical calculation → errors can be prevented.

** Being cautious, careful, physically & mentally sound → mistakes can be minimized

SURVEYING

Q. What is surveying? What are the main objectives?

Surveying is the art of determining the relative position of points on, above or beneath the surface of the earth by means of direct measurements of distance, direction or elevation. It also includes the art of establishing points by predetermined angular and linear measurements. The application of surveying requires skill as well as the knowledge of mathematics, physics and some astronomy.

** The main objective of surveying is to prepare the map of the surroundings of the projects.

** The success & unsuccess of any project depends on surveying.

** In any project → 1st step = surveying
2nd " = preparing map

** Engineering purpose is to make any project ECONOMIC & SUSTAINABLE.

** That type of design of any project is perfect which is OPTIMUM & ECONOMIC.
e.g. For protecting 6.0 rieter earthquake, the designed building should only be perfect for 6.0 rieter, not more or less than that.

Based on the instruments or methods employed:

1. Chain Surveying
2. Theodolite Surveying
3. Traverse Surveying
4. Triangulation Surveying
5. Tacheometric Surveying
6. Marine or Hydrographic Survey
7. Photographic Surveying
8. Ariel Surveying

❖ **Definition:** (chain Surveying)

Chain surveying is that type of surveying in which only linear measurements are made in the field. with the help of chain or tape.

❖ **Suitability:**

Q. For what type of projects chain surveying is suitable??

This type of surveying is suitable for surveys of small extent on open ground to secure data for exact description of the boundaries of a piece of land or to take simple details. It is not suitable for crowded or risky area.

❖ **Principle:**

Q. Compare the principle of chain & traverse surveying.

Q. Why only triangles ?? → Here we must use linear measurement & Δ is the only shape which we can plot by measuring length only

The principle of chain survey is to provide a skeleton or framework consisting of a number of connected triangles, as triangle is the only figure that can be plotted from the lengths of its sides measured in the field. To get good results in plotting, the framework should consist of triangles which are as nearly equilateral as possible.

Squares can also be plotted by measuring only length but it is not suitable for every case.

Q. Why are there so many different methods of surveying??

Instruments for Chaining:

The various instruments used for the determination of the length of line by chaining are as follows:

I. Chain
II. Tape
III. Pegs
IV. Arrows
V. Ranging rods
VI. Offset staff/rod
VII. Optical square
VIII. plumb Bob

Q. What are the factors for choosing type of surveying?
— There are 4 imp factors for choosing types of surveying —
1) Size of the project
2) Importance
3) Time Available
4) Cost / Budget

Q: What is ranging??
Q. Write down the uses of the instruments of chain surveying.

** In case of surveying, objects around that particular place will also be located while measuring. if the length of the survey line is less than the length of the chain, there will be no difficulty. If, however, the length of the line exceeds the length of the chain some intermediate points will have to be established in line with the two terminal points before starting chaining. The process of fixing such intermediate points is known as RANGING.

Uses and working principle of the these instrument are following.

I. CHAIN:

* Straight links of galvanized mild steel
* three circular or oval wire rings at the end
* Brass handle with swivel joint.

Chains are formed of straight links of galvanised mild steel wire bent into rings at the ends and joined each other by three small circular or oval wire rings. These rings offer flexibility to the chain. The ends of the chains are provided with brass handle at each end with swivel joint, so that the chain can be turned without twisting. How measured The length of a link is the distance between the centres

* length of a link → distance bet^{n} the centers of 2 consequtive middle rings.
* length of chain → the outside of one handle to the outside of the other.

of two consecutive middle rings, while the length of the chain is measured from the outside of one handle to the outside of the other handle.

There are various types of chains in common use.:
They are -

i. Metric chains
ii. Gunter's chain or Surveyor's chain
iii. Engineer's chain
iv. Revenue chain
v. Steel band or band chain.

i. Metric chains -

Metric chains are generally available in lengths of 5, 10, 20 and 30 meters. Fig shows 5, 10, 20, 30 meter chains.

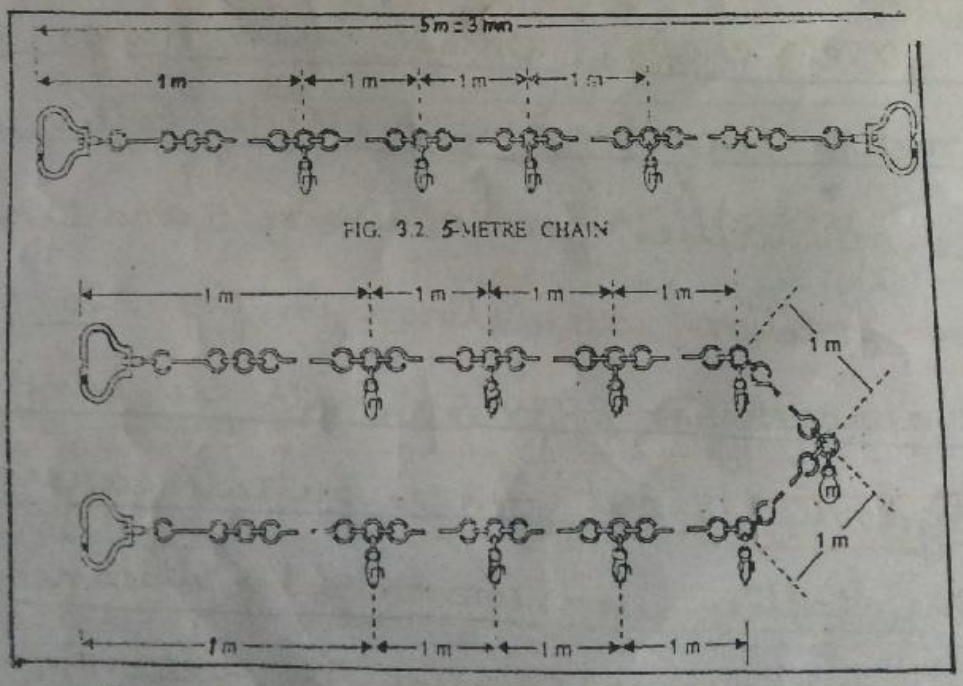


FIG. 3.2 5-METRE CHAIN

Fig: 5-metre and 10-metre chain

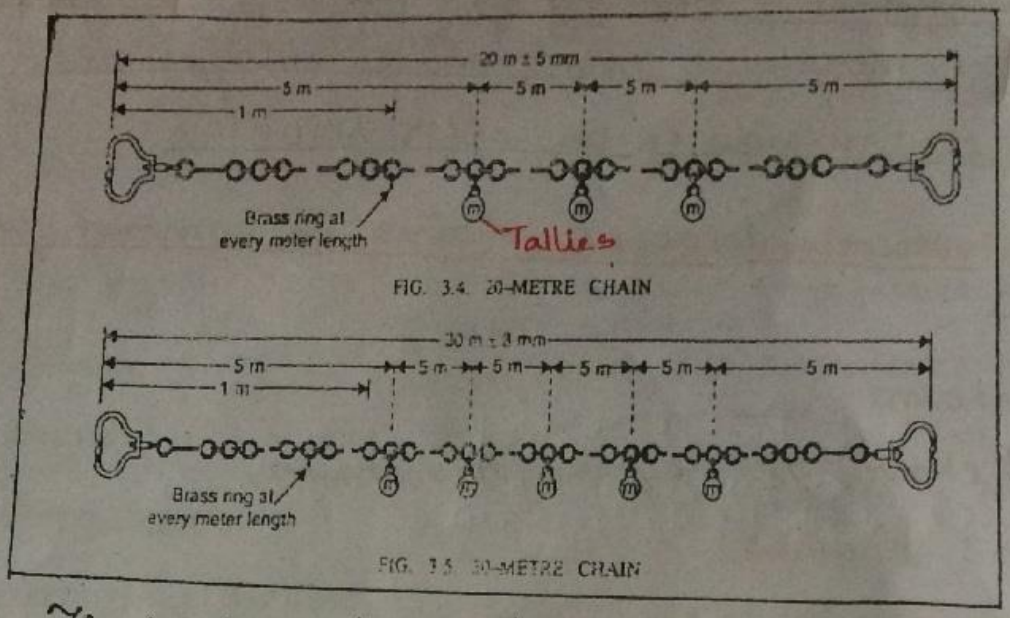


Fig: 20- metre and 30- metre chain

* For 5 & 10 m Length → tallies are every meter length

To enable the reading of fractions of a chain without much difficulty, (1) tallies are fixed at every meter length for chains of 5 m and 10 m lengths and at every five metre length for chains of 20 m and 30 m lengths. In the case of 20 m and 30 m chains, (2) small brass rings are provided at every meter length, except where tallies are attached. The shapes of tallies for chains of 5 and 10 m lengths for different positions are shown in fig. To facilitate holding of arrows in position with the handle of the chain, a groove is cut on the outside surface of the handle. The tallies used for marking distances in the metric chains are marked with the letter 'm'

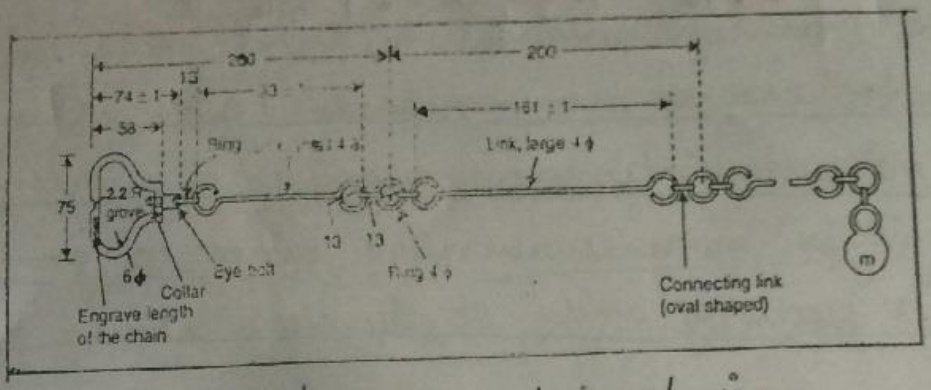
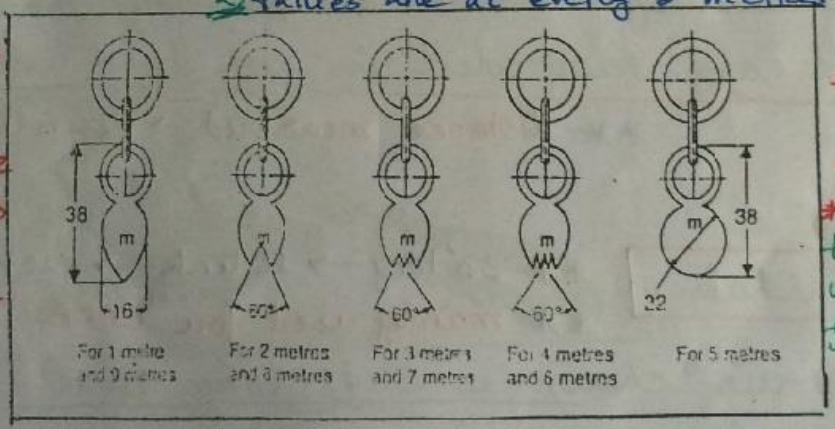


Fig: Details of a metric chain

in order distinguish them from non-metric chains. The length of chain, 5m., 10m, 20m or 30m as the case may be., are engraved on both the handles to indicate the length and also to distinguish the chains from non-metric chains.

* For 20 & 30 m length → 1) small brass rings at every meter except tally's place.
2) tallies are at every 5 metres length.

** Groove → it is cut on the outside surface of the handle → it's use is to hold arrows in position with the handle of the chain.



* Tallies are used for marking distances.

** In metric chain tallies are marked with "m" for diff. from non-metric chain.

Fig: Shapes of tallies for 5m and 10m chains

**66' long → 100 links → each link is 0.6'/7.92".
**66 is convenient for land measurement

ii. Gunter's chain or Surveyor's chain –

A gunter's chain or surveyor's chain is 66 ft long and consists of 100 links each link being 0.6 ft or 7.92 inches long. The length of 66 ft was originally

** 10 square chains = 1 acre
** 10 Gunter's chain = 1 furlong
** 80 " " = 1 mile
** 8 furlong = 1 mile

adopted for convenience in land measurement since 10 square chains are equal to 1 acre. Also, when linear measurments are required in furlongs and miles, it is more convenient since 10 gtr Gunter's chain = 1 furlong and 80 Gunter's chains = 1 mile.

iii. **Engineer's Chain –**

** total 100' long → 100 links → each link is 1' long.
** Brass tags → at every 10 links → indicates the no. of 10 link segments bet" the tag & end of the chain.

The engineer's chain is 100 ft long and consists of 100 links, each link being 1 ft long. At every 10 links, brass tags are fastened with notches on the tags indicating the number of 10 link segments between the tag and end of the chain. The distance measured are recorded in feet and decimals.

** distance measured → recorded in feet & decimals.

iv. **Revenue Chain –**

** 33' long → 16 links → each link $2\frac{1}{16}$' long
** mainly used for "CADASTRAL SURVEY."

The revenue chain is 33 ft long and consists of 16 links, each link being $2\frac{1}{16}$ ft long. The chain is mainly used for measuring fields in cadastral surv

v. **Steel band or band Chain –**

** long narrow strip of blue chain — width 12 to 16 mm — thickness 0·3 to 0·6 mm.

The steel band consists of a long narrow strip o blue steel, of uniform width of 12-16 mm and thickne of 0·3 to 0·6 mm. Metric steel bands are available in

**availabale length → 20/30m ; **brass studs at every 20 cm & numbered at every metre.
**1st & last links are subdivided into cm & mm.

lengths of 20 or 30 m. It is divided by brass studs at every 20 cm and numbered at every metre. The 1st and last links are subdivided into cm and mm. Alternatively, in the place of putting brass studs, a steel band may have graduation etched as meters, decimeters and centimeters on one side and 0.2 m links on the other. For convenience in handling and carrying, steel bands are almost invariably wound on special steel crosses or metal reels from which they can be easily unrolled.

**main disadvantage is — it is easily broken and difficult to repair.

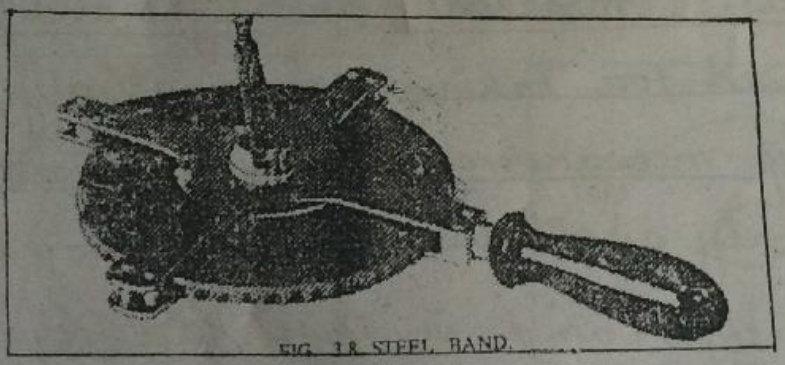


Fig: Steel Band.

For accurate work, the steel band should always be used in preference to the chain; but it should only be placed in the hands of careful chainmen. A steel band is lighter than the chain and easier to handle. It is practically unalterable in length, and is not liable to kinks when in use. Its chief disadvantage is that it is easily broken and difficult to repair.

II. **TAPES :** → are used for more accurate measurement.

Tapes are used for more accurate measurements and are classed according to the material of which they are made, such as follows :

i. cloth or linen type tape.
ii. metallic tape
iii. steel tape
iv. invar tape

i. **Cloth or linen tape :** ** used for taking comparatively rough & subsidiary measurements such as OFFSETS.

cloth tapes of closely woven linen, 12 to 15 mm wide varnished to resist moisture, are light and flexible and may be used for taking comparatively rough and subsidiary measurements such as offsets. A cloth tape is commonly available in lengths of 10 meters, 20, 25, and 35 metres, and in 33 ft, 50 ft, 66 ft and 100 f The end of the tape is provided with small brass ring whose length is included in the total length of the tape.

ii. **Metallic tape :** ** made of varnished strip of water proof linen interwoven with small brass, copper or bronze wires and does not stretch as easily as a cloth tape.

A metallic tape is made of varnished strip of water-proof linnen interwoven with small brass, copper

or bronze wires and does not stretch as easily as a cloth tape. [Usefulness/Advantage:- Since metallic tapes are light and flexible and are not easily broken, they are particularly useful in cross-sectioning and in some method of topography where small errors in length of the tape are of no consequence.] Metallic tapes are made in lengths of 2, 5, 10, 20, 30 and 50 metres In the case of tapes of 10, 20, 30 and 50 m lengths or a metal ring is attached to the outer ends and fastened to it by a metal strip of the same width as the tape

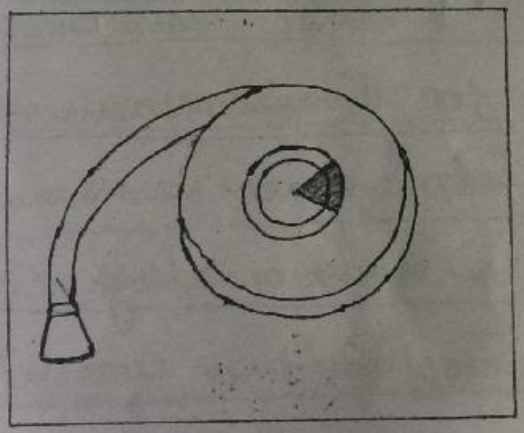


Fig: Metallic tape

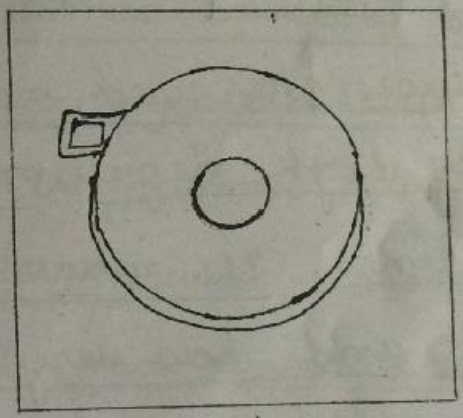


Fig: Steel tape

iii. **Steel tape:**

Steel tapes vary in quality and accuracy of graduation. A steel tape consists of a light strip of width 6 to 10 mm and is more accurately graduated.

Steel tapes are available in lengths of 1, 2, 10, 20, 30 and 50 metres. The tapes of 10, 20, 30 and 50 metre lengths are provided with a brass ring at the outer end, fastened to it by a metal strip of the same width as the tape. The length of the tape includes the metal ring. It is wound in a well-sewn leather case or a corrosion resisting metal case, having a suitable winding device. Tapes of longer length m are wound on metal reel.

iv. **Invar tape:** **used for linear measurement of a very high degree of precision i.e. measurement of BASE LINES.

Invar tapes are used mainly for linear measurements of a very high degree of precision, such as measurem of base lines. The invar tape is made of alloy of nicke and steel, and has very low coefficient of thermal expansion. Another great advantage of invar is that bands and wires made of invar enable base lines to be measured very much more rapidly and conveniently.

** made of alloy of NICKEL & STEEL; very low coefficient of thermal expansion.

** great advantage — bands and wires made of invar enable to measure base lines much more rapidly & conveniently.

3. **PEGS :**

Wooden pegs are used to mark the position of the stations or terminal points of a survey line. They are made of stout timber, generally 2.5 cm or 3 cm square and 15 cm long, tapered at the end. They are driven in the ground with the help of a wooden hammer and kept about 4 cm proper projecting above the surface.

4. **ARROWS :**

**made of stout steel wire & generally 10 arrows are supplied with a chain.

Arrows or marking pins are made of stout steel wire and generally 10 arrows are supplied with a chain. An arrow is inserted into the ground after every chain length measured on the ground. Arrows are made of good quality hardened and tempered steel wire 4 mm in diameter. The length of arrow may vary from 25 cm – 50 cm. One end of the arrow is made sharp other is bent into a loop.

** Arrows — made of good quality hardened & tempered steel wire 4mm in diameter.

** Length → may vary from (25 – 50) cm.

** One end of the arrow is made sharp.

❖ **Procedure:**

The entire operation of chain survey can be divided into three major groups namely –

i. Field work
ii. Keeping of records in the field book
iii. Plotting of data to prepare maps

❖ **Field Work:**

It includes –

a) Reconnaissance
b) Marking and Fixing survey stations
c) Running survey lines.

Reconnaissance → its purpose is to get a general idea about the sight.

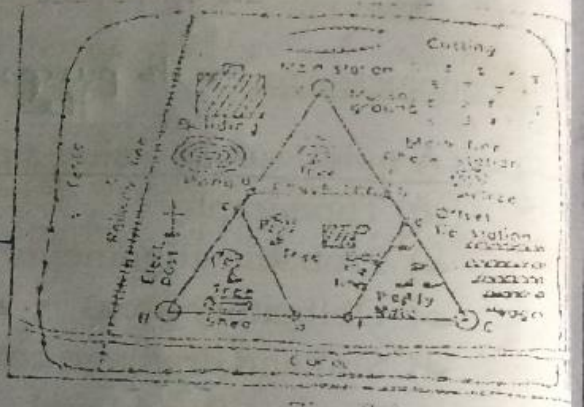
– A quick survey using simple instruments to know:

a) Topography
b) Probable alignments
c) Obligatory areas i.e. schools, mosques etc...which can't be uproote
d) Soil and drainage condition
e) Highest flood level
f) Availability of construction materials and labors
g) Land value for acquisition
h) Time required for construction
i) Slope of hills

Q. What are the purposes of reconnaissance?? (general)
Q. " " " " " " in a particular method??

(a) **Reconnaisance**

The first principle of any type of surv-ying is to work from whole to part. Before starti the actual survey measurements, the surveyor should walk around the area to fix best position of survey lines and survey stations. During reconnaisance, a refe-rence sketch of the ground should be prepared s general arrangement of lines, principal features su as buildings, roads, canals, ditches, culverts etc. sh be shown. Before selecting the sta-tions, the surveyor should examine the intervisibility of stations and should note the position of bui-dings, roads, streams etc. He shou also investigate various difficulties that may arise and think of their solution.



Q. Write down the considerations for choosing survey stations.

(b) **Marking and fixing survey stations:**

The requirements for selection of survey stations, they should be marked to enable

them to be easily discovered during the progress of the survey. The marking of a station depends upon the following considerations:

(1) The triangle should be a well-defined one i.e. nearly equilateral triangle.

(2) Every main station should be visible from the other two.

(3) There should be minimum number of obstacles in ranging and chaining.

(4) The chain line should run near the boundary of the plot.

(5) The chain line should be as few as possible.

(6) The chain line should be over an approximately levelled ground.

(7) In case of chaining along the road, it is always better to run chains at one side of the roads so as to avoid ~~in~~ interruption of vehicles. It is better not to cross road frequently.

(8) In soft ground, wooden pegs should be driven, leaving a small projection above the ground. The name of the station may be written on the top

(9) Offsets should not exceed one chain.

(10) Check and tie lines should be provided in sufficient number so that all the main lines, offsets and other details can be checked thoroughly.

(c) Running Survey Lines:

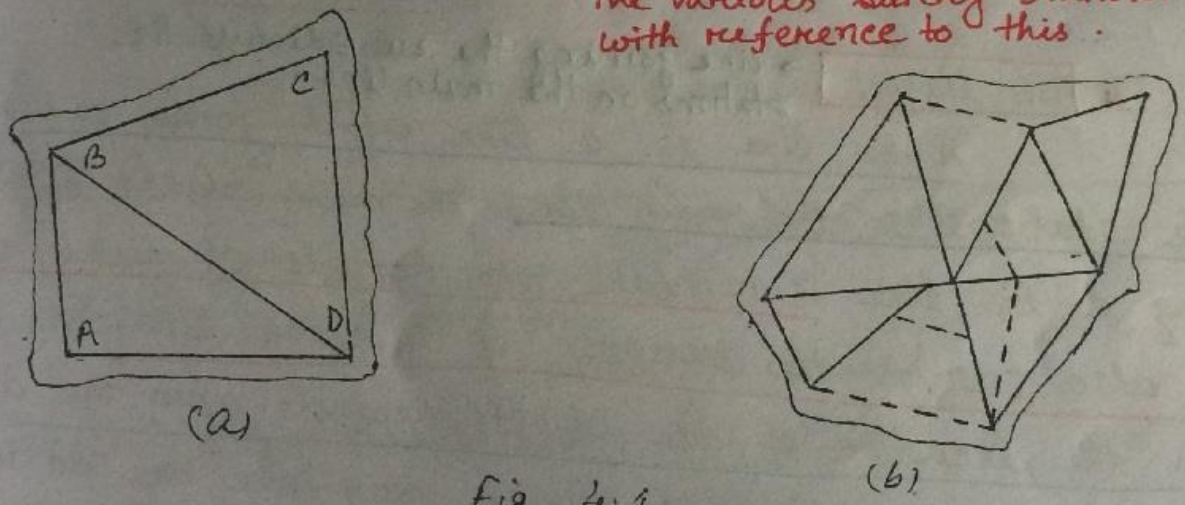
In fig. 2.6 the main station 'A' is located with respect to three permanent objects and a ranging rod is fixed on the station. One ranging rod is fixed at main station B and another at an intermediate point in between A & B. The three rods will be in a straight line when only the intermediate rod is visible if a man looks from A to B. Now, measurement of line AB is taken by chain. The chain should be properly stretched so that there is no sag in it. As the measurements proceeds offsets are taken on both sides of the line AB and recorded in the field book (shown in fig. 2.6). In this way all the lines including tie and check lines are measured and offsets taken and recorded in the field book.

A survey station is a prominent point on the chain lines and can either at the beginning of the chain line or at the end. Such stations known as main staion.

Survey Lines : → lines joining the main survey stations.

The lines joining the main survey stations are called main survey lines. The biggest of the main survey lines is called the **base line** and the various survey stations are plotted with reference to this. If the area to be surveyed has more than three straight boundaries, the field measurements must be so arranged that they can be plotted by laying down the triangles as shown in fig. 4.1 (a) or (b)

* Base Line — The biggest of the main survey lines
The various survey stations are plotted with reference to this.



(a) (b)

Fig. 4.1

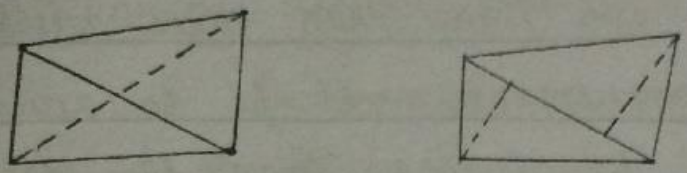
Proof Lines

Check lines : → lines run in the field to check the accuracy of the work.

Check lines or **proof lines** are the lines which are run in the field to check the accuracy of the work. The length of the check line measured in the field must agree with its length on the

plan. A check line may be laid by joining the apex of the triangles to any point on the opposite side by joining two points on any two sides of a triangle. Each triangle must have a check line. Fig 4.2 (a), (b) show the check lines by dotted lines.

***Each triangle must have a check line.



(a) (b)

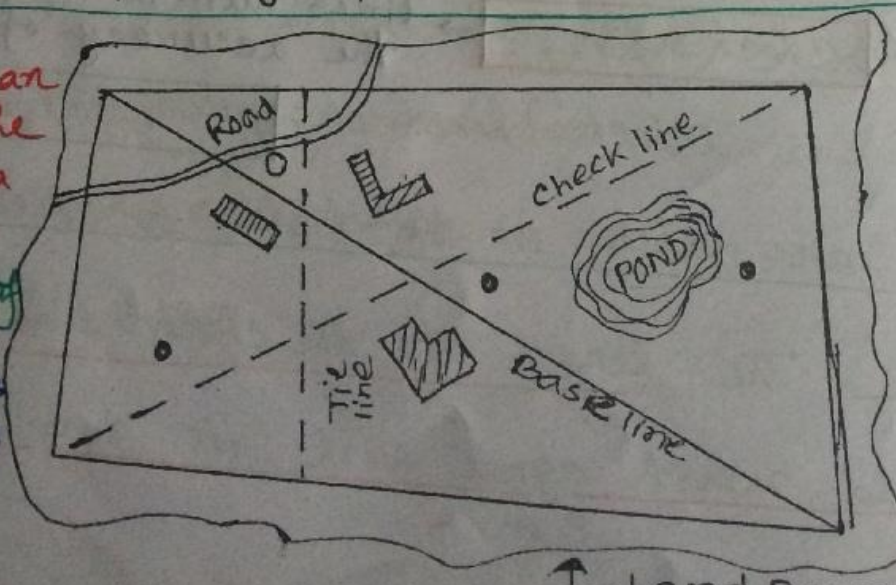
Fig. 4.2

Tie lines: → Line joining the subsidiary/ tie stations on the main line.

A tie line is a line which joins subsidiary or tie stations on the main line. The main object of running a tie line is to take the details of nearby objects but it also serves the purpose of a check line. The accuracy in the location of the objects depends upon the accuracy in laying the tie line. A frame may have one or more tie lines depending upon the circumstances fig (4.3).

***Tie line can also serve the purpose of a check line.

*Main object of tie line → to take the details of the nearby object.



Base Line

- Biggest of the main chain line.

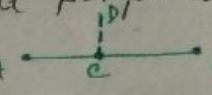
~~Offset~~ **Offset**

Fig. 4.5
Punmia Vol. 1

Basic problems in chaining:

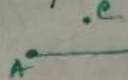
There are four Basic problem in chaining. such as →

(A) To erect a perpendicular to a chain line from a point on it.



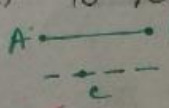
* to draw AB ⊥ CD is the problem.

(B) To drop a perpendicular to a chain line from a point outside if.



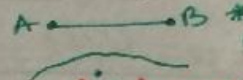
* to draw a ⊥ through C.

(C) To run a parallelled to chain through a given point.



* to draw a ∥ through C.

(D) To run a parallel to a given inaccessible line through a given point.



* to draw a ∥ through C
* C inaccessible.

All the Methods from Book

Description:

(A) To erect a perpendicular to a chain line from a point on it:

Other Methods (from Pan Pia)

(2) The 3-4-5 method:

Let it be required to erect a perpendicular to the chain line at a point C in it [Fig. 4.20(a)]. A point E is established at a distance of 3m from C. 'O' is put at the end of the tape (10m) long at E and the 5m end at C. The 5m and 6m marks are brought together to form a loop of 1m. The tape is now stretched tight by fastening the ends E and C. The point D is thus established. Angle DCE will be 90°. One person can set out a right angle by this method.

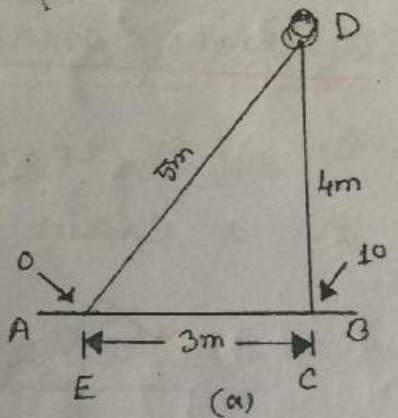
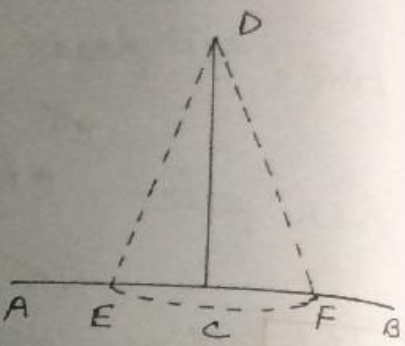


Fig. 4.20.

(b) To drop a perpendicular to a chain line from a point outside it:

Method:

Let it be required to drop a perpendicular to a chain line AB from a point D outside it.

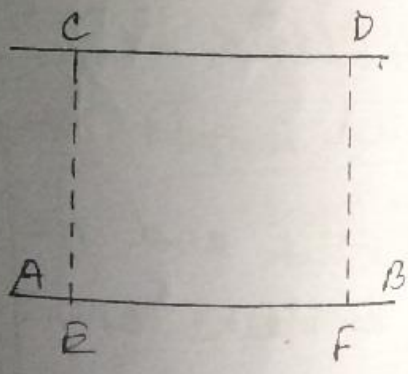


Any point E is selected on the line. With D as centre and DE as radius, an arc to cut chain line ~~in~~ E is drawn in F. Then EF is bisected at C. CD will be perpendicular to AB.

(c) To run a parallel to chain line through a given point:

Let it be required to run a parallel to a chain line AB through a given point C.

Method:



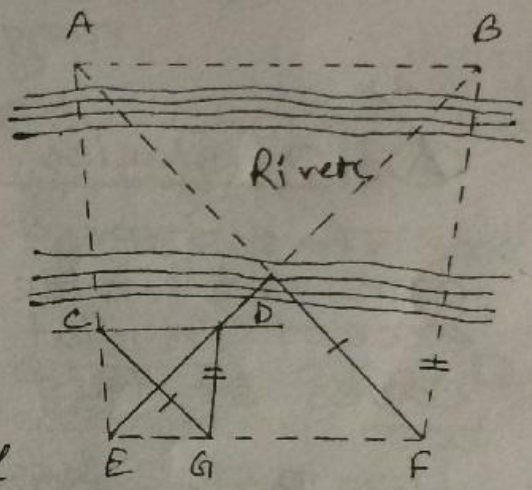
Through C, a perpendicular CE to the chain line is dropped. CE is measured. Any other point F on line is selected and a perpendicular FD is erected. FD = EC is made and C, D are joined. Line CD ∥ AB

(Extra page)

(D) To run a parallel to a given inaccessible line through a given point.

Let AB be the given inaccessible line and C be the given point through which the parallel is to be drawn.

Method:



Any point E is selected in line with A and C. Similarly Any other convenient point F is selected. E, F are made join. Through C, a line CG parallel to AF is drawn. Through G, a line GD parallel to BF is drawn, cutting BE in D. CD will be then the required line.

Please prove that $\boxed{CD \parallel AB}$

** CD ∥ AB, But অন্য পাড়ে যাওয়া যাবে না। যে পাড়ে যেতে বলা হবে সেই পাড়েই থাকতে হবে।

or, In case (d), we have to stay fixed. We can't go to the other point where the parallel should be drawn.

Obstacles in Chaining :

Obstacles to chaining prevent chainman from measuring directly between two points and give rise to a set of Problems in which distance are found by indirect measurement. Obstacles to chaining are of three kinds :

(a) obstacles to ranging → to straighten both stations
(b) obstacles to chaining
(c) obstacles to both chaining and ranging.

(a) Obstacles to ranging -

This type of obstacle, in which the ends are not intervisible, is quite common except in flat country. There may be two cases of this obstacle.

(i) Both ends of the line may be visible from intermediate points on the line.

(ii) Both ends of the line may not be visible from intermediate points on the line.

Case (i) : Assignment → from book (description) must

Method of reciprocal ranging may be used.

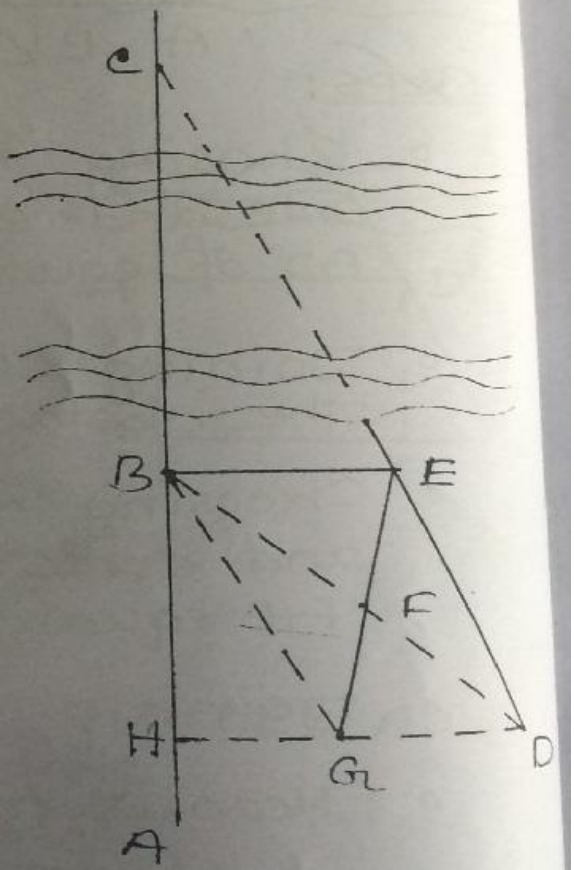
Case (ii) : In the following figure, let AB be the line in which A and B are not visible from intermediate point on it. Through A, a random line ABi is drawn in any convenient

(Similar & Problems & Examples from Pan file)

*Problem-এ figure must draw করতে হবে।
*যেখানে figure নাই।

Example 4.9

A survey line ABC cuts the banks of a river at B and C and to determine the distance BC, a line BE, 60 m long was set out roughly parallel to the river. A Point D was then found in CE Produced and middle point F of DB determined. EF was then produced to G, making FG equal to EF, and DG produced to cut the survey line in H. GH and HB were found to be 40 and 80 metres long respectively. Find the distance from B to C.



Solution:

In BEDG, DF = FD

and GF = FE

Hence BEDG is a Parallelogram.

Hence, GD = BE = 60m

$$HD = HG + GD$$
$$= 40 + 60$$
$$= 100\ m$$

From Similar triangles CHD and CBE, we get

$$\frac{CB}{CH} = \frac{BE}{HD}$$

or, $$\frac{CB}{CB + BH} = \frac{BE}{HG + GD}$$

or, $$\frac{CB}{CB + 80} = \frac{60}{40 + 60} = 0.6$$

$$\therefore CB = 0.6CB + 48$$

$$\therefore CB = 120\ m.$$

* Field book-এ alltime নিচ থেকে উপরে লিখতে হবে।
যত বার reading নিবে figure draw করা যাবে তত বার

Record keeping :

All the details including a rough sketch of different types of stations, offsets etc in the field are recorded in a book called "Field Book". It is an important book or document which should be maintained carefully. It is 9" × 5" in size with two parallel lines ruled longitudinally in the centre of the every page. These two parallel lines are imaginary lines representing the chain line and the space in between has no existence in the field.

The record keeping starts from the bottom of the end page of the field book. A rough sketch of the plot is drown before hand on the last page for reference.

At the beginning of a particular chain survey, the following details must be given-

(i) Date of survey and names of surveyors
(ii) General sketch of the layout of survey lines.
(iii) Details of survey lines.
(iv) Page index of survey lines.
(v) Location sketches of survey stations.

(P.T.O)

Recording of stations, chain lines and other details are shown in the above figures. Neat figures and sketches with clearness in representing points to which offsets are taken should be properly maintained.

Plotting a chain survey :

Generally, the scale of plotting a survey is decided before the survey is started. In general, the scale depends on (1) the purpose of survey (2) the extent of survey and (3) the finance available.

The plan must be so oriented on the sheet that the north side of the survey lines towards the top of the sheet and it is centrally placed. The way to achieve this, is to first plot the skeleton on a tracing paper and rotate it on the drawing paper. After having oriented it suitably, the points may be pricked through. To begin with, base line is first plotted. The other triangles are then laid by intersection of arcs. Each triangle may be verified by measuring the check line on the plan and comparing it with its measured length in the field.

If the discrepancy is not within the limits, measurements may be taken again. If it is less, the error may be adjusted suitably.

After having drawn the skeleton consisting a number of triangles, offsets may be plotted. There are two methods of plotting the offsets. In the

- (1) In the first method, the chainages of the offsets are marked on the chain line and perpendicular to the chain line are erected with the help of a set-square. In the other method

- (2) In the other method, the plotting is done with the help of an offset scale. A long scale is kept parallel to the chain line and a distance equal to half the length of the offset scale. The offset scale consists of a small scale having zero mark in the middle. The zero of the long scale is kept in line with the zero of the chain line. Chainages are then marked against the working edge of the offset scale and the offsets are measured along its edge. Thus, the offset can be plotted to both the sides of the line.

Errors in Chaining:

It is always very difficult Practica to measure length accurately. The er in chaing may happen in various w

- Mistake
- Compensating
- Cumulative

Mistake:

This kind of error arises from inattention, inexperience, poor judge serious personal error or confusion in reading the tallies such as 30 a 70.

Try to avoid

Compensating:

Accidental error caused by reaso beyond the ability of the observer to control.

Example: Stretching chain alw not . Assumed to obey the la of probability / chance, errors whi cancel one another and finally t effects remaining approximately

Cumulative:

Cumulative errors are these which may either go on increasi or decreasing when a chain is shorter or longer than its standard

Advantages of Chain Survey:

- This type of survey work is suited for a small plain ground.
- It requires simple instruments.
- plotting of map is very simple and easy.

Disadvantages of Chain Survey:

- This type of surveying is not suitable for undulation land where chaining operation is tedious and subject to errors.
- This method is not generally recommended for a crowded city with large number of buildings and obstacles because it cannot be divided into well conditioned triangles.
- In case of route surveying. the survey work of a road, irrigation canel. railways. water and sewer lines, tunneling etc. this method is not recommended at all.

length. When the chain is too short, the measured length of the line is too great. i.e. greater than its true length and therefore, the error is positive and the correction is negative. Again when the chain is too long, the measured length is too short. i.e. less than its true length. So the error is negative and correction is positive.

See problems related to correction

2. **Chain Survey**

The students will form a triangle in the field, after selecting proper stations. They will measure the lines and take offsets of different objects in the field. In chain survey the students will use tie lines, check lines and enter the data in the field book. They will plot the details in a drawing sheet.

References

1. A Text Book of Surveying, Third Edition, 1982.
   -M. Shahajahan & M. A. Aziz

2. Surveying, Vol. 1, Sixteenth Edition, 2005.
   -B.C. Punmia, Ashok, K. Jain & Arun K. Jain