Instruments used in Chain surveying

Chains

Types of chains

1. Metric chain

2. Gunter's chain

3. Engineer's chain

4. Revenue chain

1. metric chain

metric chains are made in lengths 20m and 30m. Tallies are fixed at every 5 metre length and brass rings are provided at every metre length except where tallies are attached.

a) length : It is 20m or 30m long and is divided into 100 or 150 links respectively. Each link measure 20 cm.

b) links: The length of a link is the distance between the centre to the two consecutive middle rings.

c) tags: Metallic tags of different patterns are fixed at various important points of a Chain. that is 5 m, 10 m, 15 m, 20 m for quick and easy reading of the Chain.

d) handles: The ends of the Chain are provided with the brass handles so that the chain can be turned around without twisting.

2. Gunter's chain

it is 66 feet long and it is divided into 100 links. Each link measures 0.66ft.

3. Engineer's chain

it is 100 feet long and is divided into 100 links. Each link measures 1 feet.

4. Revenue chain

the Chain is of 33 feet length and is divided into 16 equal links

Tapes

The following are various types of tapes

1. Metallic tapes

the cloth tape is reinforced with brass or copper wires to prevent stretching or twisting of fibres is called a metallic tape.

2. Steel tape

a steel tape is made up of Steel Ribbon with width 6mm to 10mm. Steel tapes are available in lunch of 2 m,10m, 20m, 30m,and 50 m.

Ranging rod

rod which are used for the purpose of making a line straight or ranging are known as ranging rods. Ranging rods are made of well seasoned Timber or metal or fiberglass. They are available in 2 metre or 3 metre length. The rods are usually circular in section with 30 mm diameter. The rod is divided into equal parts of 200 mm each and the divisions are painted with red and white or black and white and they are provided with iron show at the bottom.

Ranging poles

diameter of ranging poles larger than the ranging rods. The length varies from 4 metre to 6 metre and diameter where is from 60 mm 100 mm. Generally they are not painted but they are provided with the large flag. Ranging poles are used to survey long lines. In the ground by making about 50 cm holes and set vertical with the help of plumb bob.

Arrows

Arrows are made of tempered Steel wire of diameter 4mm. Arrow is 400mm. For easy carrying one end of the arrow is bent into the ring of 50mm diameter and the other end is painted to facilitate insertion into the ground

Open cross staff

it consists of two pairs of vertical slits providing two lines of sight mutually at right angles. It is a wooden box or block of size 150 mm square, round or octagonal and 38 mm deep with two fine saw cut slits at right angles to each other. The vertical saw cut give two mutually perpendicular sights for erecting perpendiculars. the block is mounted on the pole of 1.2 m to 1.5 m long and 25 mm diameter which can be fixed to the ground.

Ranging

The process of establishing number of intermediate points on a survey line joining two points in the field so that the length between them may be measured correctly is called ranging.

There are two methods of ranging

1. Direct ranging.

2. Indirect ranging.

1. Direct ranging

in this type of ranging intermediate points are fixed along the chain line by direct observation on either end station. This type of ranging is possible When two stations are intervisible and in such cases ranging can either be done by eye or through some optical instruments such as line ranger or a theodolite.

It is carried out by following methods

1. Ranging by eye.

2. Ranging by line Ranger.

3. Ranging by theodolite.

1. Ranging by eye

the following procedure is carried out

let A and B are the two points at the ends of the survey line.

1. To range a line AB , ranging rods are fixed at the ends of the line. then surveyor stands just behind the ranging rod A.

2. The assistant then goes to another ranging rod and establishes the rod at the point approximately in the line with AB by eye judgement.

3 A surveyor at A directs his assistant by hand movements to move the rod at the right or left until the ranging rods appear to be exactly in the straight line.

4. When the three rods are in the straight line the surveyor gives signal to the assistant to fix up to intermediate ranging rod at C

5. Similarly the other points can be established

2.Ranging by line Ranger

Let A and B are the ends of the line and C is an intermediate point to be fixed on this line.

Following procedure followed for locating the intermediate points C.

1. The survey stands nearly in line with station A and B and then he moves transversely to the line AB to fix intermediate station C on line AB.

2. Two Images are seen in the line Ranger one from the ranging rod at A and the other from the ranging rod at B as shown in the figure. If the point C is not in line with a AB, 2 images will appear to be separated as shown in the figure.

3. Then he moves the instrument backward and forward at right angle to the line until two images of ranging rods are end stations A and B appear one above the other exactly in the same vertical line as shown in the figure.

4. The required intermediate station C is then vertically below the instrument. The point C is then transferred to the ground with the help of a plumb bob.

Indirect ranging

When the end stations are not intervisible due to rising ground between them or due to long distance between the ends indirect ranging is done. In case of indirect ranging the the intermediate points or stations are fixed by taking indirect observation.

Indirect or reciprocal ranging

let two stations A and B are shown in the figure are not intervisible due to rising ground and R and S are two intervisible points to be established on the chain line. In such case the procedure for ranging as follows.

1. Two surveyors with ranging rod take up the positions R1 and S1 in such a way that a person at R1 can see the ranging rods at S1 and B and similarly the person at S1 can see the ranging rod at R1 and A.

2. The surveyor standing at point S1 direct the surveyor standing at the point R1 to move to new position R2 which is in line with A as shown in the figure.

3. Now the surveyor standing at point R2 directs the surveyor standing at the point S1 to move to the new position S2 which is in line with B.

4. By successive directing each other the two surveyors proceed to the line AB and finally come to R and S exactly in the line AB.

5. R and S are the required intermediate points between A and B.

As the ranging is done with reciprocal observation it is known as reciprocal ranging.

Method of chaining on sloping ground

The horizontal distance of the sloping ground is measured by

Direct method

Indirect method

Direct method or stepping method

This method is adopted when the ground is not very steep . In this method the sloping ground is divided into number of horizontal and vertical strips like steps. So this method is also known as stepping method.

Procedure

1. Let the horizontal distance between point A and B is to be measured

2. A suitable length of the chain and tape is stretched out.

3. Place one end of the chain at A. Stretch the chain horizontally and align it.

4. Transfer the other end of the chain accurately to the ground by dropping a plumbob or stone or an arrow. Let the transferred point to be a.

5. More to the point a, place one end of the chain at a align the chain in the line AB and stretch it horizontally.

6. Transfer the other end of the chain accurately as explained in step 3. Let the transferred point be b.

7. Repeat the above operation until the end point B is reached.

8. Now to horizontal distance between point A and B is equal to the sum of all the distance measured.

Survey stations

Survey stations are the points at the beginning and the end of the chain line. They may also occur at any convenient point on the chain line. Such stations may be

Main stations

Subsidiary stations

Main stations

Main station is a point in a chain survey where the two sides of the traverse or triangle meet. The stations command the boundaries of the survey and are designated by capital letters.

Subsidiary stations

Stations which are on the main survey lines or any other survey lines are called subsidiary stations. These stations are taken to run subsidiary lines for dividing areas into triangles.

Main survey line

The Chain line joining to main service stations is called main survey line.

Tie station or subsidiary station

Tie station is a station on the survey line joining two main stations. These are helpful in locating the interior details of the area to be surveyed and are designated by T1 ,T2 etc.

Base line

It is the most important line of the survey. Generally the longest of the main survey lines is considered as baseline.

Check lines

The line which is run in the field to check the accuracy of the field work is called as check line.

Tie lines or subsidiary lines

The Chain line joining the two subsidiary survey station is known as tie line.

Selection of Survey stations

The following points should be kept in mind during the selection of survey station.

1. The main stations should be intervisible.

2. Survey stations should form well conditioned Triangles.

3. The base line should be the longest of the main survey lines.

4. Every triangle should be provided with the check line .

5. The survey line should be taken through fairly level ground as far as practicable.

6. The main survey line should pass close to the boundary lines of the area to be surveyed.

7. Stations should be so selected that obstacles to chaining are avoided as far as possible.

8. The survey line should not be very close to the main roads as survey work may then be interrupted by traffic.

Offsets

The lateral measurement taken to the left or right of the survey line to locate the details such as building, boundaries, fences roads etc are called offsets.

The offsets having their length less than 15 m are called short offsets.

The offsets having their length more than 15 m are called long offsets.

The offsets are of two types

1. Perpendicular offsets.

2. oblique offsets.

1. Perpendicular offsets

when the lateral measurement from objects are made right angles to the chain line the offsets are known as perpendicular offsets.

2. Oblique offsets

An offset taken at an angle other than 90 degree to the survey line is called oblique offset.

Oblique offsets referred when the object to be located is at the long distance from the chain Line or when it is an important one such as corner of the building or the intersection of two adjoining properties. These are also used to check the accuracy of perpendicular offsets

Errors in Chain survey

errors occur in Chaining as well as in any other server due to various reasons. They are to be minimised or eliminated completely by applying suitable corrections.

sources of errors.

The three main sources of errors are

Instrumental errors

Personal errors

Natural errors

Instrumental errors

these result from imperfections in the construction and adjustment of Surveying instruments and movement of their individual parts.

Personal errors

This arise from limitations of the human senses of Sight, touch and hearing.

Natural errors

these are caused due to variation in nature such as wind, temperature, humidity etc.