

Chain survey is the easiest type of survey in which area to be surveyed is divided into a number of triangles. Because all the geometrical figures only whose shape and size are determined when the length of the sides are known. The perpendicular distance, called offsets, of various objects in the field from the line, are measured and recorded in a book called field book. From this records in the field book, the whole area can be plotted on a drawing sheet to a reduced scale.

Chain surveying instruments:

The following instruments are used in Chain survey.

- Chain
- Tape
- Arrows
- Ranging Rods
- Offset Staff
- Optical Square

Different types of Chain in Chain survey:

It is a steel wire with links connected by steel rings. It has brass handles at both ends. There are many types of chains of which the Engineer's Chain and Gunter's chain are commonly used in most of the country.

The Engineers chain is 100 ft, long and Gunter's chain 66 ft. The Engineer's chain consists of 100 links each one a foot long and at every 10 links a tally is attached to facilitate reading. The Gunter's chain is also divided into 100 links each link is 7.92 inches.



Different Types of chain in chain survey

In a metric, a small brass ring is given in every one-meter interval. Brass tallies are also given at each 5.0 m length of the chain. Every tally has a complex shape which indicates 5, 10, 15m from any one side of the chain. However, metric chains are prepared in 20 m and 30 m length.

Revenue chain is 33 ft long chain. It consists of 16 links. This chain is used for length measurements in feet & inches for small areas.



Revenue Chain

Steel bands are preferred than chains as they are more accurate and easy to use. The disadvantages are they get broken down easily, and it's difficult to service in the field. The length of the tape is 20 and 30 m, 12 to 16 mm wide and 0.3 to 0.6 mm thick. They are numbered at every meter. Brass studs divide them at every 20 cm.



Steel Band or Band Chain in chain survey

Testing and Adjustment of Chain:

Due to continuous use of chain gradually the length of the chain gets modified. Its length is shortened mainly due to warping of links. Its length is elongated either for stretching of the links or joints and opening out of the small rings. So, For actual work, it is important to test the chain time to time. We can test the chain with a steel tape or by a standard chain. Sometimes, it is useful to have a permanent test gauge established where the chain is tested.

When the length of a chain is estimated at a pull of 8 kg at 20 °C, the length of the string should contain $20 \text{ m} \pm 5 \text{ mm}$ or $30 \text{ m} \pm 8 \text{ mm}$, and for 20m and 30m long chain, the length should be close to within 2 mm. Following measures can be taken to accommodate the length of a chain.

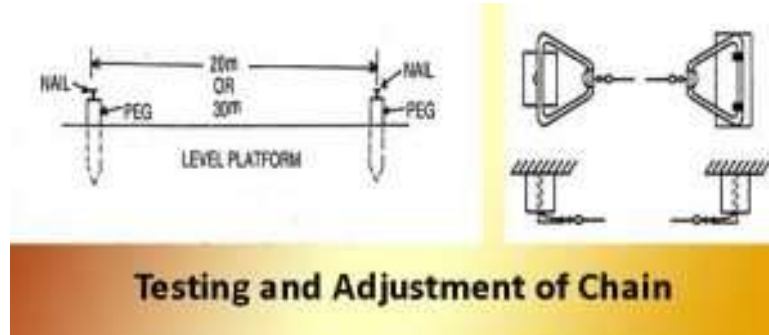
If chain is found to be too long it can be adjusted by.....

- By Locking up the joints of the rings if it found to be opened out
- Removing one or more small rings
- Reshaping damaged rings
- Adjusting the links at the end Sample

Again If the chain is found to be too short, it can be adjusted by.....

- Opening the joints of the rings
- Straightening the bent links
- Adjusting the links at the end
- Inserting new rings where necessary

- By replacing one or more small circular rings by bigger ones



Testing and Adjustment of Chain in chain survey

Measuring Tapes used in Chain Survey:

They may be either of steel or linen to measure short lengths. They are generally of 100 ft, 50 ft, 66 ft or 33 ft, and are graduated in feet and inches.

Cloth or linen Tape:

Linen tapes are closely woven linen. This type of tapes is surfaced to resist moisture. They are usually 10 m, 20 m, 25 m and 30 m long and 12 to 15 mm wide. They are normally used for offset measures. These tapes are light and flexible.

Fibre Glass Tape:

These tapes are alike to linen and plastic coated tapes. These are made of glass fibre. They are relatively flexible, strong and nonconductive. These can be used in the proximity of electrical equipment. These tapes do not stretch or shrink due to changes in temperature or moisture or other stress. They are available in length of 20 m, 30m and 50 m length.

Pegs:

These are wooden blocks of conical shape used in fixing stations.



Pegs in chain survey

Arrow:

They are of steel wire 15 inches long pointed at one end, and the other end is looped for a convenience of handling. They are used for making chain length on the ground.

Ranging Rods:

They are about 10 ft. Long, 1.5 inches diameter round or hexagonal wooden poles painted with black and white alternative bands Each band is of one-foot length.

Offset Staff:

They are wooden rods 10 feet long. Each foot is painted black and white alternately. They are used for measuring short lengths.



Optical Square:

It is used to find the foot of the perpendicular from a given object in the field to a given chain line to take the offset. It consists of a wedge-shaped hollow brass box of about 2 inches sides and 1.25 inches depth with a brass handle about 3 inches long fixed at the bottom. Two plane mirrors set at 45 degrees are fixed to the inclined sides of the box. There are two slits above these mirrors.

In using it, a ranging rod is held at an object for which an offset is to be taken. A man is holding the optical square in his right-hand stands on the chain line. He looks towards the front ranging rod on the chain line with the open face of the optical square towards the ranging rod at the object. Now the man looks through one mirror while the other mirror is turned towards the object. Then he walks along the chain line forwards and backward till he sights the image of the ranging rod at the object in the mirror and the front ranging rod in the slit in the same line. The position of the man on the chain line gives the exact point at which the perpendicular from the object meets the chain line.

Procedure of Chain surveying:

The entire operation of chain survey can be divided into three major groups namely, field work, keeping of records in the field book and plotting of data to prepare maps.

Field work in Chain surveying:

It includes reconnaissance. Selection of the station, measurement of lines and taking offsets of different objects in the field.

Reconnaissance:

This is the preliminary survey in which the survey party will examine the plot to be surveyed in order to know as to how the work can be executed in the best possible ways. The party will note all details like roads, buildings, canals, ditches, culverts and the difficulties and obstacles that may arise during the carrying out of the work. The party should locate the suitable points for stations by driving pegs. Sometimes a small triangle or a circle is made around the stations and the pegs are inserted into the centers. The party should then make a rough sketch of the plot showing the possible stations and from there the arrangement of different lines.

It is important to give a north line on the rough sketch and though the sketch is not prepared according to the scale, it should represent the approximate positions of the different things in the plot and hence to be a good guide for further work.

Stations:

These are points on the ground fixed by driving pegs. Every station should be located with respect to three permanent objects i.e. the distances from these objects to the stations should be measured very accurately and recorded in the field book. The advantage of taking this measurement is that if in future the peg at the station is lost, then it can be located again by knowing descriptions and distances of these objects.

The selection of a particular station depends upon the following important considerations:

- The triangle should be a well-defined one, i.e. nearly equilateral triangle.
- Every main station should be visible from the other two
- There should be a minimum number of obstacles in Ranging and chaining
- The chain line should run near the boundary of the plot
- The chain line should be as few as possible
- The chain line should be over an approximately leveled ground
- In the case of chaining along the road, it is always better to run chains on one side of the road to avoid interruptions by vehicles. It is better not to cross the road frequently
- Offsets should not exceed one chain
- Check and tie lines should be provided in sufficient number so that all the main lines, of sets and other details, can be checked thoroughly

Tie lines and check lines:

A tie line is one which connects two points on the two main lines of the triangle. It helps in taking offsets of the objects falling within the triangle and which are too far away from the main line. A checking line is also a tie line which helps in checking the accuracy of the work after plotting in a drawing sheet. A checking line or tie line is never extended beyond the main lines.

Measurement of lines and taking offsets:

In Fig the main station A is located with respect to three permanent objects and a ranging rod is fixed to 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 the chain. The chain should be properly stretched so that there is no sag in it. As the measurement proceeds, offsets are taken on both side's of the line AB and recorded in the field book. In this way, all the lines including tie and check lines are measured and offset taken and recorded in the field book.

Advantages and disadvantages of chain Survey:

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

But 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 a large number of buildings and obstacles because it cannot be divided into well-conditioned triangles. In the case of route surveying. i.e the survey work of a road, irrigation canal, railways, water and sewer lines, tunneling etc, this method is not recommended at all.