

Equipments used in Surveying

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Introduction: Surveying is a technique by which the position, distance and angle between two points can get determined. The determination of position, measurement of distance and angle takes place by different suitable equipments. The person who involved in surveying work is called surveyor. A surveyor must have accuracy in taking measurement and calculation work. They should also have knowledge and skill to operate different types of equipments in field condition.

Different types of surveying equipments are:

MEASURING CHAIN: A chain is made up of numbers of links which is combined together. Chain is made up of either iron or steel. Steel chains have accuracy and durability but it is more expensive. There are different types of chains are:-

1. Metric chain
2. Engineer's chain
3. Günter's chain or Surveyor's chain
4. Band chain
5. Revenue chain

1. Metric chain: - It is made up of galvanized iron or steel material having lengths 20 meter and 30 meter. It have 100 to 150 links because each link of metric chain having length 20 cm. In this chain tags and brass ring also get attached. A tag is fixed at every five meter length and small brass ring attached at every one meter length except where tag is fixed. The distance measured with metric chain is recorded in feet.

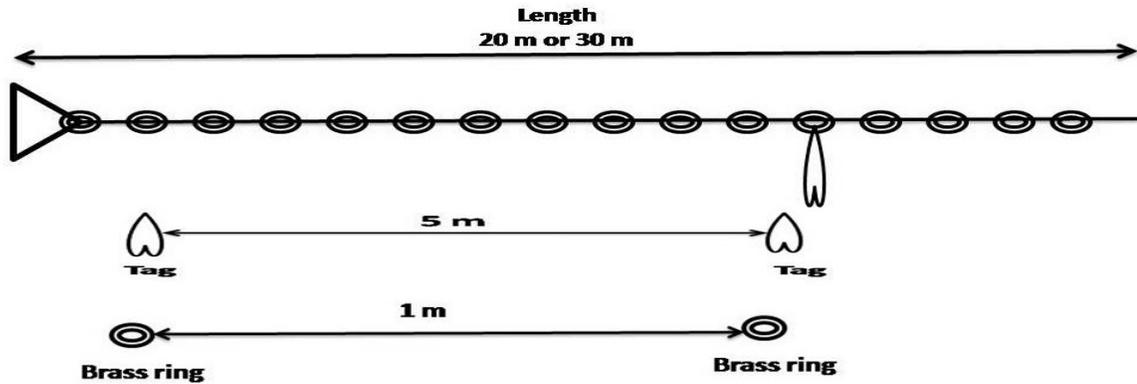


Fig. Metric Chain

2. Engineer's Chain: - The engineer's chain is made up of galvanized iron or steel material. It has total length of 100 feet where 100 links attached together. Each link of this chain having length one foot. The distance measured by engineer's chain is recorded in chains and feet. Every tenth link of this chain is marked with a tag. The tag at 10th link has only one tooth, tag at 20th link has two teeth, at 30th link have three teeth and at 90th link have nine teeth in tag. The tag at centre of the chain has circular shape.

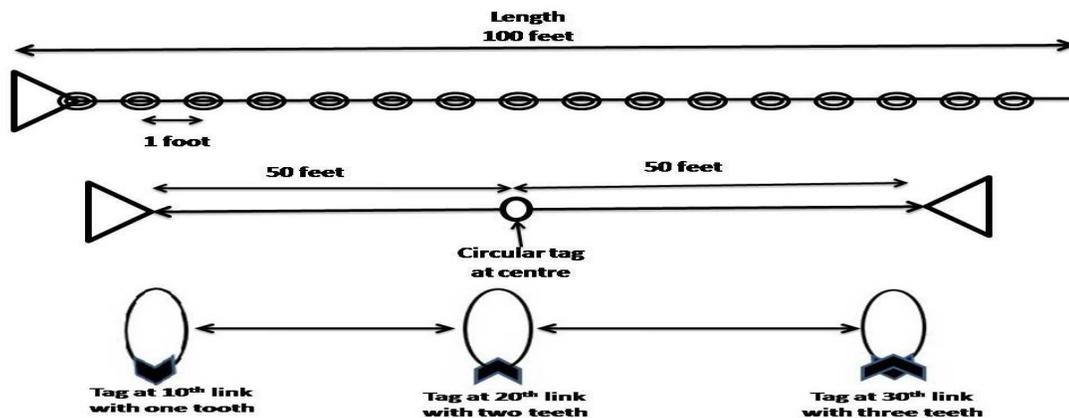


Fig. Engineer's Chain

3. Gunter's chain or Surveyor's Chain: - The Günter's chain was introduced by Edmund Gunter of England. This chain has total length of 66 feet which is divided into 100 links. Each link of this chain has 0.66 feet or 7.92 inch length. This chain is most suitable where FPS system of measurement takes place. By using this chain it is very easy to measure the distance into miles and furlongs.

- 10 Günter's chain = 1 Furlong
- 80 Günter's chain = 1 Mile
- 10 square Günter's chain = 1 acre = 43,560 sq. ft.

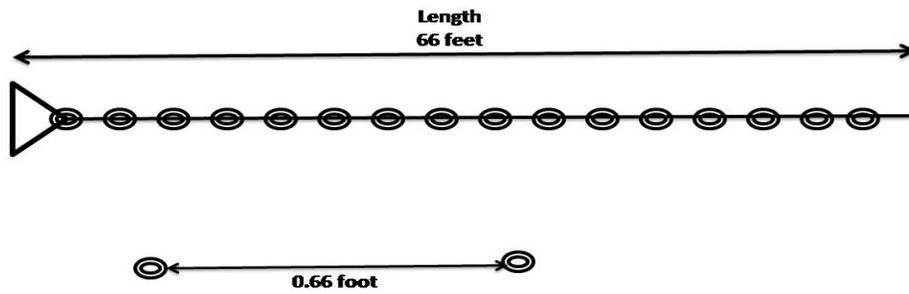
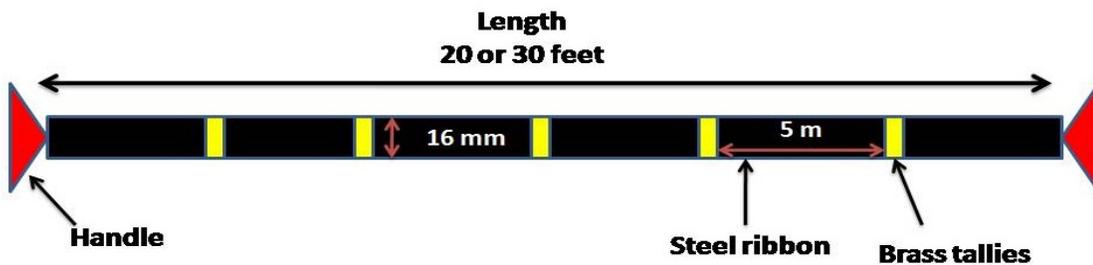


Fig. Günter's Chain

4. Band Chain:- A band chain is consists of ribbon like structure of steel. Handle is made up of brass. This chain has 20 or 30 feet length, 12 or 16 mm wide and 0.3 to 0.6 mm thick. It is rolled over a steel reel in a closed case. In this chain brass tallies are used at every 5 feet length.





5. Revenue chain: - This chain is mainly used during cadastral survey (The survey in which determination of land boundaries and area takes place is called cadastral or land survey). It is 66 feet long and divided into 16 links. Each link is 2.0625 feet long. The links of chain is made up of steel and handle is made up of brass.

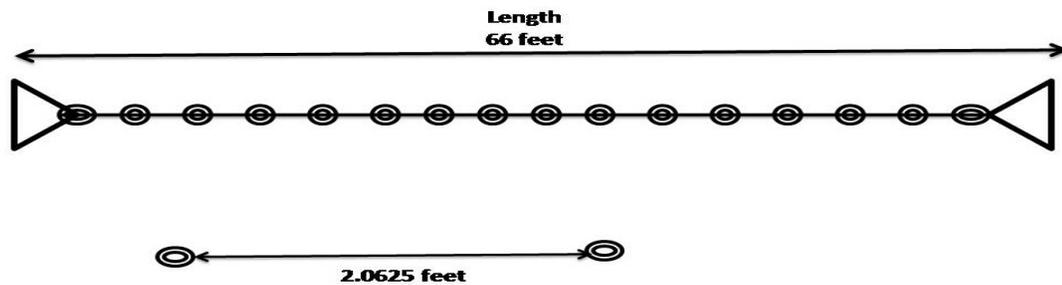


Fig. Revenue Chain

MEASURING TAPE: Tape is an instrument which is used for horizontal measurement of the land area. Due to proper graduation and easy handling tape provide better and accurate result than chain. Tapes are graduated in millimeters, centimeters, feet and meters. It is available in different lengths that are 5 m, 10 m, 15 m, 25 m, 50 m and 100 m. There are four types of tape available:

1. Cloth tape or linen tape
2. Metallic tape
3. Steel tape
4. Invar tape

1. Cloth tape or linen tape: - This tape is consists of varnished strip of woven linen of about 12 to 15 mm wide. This tape is available in the lengths of 10 m, 20 m, and 30 m. The measurement taken by this tape does not provide high degree of accuracy. This tape is packed in circular leather case when it is not in use. The one end of tape has a brass ring whose length is also included in the length of the tape. During use when the tape strip get wet and dirty, it should not be rolled in leather case until it get cleaned and dried. Do not make the continuous exposure to moisture. It requires two people for operation. One person use to hold the leather case and other hold the end of tape tightly. The tape strip should not be loose during measurement otherwise it may give wrong result. It should not be much stretched also otherwise the strength of strip may get reduced.



Fig. cloth tape with leather case

2. Metallic tape:- A strip of water proof linen inter-woven with small brass, copper or bronze wires and does not stretch as easily as a cloth tape. Due to this reason it is used for some accuracy of work. Metallic tapes are made in length of 2, 5, 10, 20, 25, 30 and 50 m.



3. Steel tape: - Steel tapes vary in quality and accuracy of graduation, but even a poor steel tape is generally superior to a cloth or metallic tape for most of the linear measurements that are made in surveying. 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 m.



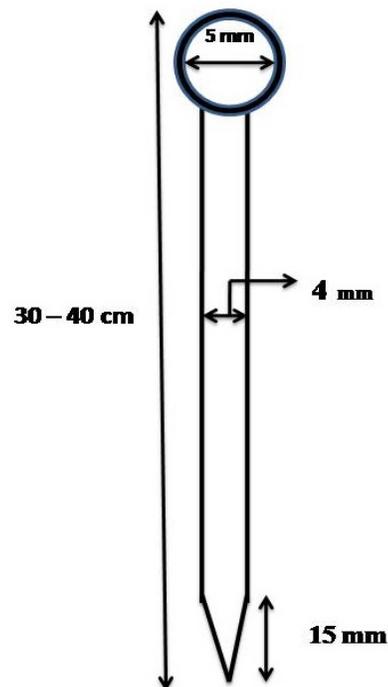
Fig. Metallic tape

4. Invar tape: - Invar tapes are used mainly for linear measurements of a very high degree of precision, such as measurement of base lines. The invar tape is made of alloy of nickel and steel, and has very low co-efficient of thermal expansion. Invar tapes and bands are more expensive. Invar tapes are normally 6 mm wide and are available in lengths of 20, 30 and 100 m.



Fig. Invar tape along with case

ARROW:- Arrow is made up of hard steel wire. It is also called chaining pin. Arrow is used to mark the end of the tape or chain during measurement process. It is pointed at one end to get insert easily into the ground and other end has loop like structure. Generally the length of arrow varies from 30 to 40 cm but in some cases the length may goes up to 45 to 60 cm. The diameter of wire and loop is 4 mm and 5 mm respectively. The length of sharp portion of loop is about 15 mm.



RANGING ROD: - Ranging rod is also known as flag sometimes because when we observe the ranging rod from more distance we use to fasten a flag on the top portion of the rod. Ranging rod is used to mark the point which must be seen from somehow more distance. The length of the ranging rod is either 2m or 3m. They are inserted in bottom with a heavy iron or steel point. Ranging rods are divided into equal parts 0.2m (20 cm) long and they are painted alternately black and white or red and white. When they are at considerable distance, red and white or white and yellow flag about 25 cm square should be fastened at the top.



PLUMB BOB:- A plumb bob is used for locating points directly below or above the other point. Plumb bob is a pointed metal weight which gets suspended by a string/thread. It is made up of brass with replaceable tip which is made up of alloy steel.

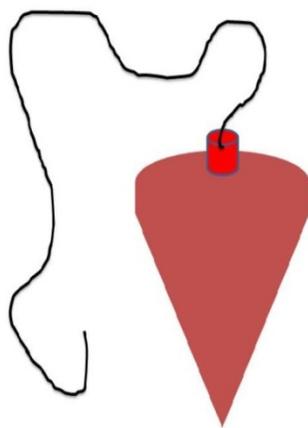


Fig. Plumb bob

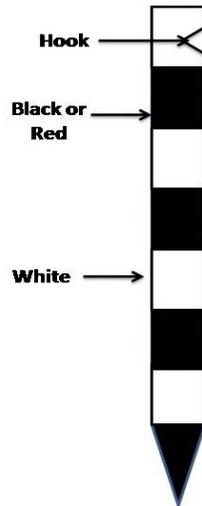
PLANE TABLE:- It is a drawing board which is made up of well seasoned wood. The top surface of table should be plane and smooth. Generally it is constructed in rectangular shape having size 75 cm x 60 cm. During use it gets mounted on tripod which is movable and get clamped. It is used in plane table surveying.



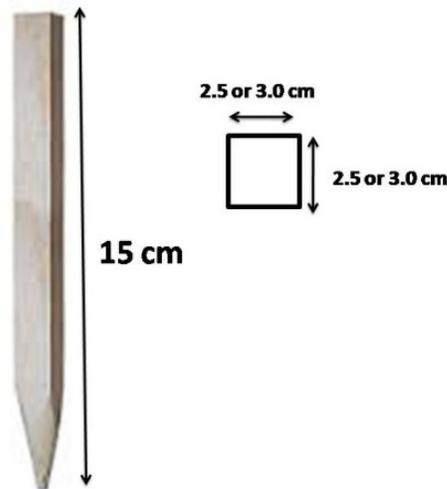
TRIPOD:- A surveyor's tripod is a device used to support any one of a number of surveying instruments, such as Theodolite, total stations, levels or transits. It has three legs which is pointed at bottom. A tripod may be made up of wood, steel, brass or aluminum. The top portion of tripod has a plane platform on which surveying equipments can be get installed. Bottom portion of leg have pointed and movable metallic cover to adjust the tripod by maintaining the required level.



OFFSET ROD:- The offset rod is used for measuring the off set of short lengths. It is similar to a ranging rod and is usually of 3m lengths. Instead of flag of ranging rod here a hook gets used.



PEGS:- These are rods made from hard timber and tapered at one end, generally 25mm or 30mm square and 150mm long wooden pegs are used to mark the position of the station on the ground.



CROSS STAFF: - A cross staff is a mechanical device used to measure the angle between two objects. Historically, the cross staff was famously used in navigation to help sailors orient themselves, and it was also used by astronomers studying the sky, and by surveyors who wanted to be able to take accurate measurements. This device appears to have been invented first by the Chinese, with Europeans beginning to use it around the 14th century; like many devices, it was probably

invented independently in several different locations, which means that several people and nations probably deserve the credit.

Also known as a Jacob's Staff, the cross staff consists of a long pole with a series of markings, and a sliding bar known as a transom or transversal which is mounted at a perpendicular angle. Many staffs have a set of transoms, so that people can select the length which would be more appropriate; this allows the staff itself to be relatively short, making it easier and more convenient to use.

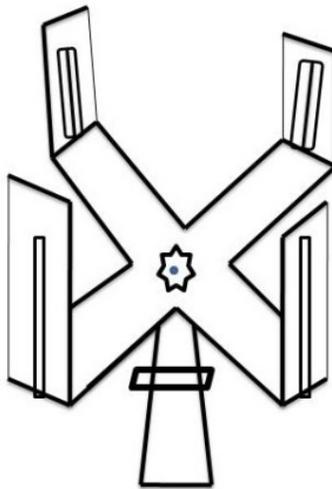


Fig. Cross Staff