CHAIN AND TAPE SURVEY

GELB 109: TOPOGRAPHIC SURVEYING

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Chain and Tape Survey

Introduction

Chain survey is the simplest method of surveying. In this survey only measurements are taken in the field, and the rest work, such as plotting calculation etc. are done in the office. This is most suitable adapted to small plane areas with very few details. If carefully done, it gives quite accurate results. The necessary requirements for field work are chain, tape, ranging rod, arrows and some time cross staff. [1]

Chain Survey Is Suitable In the Following Cases:

1. Area to be surveyed is comparatively small
2. Ground is fairly level
3. Area is open and
4. Details to be filled up are simple and less.[2]

Process of Chain and Tape Survey:

1. **Traverse**
2. **Triangulation**

1. Traverse: Traverse is a method in the field of surveying to establish control networks. Traverse networks involve placing survey stations along a line or path of travel, and then using the previously surveyed points as a base for observing the next point. [3]

When two lines meet together in a cone, the individual lines are called traverse.

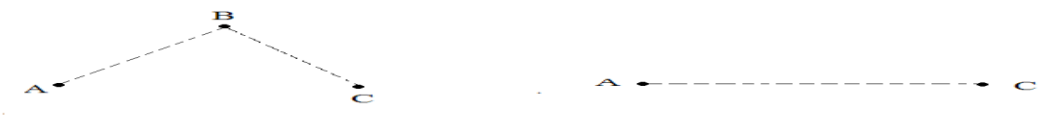

Figure 1: AB and BC is a traverse, because they meet in a cone. But AC is not a traverse because it does not meet in a cone

Types of Traverse:

i. Open Traverse
ii. Closed Traverse

- **Open Traverse**: When we do not return back to the starting point, then it will be an open traverse.
- **Closed Traverse:** When we return back it the starting point. Then it will be a closed traverse. In chain and tape survey closed traverse is usually done in small areas.

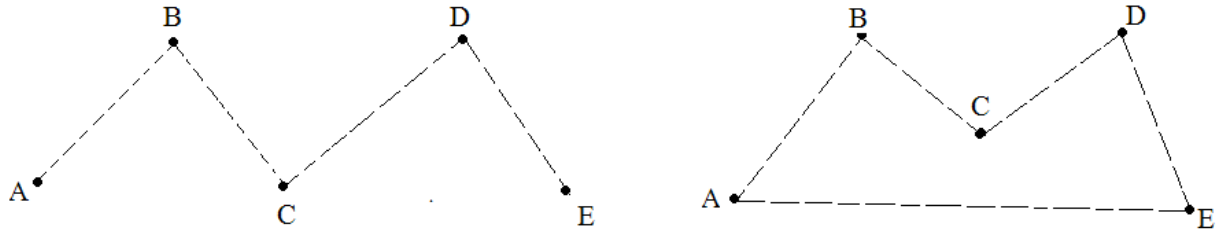

Figure 2: Open and Closed Traverse

2. Triangulation: If surveying is done along BC then it will be used to find out AB and BO. BO will also act as an arm for $\triangle$OAB .It is not a good practice to measure common arm for different triangles, because an error is carried forward cumulatively.

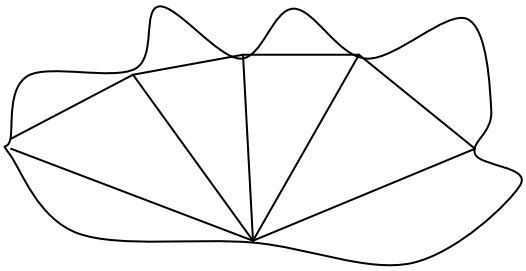

Figure 2: Triangulation

Apparatus needed for chain and tape measurements (Maintain Order):

- **Chain**
- **Metallic tape**
- **Trough compass**
- **Ranging rod**
- **Arrow**

1) Chain:

There are a 20-metre and a 30-metre long chain. Besides these chains, there are a 100-foot long chain also called Engineer's chain and a 66-foot long chain called Gunter's chain.

Gunter 's Chain:

Gunter's chain was designed and introduced in 1620 by English clergyman and mathematician Edmund Gunter (1581–1626) long before the development of the theodolite and other more sophisticated equipment, enabling plots of land to be accurately surveyed and plotted, for legal and commercial purposes. The chain is divided into 100 links, marked off into groups of 10 by brass rings which simplify intermediate measurement. Each link is 7.92 inches long, with 10 links making slightly less than 6 feet 8 inches. The full length of the chain is 66 feet.

Gunter's chain reconciled two seemingly incompatible systems: the traditional English land measurements, based on the number 4, and the newly introduced system of decimals based on the number 10. Since an acre measured 10 square chains in Gunter's system, the entire process of land measurement could be computed in decimalized chains and links, and then converted to acres by dividing the results by 10.[4]

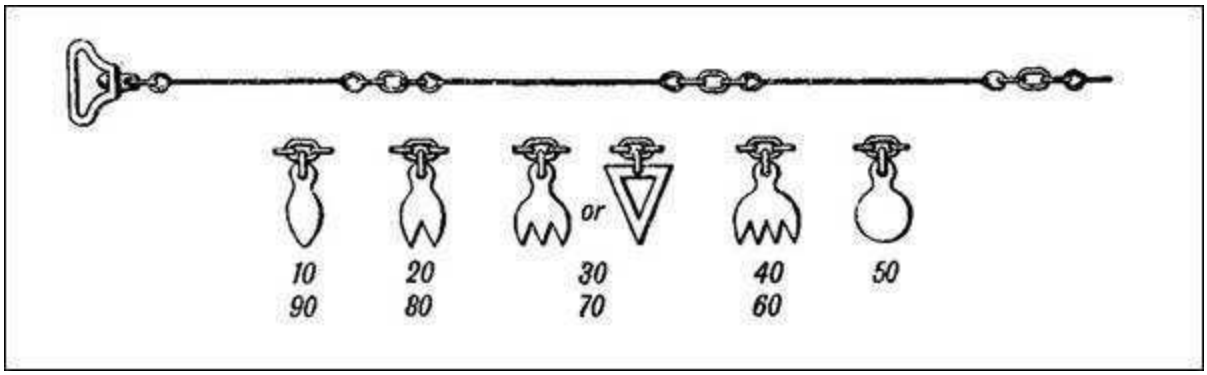

Figure 3: Gunter's Chain

Engineer's Chain:

It is 100 ft long and it is divided into 100 links. Each link is 1 ft in a length. Used in all Engineering surveys. [5]

Chain	Length of a link	No. links
20-metre	20 cm	100
30-metre	20 cm	150
100-foot (Engineer's)	1 foot	100
66-foot (Gunter's)	0.66 foot	100

In the case of Engineer's chain or Gunter's chain from either of the two ends, a tally having one tooth is attached to the chain after the first 10 links, a tally having two teeth after the first 20 links, a tally having three teeth after 30 links, a tally having four teeth after the 40 links and a tally having circular shape after the first 50 links. It should be noted here that the first, second, third, fourth and tally from either end of these chains indicate 10, 20, 30, 40 and 50 links respectively. [6]

2) Metallic Tape:

A metallic tape is made of high-grade synthetic material with strong metallic. Strands (bronze-brass- copper wire) woven in the warped face of the tape and coated with a tough plastic for

durability. Standard lengths are 50 and 100 ft. Some are graduated in feet and inches to the nearest one-fourth in. Others are graduated in feet and decimals of a foot to the nearest 0.05 ft. Metallic tapes are generally used for rough measurements, such as cross-sectional work, road-work slope staking, side shots in topographic surveys, and many others in the same category. Nonmetallic tapes woven from synthetic yarn, such as nylon, and coated with plastic are available; some surveyors prefer to use tapes of this type. Nonmetallic tapes are of special value to power and utility field personnel, especially when they are working in the vicinity of high-voltage circuits. [7]

3) Trough Compass:

It is a rectangular box covered with a glass top and having a magnetic needle well-balanced on a steel pivot fixed in the centre of the bottom of the box. Its size is 15*3*2 cm. near either end of the box there is a scale. The trough compass is used for finding magnetic north direction on the ground. It will be in magnetic north-south direction when the ends of the magnetic needle are opposite the 'zeroes' marked on the scales. The end of the needle near which 'N' is marked points towards the magnetic north. [8]

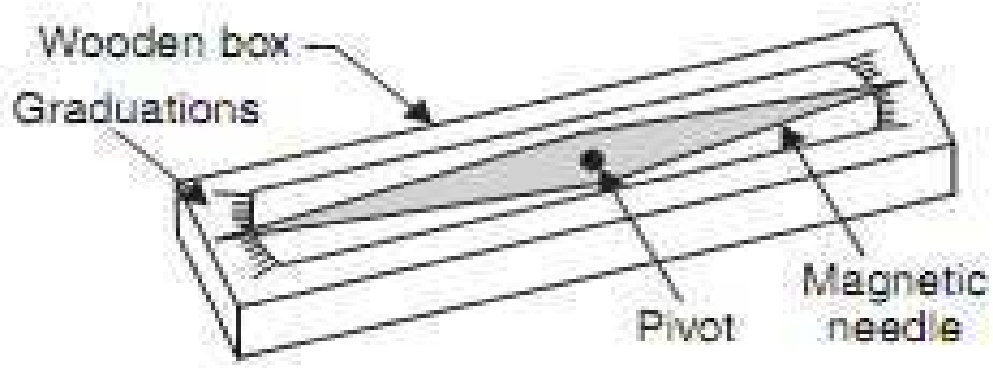

Figure 4: Trough Compass

4) Ranging Rod:

Ranging rods are used to mark areas and to set out straight lines on the field. 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. Ranging rods are straight round stalks, 3 to 4 cm thick and about 2 m long. They are made of wood or metal. Ranging poles can also be home made from strong straight bamboo or tree branches. Ranging poles may never be curved. Ranging rods are usually painted with alternate red-white or black-white bands. If possible, wooden ranging rods are reinforced at the bottom end by metal points.

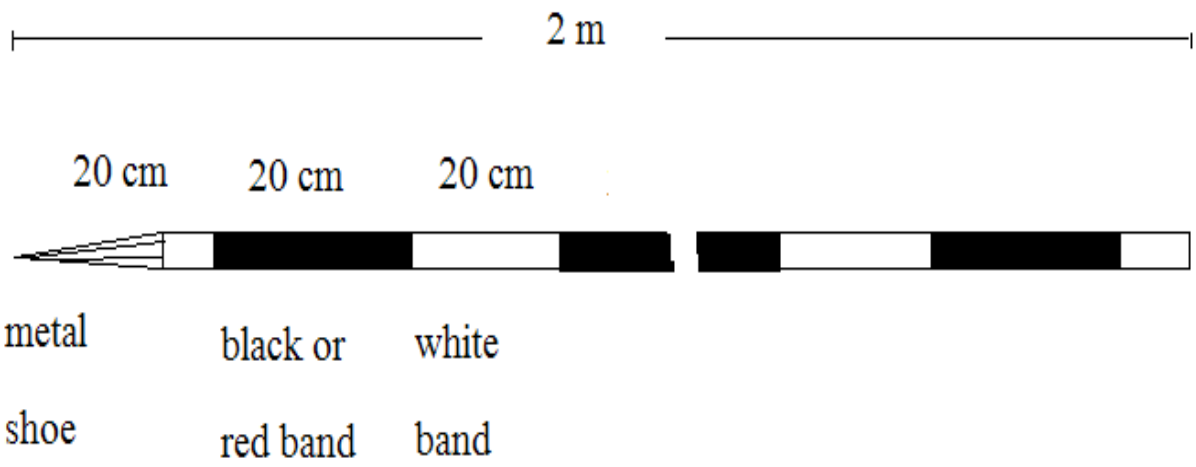

Figure 4: Ranging Rod

5) Arrows:

They are of steel wire 15'' long pointed at one and the other end is looped for convenience of handling. They are used for making chain lengths of the ground.

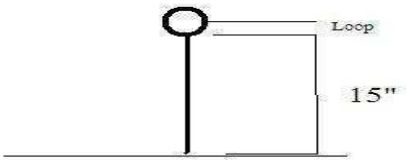

Figure 5: Arrow

Procedure:

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

Field Work:

It includes reconnaissance, selection of 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 known as to how the works can be executed in the best possible ways. The preliminary inspection of the area to be surveyed is called reconnaissance. The surveyor inspects the area to be surveyed, survey or prepares index sketch or key plan.

Stations:

Survey stations are of two kinds

1. Main Stations
2. Subsidiary or tie

Main Stations:

Main stations are the end of the lines, which command the boundaries of the survey, and the lines joining the main stations re called the main survey line or the chain lines.

Subsidiary or The Tie Stations:

Subsidiary or the tie stations are the point selected on the main survey lines, where it is necessary to locate the interior detail such as fences, hedges, building etc.

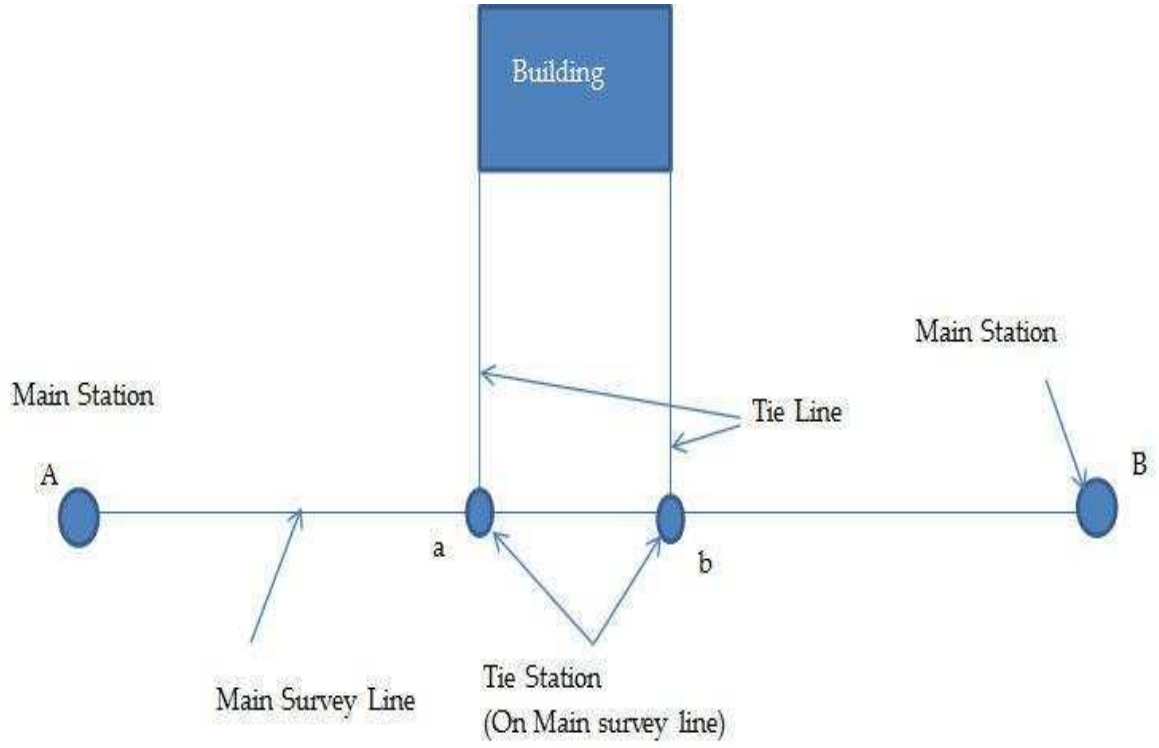

Figure 6: Tie Station and Tie Line

Tie or Subsidiary Lines:

A tie line joints two fixed points on the main survey lines. It helps to checking the accuracy of surveying and to locate the interior details. The position of each tie line should be close to some features, such as paths, building etc.

Base Lines:

It is main and longest line, which passes approximately through the centre of the field. All the other measurements to show the details of the work are taken with respect of this line.

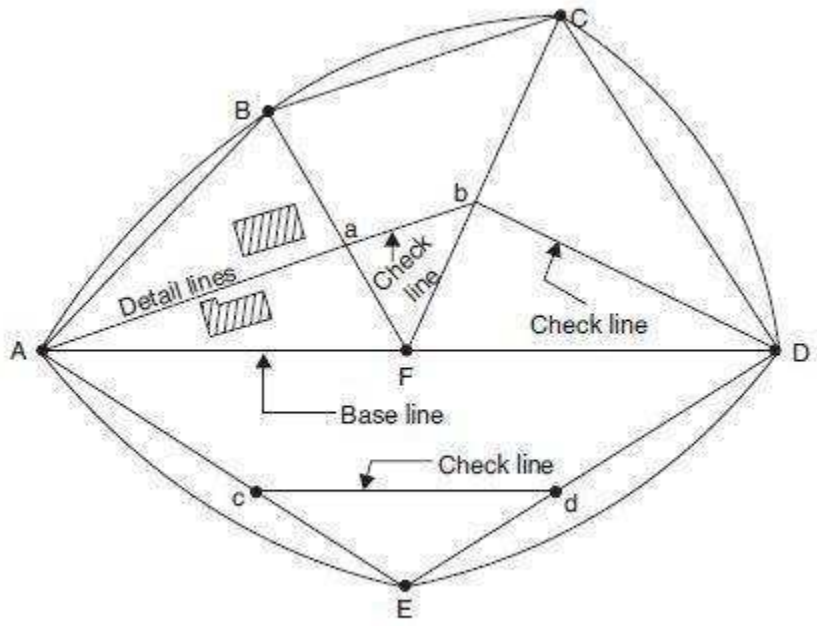

Figure 7: Base Line and Check Line

Check Line:

A check line also termed as a proof line is a line joining the apex of a triangle to some fixed points on any two sides of a triangle. A check line is measured to check the accuracy of the framework. The length of a check line, as measured on the ground should agree with its length on the plan.

Offsets:

These are the lateral measurements from the base line to fix the positions of the different objects of the work with respect to base line. These are generally set at right angle offsets. It can also be drawn with the help of a tape. There are two kinds of offsets:

1) Perpendicular offsets, and
2) Oblique offsets.

The measurements are taken at right angle to the survey line called perpendicular or right angled offsets. The measurements which are not made at right angles to the survey line are called oblique offsets or tie line offsets.

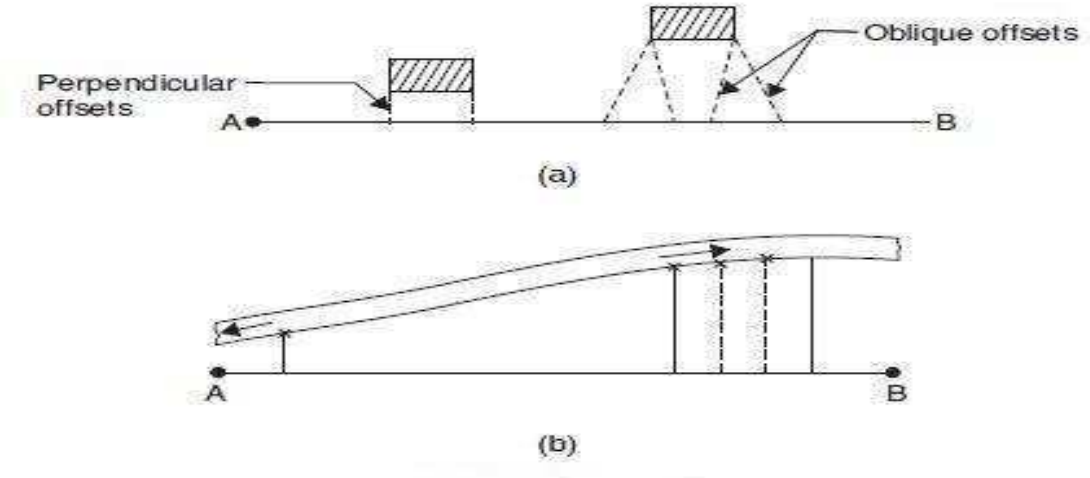

Figure 8: Offsets

Record Keeping:

All the details including a rough sketch of different types of stations, offsets, etc. in the field are records 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 every page. These two parallel lines are imaginary lines representing the chain line and the space in between has no existences 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 drowning before hand on the last page for reference.

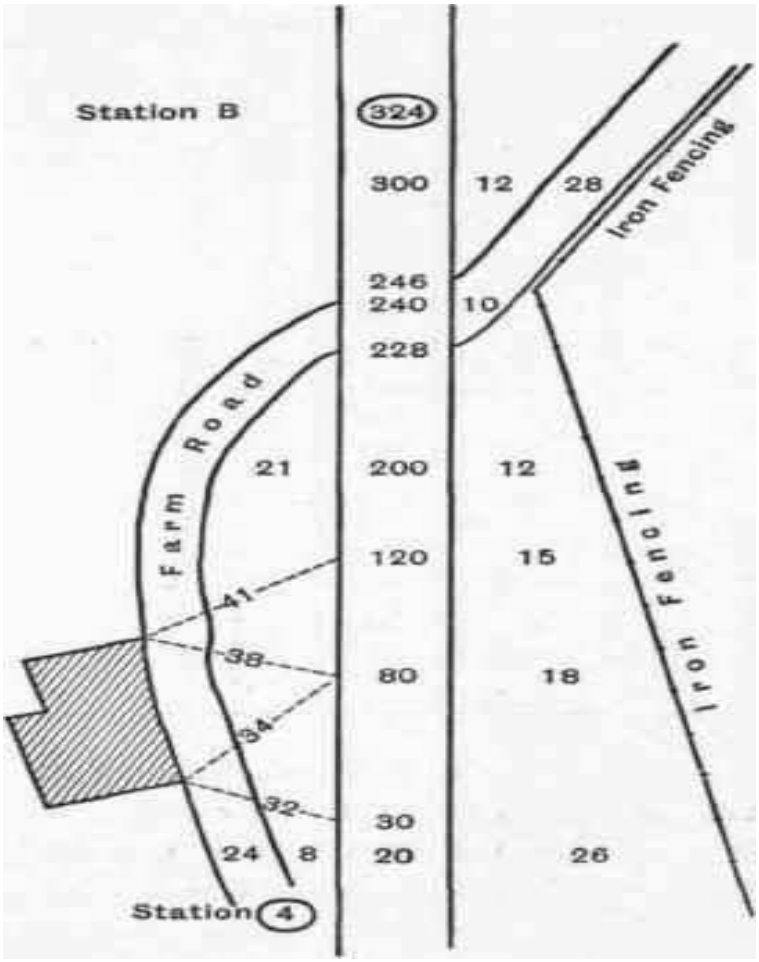

Figure 8: Record Keeping In Field Book

Plotting Of Details:

Before plotting the details of chain survey on a drawing paper a suitable scale should be chosen first. Before drawings are prepared to a reduced scale a scale is the ratio between the actual length on the ground and the corresponding length on the map.

Source of Errors in Chain and a Tape Survey:

Errors in chain and a tape survey may be due to the following reasons:

- A chain may be shorter in length than a standard chain because of bends in the links and shrinkage caused by fall in temperature
- A chain may bee longer in length than a standard chain due to increase in temperature or due to the opening and enlarging of the rings
- The leader not placing the groove of the handle of the chain against the arrows
- Unequal length of the links
- Overlapping of the rings of the chain when measuring distances
- Chain-lines not running in straight-line when measuring distances

Advantages of Surveying by a Chain and Tape:

- It is comparatively simple method of surveying
- The survey can be plotted on any convenient scale
- It is very suitable for small and level area
- Since all measurements are actually made a chain and tape, surveying by this method is more accurate than by a plane table or a prismatic compass. This is why considered an appropriate method of surveying for large scale maps showing an appropriate method of surveying for large maps as maps showing the property owned by farmers

Disadvantages of Surveying by a Chain and a Tape:

- It is time consuming and slow
- Plotting is tedious and takes long time
- It is not used for surveying a wooded area due to the fact that it is difficult to divide such an area onto triangles
- It is not found suitable for a large and uneven area

References

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