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Introduction to Surveying

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Structure of Talk

- Introduction to Surveying
- Objective of surveying
- Usages of surveying
- Classification of surveying
- Unit Measurement
- Principles of surveying



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▶ SURVEYING

Surveying is the art of determining the relative positions of different objects on the surface of the earth by measuring the horizontal distance between them. **It is related only in horizontal plane.**

▶ LEVELLING

Levelling is art of determining the relative vertical distances of different points on the surface of the earth. **It is related only in vertical plane.**



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The work of the surveyor consists of 5 phases:

1. Decision Making – selecting method, equipment and final point locations.
2. Fieldwork & Data Collection – making measurements and recording data in the field.
3. Computing & Data Processing – preparing calculations based upon the recorded data to determine locations in a useable form.
4. Mapping or Data Representation – plotting data to produce a map, plot, or chart in the proper form.
5. Stakeout – locating and establishing monuments or stakes in the proper locations in the field.



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▶ **Object of surveying**

1. The main object of surveying is to prepare a map or plan to show the relative positions of the objects on the surface of the earth.
2. To determining the boundaries of land.
3. It is very useful for the purpose of designing projects, such as dams, canals, roads, railways etc.
4. The successful completion of any engineering project mainly depends upon the accurate surveying.



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- **Uses of surveying**
1. It is useful for measurement of areas.
 2. To prepare different types of maps such as topographical map, cadastral map, engineering map, military map, contour map, geological map etc.
 3. It is very useful for the purpose of designing projects, such as dams, canals, roads, railways etc.
 4. It is used for making of plans in connection with legal documents.
 5. In case of dispute of property, certain plans may be used as a legal documents.



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Types of Surveying

Classification



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A. Primary Classification or Primary Division :

1. Plane surveying
2. Geodetic surveying



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1. Plane Surveying

➤ The shape of the earth is spherical. Thus the surface is obviously curved. But in plane surveying the curvature of earth is not taken into account. This is because plane surveying is carried out over a small area, so the surface of the earth is considered as a plane. The degree of accuracy required in this type of surveying is completely low. Plane surveying is done on an area of less than 250 sq.km.



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2. Geodetic surveying

➤ In geodetic surveying the curvature of the earth is taken into consideration. It is extended over a large area greater than 250 sq.km. The line joining any two points considered as a curved line. Very refined methods and instruments are used in this type of surveying. In this method very high precision or accuracy is required.



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B. Secondary Classification

- Survey can be classified on different bases:

1. Based on instrument:

- Chain Survey
- Compass survey
- Plane Table survey
- Theodolite survey
- Tacheometric Survey
- Photographic survey



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2. Based on methods:

- Triangulation Survey
- Traverse Survey



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4. Based on nature of field

- Land Survey
- Marine survey
- Astronomical survey



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Other Types of Surveys:

1. **Photogrammetry** – mapping utilizing data obtained by camera or other sensors carried in airplanes or satellites.
2. **Boundary Surveying** – establishing property corners, boundaries, and areas of land parcels.
3. **Control Surveying** – establish a network of horizontal and vertical monuments that serve as a reference framework for other survey projects.
4. **Engineering Surveying** – providing points and elevations for the building Civil Engineering projects.



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Other Types of Surveys:

5. **Topographic Surveying** – collecting data and preparing maps showing the locations of natural man-made features and elevations of points of the ground for multiple uses.
6. **Route Surveys** – topographic and other surveys for long – narrow projects associated with Civil Engineering projects.
 - Highways, railroads, pipelines, and transmission lines.
7. **Hydrographic Surveying** – mapping of shorelines and the bottom of bodies of water.
 - Also known as bathymetric surveying.



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Measurement of Distance

- Linear measurement is the basis of all surveying and even though angles may be read precisely, the length of at least one line in a tract must be measured to supplement the angles in locating points.
- Old surveys were often measured using a Surveyors Chain. These were literally chains made up of 100 links. Each Chain was 66 feet long. Each link was 0.666 of a foot.



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Units of Measurement

- **Acre** - The (English) acre is a unit of area equal to 43560 square feet, or 10 square chains. A square mile is 640 acres. The Scottish acre is 1.27 English acres.
- **Chain** - Unit of length usually understood to be Gunter's chain, from the heavy metal chain of 100 links that was used by surveyors to measure property bounds.



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Units of Measurement

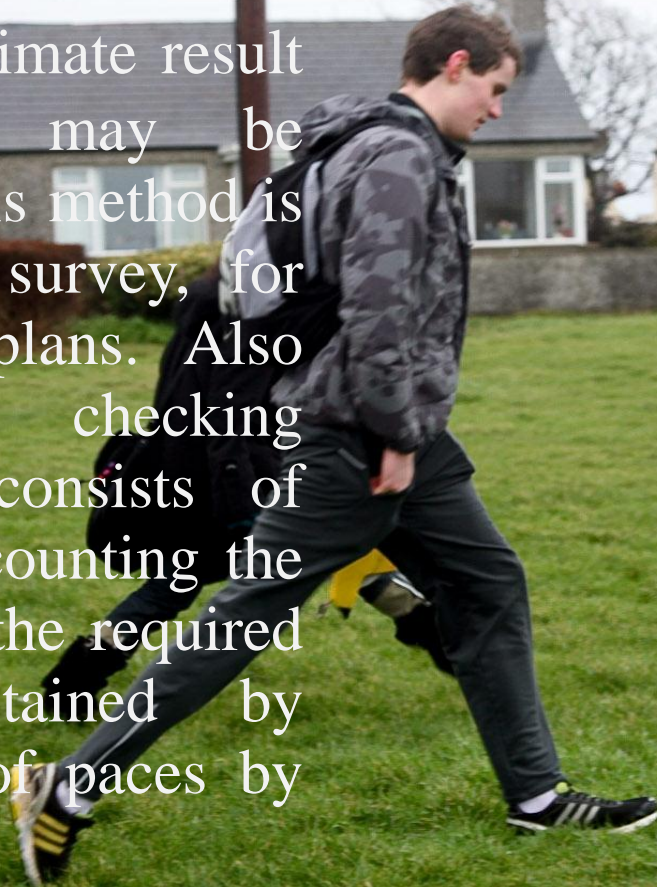
- **Hectare** - Metric unit of area equal to 10,000 square meters, or 2.471 acres.
- **Link** - Unit of length equal to 1/100 chain (7.92 inches).
- **Rood** - Unit of area usually equal to 1/4 acre.
- **Engineer's Chain** - A 100 foot chain containing 100 links of one foot a piece.



Methods of Measuring Distance

Direct Method of Measuring Distance:

1. Pacing: Where approximate result is required, distance may be determined by pacing. This method is used for reconnaissance survey, for preparation of military plans. Also used for approximate checking distance. The method consists of walking over a line and counting the number of paces (80cm) the required distance may be obtained by multiplying the number of paces by the average length of pace.





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Methods of Measuring Distance

- ❖ The length of pace varies with the:
 - Individual, age, height and physical condition
 - The nature of the ground (uphill and down hill)
 - The slope of the country and
 - The speed of pacing



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Methods of Measuring Distance

2. Passometer:

It is a pocket instrument. It automatically records the number of paces. It should be carried vertically, in waistcoat pocket or suspended from a button. The mechanism being operated by motion and strain of the body.





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Methods of Measuring Distance

3. Pedometer:



- It is similar to passometer. But it registers the distance walked by the persons carrying it. The distance is read by means of an indicator. It is fitted with a stud or knob, which when pressed release indicator to zero, it may be carried in the same way as the passometer.



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Methods of Measuring Distance



4. Odometer:

It measures the distance approximately. It can be attached to the wheel of any vehicle, such as carriage, cart bicycle, etc. It registers the number of revolution of the wheel. Knowing the circumference of the wheel, the distance traversed may be obtained by multiplying the number of revolutions. By the circumference of the wheel



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Methods of Measuring Distance

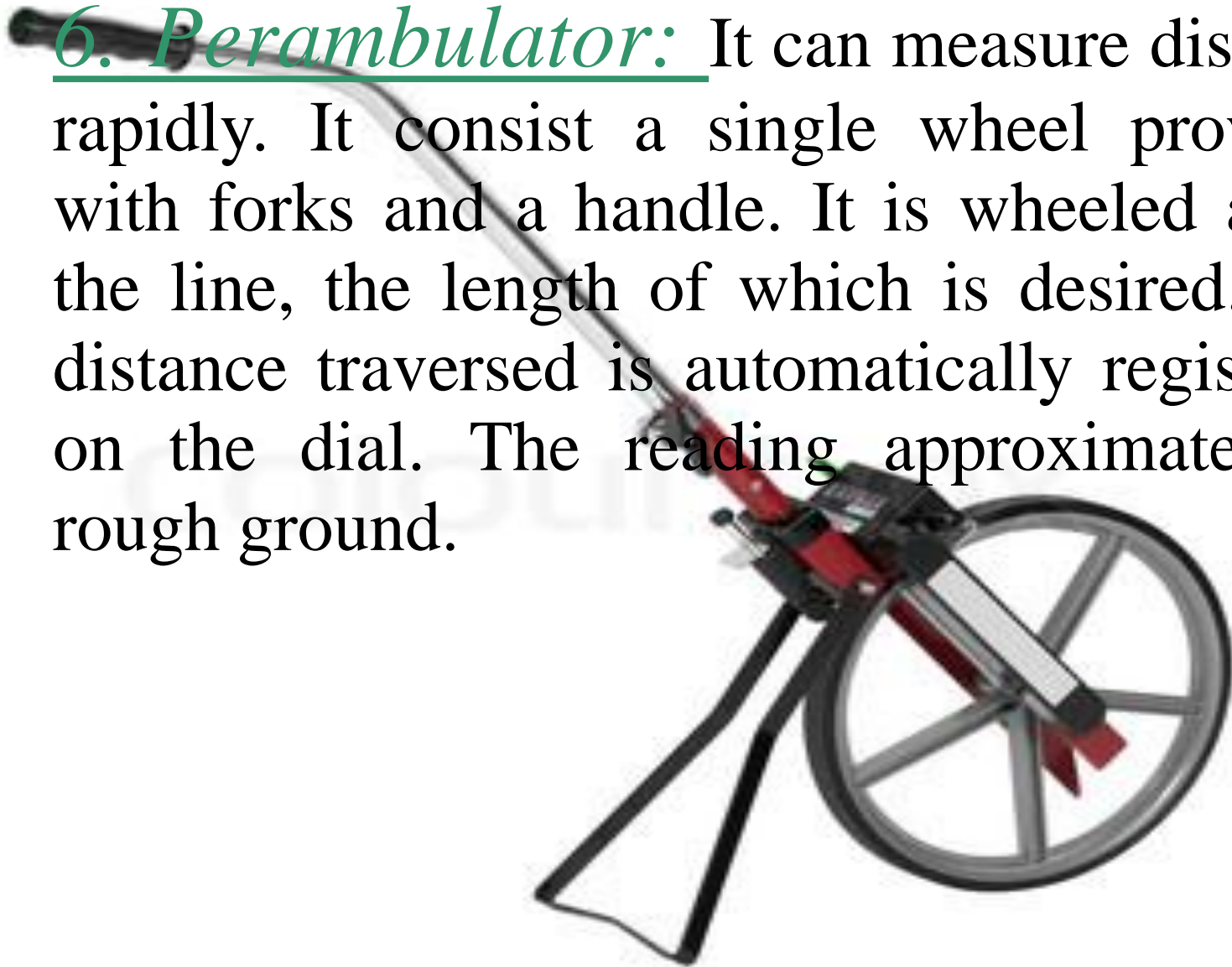
5. Speedometer: The Speedometer of an automobile may be used to measure distances approximately. It gives better results than pacing, provided the route is smooth.





Methods of Measuring Distance

6. Perambulator: It can measure distance rapidly. It consists a single wheel provided with forks and a handle. It is wheeled along the line, the length of which is desired. The distance traversed is automatically registered on the dial. The reading approximates on rough ground.





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Methods of Measuring Distance

7. Judging distance:

This is very rough method of determining distance. It is used reconnaissance survey.

8. Time Measurement:

Distance is roughly determined by time intervals of travel. Knowing the average time per km for a person at walk or a horse, the distance traversed may be easily obtained.



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Methods of Measuring Distance

9. Chaining: Measuring distance with chain or rope is the most accurate and common method, called as chaining. For work of ordinary precision a chain is used. Where great accuracy is required, a steel tape is used.





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▶ Principles of surveying

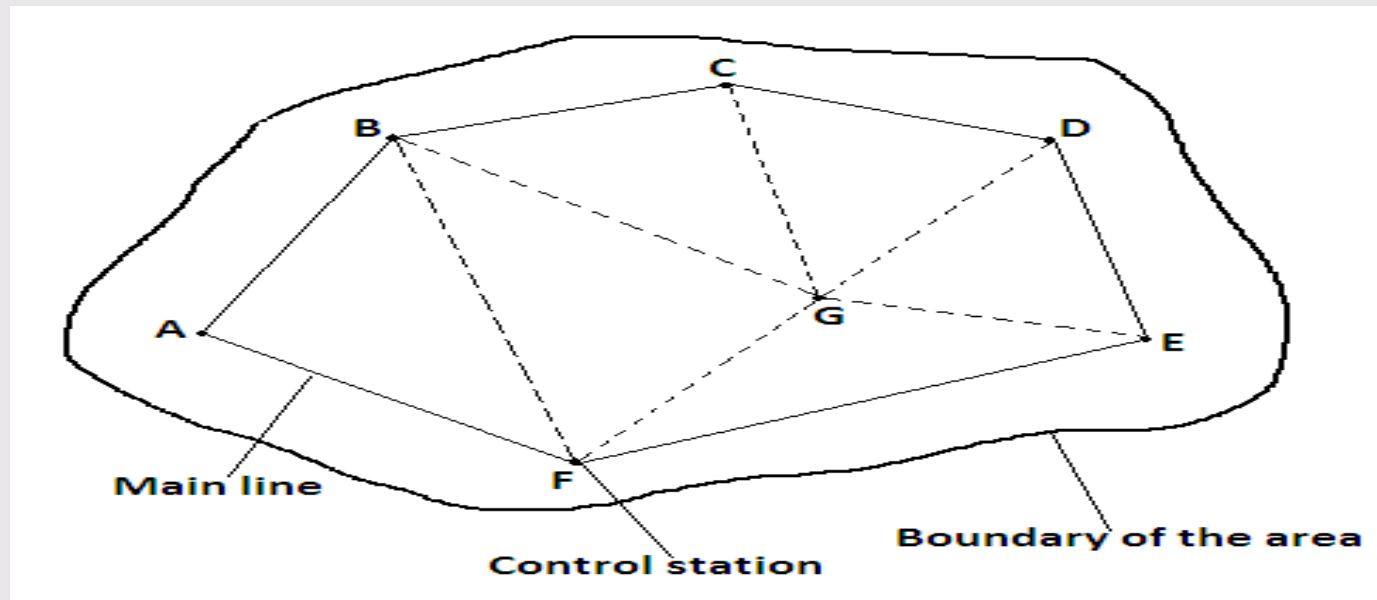
- 1. To work from the whole to the part.**
- 2. To locate a new station by at least two measurement (linear or angular) from fixed reference points.**



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1. To work from the whole to the part.



According to the first principle, the whole area is first enclosed by main stations (controlling stations) and main survey lines (controlling lines). The area is then divided into a number of parts by forming well-conditioned triangles. The main survey lines are measured very accurately with a standard chain and then the sides of triangles are measured.



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1. **To work from the whole to the part.**

The purpose of this process of working is to prevent accumulation of error. During this procedure, if there is any error in the measurement of any side of a triangle, then it will not affect the whole work. The error can always be detected and eliminated.

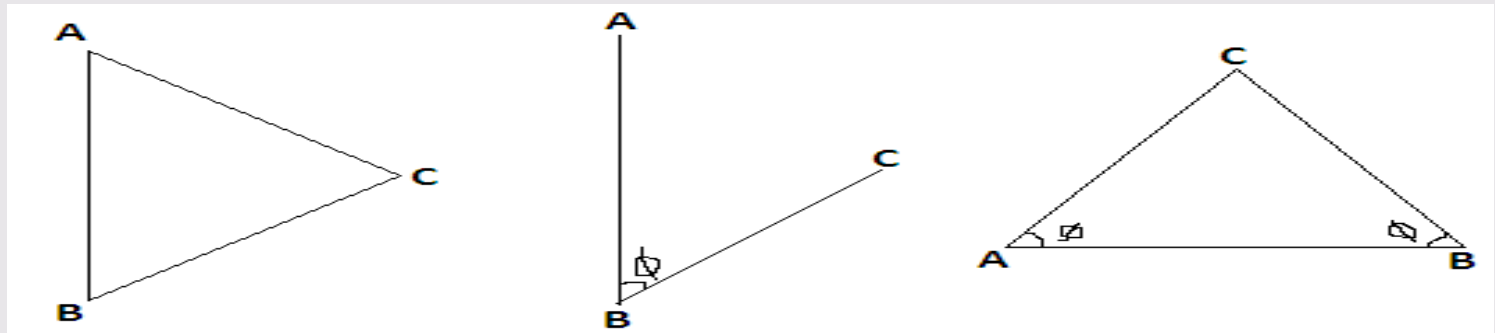
But, if the reverse process (from the part to the whole) is followed, then the minor error in measurement will be magnified in the process of expansion and these errors will become absolutely uncontrollable.



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2. To locate a new station by at least two measurement (linear or angular) from fixed reference points.



According to the second principle, the new stations should always be fixed by at least two measurement from fixed reference points. Linear measurements refer to horizontal distances measured by chain or tape. Angular measurements refer to the magnetic bearing or horizontal angle taken by a prismatic compass or theodolite.



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► **Classification of surveying**

A) Primary classification

1. Plane surveying, 2. Geodetic surveying.

B) Secondary classification

1. Based on instruments
 - a) Chain surveying, b) Compass surveying, c) Plane table surveying, d) Theodolite surveying, e) Tacheometric surveying, f) Photographic surveying
2. Based on methods
 - a) Triangulation surveying, b) Traverse surveying
3. Based on object
 - a) Geological surveying, b) Mine surveying, c) Archaeological surveying, d) Military surveying



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Classification of surveying

4) Based on nature of field

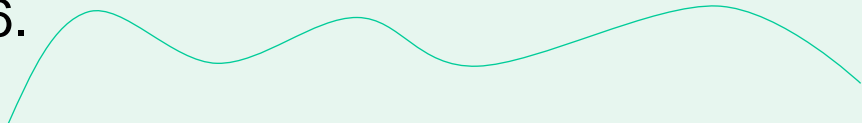
a) Land surveying, b) Marine surveying, c) Astronomical surveying,

Land surveying divided into following classes

- i) Topographical surveying :- to determine the natural and artificial features of country such as rivers, lakes, hills, roads, railways, towns etc.
- ii) Cadastral surveying :- to determine the boundaries of fields, estates, houses, etc
- iii) City surveying :- to locate the premises, streets, water supply and sanitary system etc.
- iv) Engineering surveying :- to collect data for designing of engineering works such as roads, reservoirs, railways etc.



- **Difference between Plane surveying & Geodetic surveying**

Plane surveying	Geodetic surveying
1. The effect of curvature of earth is not considered.	1. The effect of curvature of earth is considered.
2. The surface of the earth is taken as plane.	2. It involves spherical trigonometry. So it is called trigonometrical survey.
3. The area to be surveyed less than 250 km ²	3. The area to be surveyed more than 250 km ²
4. The degree of accuracy is low.	4. The degree of accuracy is high.
5. Plane surveying is conducted by state agencies like Irrigation department, Railway department.	5. Geodetic surveying is conducted by Survey of India (GTS) department.
6. _____	6. 



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REPRESENTATIVE FRACTION (R.F.)

It is the ratio of plan distance to corresponding ground distance.

In R.F. both the numerator and denominator should be in the same units.

If 10m on the ground represents 1cm on the drawing paper, the scale is 1cm = 10m.

So R.F. = $1\text{cm} / 10 \times 100\text{cm} = 1/ 1000$.



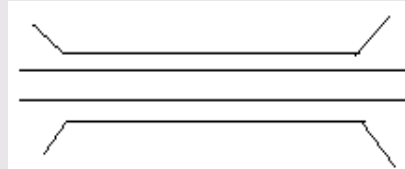
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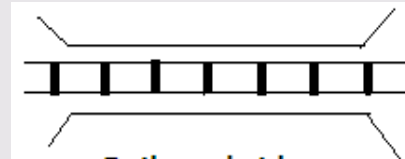
CONVENTIONAL SYMBOL



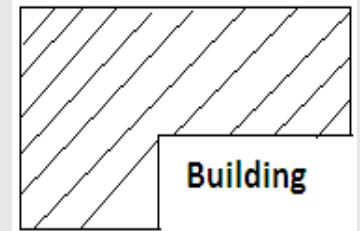
Pond or Lake



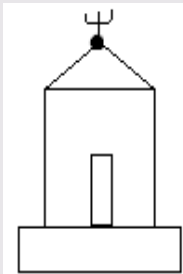
Road bridge or Culvert



Railway bridge



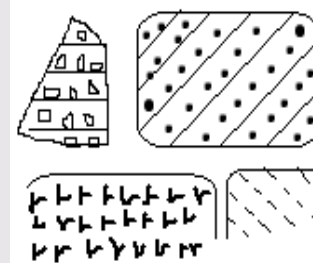
Building



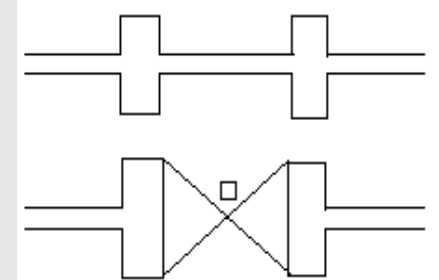
Temple



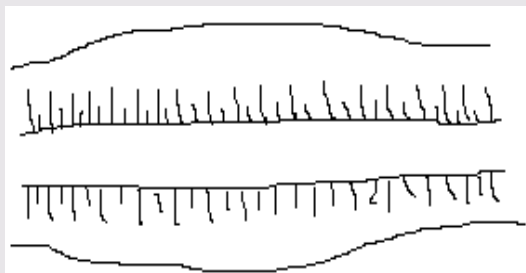
Orchard



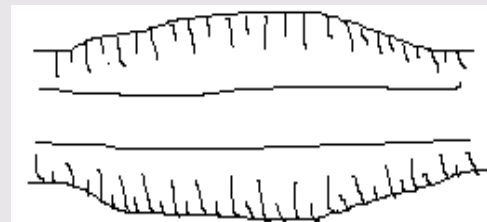
Cultivated land



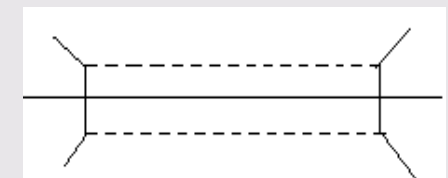
Compound wall



Embankment (Filling)



Excavation (Cutting)



Tunnel

For more detail contact us