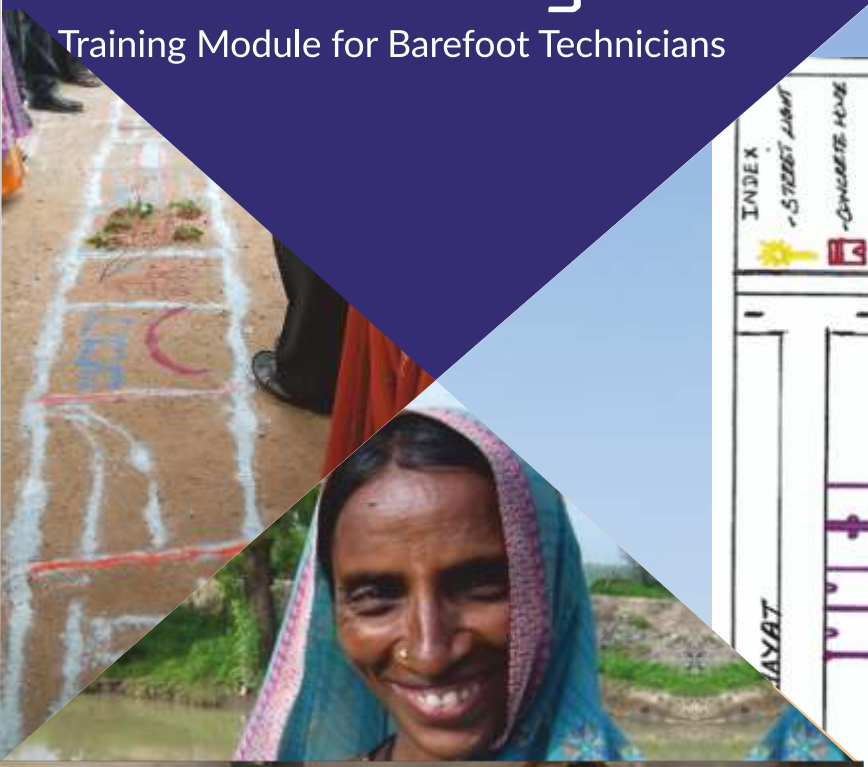
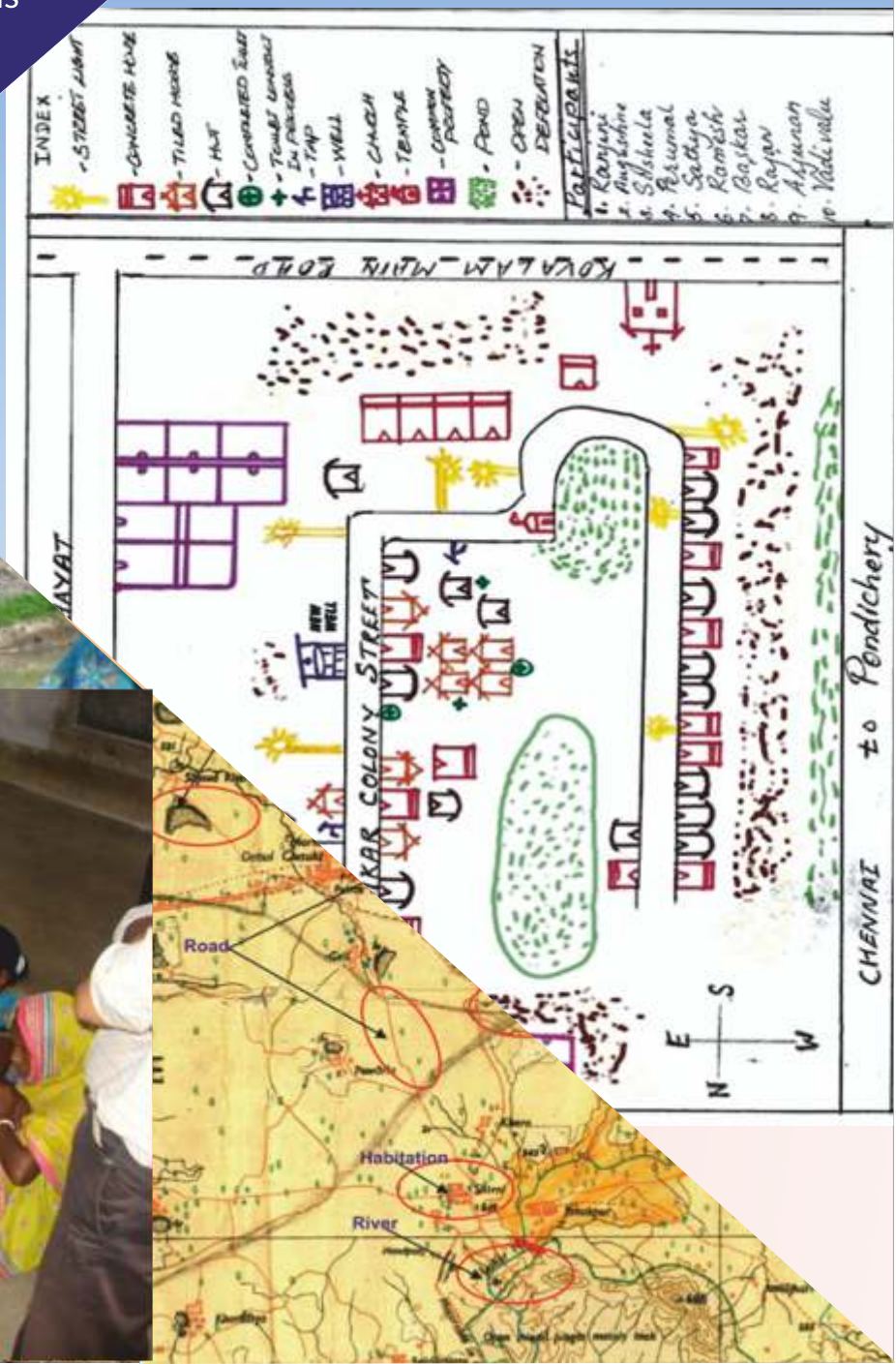
Maps, Sketches and Drawing

Training Module for Barefoot Technicians

Learning Unit 1.2





Learning Unit 1.2

Maps, Sketches and Drawings

Training Module for Barefoot Technicians

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Technical Team

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Purpose of the learning Unit

This specific learning outcome will enable you to read understand and describe different types of Maps, drawing sketches of village profile, simple works and drawing of simple works under MGNREGS.

Planning and implementation of various types of works under MGNREGA require BFT to understand and use different types of Maps like cadastral map, topographic map, resource map, social map etc . Maps would guide BFTs to identify and locate site specific structures. Cadastral and topographic maps are used for watershed planning. BFTs should also be able to draw sketches to capture the situation of the site, which would help in planning and designing of structures.

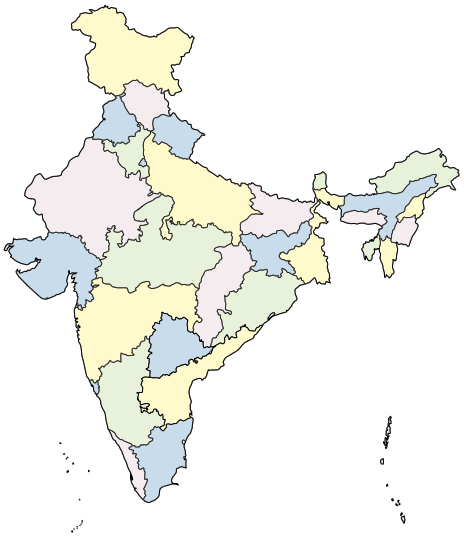


Figure1

By end of this learning unit, BFT will be able to:

1. Read and locate different features like drainage, contour, road, settlements, water bodies etc on the cadastral and topographic maps.
2. Locate specific plot /land on the cadastral map
3. Draw sketches of existing situation of sites
4. Read and understand the simple engineering drawings of works under MGNREGS.

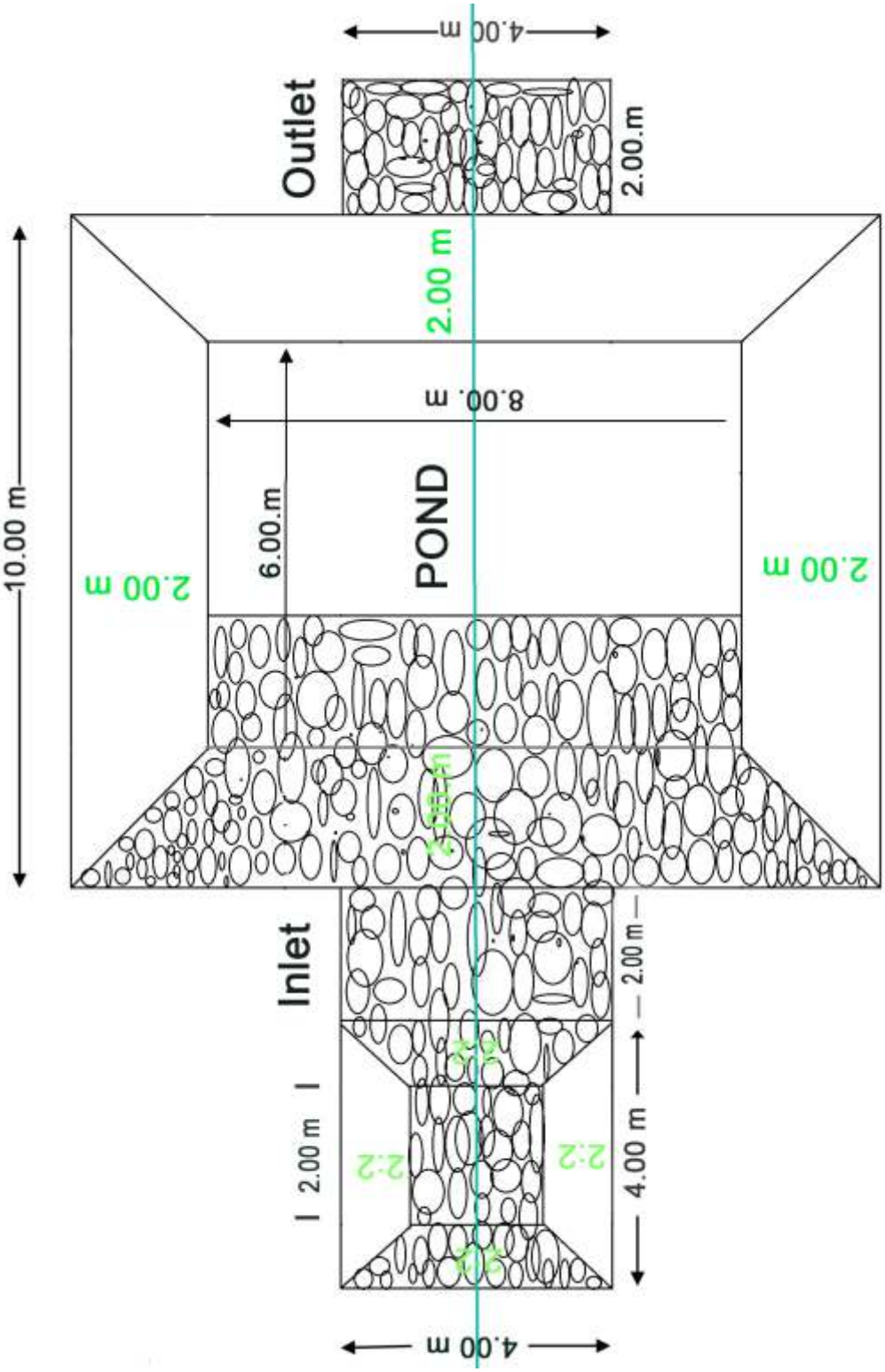
Elements of the learning Unit

This learning unit contains the following learning elements:

Elements 01: What is map and type of maps and their uses?

Element 02: Drawing sketches

Element 03- Basic Drawings- Plan and Cross section of structures



Maps, Sketches and Drawings

Element 1

What is map? Describe types of maps and their use?

Learning Element out come

This specific learning outcome will enable you to understand different types of maps and their utility. Secondly you will be able to read and locate different features like drainage, contour, road, settlements, water bodies etc on the cadastral and topographic maps.

Summary

This learning unit explains definition and objectives of various types of maps. Also it makes BFT to understand how to read the maps with purpose. The details explanation on reading maps especially identifying things like houses, habitation, water bodies, ridges, valleys, roads, forest, fields, contours etc. in a given map. How to draw the sketches to explain details quickly to somebody has also been explained in this learning element.

What is Map?

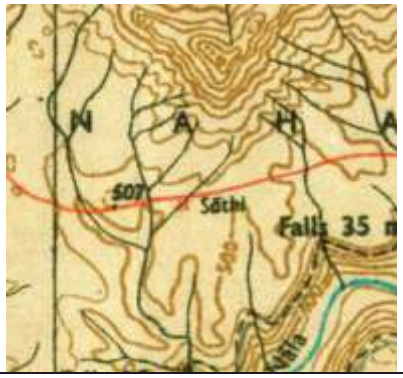
A map is a visual representation of an entire area or a part of an area, typically represented on a flat surface. The purpose of a map is to illustrate specific and detailed features of a particular area, most frequently used to illustrate geography. Depending on the needs, different kinds of maps are prepared like political, physical, topographic, population, climates, natural resources and economic etc. A quality map, in order to ensure proper representation, should consist of three attributes as described below

Figure 2

1. Direction: Direction tells you which way to hold the map. By convention, most maps are made with their top portion directed at North. The North direction is generally indicated by an arrow in the maps as shown in Figure 3.

Figure 3

1. Legend: Legend gives a detailed description of various objects using various signs and Symbols contained in the map. The legends for roads, habitation, drainage line/ stream water bodies etc are shown in the maps in one corner. The different legends used in topographical map are shown in the table below.

Legends or Symbols: Every Toposheet has a list of legends used to depict an feature. Some of the legends are shown below for quicker understanding.	
Contours: The lines shown in brown color are the contour lines. If you follow the contour line you will get the contour value or elevation like 500 means the points are 500mt above Mean Sea Level. *contour lines are imaginary lines joining points on the same elevation*	
Stream or River: The network of lines drawn in black color is drainage lines, means water drains out through these lines. If drainage is bigger or relatively perennial, then it is colored in blue.	
Habitation: Habitations in the villages are shown in Red. The name of village is also mentioned there.	

Water Body: The small water bodies are shown in black color and in round shape. If water body is bigger/ perennial it is shown in blue color.	
Roads: Village Roads are shown in thin red line, and Highways are shown by two parallel lines in red color.	
Hills and ditches: If contours are closed and very much nearer to each other, then it may represent either a hill or valley.	

In addition to above, there are other legends used in different maps.

Figure 4

1. Scale: Distances on a map are smaller than the actual distances on the ground.

Map distance, however, will be in proportion to the actual distance on ground and for any given map this proportion will not vary. The ratio of map distance to ground distance is called the scale of a map.

Scale can be written in three ways:

1. Statement of scale: Example- 1:4,000 will be written as "1 cm on map is equal to 4,000 cms or 40 m on ground". This is how scale is usually shown on village revenue (cadastral) maps in any maps in general.

2. Graphical scale: Here, a straight line is divided into a number of equal parts and each such part represents an actual distance on the ground. To find out the ground distance from the scale, we measure one part of the scale as shown in Figure 5.

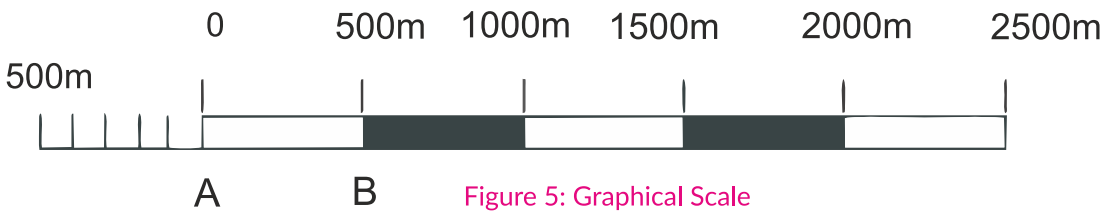


Figure 5: Graphical Scale

Suppose the distance between A and B in the scale above is 1 cm then,

1 cm = 500 m or, 1 cm = 500 × 100 cm = 50, 000 cm

The advantage of a graphical scale is that once it is placed on a map, whenever the map is expanded or reduced, its scale automatically changes.

3. Representative Fraction (RF):

The ratio of map distance to ground distance can also be shown as a fraction: = (Distance on Map/ Distance on Ground).

For example, let us assume that 1 cm on a map represents 2,500 metres on ground. The RF here will be: 1 cm on map = 2, 500 m on ground, or, 1 cm = 2, 500 × 100 cm on ground or, 1 cm on map = 2, 50, 000 cm on ground , Thus, RF = 1 : 2, 50, 000.

The most important maps used for planning and implementation of MGNREGS works are Cadastral Map and Topographic map.

Cadastral Map:

Cadastral map is the village revenue maps maintained by patwaris/TehsildarFigure 6: Cadastral Map (see Figure 6) . These maps are made by Government to collect land revenue. In addition to direction and scale, these maps also have detailed descriptions of boundaries of each plot, habitation, drainage lines, roads, water bodies, types of land etc. These are usually drawn to a very large scale, such as 1:4000 (16 inches = 1 mile). These maps are used to depict information related to watershed development work, like soil type, area calculation, displaying ongoing or planned watershed interventions etc.

Figure 6: Cadastral Map

Topographic maps:

Topographical maps provide information about the lay of the land. These maps are made after conducting detailed topographical surveys using levelling instruments. The special feature of topographical maps (or topo sheets) is that along with direction, scale Toposheetand legend, they also provide

Figure 7: Toposheet

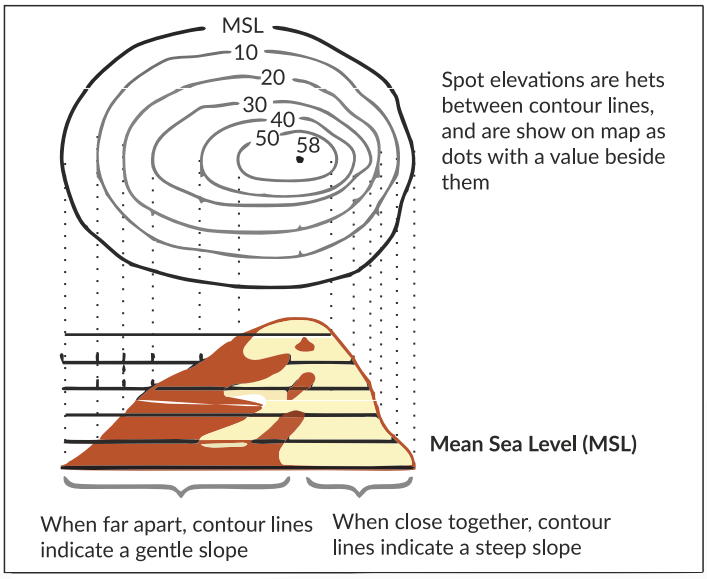
information about the topographical feature of the land using contour lines (contour lines are imaginary lines joining points on the same elevation). Hence, these maps are of extreme value in planning and executing watershed works. The different

features of an area like contours, roads,

hillocks, water bodies, habitation, drainage etc are shown in as shown in Figure 7

What are Contours?

Any point on a flat surface like a table top, will be at the same height from the floor as any other point on the table top. A line drawn through these points can be said to be a contour line. A contour is an imaginary line that joins points of the same height and are used to illustrate topography on a map. It is a line so flat and level, even water could rest on it. Just like some water spilt on the flat surface of a table top would remain on it and not dribble down. When we try to mark points at the same height on actual landscape, like on the side of a hill, these lines follow the curves of the land and look wavy. But they are not. They are at the same level so much so that if one dug a channel along the contour line, a ball would stop on it and not roll off.



Contour Intervals

The difference in elevation between successive contour lines on a given map is fixed. This vertical distance between any two contour lines in a map is called the contour interval (C.I.) of the map. It is usually constant on a given map. It is generally expressed in metres. Index contours are bold or thicker lines that appear at every fifth contour line. Contours are drawn at different vertical intervals (VI), like 20, 50, 100 metres above the mean sea level.

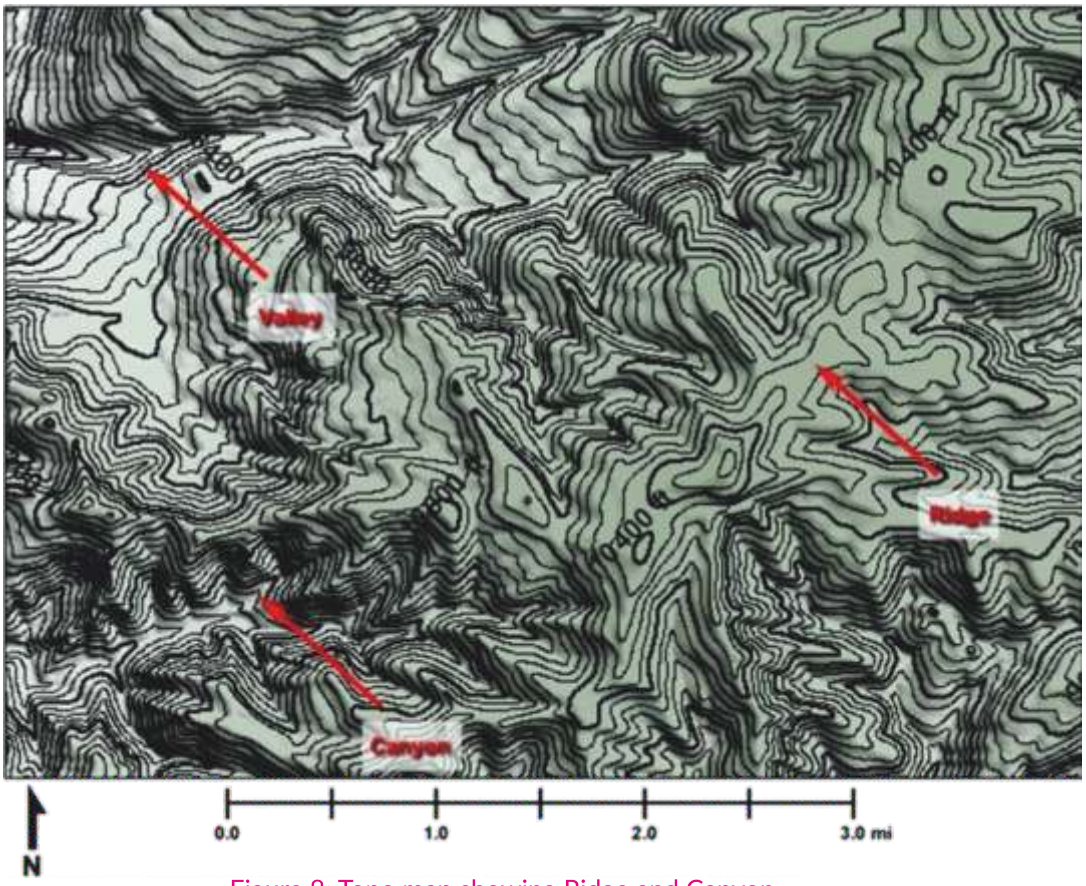


Figure 8: Topo map showing Ridge and Canyon

If the numbers associated with specific contour lines are increasing, the elevation of the terrain is also increasing. If the numbers associated with the contour lines are decreasing, there is a decrease in elevation. As a contour approaches a stream or drainage area, the contour lines turn upstream. They then cross the stream and turn back along the opposite bank of the stream forming a "v". A rounded contour indicates a flatter or wider drainage or spur. Contour lines tend to enclose the smallest areas on ridge tops, which are often narrow or very limited in spatial extent. Sharp contour points indicate pointed ridges.

Example 1 - In the figure 8, what is the vertical distance between the contour lines?

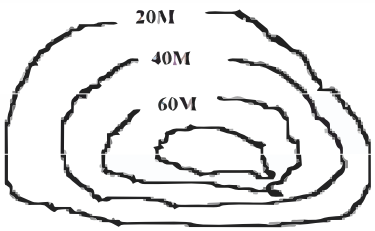


Figure 8: Contours

Pick two contour lines that are next to each other and find the difference in associated numbers. 40 M - 20M = 20 M

The contour lines in this figure are equally spaced. The even spacing indicates the hill has a uniform slope. From the contour map, a profile can be drawn of the terrain.

Example 2 - Draw a profile showing the elevations of the contour.

Note: The intervals are increasing, therefore, the contours indicate a hill. The peak is normally considered to be located at half the interval distance Widely separated contour lines indicate a gentle slope. Contour lines that are very close together indicate a steep slope.

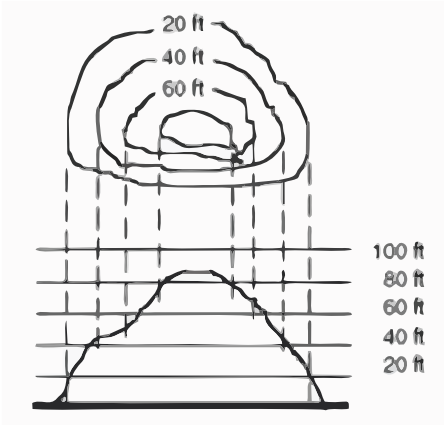


Figure 9: Profile of contour

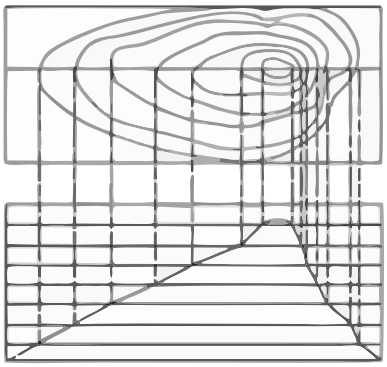


Figure 9.1: Profile of contour

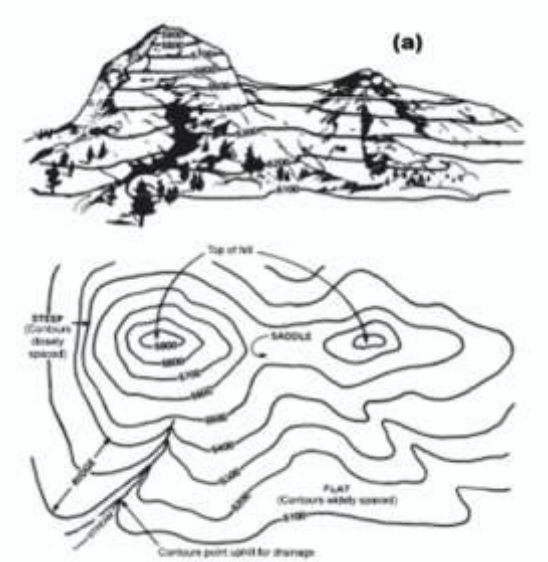


Figure 9.2: Profile of contour

The figure 9.2 illustrates various topographic features. (b) Notice how a mountain saddle, a ridge, a stream, a steep area, and a flat area are shown with contour lines.

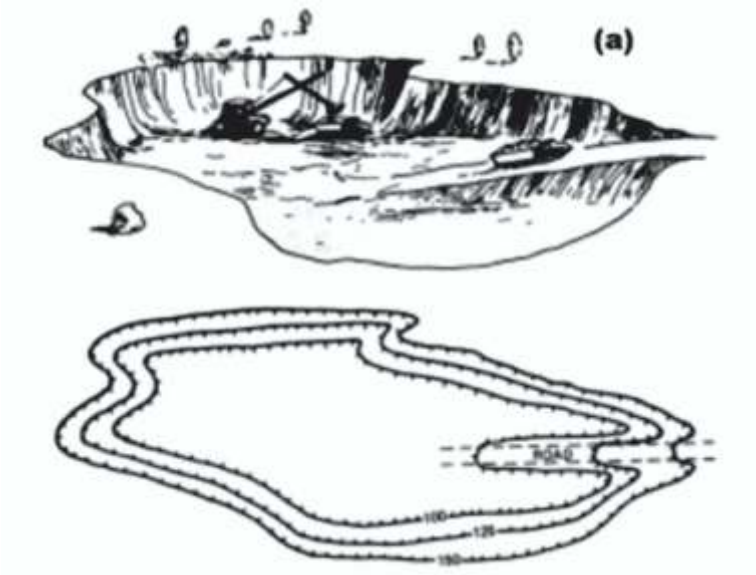


Figure 9.3: Profile of contour

The figure 9.3 illustrates a depression and its representation using contour lines. Notice the tick marks pointing toward lower elevation.

Some basic features of contour lines are

- A contour line is drawn to show places of equal heights.
- Contour lines and their shapes represent the height and slope or gradient of the landform.
- Closely spaced contours represent steep slopes while widely spaced contours represent gentle slope.
- When two or more contour lines merge with each other, they represent features of vertical slopes such as cliffs or waterfalls.
- Two contours of different elevation usually do not cross each other.

Uses of Contours map

A contour map furnishes information regarding the features of the ground, whether it is flat, undulating or mountainous.

- From a contour map , sections may be easily drawn in any direction
- Indivisibility between two ground points plotted on map can be ascertained
- It enables an engineer to approximately select the most economical or suitable site for an engineering project such as a road, a railway, a canal or a pipe line etc.
- A route of a given grade can be traced on the map.
- Catchment area and capacity of a reservoir may be determined from the contour map.
- Contour map may be used to determine the quantities of earth work.

Vertical Intervals, Horizontal Intervals and Slope

The distance between two points in the field can be expressed in two ways:

1. The horizontal interval (HI) and;

2. The vertical interval (VI)

The horizontal interval is the distance straight across as the crow flies, so to speak. For

instance, from one tree to another, from the top of one hill to another, from the road to the house and so on. The vertical distance is straight up. For instance, from the bottom of a well to the top or from the floor to the roof, and so on. But when we look at a hill it is not so simple. There is a slanting distance from the bottom of the hill to the top. This is called a slope. As we walk up a hill a few steps at a time we are gaining height. The point where we started from appears further and

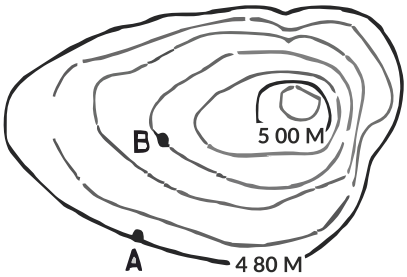
further below. For every few steps forward that we take we also take a few steps up. So we are traveling both horizontally and vertically at the same time. Just like stairs.

Slope Percent from Topographic Map

The horizontal distance between points A and B can be measured with a scaled ruler and used to determine the slope percen.

Slope percent=Vertical Interval Horizontal Interval X 100

Example 3 - What is the slope percent in figure given bellow?



$$\textit{Slope percent} = \frac{\textit{Vertical Interval}}{\textit{Horizontal Interval}} \times 100$$

Scale : 1-50000

For this computation, the rise, or vertical ground distance, and run, or horizontal ground distance, are needed.

Step 1. Measure the horizontal map distance between points A and B to get the vertical ground distance.
The horizontal map distance measures 10cm.

Step 2. Use the appropriate conversion factor to convert the horizontal map distance to horizontal ground distance.
Horizontal Interval=10cmx 50000 = 500000cm=500m

Step 3. Use the slope percent equation and solve.

We know 100cm=1m

Vertical interval between point A and B= 460m-400m=60m

$$\textit{Slope percent} = \frac{\textit{Vertical Interval}}{\textit{Horizontal Interval}} \times 100$$

$$\textit{Slope percent} = \frac{60m}{500m} \times 100 = 12\%$$

Work Book:

1. What are the elements of a map?

- _____

_____

_____

- 2. Which side of a map shows north direction:

  a. Upwards. b. Downwards

  c. Left side d. Right side

- Ans:_____

3. What are the details shown in legend of a topographical map?

_____

_____

_____

4. What do you mean by scale of map?

_____

_____

_____

5. What is the use of cadastral map in the implementation of MGNREGS woks?

_____

_____

_____

6. List the information which can be collected from a topographical map/toposheet

_____

_____

Notes: Class room

Notes: campus / Field Exercise

Element 2
Drawing sketches

Learning Element out come

This specific learning outcome will enable you to draw rough sketches of maps like Resource map, Social Map for planning & to draw existing situation of the site.

Summary

This learning element explains definition and objectives of sketches and sketch maps. Also it makes BFT to understand how to draw sketch maps with purpose.

What is Sketch?

Sketch is the rough drawing, prepared to describe about the situation of the site. The resource map and social maps are actually sketch maps, prepared in watershed programme to describe the existing situation of the village and it is drawn without scale.

Example of how to draw a sketch Map:

One fine morning, we started our journey from a village called Bahalda and moved towards east direction on the village road. While moving on the road, we found a culvert at 1km and then the road took right turn. After 1.5 KM, on the left hand side was a school building where children were playing. There was hand pump in front of the school building, where we drank water and then started our journey again. We found a small hillock on the right hand side of the road at around 2KM (from Bahalda). Then road took left turn and after 2.5Km a small Mango orchard was found. Then the road took us straight to village called Ranraingpur after around 3KM.

Now the process of drawing the above sketch is described below.

1. Take one sheet of paper and mark North direction on the right- top corner of the sheet.
2. On the left- middle of the sheet, draw 5-6 houses in one place and name it Bahalda.
3. Draw two parallel line towards eastern side and draw a culvert at 7cm (approx) and turn the parallel line down side

4. Draw a school building at 11cm (approx) and write school building and then extend parallel lines
5. Draw a hillock on the right had side at around 15cm and turn the parallel lines towards left
6. Draw a mango orchard at around 20cm and then draw the parallel lines till 30cm (approx) and
7. Draw 5-6 houses in one place and name it Rairangpur
8. Mention the distances between features

NB: Sketch is drawn not to scale, but if features are drawn in rough proportionate distance, then it will give a fair idea of the scenario. The Sketch Map is drawn below:

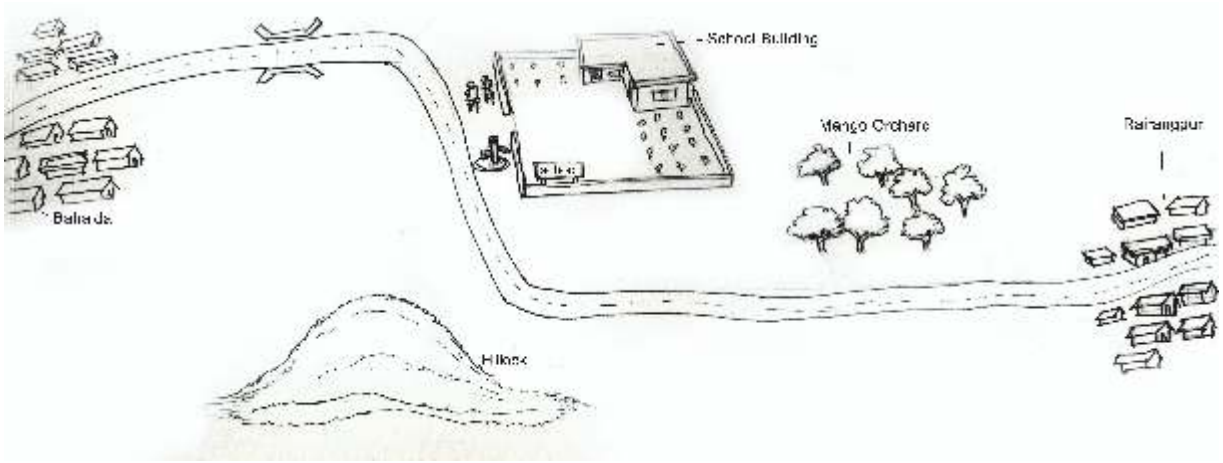


Figure 11 : sketch map

Social and resource Map

Social and Resource Maps are also sketch maps, which are drawn during the participatory exercise in the villages. The brief descriptions about these maps are described below.

Social map is drawn on the floor with active participation of community. It consists of drawing road, settlement pattern, housing, school buildings, dug wells, tube wells, temple/ mosque etc to describe the settlement pattern and socio- economic situation as shown in figure 9. Once the map is completed on the ground, it is transferred on the chart paper or brown sheet for storing and for further use. The figure 09 placed bellow is a social map prepared for a colony.

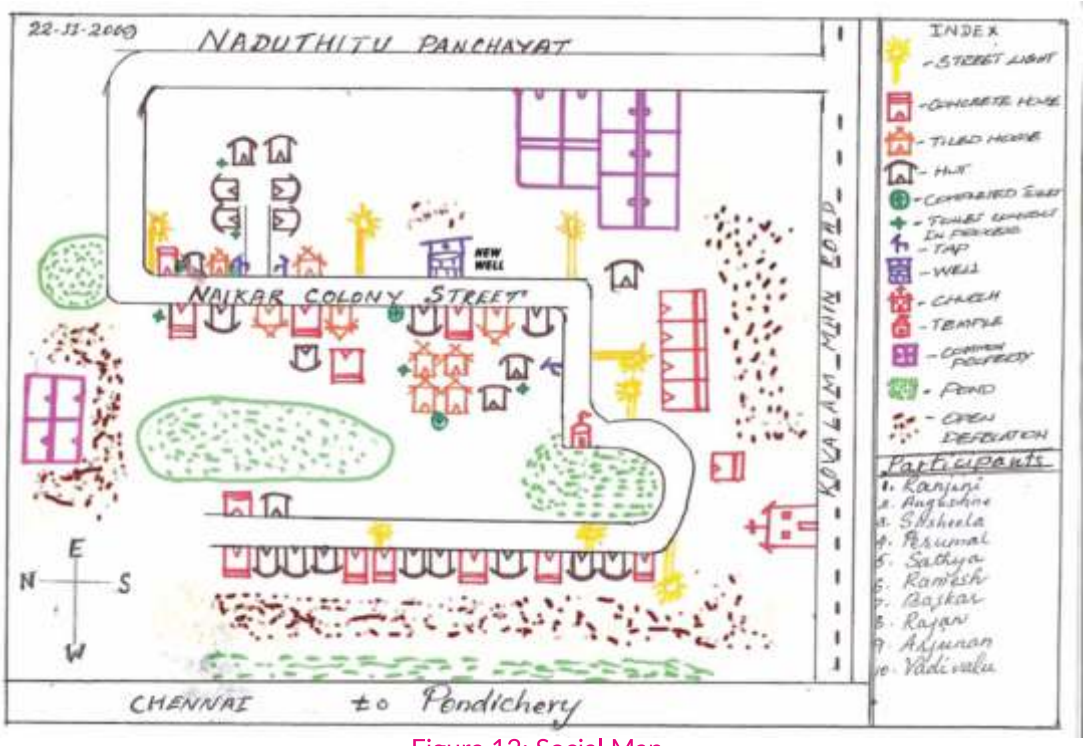


Figure 12: Social Map

Resource map: Resource map is drawn either on the ground or on the cadastral map directly to depict and describe the natural resources like forest, water bodies, different types of land etc. If drawn on ground, then it should be transferred on the chart paper / brown sheet for storing and further use as shown in Figure 10. This map is prepared not to scale. Resource map is also prepared either on ground or on brown sheet or directly on the cadastral map, where the natural resources and infrastructures like dams, wells, roads, habitation etc are colored with different colors. The resource map maintains the scale as that of cadastral map, when it is supper imposed on cadastral map.

Figure 13: Resource Map

Work Book:

1. What is a sketch?

- _____
_

_____

_____

2. Draw a sketch part of the building where your class room is located.

_____

_____

_____

3. What kind of information we can get from a resource map and social map?

_____

_____

_____

4. How useful is resource map and social map in planning and implementation of MGNREGA works.

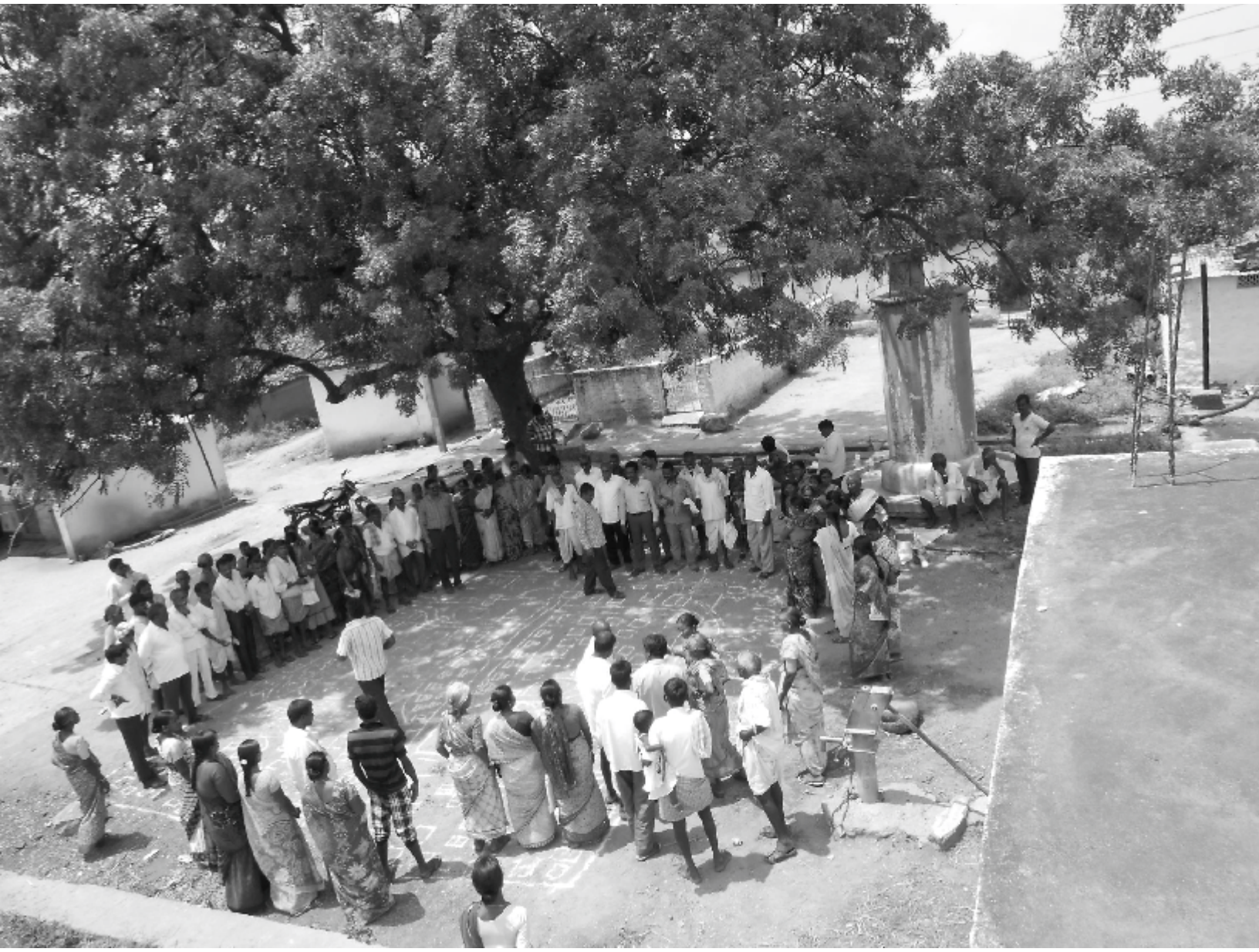
_____

_____

_____

Notes: Class room

Notes :campus / Field Exercise



Element 3

Basic Drawings Cross section, Plan/layout

Learning Element out come

This specific learning outcome will enable you to describe basic engineering drawings of simple works which includes plan & cross section of different structures to be implemented in MGNREGS and also to read and describe different components and materials involved in drawing.

Summary

This learning element explains definition and objectives of various types of drawings of simple engineering works. Also it makes BFT to understand how to read the drawing.

What is Basic Drawing: Plan and Cross Section

The basic engineering drawings like plan and cross sections are drawn to convey the actual shape (geometry), size with units (Dimensions) and various components involved in the structure. Unlike sketches, drawings are prepared with a specific scale with detailing.

Plan of a structure: The drawing plan provides the top view of an object/ structure, drawn on a sheet with scale and specifications. It is two dimensional and describes the actual shape (geometry), size with units (Dimensions) and materials involved in the structure.

The drawing shown below is the plan of a single class room. It helps in giving layout and monitors the proper dimensions while the construction is in progress.

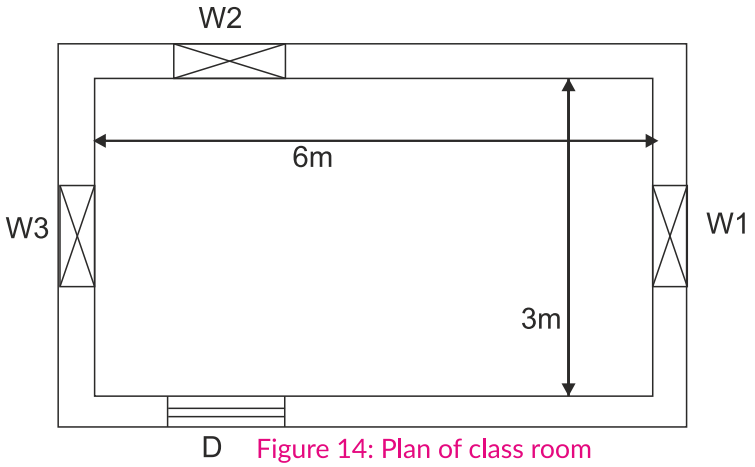


Figure 14: Plan of class room

The cross section:

The cross sectional drawing shows the front view of a cross section of a structure at a particular point. The cross section of a single room house is shown below. It has shown the different features exist across the width of the house at a particular point. The different features like length and breadth of the house, height of the roof, wall thickness, windows and dimensions are shown below.

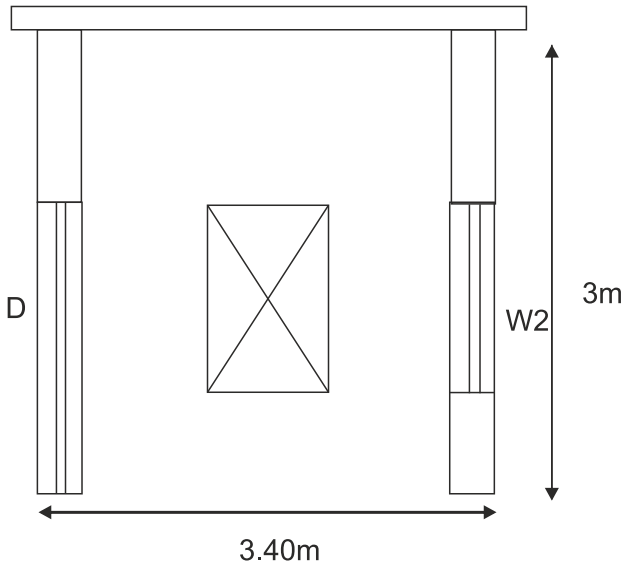


Figure 15: Cross section

Longitudinal section of class room: The picture shown below is the cross section of the class room along its length at the centre line. It shows the height of room at different point across the class room.

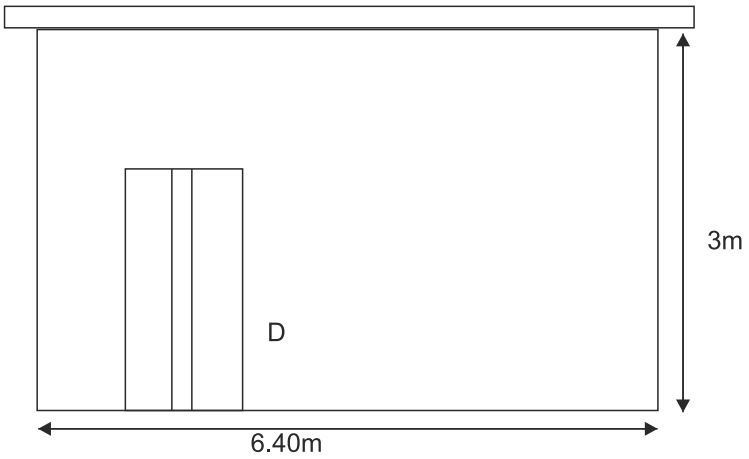


Figure 16 Longitudinal Section

Work Book:

1. Describe the basic drawing and what it consist of?

_____

_____

_____

2. What is use of plan in a drawing?

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_____

_____

3. What information we get from cross section of a class room?

_____

_____

_____

Notes :campus / Field Exercise

Notes: Class room

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