



सत्यमेव जयते

Ministry of Rural Development
Government of India

Training rural masons

Learning unit 2



Setting out construction works



International
Labour
Organization

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Learning Unit 2

Setting out construction works



2.1 Introduction

The purpose of this Learning Unit is to enable a rural mason to read and interpret simple construction drawings and sketches for rural housing projects and to mark out rural houses.

By the end of this Learning Unit the rural mason should be able to:

- ✓ Read and interpret construction drawings and sketches for simple rural houses including toilet installations,
- ✓ Set out foundations, walls, and sewer tanks,
- ✓ Transfer and maintain levels when carrying out masonry works.

Rural houses have diverse designs, and it is therefore important that a rural mason can



read and interpret simple construction drawings and sketches. All construction details are usually specified in drawings. For this reason, it is essential to be able to read and understand them and thereby adhere to the designs when building the house.

The general ground plan describes the position and dimensions of the house. Other more detailed drawings explain the location and levels of the foundation and all other dimensions of the house. This information is required to be able to set out every step of works, starting with clearing and levelling the ground, followed by excavating the foundation, building the foundation and so on until the house is complete. Every work step requires setting out and checking the measurements and levels.

This Learning Unit provides the necessary information on how to read and interpret drawings, how to set out for works and how to transfer and check levels.

2.2 Reading and interpreting construction drawings

This section describes how to:

- Read and interpret basic work drawings, sketches and basic specifications,
- Identify and interpret abbreviations and symbols on plans and work drawings;
- Identify any preliminary work from plans, and drawings; and
- Use plans, drawings and specifications to determine the quality and types of materials required.

Summary

Construction drawings for houses consist of:

- (i) **Plans**; showing all walls and openings as seen from top (bird's eye view) with dimensions;
- (ii) **Sections**; showing levels, dimensions and construction details in a vertical view (as if cut through with a knife). To show the important details of a structure, several sections may be required;
- (iii) **Elevations**: showing the outside (face) of the building.

Reading and interpreting basic working drawings and sketches

The purpose of drawings is to present clear, concise and easily readable information on a proposed building project. This way everyone involved in the project is informed of what exactly is required. Various types of drawing methods are used to communicate this information.

Construction drawings are used to communicate ideas and information in a graphic form. Sketches are prepared first, then final working drawings are completed once the design details have been decided. Each drawing should be neat and clearly labelled. Sketches are not always drawn to scale.

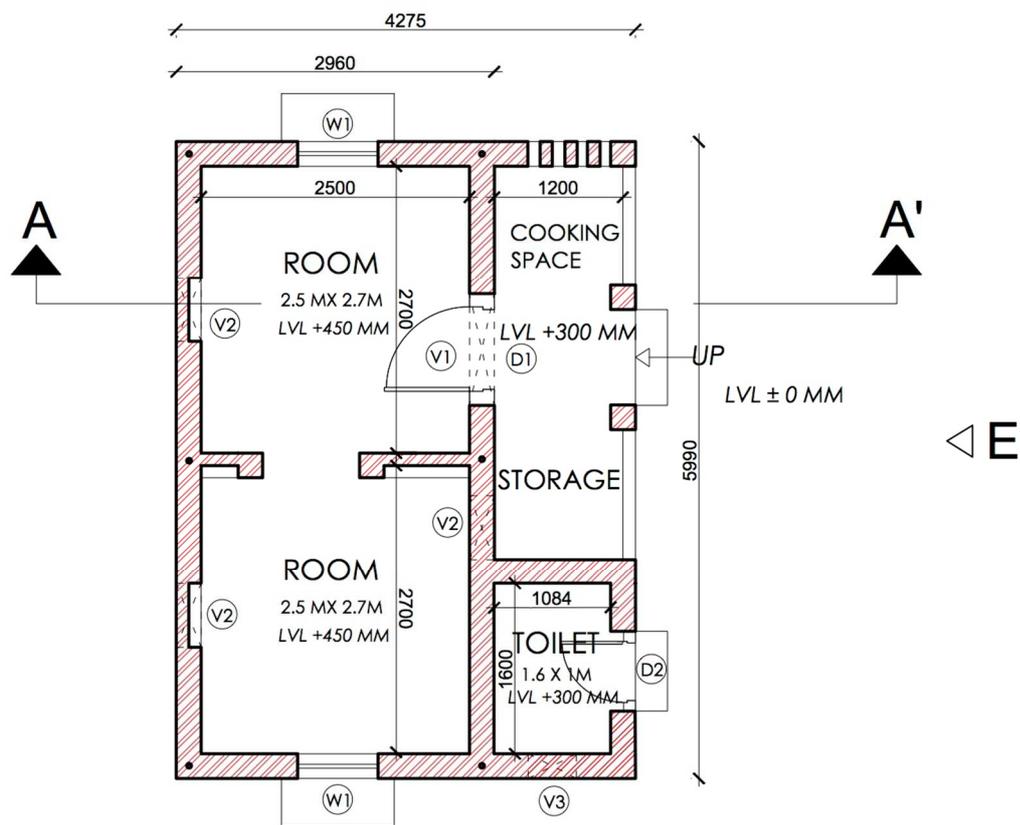
The exact location, dimensions and levels are shown on the construction drawings. These usually include a plan and cross-sections. The drawings or sketches include all essential structures, e.g. walls, windows, doors and columns. It also shows the exact measurements of these elements and describes the materials to be used.

Unlike sketches, building drawings are presented at a specific scale. When preparing a set of work drawings it is not possible to draw the building elements at full size. Therefore the drawings are reduced proportionally to a size allowing it to fit on conveniently sized drawing paper. This reduction process is called scaling. The extent to which the drawings have been reduced from their real size is clearly marked on the drawing. For example, a scale of 1:100 means 1cm on the drawing represents 100cm of the object in real terms.

All dimensions should be precisely indicated on the drawing irrespective of the scale. In house construction the most common units of measure are metres, centimetres or millimetres. Dimensions on drawings are usually only meant to be read, not measured.

The plan is the view seen when looking directly down from above. It provides information about:

- Overall length and width;
- Dimensions of parts of the construction;
- Position and size of windows and doors;
- Function of areas such as kitchen, toilet, etc.;
- Scale of the plan.

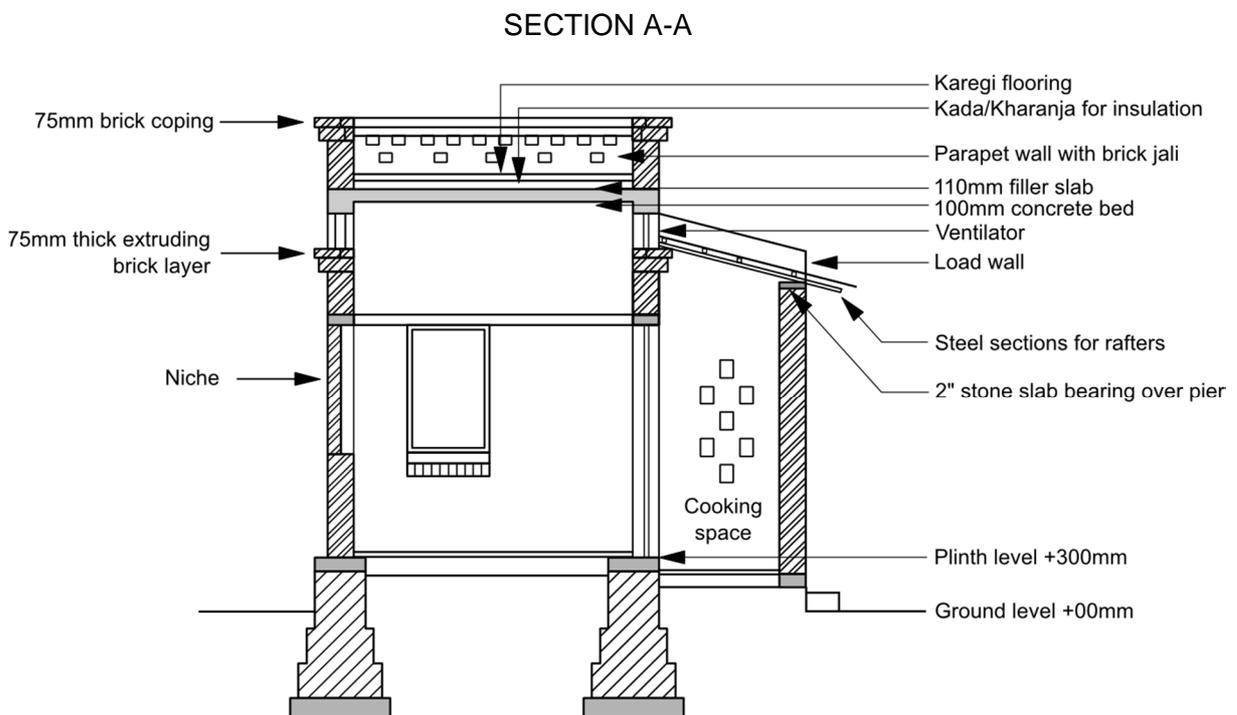


PLAN OF THE HOUSE

It is often necessary to show the details of a building that are normally hidden. To do this it is necessary to imagine that it has been sliced through or sectioned. The position of a section is indicated on the plan using a section line.

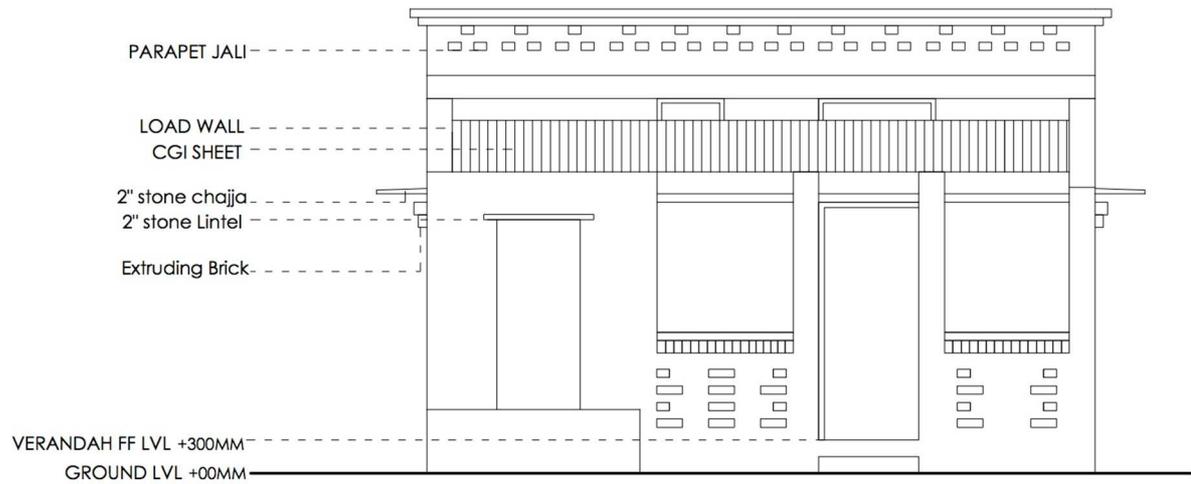
A section view differs from an elevation, as it shows the details through the construction. It can provide information about:

- Foundation shape and sizes and positioning of reinforcement steel;
- Floor and ground levels;
- Roof design;
- Window and door heights.



An elevation is the view from one side of the construction when looking at it from outside. It can provide information about:

- Shape of the building from each direction;
- Height of the construction;
- Positions of doors and windows;
- Window details and height;
- Roof shape.



ELEVATION 'E'

2.3 Setting out

This section explains how a rural mason can set out the works as per sketches and drawings.

Summary

Setting out is bringing the dimensions from a plan to the real situation. The activity consists of establishing the exact location and measurements of the house to be built.

Setting out the building perimeter

The first activity of setting out is to clear the ground of any debris, vegetation and other obstructions. Ideally the ground should be level, although in hilly areas houses can also be constructed on slopes.

Before starting construction works it is necessary to know the exactly location and size of the house. Therefore, the exact position of the corners of the house is defined and marked on the ground. This is usually done by fixing reference points outside the actual perimeter of the building. From these reference points it is always possible to re-measure and check the exact position of the foundation and walls.

According to the measurements on the construction plan the building is set out with stone or brick pedestals that indicate the exact position of the centrelines of the walls.

Tips for the facilitation of Worksheet S1: *Setting out a right angle*

When facilitating the work process described in this worksheet the following approach is recommended:

- Display the poster of Worksheet S1 so that all trainees can easily see it.
- Ask the trainees to open their reference handbook at 'Worksheet S1' and refer to it throughout the lesson.
- Also link the explanation to the respective training posters.
- Start explaining the work sheet by giving an introduction to the purpose of establishing right angles in building construction. Ask the trainees to list where right angles occur in a building and discuss the importance of always assuring that the right angle is observed.
- Demonstrate setting out a right angle using a 'dry-run' exercise. Use pegs and string on an open ground. Carefully explain every step as described in the Worksheet S1.
- Split the trainees into groups of three and let them exercise the same procedure on their own. Assist where necessary → demonstrate → observe → correct → encourage → refer to the worksheet all the time.
- When the trainees have completed their tasks, let them assess each other's work and comment on the achieved quality.
- Recapitulate together the work done. Use the training poster to review the 'Remember List'.

This exercise is in preparation for the actual setting out of the building as described in Worksheet S2.

Throughout the training process refer to the required safety measures. Always display Training Poster No. 1: Safety measures.

Worksheet

S1

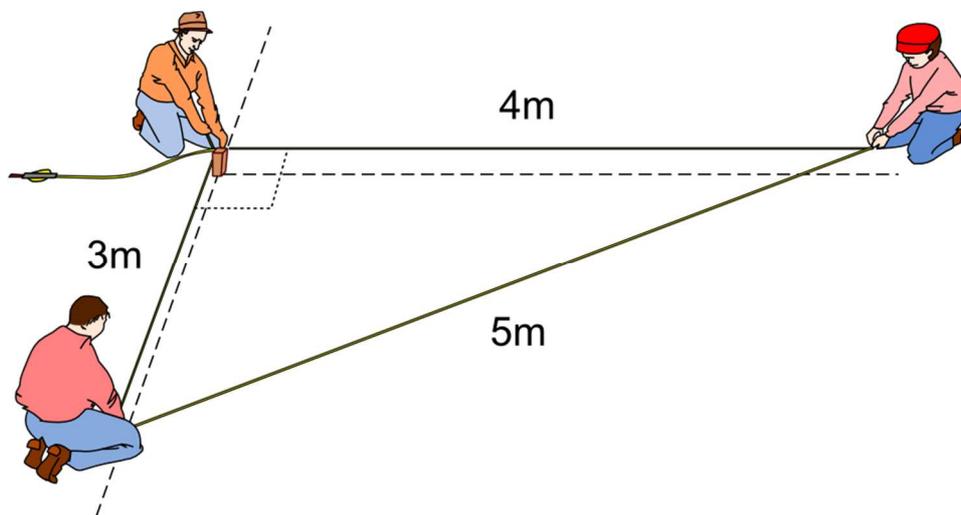
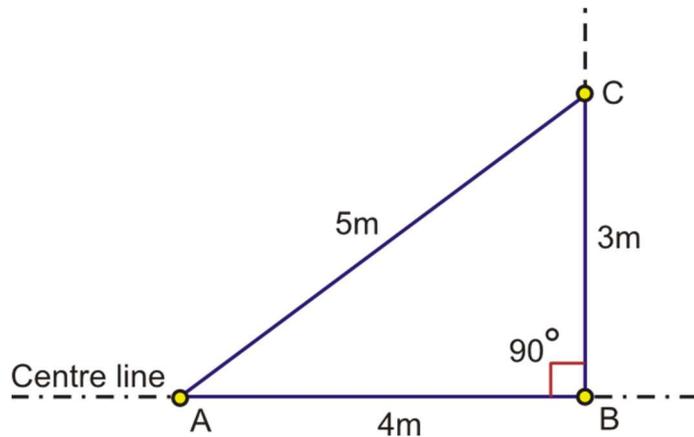
Activity: Setting out a right angle

Work method:

Ensuring right angles (90 degrees) is important when setting out the initial perimeter of the house. This can easily be achieved using the 3:4:5 triangle method.

A triangle, which has sides of length 3 metres, 4 metres and 5 metres, will always have a right angle between the 3-metre side and the 4-metre side. One can therefore construct a right angle using only a tape measure as follows:

1. Measure the length A to B of 4 metres along the line from where a perpendicular line needs to be defined. Place pegs exactly at points A and B,
2. Hold the zero point of the tape measure on the peg A,
3. A second person holds the mark 8.0 metres on the tape measure on peg B,
4. A third person holds the tape measure on mark 5.0 metres, which will lead to point C when the tape measure is pulled tight. Set a peg on point C.
5. Extend the now perpendicular line from point B to point C to any length as required.



Labour:

- Rural mason
- Labourers to assist

Tools:

- Tape measure
- Hammer

Material:

- String
- Pegs

Quality checkpoints:

- After constructing the right angle check again that the triangle lengths represent exactly the 3:4:5 proportions.
- Ensure that all reference pegs are firmly fixed.

Tips for the facilitation of Worksheet S2: *Setting out the building perimeter*

When facilitating the work process described in this worksheet the following approach is recommended:

- Display the poster of Worksheet S2 so that all trainees can easily see it.
- Ask the trainees to open their reference handbook at 'Worksheet S2' and refer to it throughout the lesson.
- Also link your explanation to the respective training posters.
- Start explaining the work sheet by giving an introduction on the purpose and process of setting out the construction of the building.
- Carry out the work step by step together with the trainees.
 - Clear the ground before embarking on the work.
 - Establish exact position of the building.
 - Install pedestals on all four corners → establish right angles.
 - Mark the exact position of the centre lines on all pedestals.→ demonstrate → observe → correct → encourage → refer to the worksheet all the time.
- When you have finished the job together with the trainees, let them assess the work achieved together. It is important that everybody fully comprehends the process of setting out.
- Recapitulate together the work done. Use the training poster to review the 'Remember List'.

Refer to the required safety measures throughout the training process. Always display Training Poster No. 1: Safety measures.

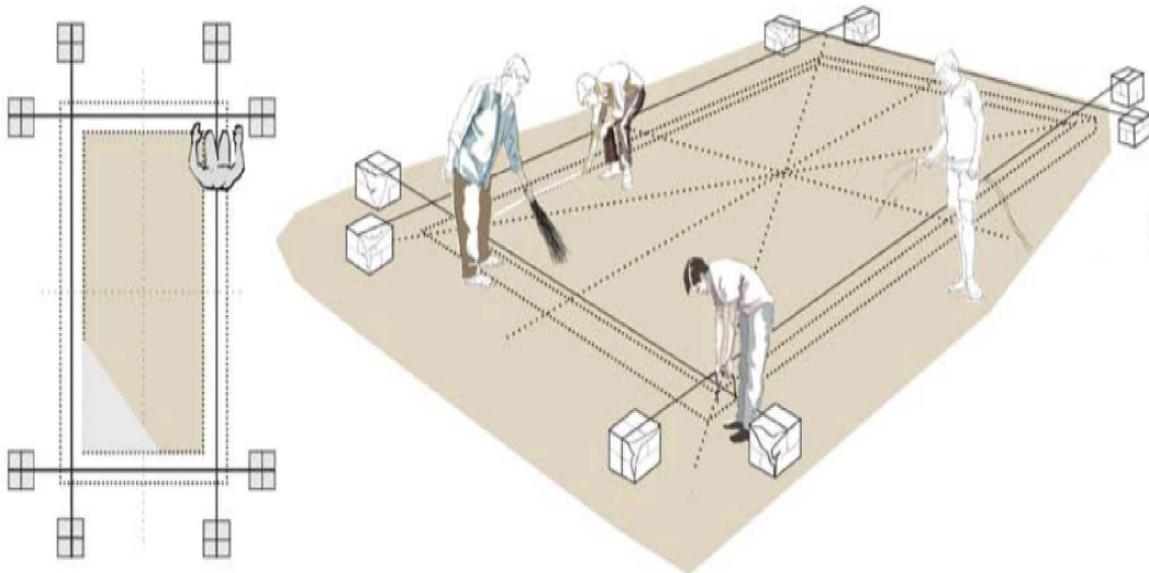
Worksheet

S2

Activity: Setting out the building perimeter

Work method:

1. Clear the ground where the house will be located and ensure that it is level.
2. Place solid pedestals on all corners, approximately 1.5 m away from the planned outside walls of the building.
3. Ideally all pedestals should be of the same height and keep the string well off the ground.
4. Mark the centre of the outer walls using a string line and tape measure. Fix the string tightly so it does not sag.
5. The string lines should cross each other at a right angle. Use the 3:4:5 string method to obtain the 90 degree angles for the house corners (ref. Worksheet S1).
6. Check the diagonals. For a perfect layout they must be of equal length.



Labour:

- Rural mason
- Labourers to assist

Tools:

- Tape measure
- Plumb bob

Material:

- Bricks, blocks or stone for pedestals
- Cement mortar for pedestals
- Strong string

Quality checkpoints:

- Make sure the pedestals are solid enough so they do not easily shift.
- Check that the measured dimensions on the ground conform with the drawings.
- Check that all corners have a right angle and that the two diagonals are of equal length.

2.4 Transferring and checking levels

This section explains how to:

- Identify, transfer and confirm levels using water tube level, and
- Secure correct levels of masonry work.

Summary

Transferring and checking levels is a frequently recurrent activity that a rural mason needs to master. The water tube level is an effective tool for transferring or checking levels over longer distances and around corners. For masonry activities the spirit level in combination with a straight edge is more suitable.

Transferring and checking levels



The water tube level is a simple and ideal instrument to transfer and check levels on smaller building sites. Accurate measurements are possible, for example when lintels have to be set on the same level, or when the floors have to be cast on the same level one can mark the levels along the wall using the water tube.

For checking levels when carrying out masonry works the use of a spirit level is best suited, especially in combination with a straight edge.



Tips for the facilitation of Worksheet S3: *Transferring levels using a water tube*

When facilitating the work process described in this worksheet the following approach is recommended:

- Display the poster of Worksheet S3 so that all trainees can easily see it.
- Instruct the trainees to open their reference handbook at 'Worksheet S3' and refer to it throughout the lesson.
- Also link the explanation to the respective training posters.
- Start explaining the work sheet by giving an introduction on the use of the water tube level. Ask the trainees about their experience with using a water tube level.
- Demonstrate step by step how to use the water tube in the correct way.
- Split the trainees in to groups of two and let them exercise the use of the water tube level in various positions of the building. E.g. one group could transfer a level while the other groups check afterwards whether this has been correctly done.
→ demonstrate → observe → correct → encourage → refer to the worksheet all the time.
- When having completed the tasks together with the trainees, let them assess the exercise. It is important that everybody fully understands the process of transferring and checking levels using the water tube level.
- Henceforth always remind the trainees to use the water tube level in their work, as this is important for most of the activities when building a house.
- Recapitulate together the work done. Use the training poster to review the 'Remember List'.

Throughout the training process refer to the required safety measures. Always display Training Poster No. 1: Safety measures.

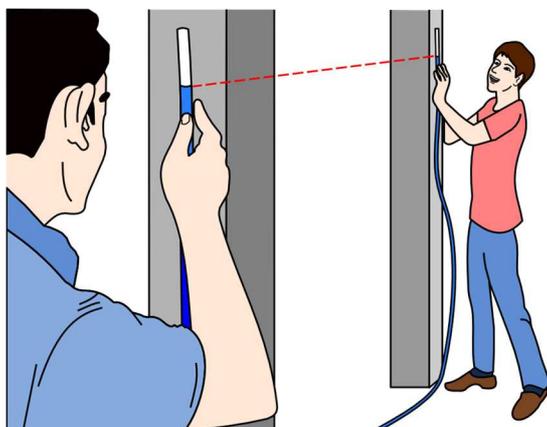
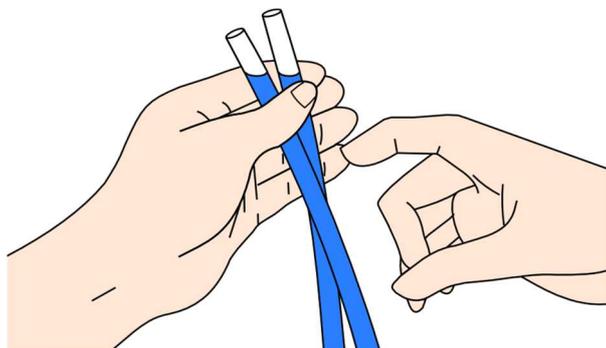
Worksheet

S3

Activity: Transferring levels using a water tube level

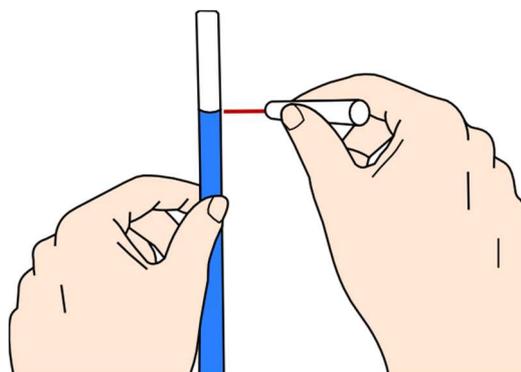
Work method:

1. Use a transparent 10m long water tube and fill it with water.
2. Hold both ends of the tube vertically so that no water escapes. Tap with a finger along the tubing to loosen and expel any trapped air bubbles. Hold the ends of the tube even with one another, and verify that the water lines up equally. Continue tapping the tube to remove any air bubbles.



3. Identify the reference level point you wish to transfer to another location. Mark it clearly.
4. Have an assistant stand at the reference level point. This person should hold the tube against the mark and ensure that the water line in the tube is exactly on the marked reference level.

5. The level of the water line can now be marked wherever required. For example, mark the level on a wall and measure from that mark any height that you need to define or check.



Labour:

- Rural mason
- Labourer to assist

Tools:

- Water tube level
- Tape measure
- Marker

Material:

None

Quality checkpoints:

- ✓ Use a transparent water tube without any kinks or other damages.