TVET CERTIFICATE III in MASONRY

WALL PLASTERING

MASWP301

Carry out wall plastering

Competence

Credits: 8

Learning hours: 80

Sector: Construction and building services

Sub-sector: Masonry

Module Note Issue date: October, 2020

Purpose statement

This is a core module which describes the skills, knowledge and attitude to be acquired by the learner to perform good work by preparing the working area and applying different coats in plastering in order to provide protection and good appearance of the wall at construction site.

Table of Contents

Learning Unit 1 – Prepare the area

LO 1.1 – Proper selection of ingredients

- *Content/Topic 1: Introduction to plastering*

1.1. Definition

Plastering is the process of covering rough surfaces (of walls, columns, ceiling, and other components of the building) with a thin coat of plastic or mortar to form a smooth and durable surface. Note that Plastering done on external exposed surface of the building is commonly known as "**external rendering"**

1.2. Objective of plastering

Plastering is done to achieve the following objectives:

1 To protect the external surfaces against penetration of rainwater and other atmospheric agencies.

2 To impart (give) a smooth surface in which dust and dirt cannot lodge.

3 To give decorative effects.

4 To protect the surfaces of the walls against termites.

5 To increase the durability of the structure.

6 To hide some defects of workmanship or to conceal inferior materials

1.3. Requirements of good plaster

A good plaster, either flesh or hardened, should fulfill some requirements in order to meet plastering objectives.

1.3.1. Fresh plaster should have the following properties:

1. **Adhesion**

The capability of mortar to stick to the surface which is developed in the plaster by the combination of materials and application technique. Adhesion is influenced by aggregate, water-cement ratio, and the absorptive characteristics of the base. This property should remain in all variations seasons.

2. **Cohesion**

The ability of plaster to stick itself which is affected by the Portland cement type; shape and gradation; and quantity of aggregate and water used in mortar preparation.

3. **Workability**

Workability of plaster is the ease with which the plaster is placed, shaped, floated, and troweled. Workability involves adhesion, cohesion and spreadability. To give the best workability, all materials should be proportioned properly during mixing. Plaster with poor workability requires greater effort to apply.

1.3.2. Properties of finished and hardened plaster should have the following:

1. Weather resistance

The ability of plaster to withstand weathering includes resistance to wind and rain penetration, resistance to freezing and resistance to thermal and moisture changes. Resistance to aggressive chemicals in the atmosphere, such as acid rain, is also of concern.

2. Sulfate resistance

In aggressive sulfate environments, additional resistance to sulfate may be obtained with the use of Portland cement Type II or Type V. Additional precautions may include application of a water-resistant surface coating.

3. Hardness and durability

Hardness of plaster is the ability of plaster to withstand scratching. Proper curing of a well-proportioned and well applied plaster is critical to obtaining optimum hard plaster.

Apart from the fresh and hardened plaster, the plaster should be cheap.

1.4. Terminology used in plastering works

There are many specific terminologies used in plastering works including:

1. **Background:** it is the surface to which the first coat of plaster is applied.
2. **Blistering:** this is the development of local swellings on the finished plastered surface, due to residual unslaked lime nodules.
3. **Cracking:** this is the development of one or more fissures in the plaster due to movements in the background or surrounding structure.
4. **Crazing:** this is the development of hair cracks, usually in an irregular pattern, over the finished surface.
5. **Dado:** this is the lower part of the plastered wall. It has to be well treated to give better resistance against the attack of water flowing on the floor.
6. **Dots:** these are small projections of plaster, laid on the background, for fixing the screeds. They are reference points for plastering. Their size may be 15cm×15cm.

7. **Dubbing coat:** it is a coat applied to the background to fill up hollow spaces in the solid background, before applying the main body of the plaster.
8. **Under-coat:** they are the coats of plaster applied under the finishing coat.
9. **Finishing coat:** it is the final coat of plaster. Such a coat is also known as **setting coat** or skimming coat
10. **Flaking:** the process of removing the patches plaster of previous coat, due to the lack of adhesion with under coat.
11. **Gauging:** it is the process of measuring various constituents of plaster.
12. **Grinning:** is the reflection or appearance on the surface of plaster or the pattern of joints or similar patterns in the background.
13. **Hacking:** it is the process of roughening the background to provide suitable bond or key for plastering.
14. **Grounds:** these are the wooden strips fixed to the background to provide suitable bond or key for plastering.
15. **Keys:** they are openings or corrugations on the background or surfaces of the under coats, to which plaster will form mechanical bonds.
16. **Laitance**: this occurs when a fresh mortar is subjected to excessive trowelling and a screen consisting of a thin layer of fine cement particles is formed. This layer is known as laitance.
17. **Peeling**: this is the term applied to the dislodgement of plaster work from the background.

- Content/Topic 1: Materials for plaster

Plaster is generally a mixture of a binder (e.g. cement, lime or the two combined) and a filler/aggregate (usually sand). The ingredients for plaster are cement or lime, graded sand, sometimes Additives/admixtures and water.

The selection of proper ingredients for a plaster depends on:

a) Availability of binding materials
b) Durability requirement
c) Finishing requirement
d) Atmospheric conditions and variations in weather
e) Location of surface (i.e. exposed surface or interior surfaces)

Choosing the right ingredients is essential for making a good plaster. Sand, for example, should be well graded, which means that the grains should vary in size from coarse to fine depending on the coat to be applied.

1. **Cement**: is the essential component of plaster which, when hydrated, binds the fine aggregates together to form the hard, strong and monolithic whole that is so useful.

Cement is obtained by burning a mixture of calcareous (calcium) and argillaceous (clay) material at a very high temperature and then grinding the clinker so produced to a fine powder.

It was first produced by a mason Joseph Aspin in England in 1924 and he patented it as **Portland cement**, since then over 95% of the cement used in masonry throughout the world is **Portland cement** in its various forms.

2. **Lime**: This is also used as a binding material for aggregates as cement but it is recommended to use it for construction works that will not be in contact with dampness.

3. **Water:** The purpose of adding water in mortar is to cause hydration of the cement or lime

4. **Sand**: these are those fine aggregates that pass a standard 5mm sieve, basically used as filler in the production of plaster. They are derived from rocks or manufactured from blast furnace slag, etc.

5. **Additives/admixtures:** These are chemical products added in mortar/plaster in order to increase its performance, bond strength, improve water resistance compared to non-modified mortars.

5.1. Benefits of using admixtures

1. It helps to maintain water content in mortars
2. Reduces efflorescence
3. Improves workability/consistency
4. Improves strength
5. Minimizes water absorption

5.2. Types and Uses of Mortar Admixtures

Types of mortar admixtures decide their respective uses, such as:

1. **Waterproofing admixture** is used to reduce moisture movement through bedding of masonry or renders.
2. **Water retaining admixture** reduces the suction of water from mortar into the masonry blocks or units and enhances the workability, cohesion and reduces the bleeding.
3. **Air entraining mortar admixture** enhances the workability.
4. **Accelerating mortar admixture** reduces the setting times and is used where early strength gain is necessary.

5. **Retarding admixture** increases the setting times and is generally used for ready-mixed mortars.
6. **Polymer dispersion admixture** helps in air bonding and provides flexibility and water repellency to masonry mortars.
7. **Bonding aids** (or bonding liquids) are often used in plaster mixes and spatter dash applications for bonding plasters to substrates. They are by no means a substitute for good surface preparation and workmanship, but they do impart good workability to the mix, although overdosing can lead to low strength.
8. **Pigments** are used to add colour, pigments should comply with BS EN 12878 or an equivalent quality standard. The pigments must be alkali-tolerant and if exposed to sunlight, ultraviolet-resistant and should not increase the water requirement of the mix unduly.

- Content/Topic 2: Grading of aggregates and Bulking of sand

1. Gradation of sand

The term gradation means particle size distribution of an aggregate which is determined by sieve analysis. Gradation is determined by passing the material through a series of sieves stacked with progressively smaller openings from top to bottom and weighing the material retained on each sieve.

If all the particles of an aggregate are of uniform size, the compacted mass will contain more voids whereas aggregate comprising particles of various sizes will give a mass with lesser voids.

The particle size distribution of a mass of aggregate should be such that the smaller particles fill the voids between the larger particles. The proper grading of an aggregate produces dense concrete and needs less quantity of fine aggregate and cement waste, therefore, it is essential that coarse and fine aggregates be well graded to produce quality concrete.

Well graded sand is sand that contains particles of various sizes. Well graded gravel is classified as GW while well graded sand is classified as SW.

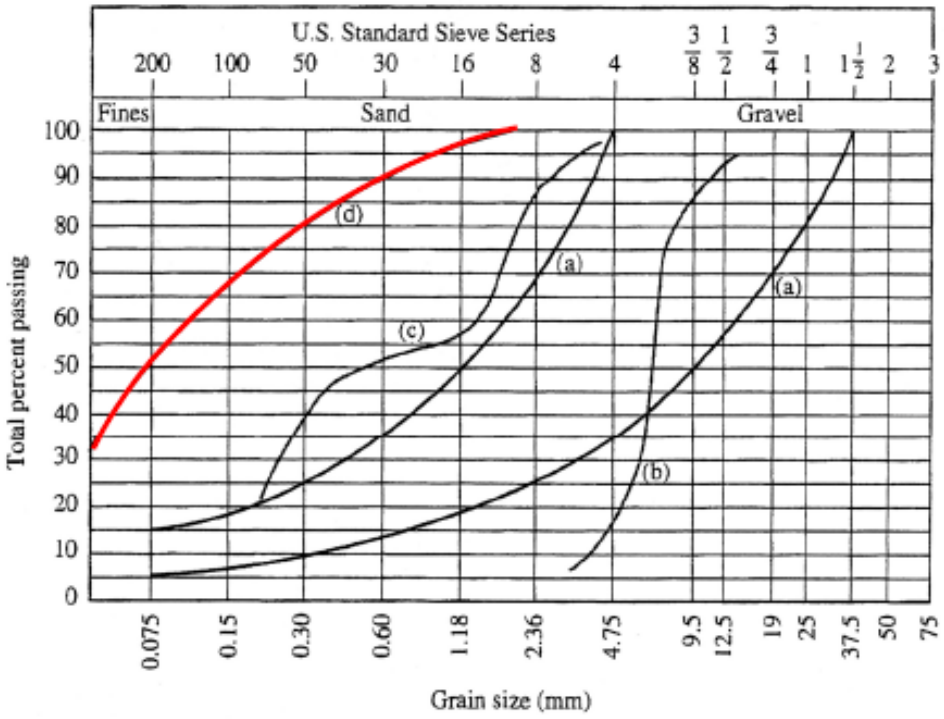
Poorly graded sand is sand that does not have a good representation of all sizes of particles distribution. Poorly graded gravel is classified as GP while poorly graded sand is classified as SP.

1.2. Gradation Analysis

As we described above the gradation of aggregate is taken as a screening process in which coarse fractions of soil are separated by means of series of sieves. Particle sizes larger than 0.075 mm (U.S. No. 200 sieve) are usually analyzed by means of sieving whereas Soil materials finer than 0.075 mm (-200 material) are analyzed by means of sedimentation.

2.2. Grading curves

The results from the particle size determination tests are plotted as grading curves. These show the particle size plotted against the percentage of the sample by weight that is finer than that size. The results are presented on a semi-logarithmic plot as shown in figure below.



Produced grading curve for the sample, determining the values of the critical particle sizes, **D60**, **D30** and **D10** that correspond to 60, 30 and 10 % passing, calculating the values of the coefficients of uniformity(**Cu)** and curvature(**Cc)** and finally comparing these values to critical ranges to determine whether the material is well graded or poorly graded. These coefficients are calculated as shown below:

$$C_u = \frac{D_{60}}{D_{10}} \qquad C_c = \frac{(D_{30})^2}{D_{60} D_{10}}$$

If more than half of the material is coarser than the 75 □m sieve, the aggregate is classified as coarse. The following steps are then followed to determine the appropriate 2 letter symbol

1. Determine the prefix (1st letter of the symbol)

If more than half of the coarse fraction is sand then use prefix S

If more than half of the coarse fraction is gravel then use prefix G

2. Determine the suffix (2nd letter of symbol)

First determine the percentage of fines that is the % of material passing the 75µm sieve.

Then if % fines is < 5% use W or P as suffix> 12% use M or C as suffix between 5% and 12% use dual symbols. Use the prefix from above with first one of W or P and then with one of M or C.

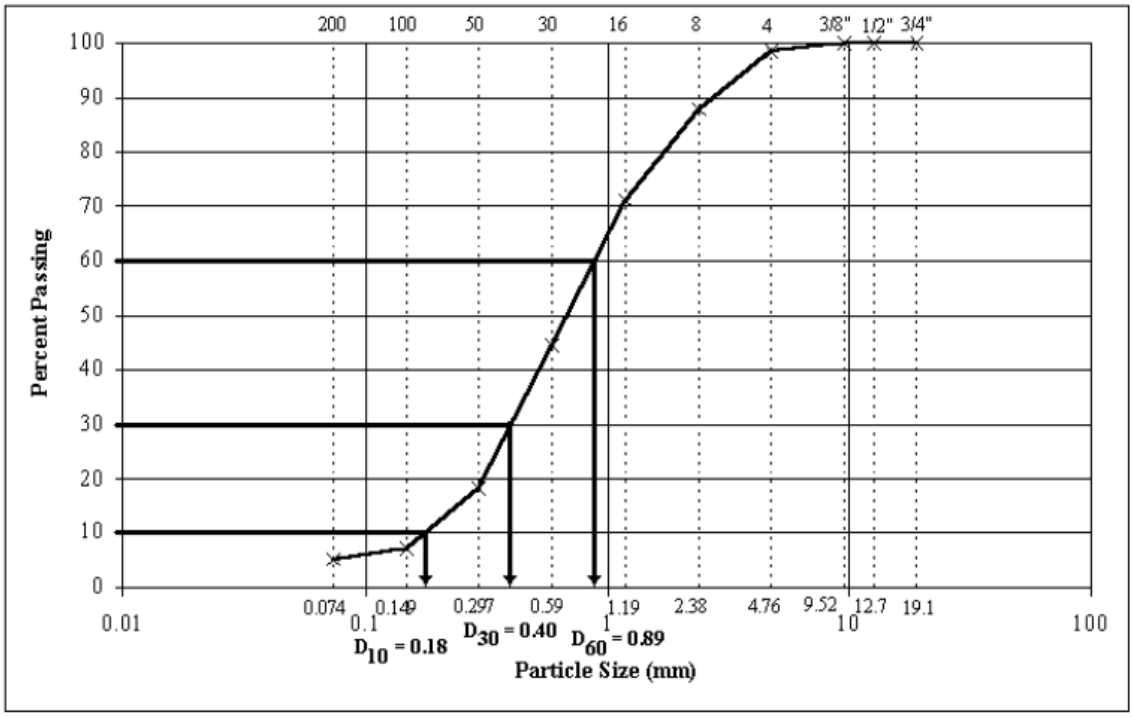
If prefix is G then suffix is W if Cu > 4 and Cc is between 1 and 3 otherwise use P

If prefix is S then suffix is W if Cu > 6 and Cc is between 1 and 3 otherwise use P

Example1. Sieve Analysis Data for Fine Aggregate

SIEVE		%
Designation	Size (mm)	PASSING
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.52	100.0
No. 4	4.75	98.6
No. 8	2.38	87.9
No. 16	1.19	71.1
No. 30	0.59	44.5
No. 50	0.297	18.1
No. 100	0.149	7.2
No. 200	0.074	5.3

The gradation curve for the sample data above is presented in Figure 2.



Determine % of different particle size fractions:

- % fines from the grading curve(Silt and Clay)= 5,3%
- Gravel= 100-98.6=1.4%
- Sand= 98.6-5,3= 93.3%

Cu=$\frac{0.89}{0.18} = 4.94$, **Cc=**$\frac{0.4^2}{0.89*0.18}$**=0.99**≈ 1 and hence Suffix1 = p

Of the coarse fraction about 93.3% is sand, hence Prefix is S

2. Bulking of sand

Bulking in sand occurs when dry sand interacts with the atmospheric moisture. Presence of moisture content forms a thin layer around sand particles. This layer generates the force which makes particles to move a side each other. This results in the increase of the volume of sand. Extremely fine sand particularly the manufactured fine aggregate bulks as much as about 40%.

2.1. What causes bulking of aggregate?

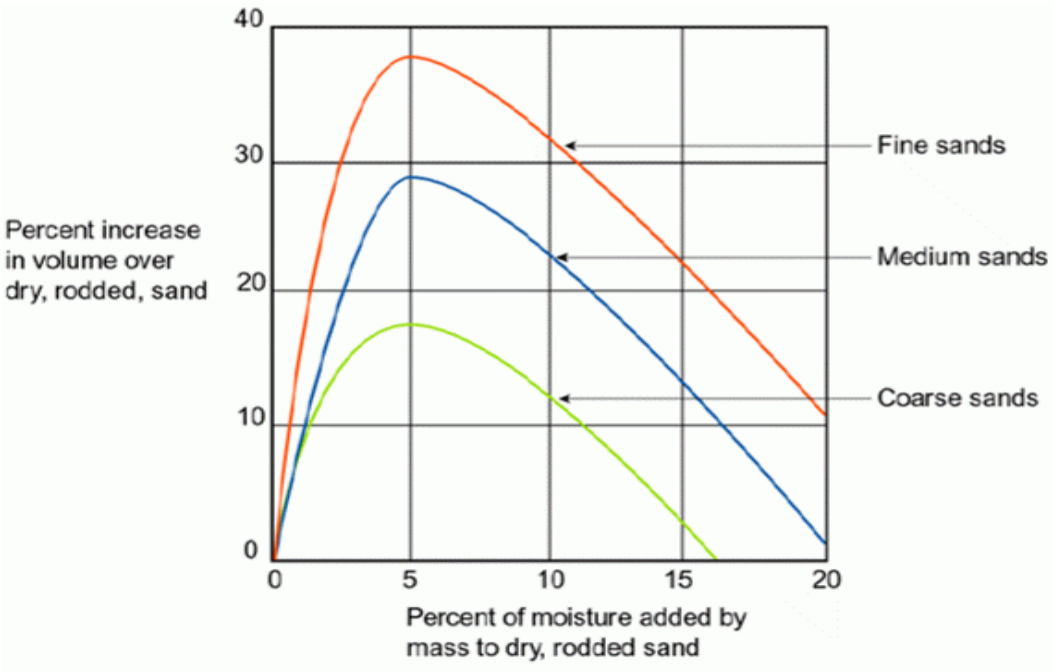
The moisture present in aggregate forms a film around each particle. These films of moisture exert a force, known as **surface tension,** on each particle. Due to this surface tension each particles gets away from each other. Because of this no direct contact is possible among individual particles and this causes bulking of the volume.

Bulking of aggregate is dependent upon two factors,

1. Percentage of moisture content
2. Particle size of fine aggregate

Bulking increases with increase in moisture content up to a certain limit and beyond that the further increase in moisture content results in decrease in volume. When the fine aggregate is completely saturated it does not show any bulking. Fine sand bulks more as compared to coarse sand, i.e. percentage of bulking in indirectly proportional to the size of particle.

The figure below shows percentage of bulking of sand with moisture content



2.2. Why to determine percentage of bulking?

Due to bulking, fine aggregate shows completely unrealistic volume. Therefore, it is absolutely necessary that consideration must be given to the effect of bulking in proportioning the concrete by volume. If care is

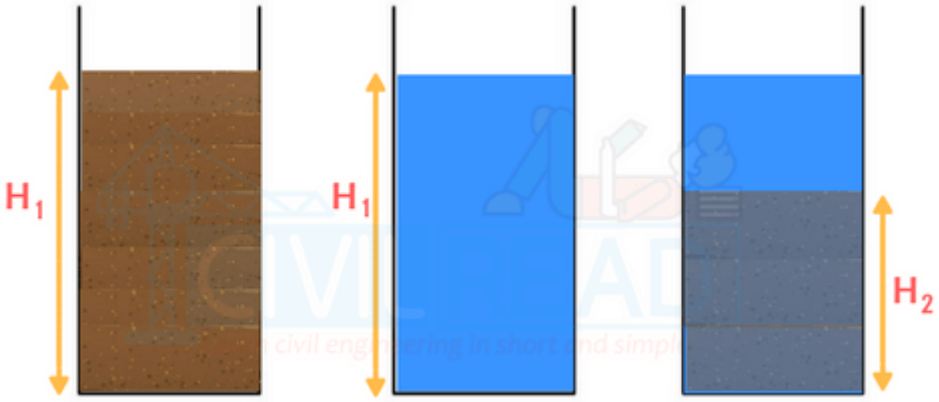
not given to the effect of bulking, in the case of volume batching, the resulting concrete is likely to be under sanded and harsh. It will also affect the yield of concrete for a given cement content.

2.3. Determination of percentage of bulking?

The extent of bulking can be estimated by a simple field test.

1. Take a simple container and add 2/3 part of sand in it.
2. Measure the exact height of sand using the scale and note it down. (H1)
3. Now fill the container up to 2/3 part with water. (Same height of Sand)
4. Now add the measured sand to the container and wait for some time to settle down.
5. Now calculate the height of Sand in water. (H2)

$$\% \text{ of Bulking of sand} = \frac{H_1 - H_2}{H_2} \times 100$$



- Content /Topic 3: Mix ratio

1. Mixing ratio

The correct method of measuring the different aggregates of concrete or cement mortar is to weigh them. But this is not possible at most sites. The common way is to measure the volume. Although this is not a precise method, it is efficient enough if performed carefully. Measuring by the shovelful is not acceptable since this is too inaccurate. Measuring must be done with buckets or wooden boxes, all of equal size. A 1:3 mixture means three measurements of sifted sand to one measurement of cement.

These two dry components have to be mixed (see Figure below) by shovelling a pile of sand with the required amount of cement added from one side of the mixing platform to the other and then back. This procedure has to be repeated 4-6 times until the dry mixture is of equal colour. Before adding water, prepare another pile of dry mixture. A second pile of dry mixture should always be ready before water is added to the first pile. This gives a certain guarantee that there will be no interruption of the supply of mortar for the plasterers.

Water must be added very carefully. It is appropriate to make a test of a small amount first and let the plasterer try to work it. The content of water in the mixture is a most sensitive issue. It is called water-cement ratio. For easy understanding it should be realized that where water is, no other material can be. But since water will eventually run off, it will contain cement. The structure will be weakened if too much water is added. It can be said that only 10% more water than necessary to make the plaster workable will reduce the strength of the plaster by 15%. If 50% more water is added, the plaster will lose 50% of its strength.

1.1. Recommended Cement Mortar ratio for Plastering:

Mix Ratio of Mortar	General Usage Recommended
1:3	Very rich mortar mix. Not recommended for general usage at sites. Can act as a repair mortar with a waterproofing/bonding agent
1:4	For External Plaster and for ceiling plaster
1:5	Brickwork Mortar and for Internal plaster (If sand is not fine Fineness Modulas > 3)
1:6	For Internal Plaster (if fine sand is available)

EXAMPLE:

Suppose we have an Area of **the 200-meter square (Length, Width)** over that area we need to perform plaster and the ratio of cement and sand we are using **1: 4** and the thickness of plaster will be **13 mm**. You

are requested to calculate the required quantity of water, Cement and Sand use in this plaster. Take water cement ratio of 0.5

1. **Given Data:**

Plaster Thickness = 13 mm = 0.013 m <Remarks 1 m = 1000 mm>

Area = 200 m^2

Mixing ratio = 1: 4

2. **Unknown/Required**

Quantity =?

3. **Solution:**

First, we calculate the volume of the plaster (Wet volume) and the volume we calculated is a wet volume (water + wastage + bulking of sand) then we convert this volume into the dry volume. After calculating the volume, we just find the quantity of cement, Sand and water required in this plasterwork according to these given data.

The volume of cement mortar required = (Area of Plaster x Thickness)

Volume of cement mortar required = 200 x 0.013

Volume of cement mortar required = 2.6 m^3 (wet volume)

So 2.6-meter cube is a wet volume of cement mortar (with water). But we need dry volume to get dry volume to consider **20% bulking of the sand** and **15% Wastage of the sand** at the site.

= 2.6 m^3 x (1 + 0.2 + 0.15) <Remarks 20/100 % = 0.20 or just multiply by 1.35 >

=3.51 m^3 (dry Volume).

3.1. Cement required:

Cement: = (Dry volume x Ratio x Density of cement)/Sum of ratio

Cement = (3.51 x 1 x 1440) /5

Cement = 1010.88 kg /50

Cement = 20.21 bags

3.2. Sand required:

Sand = (Dry volume x Ratio x 35.3147)/Sum of ratio

Sand = (3.51 x 4 x 35.3147)/5 < 1 meter cube = 35.3147 cubic feet >

Sand = 99.16 Cubic feet.

3.3. Water required:

Water = (Weight of cement x water cement ratio)

Water = 1010.88 x 0.5 < 0.5 kg water every 1 kg of Cement >

Water = 505.4 kg or 505.4 Litters.

3.4. Conclusion:

Cement: **1010.88 kg**

Sand: = **99.16 cubic feet**

Water: = **505.4 Litters**

So these quantities are going to use in a **13 mm thick plaster**.

Note: The water-cement ratio 0.5 is not fixed it depends on the which type of plaster is going to do or the compressive strength we get after fixing the water-cement ratio in 1: 4 mix.

- Content/Topic 4: Plaster thickness

2. Plaster thickness

The thickness of the plaster is one of the most basic factors that subsequently affects the operational characteristics of the structure. Layers are applied both from the external and internal sides of the walls. Finishing coats (and single-coat work, where employed) should be of such minimum thickness as just to provide a sufficient body of material to harden satisfactorily under the site conditions in any particular case.

The total thickness of two-coat work exclusive of keys or dubbing out shall be generally about, but shall not normally exceed 20 mm and it shall not exceed 15 mm in the case of in situ concrete soffits. The thickness of three-coat work shall be about, but shall not normally exceed 25 mm.

2.1. The recommended thickness of cement plastering depending on background materials is given below.

- Recommended thickness of plastering for brick walls is 12 MM, 15 MM or 20 MM.
- 12 MM thick cement plaster is done where the plain surface of brick masonry is plastered.
- 15 MM cement plaster is required on the rough side of 9” and 4.5” wall.
- 20 MM thick cement plaster is done in two coats in some cases on rough side of wall or according to the design requirement.
- 18 MM thick cement plaster with neat cement slurry is required for making ‘Dado’ with the cement concrete flooring.
- Recommended thickness of plastering for RCC surface is 6 MM and 10 MM.
- 6 MM thick cement plaster is done on the RCC surface where it is required.
- 10 MM thick cement plaster is done underside of the RCC ceiling/ roof.

2.2. The recommended thickness of an individual coat for different no. of plaster coats is as follows.

No. of Coat of Plaster	**Thickness**
Single coat plaster	10 to 15 mm
Two coat plaster (a) for under coat	10 to 12 mm
Two coat plaster (b) for finishing coat	3 to 8 mm
Three coat plaster (a) Base coat	10 to 15 mm
Three coat plaster (b) Second coat	3 to 8 mm
Three coat plaster (c) Finishing coat	3 to 5 mm

LO 1.2 – Select tools and equipment

- Content/Topic 1:Plastering tools and equipements

In plastering works, hand tools and some pieces of light equipment are used to produce the same results. It is therefore extremely important to know how to select, use and maintain your tools and equipment

1. Tools

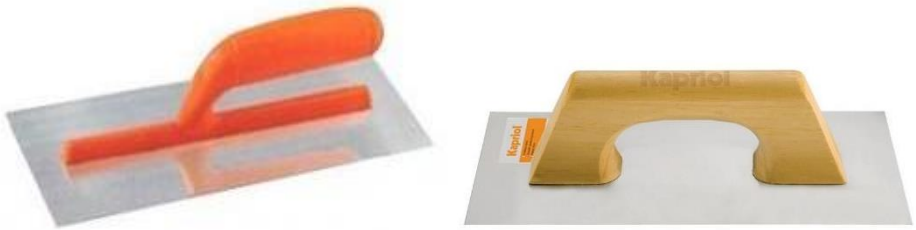
In plastering, we use some common tools as used in other construction works such:

1. **Tape measure and folding ruler:** These are used for measuring lengths.
2. **Spirit level and hose pipe level:** Is used for levelling and checking the horizontal plane of masonry works and to stretch the verticality of masonry work piece.
3. **Building line:** This is used for horizontal levelling and setting out of the building.
4. **Claw hammer:** It is used in fixing and pulling out of nails.
5. **Masonry chisels:** Used for background preparation
6. **Steel square:** This is used for controlling right angles when building walls and setting out.
7. **Plumb bob:** Is used for stretching vertically or to control the verticality of constructed structures
8. **Bucket:** Used for carrying water.
9. **Spade / shovel:** Is used for mixing sand, cement, collecting, loading on and off loading the materials.
10. **Gauge box:** Is used for measuring the proportion of materials and to control the ratio by volume
11. **Pan:** Is used for carrying materials usually mortar.
12. **Mortar hawk:** Is used for holding mortar.
13. **Straight edge:** Used to check the flatness of the wall
14. **Brush:** Is used for cleaning and also for painting.
15. **Scraper:** Is used to remove extra mortar from walls, floors, and to scrap the wall ready for painting
16. **Scratching tool:** Is used for making scratches on plaster while plastering.

Apart from those common tools, there are other specific tools which are used in plastering such as:

1) **Float**: A float is used for applying and spreading mortar on the surface. It is made of either metal or wood.

1.1. **Metal float** is known as **laying trowel.** It is used for troweling, to get desired smooth finish.

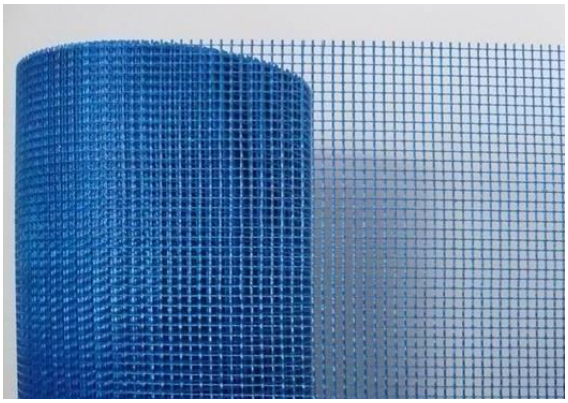


1.2. **Wooden float** is commonly known as **skimming float.** It is used for finishing coat of plaster. Its size is 10cm×30cm to 11cm×33cm.

2) **Floating rule**: Any wooden/metal or steel member with even and straight surface used for checking the level of the plastered surfaces between screeds.

3) **Dry wall Corner shaper (angle tool):** These are trowel like tools used for making corners either internal or external (quoin)

4) **Fiberglass/steel mesh sieves:** These are used as Sieves depending on needed particle size of sand to be used



2. Equipment

Same as for tools, in plastering also there are common used equipment such as:

1. **Wheelbarrow:** This is used for transporting materials on the site
2. **Mortar mixer:** This used for quick mixing of large quantity of mortar/ plaster

But there is also other specific equipment used such as:

1. **Electric rotary soil sieve:** This is used for sand sieving

LO 1.3 – Prepare surfaces

- Content/Topic 1: Method of preparing surfaces

1.1. Introduction

Anyone who is new to plastering might think that it's simply all about sticking a load of plaster on a wall and smoothing it flat, but anyone with a bit more experience will know that not bothering with the bits before this part can mean the road to disaster.

One of the most important stages of plastering is the preparation before you put the plaster on the wall. It's vital to know what levels of suction you're dealing with, for example, so you can ensure that when the plaster goes on, it's going to stay that way and won't dry too fast or come away from the wall.

Checking properly is more than visually looking at the wall/ceiling. Obviously there is a reason why the area needs plastering. It maybe that it's rough and needs a reskim, it could be full of cracks, it could even be back to the brick etc.

- Tap or knock the wall for hollow spots. If any are found the spot will need knocking off back to brick. Then filling with a backing plaster like bonding, browning, hard wall etc.
- Check for cracks. If any are found they need racking out then filling with backing plaster. Also applying scrim tape over the joint.

1.2. Background Surfaces for Plaster

Type of plaster and its application varies depending on the surface of the wall or ceiling which are set to be plastered. Bricks or blocks with rough and solid surfaces possess means of mechanical adhesion when plaster is applied to the background walls or ceilings.

The mechanical keys which adhere hardened plaster to the surfaces is created after spread wet undercoat plaster is dried. Plaster keys limit or restrain shrinkage of the cement that is principal component of undercoat plaster.

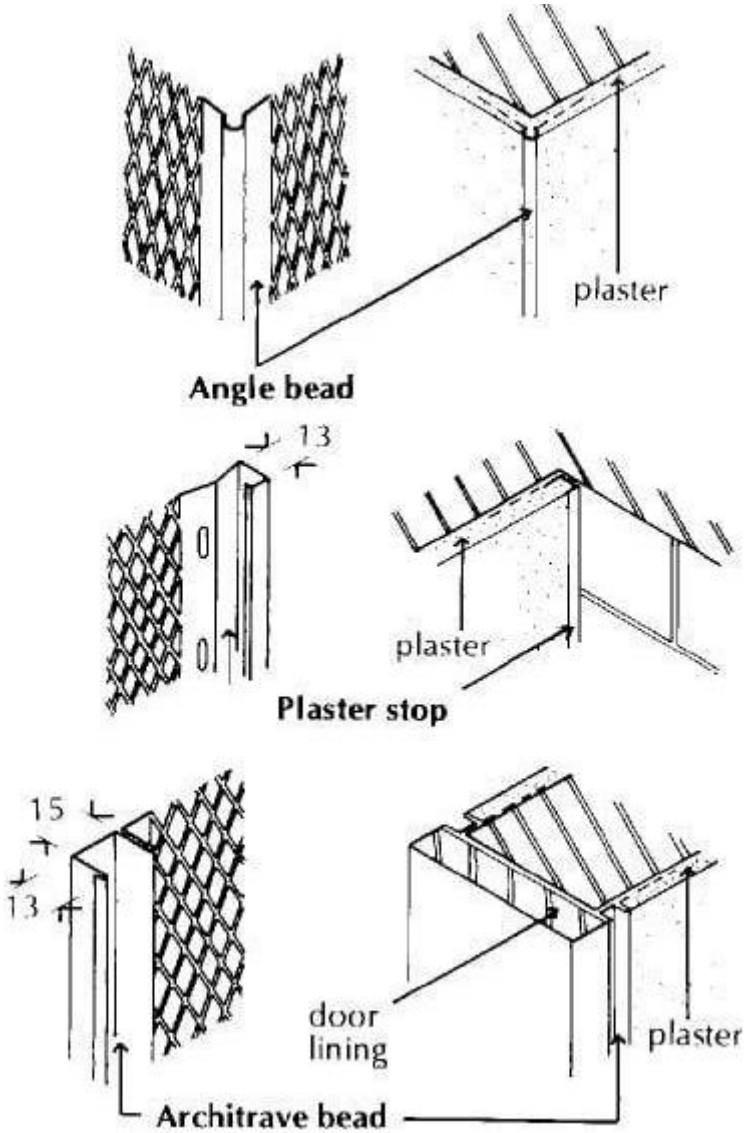
Machine pressed bricks with high density and smooth surfaces absorb suitable amount of water that will help adhering plasters to surfaces. The degree of water absorption by dense smooth surface bricks which assist in plaster adhesion is called suction.

Blocks produced by light weight concrete have large suctions that prevent attaching plasters to surfaces properly. Therefore, it is advised to decrease water absorption degree by either liquid primer or spraying water before plastering.

There are two different solutions for surfaces with low suction include PVA bonding agent and polymer bonding agent. In the former method, polyvinyl acetate is brushed on the surface and plaster is spread over when the PVA is still sticky which creates bond. In the latter, surfaces are treated by combination of silica sand and polymer and the bond is provided by silica sand grain after the polymer is dried.

There are various types of galvanized steel beads and stops which are produced to employ with plaster and plasterboard as angle and stop reinforcement. The beads are used at the junction of wall to ceiling plaster and plaster to other materials.

Galvanized steel utilized as stops to create perfect finishes at junctions of plaster to another material at angles, around windows and doors, and skirting as shown in Figure 2.



Metallic Beads and Stop for Plasters

When you are preparing walls for plastering there are several steps you can take to test the suction, whether you're working with a previously plastered or painted background or a properly prepared and well scratched backing coat. If you're plastering onto plasterboard, then you don't need to worry so much about a suction test as the paper on the board will do the job for you.

If there is any doubt about the suitability of a background for direct plastering, a trial panel should be plastered and tested for adhesion once dry. If adhesion is inadequate, the appropriate preparation and bonding agent must be applied to the background prior to plastering.

- Content/Topic 2 : Types of dusts on the wall and Removal of any projections

1.2.1. General steps of background preparation

1. Keep all the mortar joints of wall rough, so as to give a good bonding to hold plaster.
2. Roughen the entire wall to be plastered.
3. If the surface to be plastered present some oil or grease, clean the surface with a wire brush
4. If the projection on the wall surface is more than 12 mm, then knock it off, so as to obtain a uniform surface of wall. This will reduce the consumption of plaster.
5. If there is any cavities or holes on the surface, then fill it in advance with appropriate material.
6. Cleaned off all dirt, dust and humidify the entire wall to be plastered, and keep it wet for at least 6 hours before applying cement plaster.

- Content /Topic 3: Properties of surface for plastering

All surfaces should be reasonably dry and protected from the weather. Backgrounds need to be suitable with regards to:

— **Its strength** – can it take the weight of the plaster

— **Suction** – how quickly will it pull the moisture out of the plaster as it sets

— **Bonding properties** – does it have a texture for a key

— **Shrinkage** – will it continue to shrink underneath a layer of plaster

— **Thermal movement characteristic** – will it expand or contract causing the plaster to crack

— **Water and soluble salt content** – are the levels likely to cause problems to the key or finish

- Content/Topic 4 :Clean and level the surface for plastering

METHODS OF PLASTERING

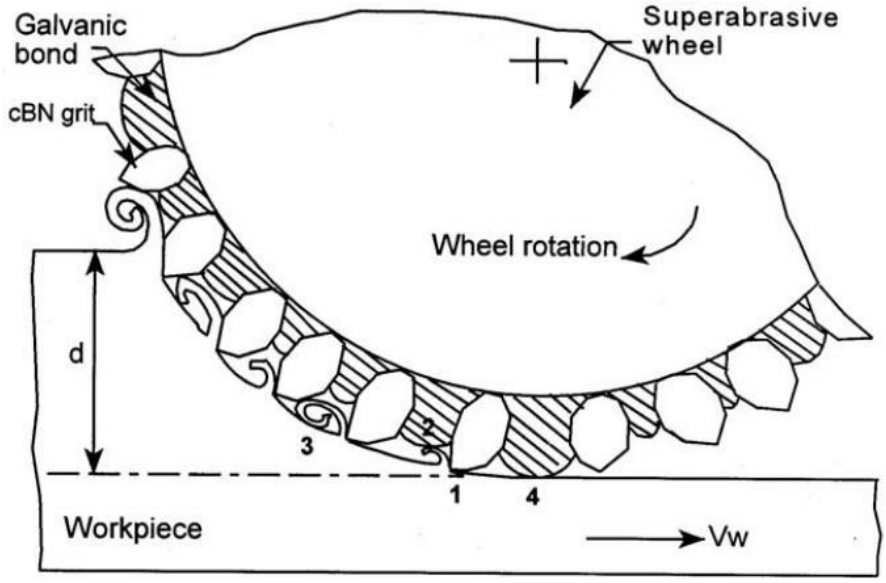
Procedures of plastering:

- **Preparation of background:** For plastering new surfaces, all masonry joints should be raked to a depth of 10 mm in brick masonry and 15 mm in stone masonry for providing key to the plaster. All mortar droppings and dust, and laitance (in case of freshly laid concrete) should be removed with the help of stiff wire brush. Any unevenness is levelled before rendering is applied. For finishes applied in three coats, local projections should not be more than 10 mm proud of general surface and local depressions should not exceed 20 mm. For two coat plaster, these limitations are 5 mm and 10 mm respectively.
- The surface should be washed with clean water and kept damp uniformly to produce optimum suction. In no case the surface should be kept soaked with water so as to cause sliding of mortar before it sets or kept less wet to cause strong suction which withdraws moisture from mortar and makes it weak, porous and friable. If plaster is to be applied on old surface, all dirt, scool,
  Oil, paint etc. should be cleaned off.
- Attaching the straight wooden batten or wood strip on surface
- Use sprit level or plumb- bob to make sure that these straight wooden battens are well leveled vertically.
- . In order to maintain uniform thickness of plaster, *screeds* are formed of plaster on wall surface
- Fill the plaster between the screeds.
- Use the long straight edge to remove the extra plaster
- Remove the battens and fill plaster in empty space
- Finishing and curing.

LO 2.1 – Perform smoothness of terrazzo

- Content/Topic 1: Function of grinding and working principle of grinding machine

- A **grinding machine,** often shortened to **grinder,** is any of various power tools or machine tools used for grinding, which is a type of machining using an abrasive wheel as the cutting and smoothing tool. Each grain of abrasive on the wheel's surface cuts a small chip from the work piece via shear deformation.
- The 'grinding tool' is made up of abrasive grains and pores and exhibits an irregular distribution of cutting edges. And the functions of grinding are summarized as follow:
- Level the surface
- Bring out a shine in a surface
- Bring out the high gloss terrazzo
- Level the surface



Abrasive wheel

- Content /Topic3: Method of grinding

1. Wet method

In the wet method, water is required to cool the diamond grits and cleaning the dust that is formed while grinding process.

In this type of grinding, water works as lubricant, down the friction and elevates the life of polishing equipment, particularly the disks, which can melt due to high temperature.

2. Dry method

In dry grinding the tool is bring out with a separate provision to retain the dust within a cover leaving no mess behind.

You can use both types of grinding to get the finest and desired shine in the concrete. Initially you can try dry grinding and finally the wet process to clean and finish the floor completely.

Learning Unit 3 – Apply plastering coats

LO 3.1 – Identify types of plastering

- Content/Topic 1: Types of plastering

TYPES OF PLASTER FINISHES

Plastered surface may be finished in the following varieties:

1. Smooth cast finish. In this finish, smooth, levelled surface is obtained. The mortar for the finish may be made of cement and fine sand in the ratio of 1: 3. Mortar is applied with the help of wooden float. Steel floats are not recommended for external renderings since they give a very smooth finish which is liable to cracking and crazing under exposure to atmospheric conditions.

2. Sand faced finish. This is obtained by plastering in two coats. The first coat is applied in 1: 4 cement sand mortar 12 mm thickness. It is provided with zig-zag lines. After curing it for 7 days, the second coat is applied in the thickness of 8 mm. The mortar for the second coat is prepared from cement sand mix ratio 1:1. The sand for this is perfectly screened so that uniform size is obtained. Sponge is used in the second coat when it is still wet. The surface of final coat is finished by rubbing clean and washed sand of uniform size by means of wooden float. This results in the surface having sand grains of equal and uniform density.

3. Rough cast finish or spatter dash finish. In this, the mortar for the final coat contains fine sand as well as coarse aggregate in the ratio of 1: l: 3 (cement: sand: aggregate). The coarse aggregates may vary from 3 mm to 12 mm in size. The mortar is dashed against the prepared plastered surface by means of large trowel. The surface is then roughly finished using a wooden float. Such a finish is water proof, durable and resistant to racking and crazing, and may be used for external renderings.

4. Pebble dash or dry dash finish. In this the final coat, having cement: sand mix proportion of 1: 3 is applied in 12 mm thickness. Clean pebbles of size varying from 10 to 20 mm size are then dashed against the surface, so that they are held in position. The pebbles may be lightly pressed into the mortar, with the help of wooden float.

5. Depeter finish. This is similar to pebble dash finish in which the 12 mm coat is applied and while it is still wet, the pieces of gravel or flint are pressed with hand on the surface. Flints of different colours may be used to obtain beautiful patterns.

6. Scrapped finish. In this, the final coat of 6 to 12 mm thick is applied and after it has stiffened for few hours, the surface is scrapped in patterns for a depth of 3 mm. For scrapping, steel straight edge, old saw blade or such other tool may be used. Such scrapped surface is less liable to cracks.

7. Textured finish. This is used with *stucco plastering.* Ornamental patterns or textured surfaces are made on the final coat of stucco plastering, by working with suitable tools.

LO 3.2 – Apply plaster

- Content/Topic 1 : Surface humidification

The surface should be washed with clean water and kept damp uniformly to produce optimum suction. In no case the surface should be kept soaked with water so as to cause sliding of mortar before it sets or kept less wet to cause strong suction which withdraws moisture from mortar and makes it weak, porous and friable. If plaster is to be applied on old surface, all dirt, scool, Oil, paint etc. should be cleaned off.

- Content/Topic 2: Plastering techniques

- For plastering new surfaces, all masonry joints should be raked to a depth of 10 mm in brick masonry and 15 mm in stone masonry for providing key to the plaster. All mortar droppings and dust, and laitance (in case of freshly laid concrete) should be removed with the help of stiff wire brush. Any unevenness is levelled before rendering is applied. For finishes applied in three coats, local projections should not be more than 10 mm proud of general surface and local depressions should not exceed 20 mm. For two coat plaster, these limitations are 5 mm and 10 mm respectively.
- The surface should be washed with clean water and kept damp uniformly to produce optimum suction. In no case the surface should be kept soaked with water so as to cause sliding of mortar before it sets or kept less wet to cause strong suction which withdraws moisture from mortar and makes it weak, porous and friable. If plaster is to be applied on old surface, all dirt, scool,
  Oil, paint etc. should be cleaned off.
- Attaching the straight wooden batten or wood strip on surface
- Use sprit level or plumb- bob to make sure that these straight wooden battens are well leveled vertically.
- . In order to maintain uniform thickness of plaster, *screeds* are formed of plaster on wall surface
- Fill the plaster between the screeds.
- Use the long straight edge to remove the extra plaster
- Remove the battens and fill plaster in empty space
- Finishing and curing.

- Content /Topic3: Coats of plaster

Under-coats. These are the coats of plaster applied under the finishing coat.

Dubbing coat This is the process of filling up hollow spaces in the solid background, before applying the main body of the plaster.

The *first coat* (under-coat or *rendering coat)* provide means of straightening or levelling an uneven surface. It seals the surface of wall and to some extent prevent rain penetration. The *second coat* is known as *floating coat.* The *third or final coat* provide smooth surface; it is also known as *setting or finishing coat.* The average thickness of rendering coat and floating coats may be 10 to 15 mm and 6 to 9 mm respectively. The final coat may be of 2 to 3 mm thickness. If plastering is done in single coat only, its thickness should not exceed 12 mm nor should it be less than 6 mm.

- Content /Topic 4: Application of different Coats of plaster

1. LIME PLASTER

Lime plaster is applied either in three coats or in two coats. Before the application of plaster, the background is prepared as described above.

(a) Three-coat plaster

In the 3-coat plaster, the first coat is known as *rendering coat* second coat is known as *floating coat* and the third coat is known as setting coat or finishing coat.

1. ***Application of rendering coat***

The mortar is forcibly applied with mason's trowel and pressed well into joints and over the surface. The thickness of coat should be such as to cover all inequalities of the surface; normal thickness is 12 mm. This is allowed to slightly harden, and then scratched criss-cross with the edge of trowel (or with devil float); the spacing of scratches may be 10 cm. The surface is left to set atleast for 7 days. During this period, the surface is cured by keeping it damp and then allowed to dry completely.

2. ***Application of floating coat***

The rendering coat is cleaned off all dirt, dust and other loose mortar droppings. It is lightly wetted. Patches 15 cm x 15 cm or strips 10 cm wide are applied at suitable spacings to act as gauges. The mortar is then thrown with mason's trowel, spread and rubbed to the required plain surface with wooden float. The surface so obtained should be true in all directions. In case of lime-sand plaster, the finishing coat is applied immediately. In the case of lime-surkhi plaster, the floating coat is allowed to slightly set and then lightly beaten criss-cross with floats edge at close spacings of 4 cm. It is then cured to set completely for atleast 10 days and then allowed to dry out completely. In either case, the thickness of coat varies from 6 to 9 mm.

3. *Application of finishing*

In the case of lime-sand mortar the finishing coat is applied immediately after the floating coat. The finishing coat consists of cream of lime (called *neeru* or *plaster's putty,* having limt cream and sand in the ratio of 4 : 1) applied with steel trowel and rubbed and finished smooth. The rubbing is continued till it is quite dry. It is left for 1 day, and then curing is done for atleast 7 days. In the case of lime-surkhi mortar,

the finishing coat is applied. 7 days after the floating coat, after cleaning the surface of all dirt, dust and mortar droppings and after fully wetting the surface of previous coat. The finishing coat is rubbed hard and finished smooth.

(b) Two-coat plaster

In thecase of two-coat plaster, *the rendering coat* is a combination of the rendering floating coats of 'three-coat plaster' and is done under one continuous operation except that the scratching of rendering coat, as specified in the three-coat plaster, is not done. The total thickness may be about 12 mm. The finishing is then applied in a manner similar to the three-coat plaster.

2. CEMENT PLASTER AND CEMENT-LIME PLASTER

Cement plaster is applied either in two coats or in three coats, the former being more common. For inferior work, single coat plaster is sometimes provided.

(a) Two-coat plaster.

The following procedure is adopted:

1. The background is prepared by racking the joint to a depth of 20 mm, cleaning the surface and well-watering it.

2. If the surface to be plastered is very uneven, a preliminary coat is applied to fill the hollows, before the first coat.

3. The *first coat* or *rendering coat* of plaster is applied, the thickness being equal the specified thickness of plaster less 2 to 3 mm. In order to maintain uniform thickness of plaster, *screeds* are formed of plaster on wall surface by fixing dots of 15 cm x 15 cm size. Two dots are so formed in vertical line, at a distance of about 2 m, and are plumbed by means of a plumb bob. A vertical strip of mortar, known as screed, is then formed. A number of such vertical screeds are formed at suitable spacing. Cement mortar is then applied on the surface between the successive screeds and the surface is properly finished.

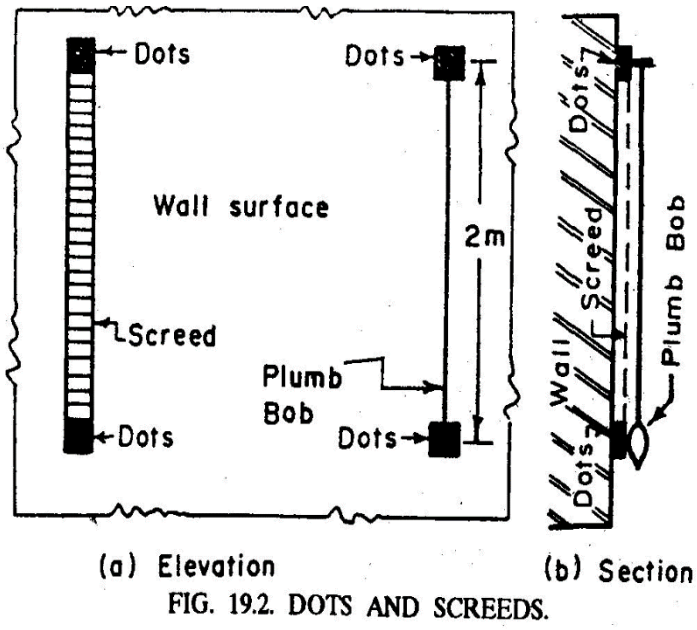


FIG. 19.2. DOTS AND SCREEDS.

4. Before rendering hardens, it is suitably worked to provide mechanical key for the final or finishing coat. The rendering coat is travelled hard forcing mortar into joints and over the surface. The rendering coat is kept wet for at least 2 days, and then allowed to dry completely.

5. The thickness of final or ***finishing coat*** may vary between 2 and 3 mm. Before applying the final coat, the rendering coat is damped evenly. The final coat is applied with wooden floats to a true even surface and finished with steel trowels. As far as possible, the finishing coat should be applied starting from top towards bottom and completed in one operation to eliminate joining marks.

(b) Three-coat plaster. The procedure for applying three-coat plaster is similar to the two-coat plaster except that an intermediate coat, known as *floating coat* is applied. The purpose of this coat of plaster is to bring the plaster to an even surface. The. thickness of rendering coat, floating coat and finishing coat are kept 9 to 10 mm, 6 to 9 mm and 2 to 3 mm respectively. The rendering coat is made rough. The floating coat is applied about 4 to 7 days after applying the first coat. The finishing coat may be applied about 6 hours after the application of floating coat.

(c) Single-coat plaster. This is used only in inferior quality work. It is applied similarly as two coat plaster except that the rendering coat, as applied for two-coat plaster, is finished off immediately after it has sufficiently hardened.

7. PLASTER ON LATH

Laths are adopted to provide foundation for plaster work. Laths are also provided for plastering thin partition walls and for plastering ceilings. Laths may be of two types: (i) wooden laths and (//) metal laths.

Wooden laths used for plastering over wooden partition walls and ceilings, are in the form of well-seasoned wooden strips 25 mm wide and 1 to 1.2 m long. These strips are fixed in parallel lines with clear spacing of 10 mm, and secured to the surface with galvanized iron nails.

Metal laths are available under various patent names. The plain expanded metal lath (Exmat) is commonly used. Metal laths are fixed to the surface by G.I. staples. In case of concrete or masonry surface, wooden plugs have to be embedded for fixing the lath.

After fixing the lath, the surface is plastered, usually in three coats. Cement mortar is used.

Learning Unit 4 – Carry out smoothing

LO 4.1 – Smooth the plaster

- Content/Topic 1 : Smoothing tools and materials

The commonly Smoothing materials for plastering are cement and lime. Whereas smoothing tools is steel float. Steel float or **Metal float** is known as **laying trowel.** It is used for troweling, to get desired smooth finish.

Dry wall Corner shaper (angle tool): These are trowel like tools used for making corners either internal or external (quoin)

- Content/Topic 2 : Smoothing techniques

LO 4.2 – Clean tools and equipment

- Content/Topic 1 : Safety precautions

All tools must be kept safe. The workers must also wear personal protective equipment in order to perform the task effectively and effectively

Cleaning methods:

- leave a clean and dry surface, free from moisture or dry waste – e.g. 'clean-to-dry'
- do not leave a build-up of cleaning products
- maintain the slip resistant properties of the floor/surface (if non-slip flooring)
- are based on advice from the flooring supplier
- are tailored to the specific flooring and contaminants – i.e. type and concentration of chemicals etc. For example, the time detergent is on the floor has been shown to have a significant effect on cleanliness. It is also noted that flooring that is slip resistant can be cleaned to be as hygienic as other flooring.

Cleaning schedules:

- are systematic and well planned
- have routine daily cleaning conducted during quiet/slow periods
- include periodic deep/comprehensive cleaning
- provide a rapid/urgent response to spills
- include indoor and outdoor areas

- include customer/visitor areas
- accommodate for periods of bad weather.

Cleaning equipment/products:

- suited to the task, environment and the users
- don't spread the problem (e.g. paper-towel instead of wet mop for small spill, or 'spill-kit' materials for oil leaks, spill stations where resources are kept etc.)
- includes barriers and signs to keep people off any wet areas if 'clean-to-dry' is not possible.

Personnel responsible for cleaning:

- cleaners are trained, equipped and supervised to do routine cleaning
- all workers assist in spot cleaning/spills management
- supervisors are trained and able to oversee work practices
- workplace visitors and others encouraged to report hazards where appropriate.

Details regarding the correct cleaning system may be provided in a Safe Work Method Statement or other procedural guidance.

Cleaning methods to consider

The cleaning method you use will depend on a number of factors. This is best decided in consultation with the flooring and cleaning equipment suppliers based on the workplace's requirements. A combination of methods may be used across the workplace. The following table is from a review of cleaning options for health settings, and may be relevant to other similar settings.

- Content/Topic 2 : Carry out periodic maintenance of safety of work tools and equipment

  At the end of work; all tools and equipment should be cleaned to remove dusts and other wastes on them.

  Purposes of cleaning tools and equipment:

  1. Avoid rust of the tools and equipment
  2. Preventing equipment damage.
  3. Increase the durability of the tools and equipment
  4. Improve safety and health of the employees.
  5. Reduces overall tool cost through maintenance

- Content /Topic3 : Safe store of equipment and tools

  Adequate storage facilities for tools and equipment must also be provided for when it is not in use, unless the employee can take tools or equipment away from the workplace.

Importance of proper storage of tools & equipment

1. Improve safety and health of the employees.
2. Improves appearance of construction areas.
3. Reduces overall tool cost through maintenance
4. It ensures that tools are in good repair at hand.
5. Teaches workers principles of tool accountability.
6. Avoid rust of the tools and equipment

Points to follow in storing tools and equipment:

1. Have a designated place for each kind of tools and equipment.
2. Label the storage cabinet or place correctly for immediate finding.
3. Store them near the point of use.
4. Wash and dry properly before storing.
5. Store sharp tools properly when not in use with sharp edge down.
6. Put frequently used items in conveniently accessible locations.
7. Gather and secure electrical cords to prevent entanglement or snagging.
8. Cutting boards should be stored vertically to avoid moisture collection.
9. Metal equipment can be stacked on one another after drying such as storage dishes and bowls.
10. Make sure the areas where you are storing the equipment are clean and dry.

Process of storing tools and equipment:

1. Selection of area for storing tools and equipment
2. Prioritize tools and equipment
3. Separate tools and equipment
4. Remove unused tools and equipment

LO 4.3 – Clean work area

- Content/Topic 1 : Removal of any wastes on working area after work

Also the workplace should be cleaned to remove waste materials.

The importance of a clean workplace

1. Provide safety to the employees
2. Improve health to the employees
3. Increase the appearance of the work place
4. Elevate your brand

Methods of cleaning work place:

1. By water
2. By brush
3. By air compressor

References:

1. Brian F. P., Stagg W. D. (2007). *Plastering: An Encyclopaedia* (4th edition), Wiley-Blackwell
2. Taylor J.B., (1990). *Plastering* (5th Edition), Longman
3. William M., George B. (2013). *Plastering Plain and Decorative:* (4th Revised Edition), Taylor & Francis Ltd