

# AR 17-53 BUILDING MATERIALS AND CONSTRUCTION - IV

**MODULE I - WALL FINISHES (12 hrs)**

# MODULE -I

- **Plaster**: Lime plaster and gypsum plaster. Fire resistant plaster, X-Ray shielding plaster and acoustic plaster. Plaster over masonry and ceiling.
- **Paints and varnish**: Characteristics of an ideal paint and varnish. Classification – various types of paints. Painting process. Defects in painting works. Process of varnish.
- **Wall cladding** : stone cladding, tile cladding, Wooden cladding and metal cladding. Stucco finish and other finishes.
- **Sketches** : Stone cladding, Metal cladding

# MATERIALS FOR FINISHES

## WALL FINISHES

As the name “Wall Finishes” itself suggests that it is finish given to the wall to enhance the interior or exterior look of the structure.

- Wall finishes used for the interiors are quite delicate and need maintenance.
- Wall finishes provide a decorative skin to conceal building components including structural members, insulation, ductwork, pipes, and wires.
- The new contemporary trend has brought about great deal of increase in the usage various types of wall finishes for the aesthetic purpose.
- Concrete, masonry wall may be left exposed or plastered.
- Wood or metal stud walls can support a variety of finishes.

# MATERIALS FOR FINISHES

## TYPE OF WALL FINISHES

- PLASTERING
- PAINTING
- TILING

Type of background for **plastering** work

- Claybrick
- Blockwork
- concrete
- boards

# PLASTERING

- **Plastering** is a process of obtaining smooth surface on the rough surfaces of walls, roofs, columns and ceilings etc. for long lasting purposes and to meet its estimated design life period.
- **Plaster** is the word used to describe the material that is spread(plastered) over irregular and coarse textured wall and ceiling surfaces to provide a smooth level finish.
- Also plastering make the rough surfaces smooth thereby make it good looking and attractive. Also it helps in preventing damp proofing.
- The coat formed on the rough surface is called **plaster** when applied inside of the building and it's called as **rendering** when applied outside of the building i.e. at outer wall exposed to direct environmental condition.

# OBJECTIVES AND REQUIREMENTS OF A GOOD PLASTER:

- **Objective:**
- Protection of surface against environmental condition and rain water as well as sun light.
- Protection against insects and fungus etc.
- Provides aesthetically beautified construction.
- Defective construction is patched and a little strength is gained.
- **Requirements of a Plaster:**
- It should stick to the back ground and should not spall off during bad weather.
- It should be inert and should not chemically react with reinforcement or other decorative finishing or floorings.
- It should be economical and easily available.
- It should possess water resistance nature and should be environmental friendly as far as possible.
- It should be durable, hard and possess good workability.

# General Plastering Materials

## **MATERIALS USED IN PLASTER**

### **Lime plaster**

Lime is mixed with sand and water in the proportion of 1 of lime to 3 parts of sand by volume, with water for use as undercoat and by itself with water as a finish coat.

### **Cement plaster**

used as a fine grey powder which, when mixed with water, hardens to a solid, inert mass. It is mixed with sand and water for use as an undercoat for application to brick and block walls and partitions. It is used on strong backgrounds as 1 part of cement to 3 or 4 parts of clean, washed sand by volume.

## Special Plastering Materials

### **Gypsum plaster**

During the last 70 years the use of gypsum plaster has increased greatly for both undercoat and finish plaster to the extent that it has largely replaced lime and cement.

The advantage of gypsum plasters is that they expand very slightly on setting and drying and are not, therefore, likely to cause cracking of surfaces.

Gypsum is a chalk like mineral. It is available as both natural gypsum, which is mined in areas all over the world, and as a synthetic by-product of major industries such as fossil fuelled power stations.

Gypsum is a crystalline combination of calcium sulphate and water ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ).

### **Hemihydrate gypsum plaster (plaster of Paris)**

When powdered gypsum is heated to about  $170^\circ \text{C}$  it loses about three quarters of its combined water and the result is described as hemihydrate gypsum plaster ( $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$ ). This material is better known as plaster of Paris.

## SPECIAL PLASTERING MATERIALS

- **Fire resistant plaster**
- **Acoustic Plaster:** This is plaster of gypsum mixture with plaster to obtain a sound proof plastering which is applied as finishing coat in two layers of 6 mm each. The sound insulation property is due to honey combing of the coat on undergoing chemical reaction. These are used therefore in the interior walls of auditorium, picture halls and conference halls etc.
- **Barium Plaster:** Barium sulphate is used for plastering in barium plaster with cement and sand. This is X-ray resistive and hence protects the pathologists and others working in the X-ray room frequently.



# Barite plaster/ Barium plaster

- Has been largely used as shielding material in installations housing gamma radiation sources as well as x-ray generating equipment, in order to minimize exposure to individuals.
- Barite plaster is a compound of cement, sand, barium sulphate and water mixed in a controlled proportion.
- The basic ratio of cement to water determines plaster strength.
- The knowledge of the physical and chemical characteristics of both the barite mineral and barite plaster as well as the degree of radiation attenuation provided are very important when dealing with shielding calculations for both medical and industrial installations.
- Effective protection against X-ray radiation
- Lead-free application - eliminates use of lead and a safer alternative to other lead-based systems
- Sound resistance
- Fire resistance
- Plasterboard® must be jointed with Jointing Compounds to provide lead equivalent joints.
- Applications
- Medical Facilities, Dental Clinics, Areas exposed to X-Ray radiation

# Heat Resistant Plaster

- Fire resistant plaster consisting of
  1. a mix of vermiculite-perlite grains, with gypsum as a binding agent and additives.
  2. fibrous (including [mineral wool](#) and glass fiber)
  3. cement mixtures either with mineral wool or with [vermiculite](#)
  4. gypsum plasters, leavened with [polystyrene](#) beads, as well as chemical expansion agents to decrease the density of the finished product
- Heat Resistant Plaster is a replacement material for gypsum plaster where the temperatures are too high for gypsum plaster to stay on the wall.
- Heat Resistant Plaster is a fully blended fine powdered material which is mixed with water to a trowellable/ floating consistency.
- Heat Resistant Plaster should be used on walls and chimney breasts where the temperature is likely to exceed 50°C particularly around the so-called “hole in the wall” type fires and stoves.
- It is recommended that the plaster is used in combination with Heat Proof Screed.

# Heat Resistant Plaster

## USES

- Around log burning stoves.

For use with “cassette” or “hole in the wall” fire places.

- On walls and chimney breasts where the temperature is likely to exceed 50°C.
- Any domestic application where high temperature resistance is needed.

## CHARACTERISTICS / ADVANTAGES

- Easy trowelable formulation.
- Temperature resistant up to 500°C.
- Works on most common solid materials. Is compatible with all backing plasters (important where the plasters meet going from fire rated areas)

# Heat Resistant Plaster

## **APPLICATION :**

- Always use clean fresh water and follow the surface preparation guidelines. Use a drill mixer attachment as it is not possible to mix this product by hand. Mix, in a step-wise manner, approximately 1 part water to 2.5 parts Heat Resistant Plaster by volume powder until a smooth trowelable consistency is achieved - normally within 10-15 mins of mixing.
- Allow the mix to stand for 5 to 10 minutes (dependant on the ambient temperature).
- The product can then be floated within approximately 1 hour of application (dependant on ambient temperature and humidity).
- Smooth off and allow three days minimum to cure naturally before heat is applied.

## • **LIMITATIONS**

- ▪ Low temperature/ high humidity will impair drying.
- Do not apply when the ambient temperature is below 5°C or RH exceeds 90%.

### 1. PREPARATION

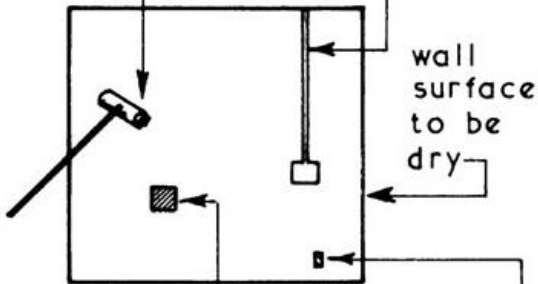
surface well brushed with hard broom to remove loose material and dust

chases cut before plastering

wall surface to be dry

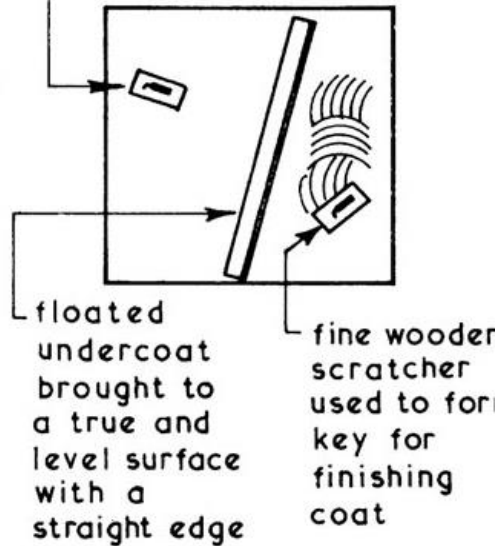
any metal fixings to be painted or galvanised to prevent staining

fixing plugs inserted before plaster is applied



### 2. UNDERCOATING

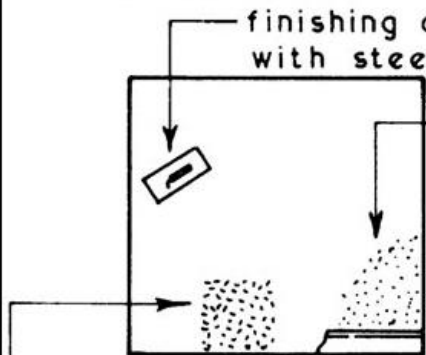
thin coats of undercoat plaster applied and built up to required thickness



### 3. FINISHING

finishing coat of plaster applied with steel trowel to give a smooth finish

trims and decorative finishes applied after plaster has set and cured



textured surfaces can be obtained by using a sponge, hair brush, felt float or steel combs

### TYPICAL DATA FOR BRICK AND BLOCK BACKGROUNDS

Undercoat - 8 to 10mm thick  
Finishing coat - 2mm thick  
Setting times:  
Undercoat - 2 hours  
Finishing coat - 1 hour

## MATERIALS FOR FINISHES

Internal Wall Finishes ~ these can be classified as **wet** or **dry**.

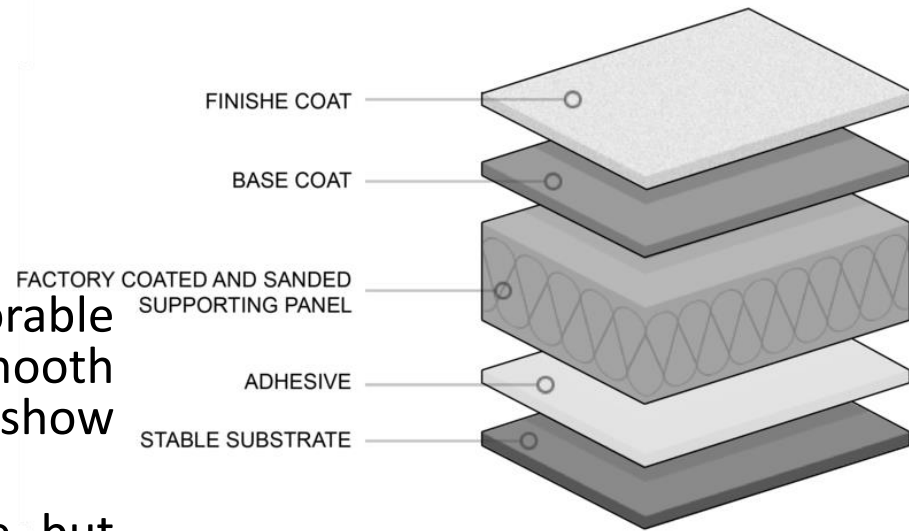
The traditional wet finish is plaster which is mixed and applied to the wall in layers to achieve a smooth and durable finish suitable for decorative treatments such as paint and wallpaper.

# ACOUSTIC PLASTER

- **Acoustic plaster** is [plaster](#) which contains fibres or aggregate so that it [absorbs sound](#).
- Early plasters contained [asbestos](#), but newer ones consist of a base layer of absorptive substrate panels, which are typically [mineral wool](#), or a non-combustible inorganic blow-glass granulate.
- A first finishing layer is then applied on top of the substrate panels, and sometimes a second finishing layer is added for greater sound attenuation.
- Pre-made acoustic panels are more commonly used, but acoustic plaster provides a smooth and seamless appearance, and greater flexibility for readjustment.
- The drawback is the greater level of skill required in application.

# ACOUSTIC PLASTER

- Acoustic plasters are aesthetically favorable because it allows for seamless smooth application compared to panels that show visible joints.
- Some acoustic plasters contain aggregate, but better systems incorporate fiber.
- Acoustic plasters are generally applied at a thickness between 1/16" and 1.5".
- Acoustic plasters consist of a **base layer** of absorptive substrate panels, which are typically mineral wool, or a non-combustible inorganic blow-glass granulate.
- A first **finishing layer** is then applied on top of the substrate panels and when dried, produces a first layer of sound attenuation.
- A second finishing layer may also be added to create a second system of sound attenuation.



# ACOUSTIC PLASTER

- Compared to acoustic plaster, acoustic panels are the most commonly used material for controlling the sound environment of space.
- Acoustic panels were often made of a mineral wool composition that is very absorbent of sound.
- Although acoustic panels are common in basements or recreational areas, they are seldom used in living spaces due to aesthetic reasons.
- Instead, conventional plaster or drywall systems were more frequently used in homes and other environments where interior aesthetics is a more important consideration but these are, however, not ideal in sound absorption.



# Application of Plaster

- **Ceiling plaster** shall be completed before commencement of **wall plaster**.
- Plastering shall be started from the top and worked down towards the floor.
- All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 × 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges.
- The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface.
- The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness.
- This shall be brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time.
- Finally the surface shall be finished off true with trowel or wooden float according as a smooth or a sandy granular texture is required.
- Excessive troweling or over working the float shall be avoided.

# Application of Plaster

- When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically.
- When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with cement slurry before plaster is applied to the adjacent areas, to enable the two to properly join together.
- Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arrises.
- It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arrises.
- Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages.
- The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

# Application of Plaster

## **CURING**

- Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered. The plaster shall be kept wet for a period of at least 7 days.

## **FINISH**

- The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required.
- The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long and with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

# METHODS OF PLASTERING:

- There are basically three types of plastering i.e. lime plaster and cement plaster or combination of both. Before plastering, however, the back ground should be prepared since the adhesion of plaster is highly affected by the back ground. Hence at first back ground is prepared.
- **Preparation of Background:**
- All masonry joints should be raked 10 mm in case of brick masonry and 15 mm in case of stone masonry for providing key to the plaster before onset of plastering operation.
- All mortar drops, dusts and freshly laid concrete or laitance should be removed with the help of a stiff brush. Rendering is applied after any existing unevenness is removed.
- For a three coat finishes the local projection should not be more than 10 mm and local depression should not exceed 20 mm.
- For two coat plaster these limitations are reduced to 5 and 10 mm respectively.
- The surface should be kept damp for suction and it should be cleaned 1<sup>st</sup>.
- The surface should not be kept soaked and neither it should be kept less wet so as to cause strong suction which withdraws the water from mortar and makes it weak and porous.

# MATERIALS FOR FINISHES

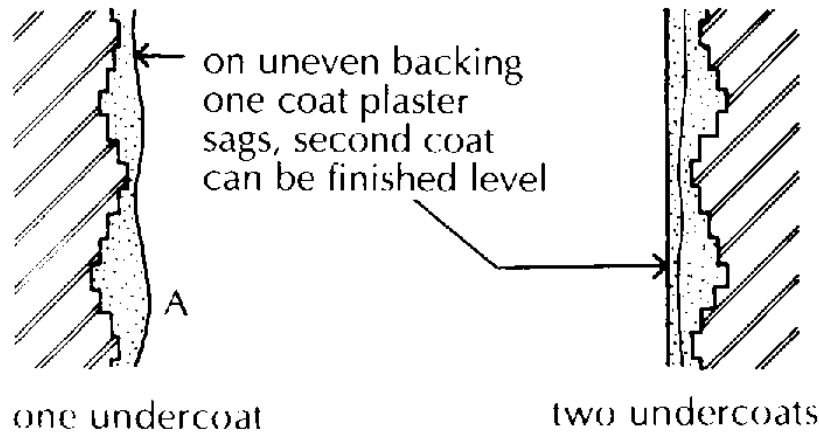
## **Plaster undercoats and finish coat**

The finished surface of plaster should be flat and fine textured (smooth). It would seem logical, therefore, to spread some fine grained material, such as lime or gypsum mixed with water, over the surface and trowel it smooth and level. The maximum thickness to which a wet, fine grained material can be spread and levelled is about 3 mm. The irregularities in the surface of even the most accurately laid brick or blockwork are often more than 3 mm and it would be necessary to apply two coats to achieve a satisfactory finish.

Instead of applying a fine grained plaster in two coats to irregular surfaces it is practice to spread some cheaper, coarse grained material that is easily spread as one or two coats to render the surface level and then finish with a thin coat of fine grained material to provide a smooth finish.

The coarse grained coat or coats of plaster are termed undercoats and the fine grained final coat a finish or finishing coat.

# MATERIALS FOR FINISHES



**Fig. 212** The advantage of two undercoats.

If one thick undercoat were spread and levelled on an irregular surface it would tend to sag, as illustrated by line A in Fig. 212, due to the weight of the still plastic, wet plaster. If, however, a thinner first undercoat is spread and allowed to harden, a second undercoat can be spread to take out variations in level as indicated in Fig. 212. The first undercoat was called the render and the second the float coat.

# MATERIALS FOR FINISHES

## Cement Textured /Plastered Finish:

- This is a decorative finish and its mortar is prepared in cement based material. It is applied faced plaster with a trowel and after that it is coloured with paint.



# MATERIALS FOR FINISHES

## Plaster of Paris Finish :

- Plaster of Paris (POP) is a building material having Gypsum as its main component. It is used for coating walls and ceilings and also for creating architectural designs.
- Plaster of Paris or simply plaster is a type of building material based on calcium sulphate hemihydrates.
- This is a smooth finish achieved by plaster of Paris generally applied on internal walls.





# MATERIALS FOR FINISHES

## **Gypsum plasters:**

- In gypsum plaster, gypsum and water is required for plastering. This just like plaster of Paris finish but gypsum based material is used to prepare mortar. It is more durable and finer as compared to Plaster of Paris Finish.

## **Advantages of Gypsum Plasters**

There are some advantages of gypsum plaster over the cement sand plaster & POP finish as detailed below.

- Gypsum plaster is directly applied on brick, block or RCC, no separate finishing product required.
- It requires no curing, therefore ready to paint.
- Gypsum plaster saves time during construction and ensures timely possession of homes/building.
- Gypsum plaster expands slightly on setting and is not, therefore likely to cause cracking of surface.
- On drying out it forms a sufficient dense surface to resist normal knocks.
- Gypsum plaster is comparatively easy to spread and level.
- Gypsum plasters have no appreciable chemical action on paint.
- Gypsum plaster spread and finished to a minimum thickness increasing carpet area.
- Gypsum plaster is perfectly lined, leveled, sharp corner and smooth surface.
- Saving on electricity used for air conditioning as gypsum has very low thermal conductivity.
- It is more durable and green material.
- Gypsum plaster light in weight, therefore reduces the load on structure.
- More cleanliness on site because it is bag packed product and no curing is required.

# MATERIALS FOR FINISHES

## **GYPSUM PLASTERS:**

### **Disadvantages of Gypsum Plaster**

- Gypsum plaster is not suitable for exterior finish, as it can not be used in damp situations.
- Gypsum plaster is more expensive than cement sand plaster but cost disadvantages should be weighed against the advantages and the fact that the labour cost is appreciably greater than that of materials in plastering.
- Cement plaster add structurally strength to the wall but not in case of Gypsum plaster.

# MATERIALS FOR FINISHES

## Marble Powder Finish

- This is a very smooth finish. The finish looks like Marble flooring. This finish is obtained by mortar of marble powder, white cement and water. It is applied manually.



# MATERIALS FOR FINISHES

## Textured-finish

The colour and texture of smooth rendering appear dull and unattractive to some people and they prefer a broken or textured surface.

Textured rendering is usually applied in two coats. The first coat is spread and allowed to dry as previously described. The second coat is then spread by trowel and finished level. When this second coat is sufficiently hard, but still wet, its surface is textured with wood combs, brushes, sacking, wire mesh or old saw blades. A variety of effects can be obtained by varying the way in which the surface is textured.

An advantage of textured rendering is that the surface scraping removes any scum of water, cement and lime that may have been brought to the surface by trowelling and which might otherwise have caused surface cracking.





# MATERIALS FOR FINISHES

## **Pebbledash (drydash) finish**

This finish is produced by throwing dry pebbles, shingle or crushed stone on to, and lightly pressed into, the freshly applied finish coat of rendering so that the pebbles adhere to the rendering but are mostly left exposed as a surface of pebbles. Pebbles of from 6 to 13 gauge are used. The undercoat and finish coat are of a mix suited to the background and are trowelled and finished level. The advantage of this finish is that any hair cracks that may open due to the drying shrinkage of the rendering are masked by the pebble dash.

## **Pebbles Finish**

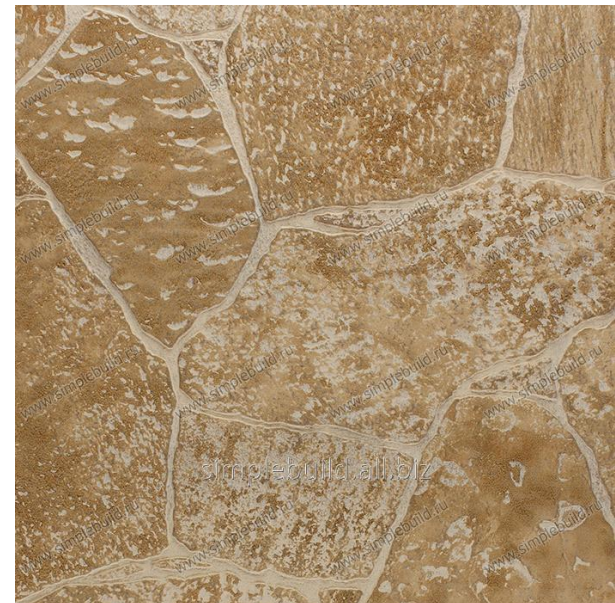
- This a very simple and attractive finish obtained by pasting small pebbles on the walls with cement mortar as an adhesive.
- Pebbles finish is usually preferred for exterior facade.
- It is also commonly used to give nice flowing effect to the waterfalls that are created especially designed for Hotel Interiors or as a part of Exterior Landscaping



# MATERIALS FOR FINISHES

## Canfor finish/Faux finish

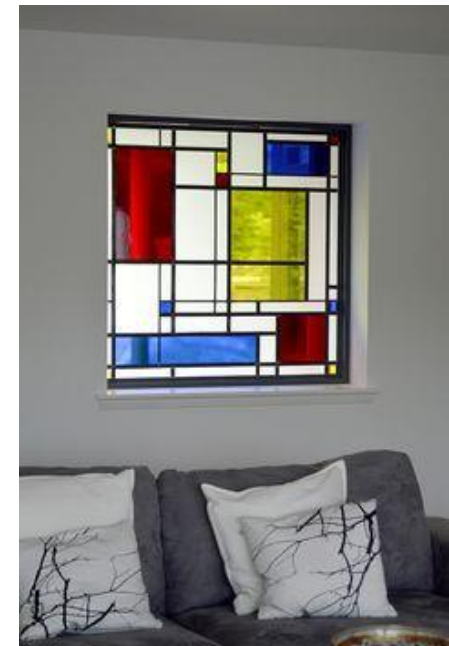
- Canfor finish is also known as Faux finish. This material is used for the interiors of residences.
- It adds a unique aesthetic appeal to the place. It comes in 6mm thickness and in different designs.
- This finish is chosen when a false finish is to be given. It gives a stone wall or brick wall effect
- faux finishing are terms used to describe decorative paint finishes that replicate the appearance of materials such as marble, wood or stone.



# MATERIALS FOR FINISHES

## Stained Glass Finish

- It involves lot of creative work.
- The glass is decorated with itching, frosting, glass pasting and finally colouring with suitable colours according to the theme.
- The stained glass panels are used on walls and ceilings.





# MATERIALS FOR FINISHES

## Flakes Finish

- It is a special material used to enhance the elevation treatment of the building.
- It is majorly used for the exterior facade.
- It has also been used for the interiors but to a very small extent.
- Application of flakes finish is avoided in the interiors because chipping off of flakes is a trouble.
- The flakes are applied with a trowel on walls over a coat of adhesive.





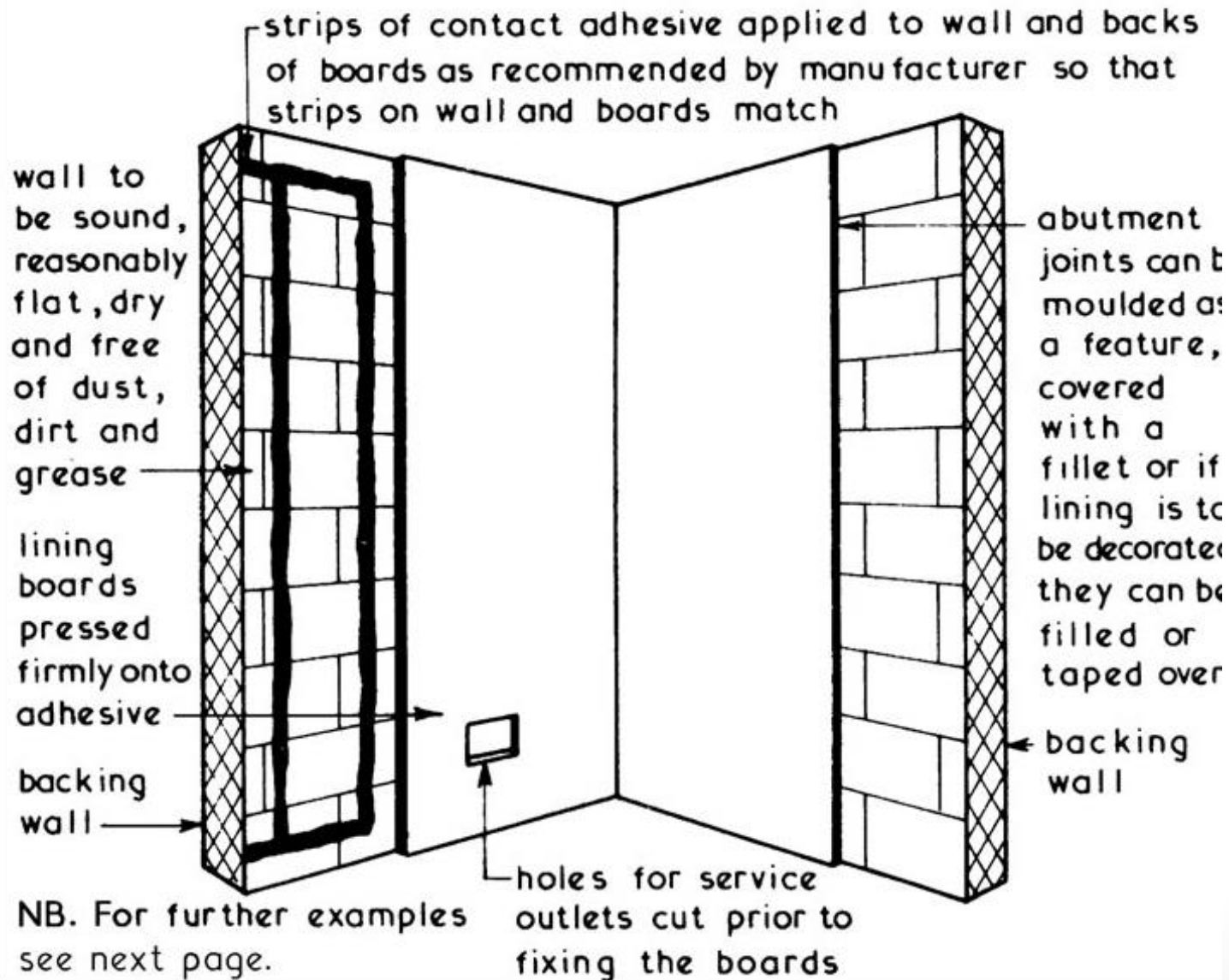
# MATERIALS FOR FINISHES

## DRY LININGS

- An alternative to wet finishing internal wall surfaces with render and plaster.
- Dry lining materials can be **plasterboard, insulating fibre board, hardboard, timber boards and plywood**, all of which can be supplied with a permanent finish or they can be supplied to accept an applied finish such as paint or wallpaper.
- For plasterboard a dry wall sealer should be applied before wallpapering to permit easier removal at a later date.
- The main purpose of lining an internal wall surface is to provide an acceptable but not necessarily an elegant or expensive wall finish.
- It is also very difficult and expensive to build a brick or block wall which has a fair face to both sides since this would involve the hand selection of bricks and blocks to ensure a constant thickness together with a high degree of skill to construct a satisfactory wall.
- The main advantage of dry lining walls is that the drying out
- period required with wet finishes is eliminated. By careful selection and fixing of some dry lining materials it is possible to improve the thermal insulation properties of a wall.

# MATERIALS FOR FINISHES

Typical Example ~



# AUTOMATIC WALL PLASTERING MACHINE

- Due to manual process of wall plastering on construction site, there is a huge scale requirement of labor and hence the labor cost is responsible for increasing the price of construction or project work.
- The quality of work is mostly depending on the skill of the labor work in manual plastering process.
- The solution of these problems is just to automate the process, so that there will be a saving of period and cost and getting good plaster finishing to the walls.
- The plastering machine can plaster the walls automatically and very smoothly.

Sr. No.	Objective	Existing method	Automatic plastering machine
1.	No. of labors required	2 to 3	1 or 2
2.	Time required (hours)	6 to 7 (hours)	1 to 2 (hours)
3.	Material	More material required compared to plastering machine as there is more wastage of mortar.	Less material required, compared to conventional method as less material wastage is there.
4.	Cost	Comparatively high cost. (As number of labors and time required is more)	Comparatively low cost. (As no. of labors and time required is less)



*model of components of plastering machine*

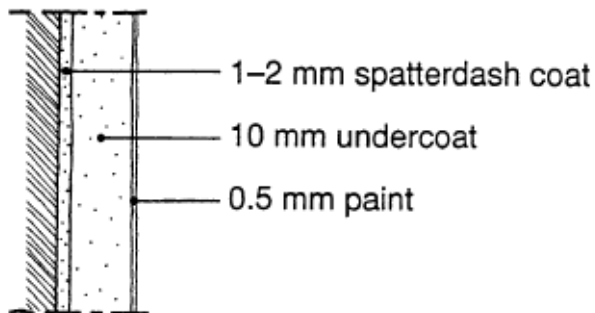
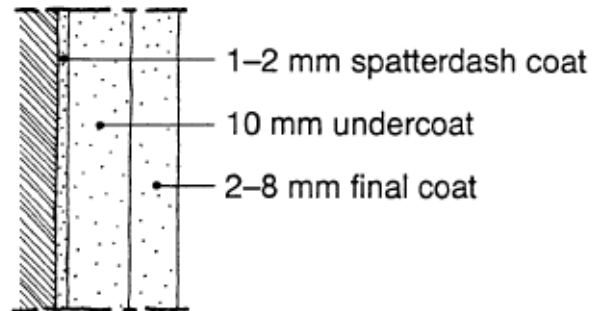
# Rendering

A rendering has several functions, such as:

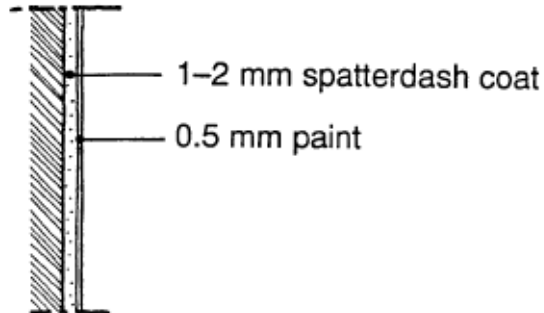
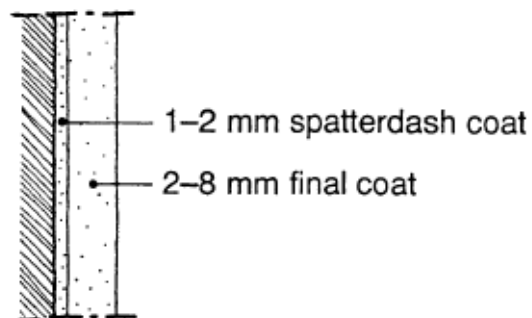
- to protect the building from external climatic and mechanical stresses,
- to create an aesthetically pleasing appearance,
- to create a smooth surface for a final finish.

The simplest is just one coat, and normally the maximum is three. A basic principle in building up the rendering is that the strength of each layer is less as one moves outwards.

## Three-coat Rendering



## Two-coat Rendering



## One-coat Rendering

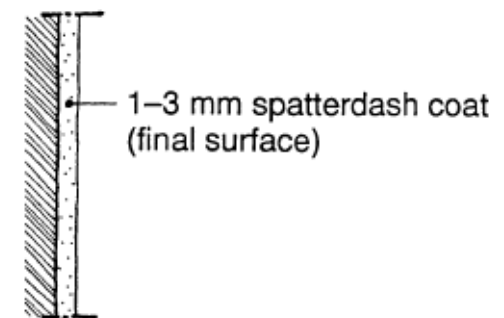


Fig. 8 Types of Rendering Systems.

# Rendering

- If the background is relatively uneven, such as ordinary brickwork, and the surface is to be smooth, it is necessary to have a total thickness of 10–15 mm.
- The thickest rendering consists of three coats: spatterdash coat, undercoat and final coat.
- ***The spatterdash coat*** - is a fluid mortar, the consistency of thin porridge. This is applied manually or with a spray and spread to a thickness of 1–2 mm.
- The main function of the spatter dash coat is to control and even out the absorbency of the background.
- When it is hot and dry, the spatter dash coat should be wetted to prevent rapid drying. It should cure for 1–3 days before the undercoat is applied. Very long curing (months) should be avoided
- ***The undercoat*** is applied 1–3 days after the spatterdash coat. If the weather is hot and dry, the spatterdash coat should be wetted carefully before the undercoat is applied