Lecture-20
Floor

by

Dr. Himanshu Chawla

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

CONTENT

- Introduction
- Components of floor
- Materials for Construction
- Selection of Flooring Materials
- Types of Flooring

INTRODUCTION

- The purpose of a floor is to provide a level surface capable of supporting the occupants of a building, furniture, equipment and sometimes internal partitions.
- To perform this function and in addition, others which may vary according to the situation of the floor in the building and the nature of the building itself, the floor must satisfy the following requirements:-

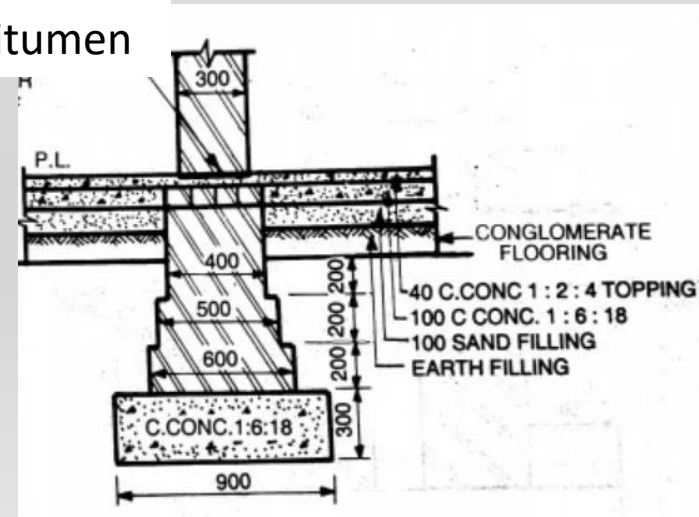
i) Adequate strength and stability
ii) Adequate fire resistance
iii) Sound insulation
iv) Damp resistance
v) Thermal insulation

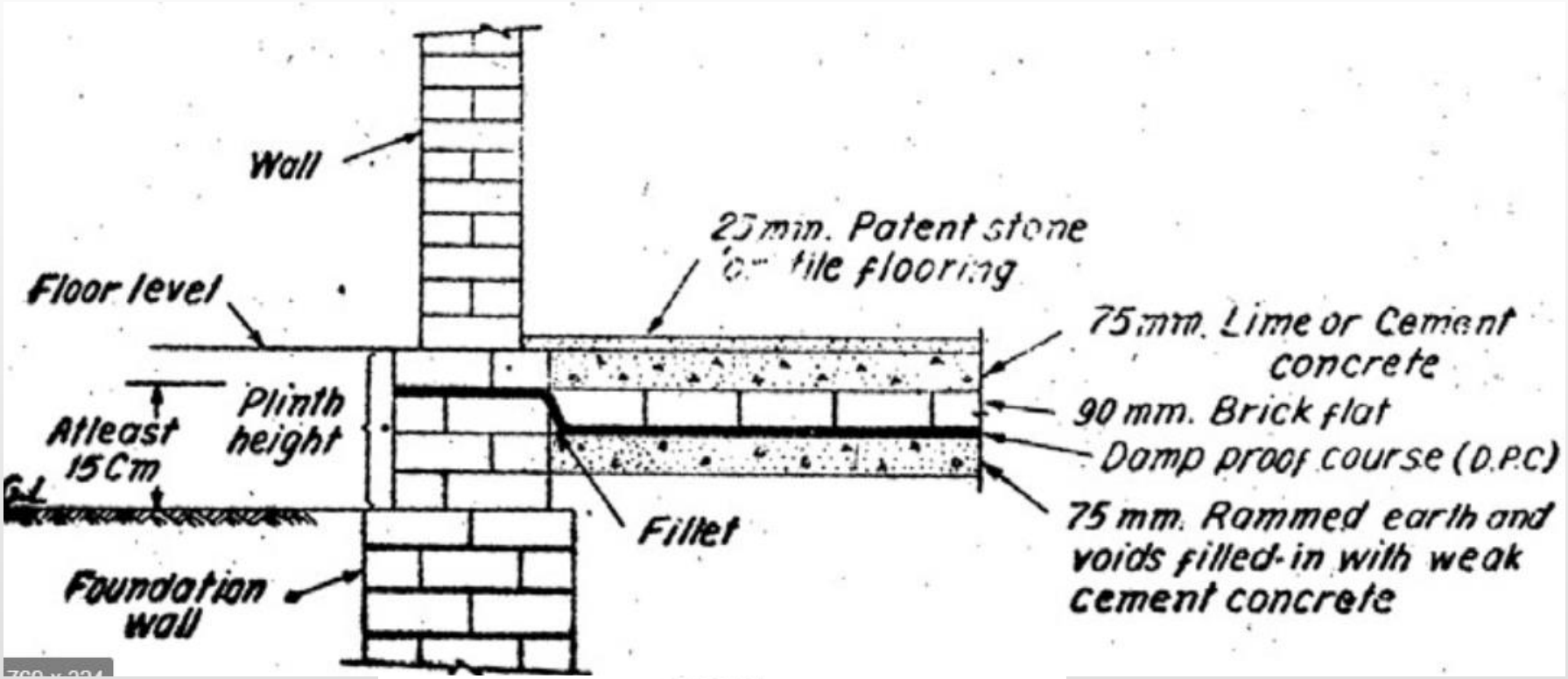
COMPONENTS OF FLOORING

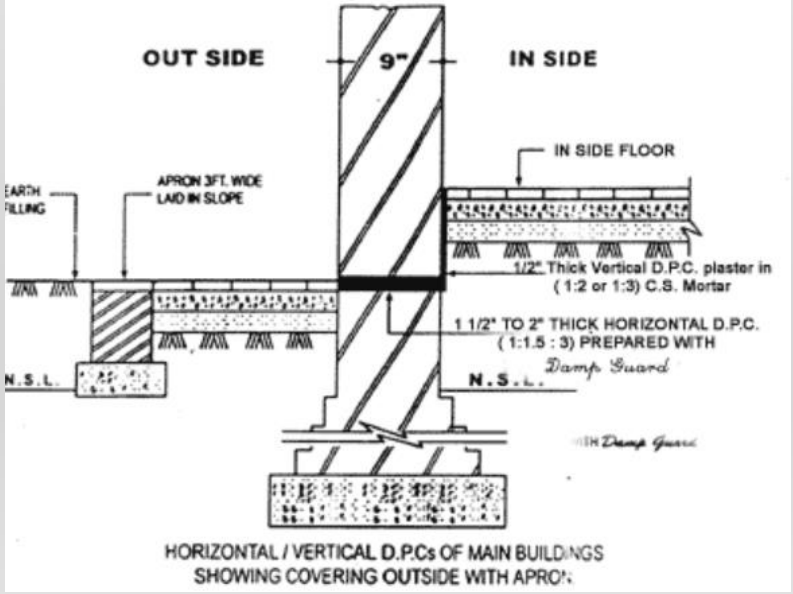
1. Sub floor, base course or floor base:-

- The floor base is a structural component which supports the floor covering.
- For the ground floors, the object of floor base is to give proper support to the covering so that it does not settle and to provide damp resistance and thermal insulation.
- Ground floors may either rest directly on the ground or may be supported a little distance above the ground.

2. Floor covering or simply flooring







HORIZONTAL / VERTICAL D.P.Cs OF MAIN BUILDINGS
SHOWING COVERING OUTSIDE WITH APRON

MATERIALS FOR CONSTRUCTION

- Cement concrete
- Lime concrete
- Stones
- Bricks
- Wooden blocks

SELECTION OF FLOORING MATERIAL

- **INITIAL COST:-** The cost of material should be in conformity with the type of building and its likely use.
- **APPEARANCE:–** Covering should give pleasing appearance, so that it should produce the desired color effect and architectural beauty
- **CLEANLINESS:–** The flooring should be capable of being cleaned easily and it should be not absorbent.
- **DURABILITY:–** The flooring should have sufficient resistance to wear, temperature changes, disintegration with time and decay so that long life is obtained.

SELECTION OF FLOORING MATERIAL

- **DAMP RESISTANCE:–** Flooring should offer the resistance against dampness so that healthy environment is obtained in the building.
- **SOUND INSULATION:–** The flooring should insulate the noise. Also, it should not be such that the noise is produced when users walk on it.
- **THERMAL INSULATION:–** The flooring should offer reasonably good thermal insulation so that comfort is imparted to the residents of the building.
- **SMOOTHNESS:–** The flooring material should be smooth and should have even surface. However, it should not be slippery.

SELECTION OF FLOORING MATERIAL

FIRE RESISTANCE:– This is more important for upper floors. Flooring material should offer sufficient fire resistance so that fire barriers are obtained between different levels of the building.

HARDNESS:– It should be sufficiently hard so as to have resistance to indentation marks, imprints etc. likely to be caused by shifting of furniture, equipments etc.

MAINTENANCE:– The flooring material should require least maintenance.

MUD FLOORING

MUD FLOORING

MUD FLOORING

- This flooring is cheap, hard, fairly impervious, easy to construct & easy to maintain.
- It has good thermal insulation property.
- Over a well prepared ground a 25 cm thick moist earth is spread & then rammed well to get compacted thickness of 15 cm.
- In order to prevent cracks, small quantity of chopped straw is mixed in the moist earth before rammed.
- Sometimes, cow-dung is mixed with earth & a thin layer of this spread over the compacted layer.

CHOPPED STRAW

MURAM FLOORING

- Muram is a form of disintegrated rock with binding material.
- To construct such a floor, a 15 cm thick layer of muram is laid over prepared sub grade.
- Over it 2.5 cm thick layer of powder muram is spread & water is sprinkled over it and surface is then rammed well.
- After ramming, the surface is saturated with a 6mm thin film of water.
- The surface is well-compacted under the feet of workmen till the cream of muram rises to top.
- Then surface is leveled & allow to dry.

BRICK FLOORING

- It is used in cheap construction, specially where good bricks are available.
- This flooring is specially suited to ware-house, stores, godowns etc.
- 10 to 15 cm thick layer of lean cement concrete (1:8:16) or lime concrete is laid over the prepared sub grade.
- This forms the base course, over which bricks are laid flat on 12 mm thick mortar bed in such way that all the joints are full with mortar.

BRICK FLOORING

BRICK FLOORING

BRICK FLOORING

FLAG STONE FLOORING

FLAG STONE FLOORING

- Flag stone is sand stone available in 2 cm to 4 cm thickness in the form of stone slabs of square (30 cm X 30 cm, 45 cm X 45 cm, 60 cm X 60 cm) or rectangular size (45 cm X 60 cm).
- Sub soil is properly compacted, over which 10 to 15 cm thick lime or lean cement concrete is laid. This forms the base course.
- The Flag stones are then laid over 20 to 25 mm thick layer of bed mortar.
- In laying the slabs, work is started from two diagonally opposite corners & brought up from both sides.

FLAG STONE FLOORING

FLAG STONE FLOORING

FLAG STONE FLOORING

CEMENT CONCRETE FLOORING

- This is commonly used for residential, commercial & even industrial building.
- It is moderately cheap, quite durable and easy to construct.
- The floor consists of two components:-

  a) Base concrete b) Topping or wearing surface.
- They are constructed either monolithically or non-monolithically. When the floor is laid monolithically, good bond between the two components is obtained resulting in smaller overall thickness. However, such a construction has three disadvantages.

CEMENT CONCRETE FLOORING

a) Topping is damaged during subsequent operations.

b) Hair cracks are developed because of settlement of freshly laid base course which has not set.

c) Work progress is slow because to wait till the initial setting of base course. Hence, in most of the cases, non-monolithic construction is preferred.

CEMENT CONCRETE FLOORING

- The base course is usually 7.5 to 10 cm thick, either in lean cement concrete (1:3:6 to 1:5:10) or lime concrete containing 40% mortar of 1:2 lime-sand & 60% coarse aggregate of 40mm nominal size.
- When base concrete is hardened, its surface is brushed with stiff broom & cleaned thoroughly.
- It is wetted the previous night and excess water is drained.

CEMENT CONCRETE FLOORING

- The topping consists of 1:2:4 cement concrete, laid in desired thickness (usually 4cm) in one single operation.
- Other alternate layers are then laid after 72 hrs, so that initial shrinkage of already laid panels takes place, thus eliminating the cracks.
- The prepared surface is protected from sunlight, rain, other damages for a period 12 to 20 hrs.
- The surface is then properly cured for a period of 7 to 14 days.

CEMENT CONCRETE FLOORING

TERRAZZO FLOORING

TERRAZZO FLOORING

- Terrazzo is special prepared concrete surface containing cement and marble chips in proportion to 1:2.
- It is very decorative and has good wearing properties. The flooring is however more expensive.
- It is widely used in residential buildings, hospitals, offices, schools and other public buildings.
- When surface has set, the chips are exposed by grinding operation. The sub base preparation and concrete base laying is done in the similar manner of cement concrete flooring.

TERRAZZO FLOORING

- The top layer may have 40 mm thickness consisting of:-

a) 34mm thick cement concrete layer (1:2:4) laid over the base concrete.

b) About 6 mm thick terrazzo topping.

- Concrete of the grade 1:2:4 is then laid in alternate panels leveled and finished to rough surface. When the surface is hardened, the terrazzo mix is laid and finished to the level surface. Additional marble chips may be added during the temping and rolling operations. So that, at least 80% of the finished surface show exposed marble chips.

TERRAZZO FLOORING

- The surface is then floated and trowelled and left to dry for 12 to 20 hours. After that the surface is cured properly for 2 to 3 days.
- The first grinding is done, preferably by machine using course grade (no. 60) carborundum stones using plenty of water. The ground surface is then scrabbed and cleaned.
- Cement grout of cream like consistency, is then applied and is cured for 7 days. Then second grinding is done with carborundum stones of fine grade (no. 120).

TERRAZZO FLOORING

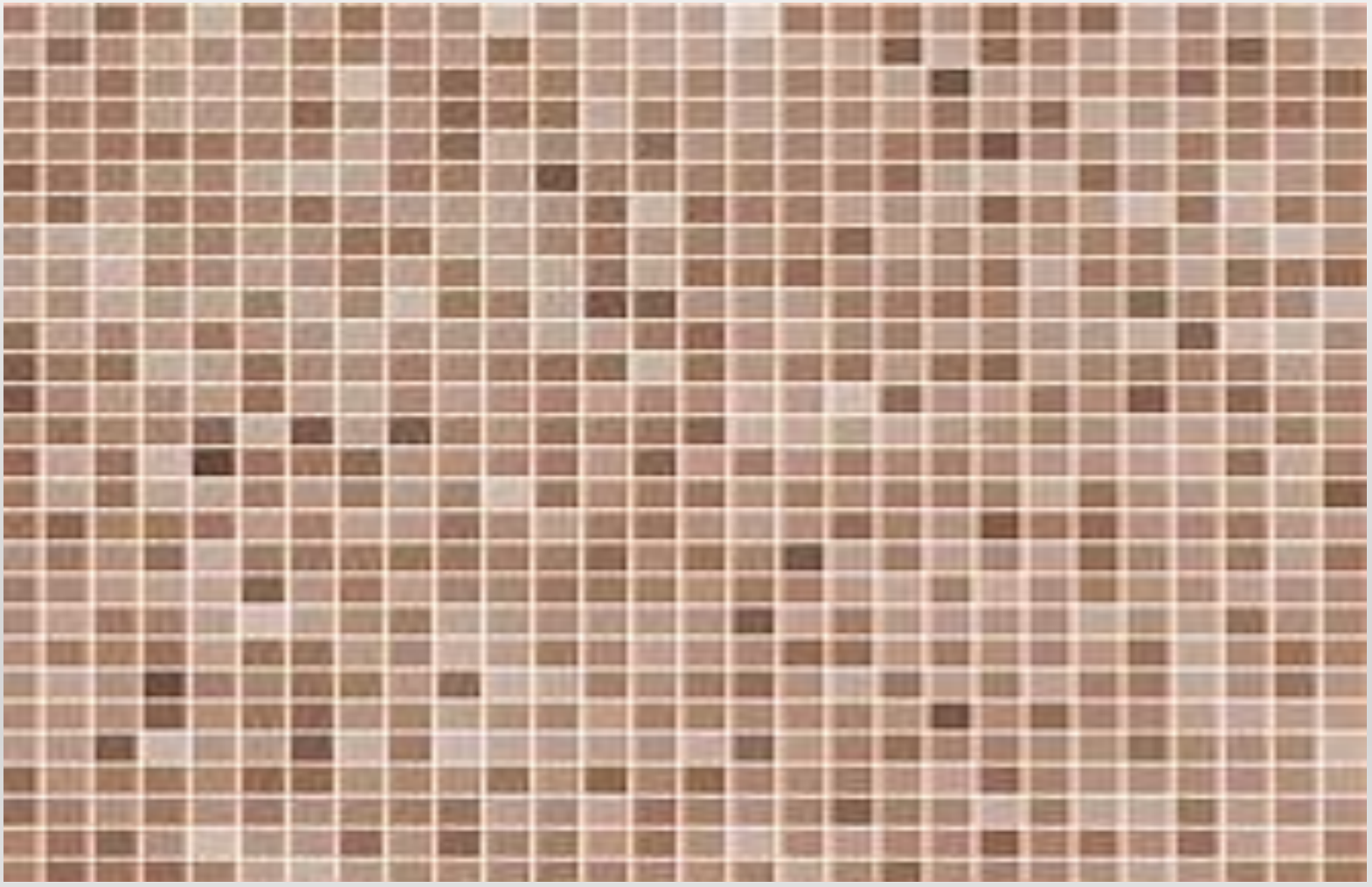
- The surface is cured for 4 to 6 days and final grinding is done with carborundum stone of 320 grit size.
- The surface is thoroughly scrabbed and cleaned using plenty of water.
- Wax polish is applied with the help of polishing machine to get final glossy surface.

TERRAZZO FLOORING

TERRAZZO FLOORING

TERRAZZO FLOORING

MOSAIC FLOORING



MOSAIC FLOORING

- It is made of small pieces of broken tiles of china glazed or of cement or of marble arranged in different pattern.
- A concrete base is prepared as in the case of concrete flooring and over it 5 to 8 cm thick lime-surkhi (Powder of bricks) mortar is spread and leveled.
- On this, a 3 mm thick cementing material in the form of paste of 2 parts of slaked lime, one part of powdered marble and one part of puzzolana material is spread and is left to dry for about 4 hours.

MOSAIC FLOORING

- Thereafter small pieces of broken tiles are arranged in definite patterns and hammered into cementing layer.
- The surface is gently rolled by a stone roller of 30 cm diameter and 40 to 60 cm long, sprinkling water over the surface, so that cementing materials comes up through the joints and an even surface is obtained.
- Floor is allowed to dry for 2 weeks before use.

MOSAIC FLOORING

MOSAIC FLOORING

TILED FLOORING

- Tiled flooring is constructed from square, hexagonal, or other shapes made up of clay, cement concrete or terrazzo.
- These are commonly used in residential flooring, offices, hospitals, schools and other public buildings.
- Over the concrete base, a 25 to 30 mm thick layer of lime mortar 1:3 is spread to serve as a bedding.
- Before laying the tiles it is cured for 12 to 24 hours, neat cement slurry is spread over the bedding mortar and the tiles are laid flat over it, gently pressing them into the bedding mortar with the help of wooden mallet till level surface

TILED FLOORING

TILED FLOORING

MARBLE FLOORING

- It is a superior type of flooring used in bathrooms and kitchens of residential building and in hospitals, sanatoriums, temples etc. where extra cleanliness is an essential requirement.
- The base concrete is prepared in the same manner as that of concrete floor.
- Over the base concrete, 20 mm thick bedding mortar of either 1:4 cement-sand mix is spread under the area of each individual slab.
- The marble slab is then laid over it, gently pressed with the wooden mallet and leveled. The paved area is properly cured for about a week.

MARBLE FLOORING

MARBLE FLOORING

MARBLE FLOORING

WOODEN FLOORING

- It is used for carpentry halls, dancing halls, auditorium etc.
- They are not commonly used in residential building of India because timber flooring is quiet costlier.
- In hilly areas, where timber is cheaply & readily available, and where temperature drops very low, timber flooring is quite common.
- One of the major problems in timber flooring is the damp prevention.
- This can be done by introducing D.P.C. layer below the flooring.

WOODEN FLOORING

WOODEN FLOORING

WOODEN FLOORING

RUBBER FLOORING

- It consists of sheets or tiles of rubber in variety of patterns and colors with thickness varying from 3 to 10mm.
- The sheets or tiles are fixed to concrete base or wood by means of appropriate adhesives (epoxy-polyurethane).
- Rubber flooring are resilient and sound proof, however they are costly.
- They are used only in office and public buildings.

RUBBER FLOORING

RUBBER FLOORING

RUBBER FLOORING

RUBBER FLOORING

LINOLEUM FLOORING (COVERING)

- It is covering which is available in rolls and which is spread directly on concrete or wooden flooring.
- The sheets are either plane or printed and are available in 2 to 6 mm thickness and 2 to 4 m wide rolls.
- Linoleum tiles are also available which can be fixed to concrete base in different pattern.
- Linoleum covering are attractive, resilient, durable and cheap and can be cleaned very easily.
- However it is subjected to rotting when kept wet or moist for some time. Therefore it cannot be used for bathrooms, kitchens etc.

LINOLEUM FLOORING

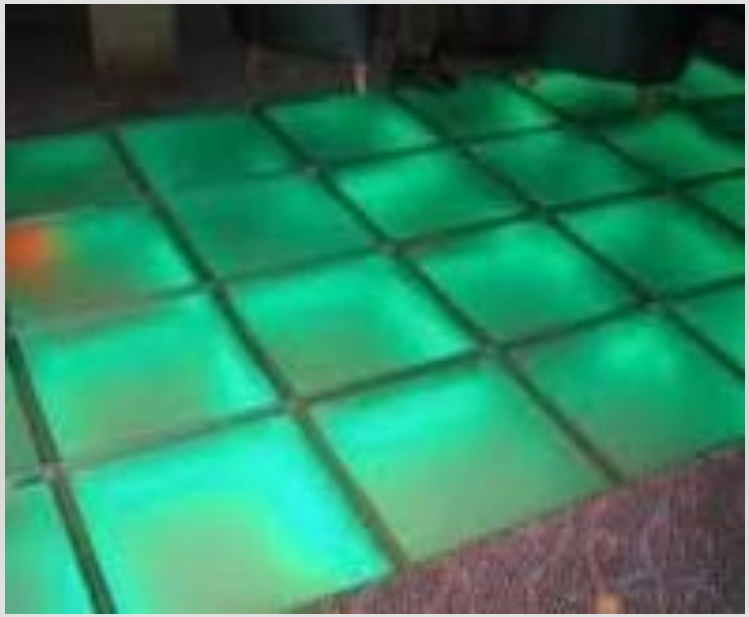
CORK FLOORING

- It is perfectly noise less and used in libraries, theatres, art galleries, broadcasting stations etc.
- Cork is the outer bark of cork oak tree, is available in the form of cork carpet and cork tiles.
- It is fixed to concrete base by inserting a layer of saturated felt.
- They are available in various sized (10cm x 10cm to 30cm x 90cm) various thickness (5 to 15mm) and various shades.

CORK FLOORING

GLASS FLOORING

- This is a special purpose flooring used in circumstances where it is desired to transmit light from upper floor to lower floor and specially to admit the light at the basement from the upper floor.
- Structural glass is available in the form of tiles in thickness varying from 12 to 30 mm.
- Glass flooring is very costly and it is not used commonly.



References

- Building Construction by Sushil Kumar
- **Building Construction** by **B.C. Punmia**; Ashok Kumar Jain and Arun Kumar Jain
- **Building Construction & Materials by Gurcharan Singh**


Thank you