

DAMP PROOF COURSE

Lecture 14

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UCE306: ARCHITECTURE DRAWING AND BUILDING CONSTRUCTION



DAMP PROOF COURSE



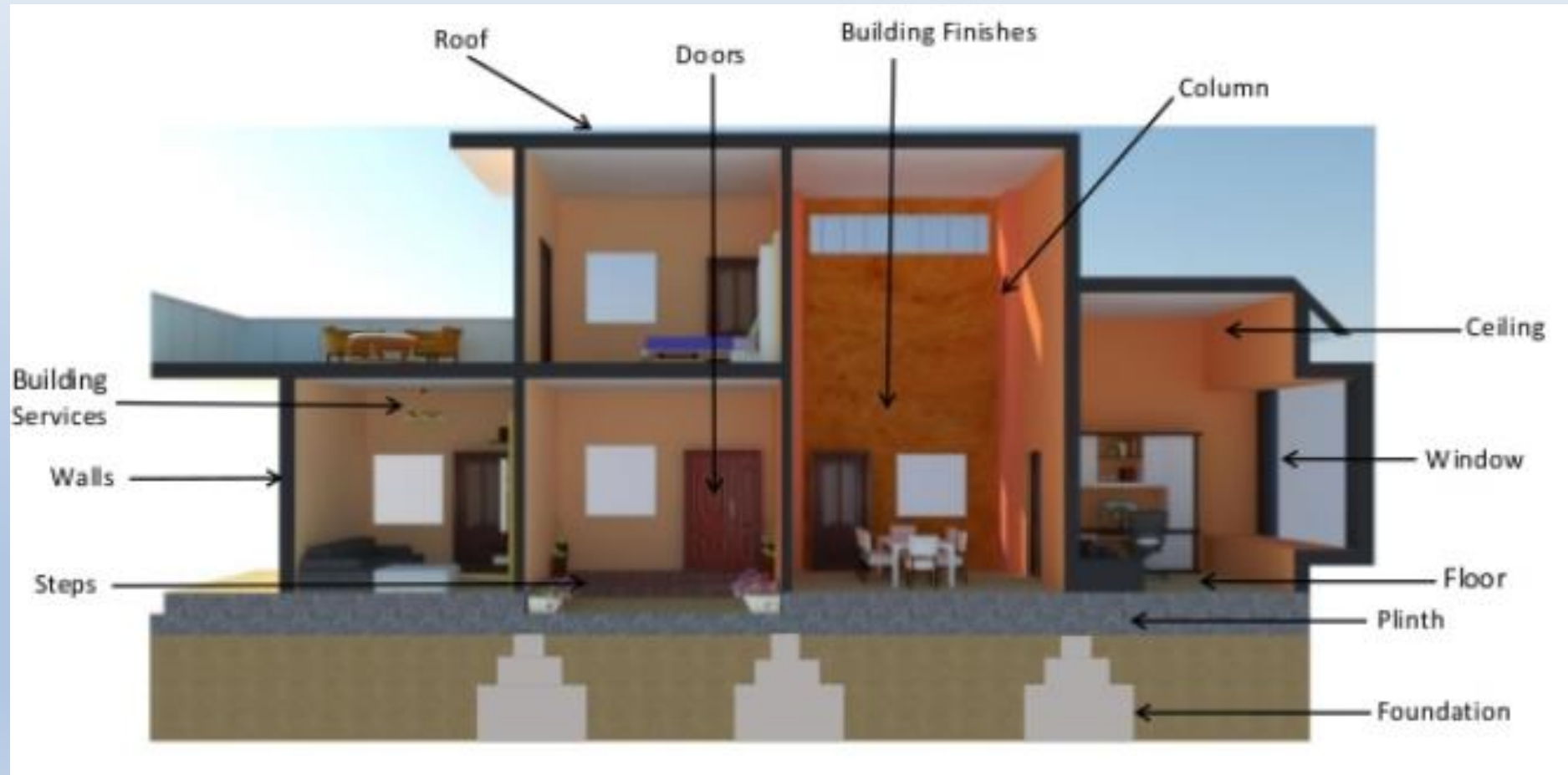
PLINTH



CAUSES OF DAMPNESS



Building Components

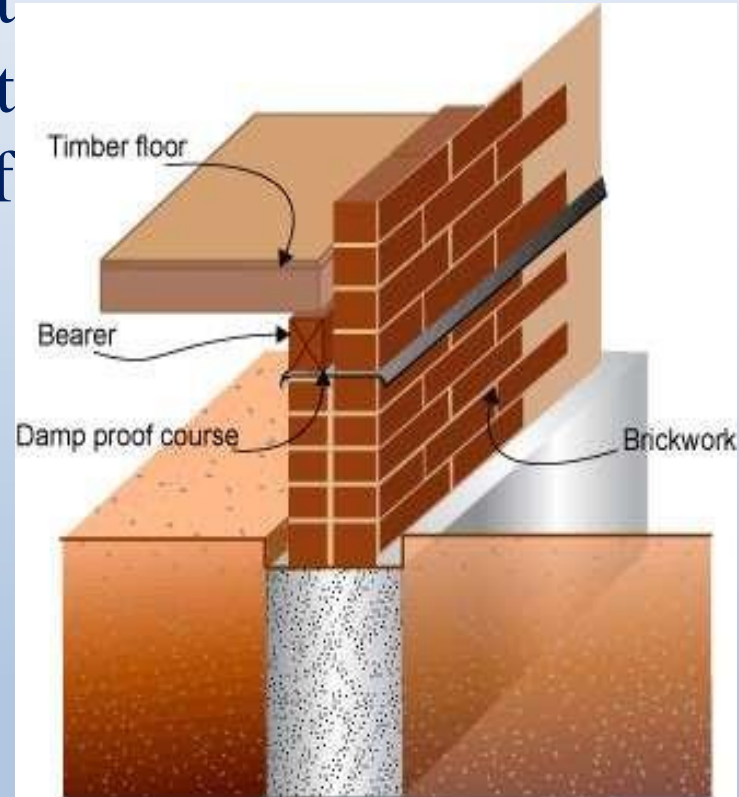


DAMP PROOF COURSE

Damp proof course (DPC) is a barrier of **impervious material** built into a wall or pier to prevent moisture from moving to any part of the building.

The DPC is built into base wall brickwork. It bridges brick skins and/or the brick and pier.

The DPC is laid into the brick wall approximately two courses (two bricks) below the lowest timber member, typically the bearer.



Examples of dampness



Examples of damp-proofing seen in walls...



A metal *damp proof course* between the stone foundation and brick wall

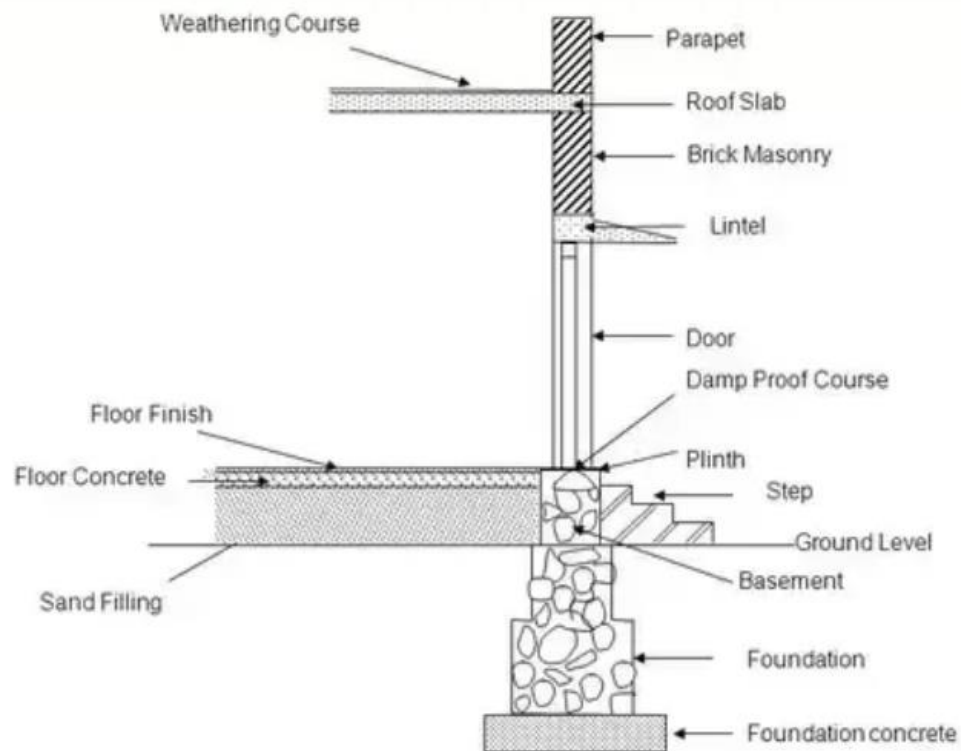


DPC visible between concrete foundation and brickwork.

PLINTH

The horizontal projecting or flush course of stone or brick or concrete layer provided at the base of the wall above ground level is known as plinth.







Traditional Plinth



Plinth in Random Rubble Masonry to receive A Load-Bearing wall Above.



**Plinth
Platform**



**Conventional Plinth in
Rural Areas**

CAUSES OF DAMPNESS

Definition

“Dampness is the presence of hygroscopic or gravitational moisture”

- Building should remain dry or free from moisture travelling through walls, roofs and floors.
- Dampness gives unhygienic conditions apart from reduction in strength of structural components.
- Provision of damp proof courses prevent entry of moisture in the building.

Hygroscopic tending to absorb moisture from the air.

CAUSES OF DAMPNESS (cont.)

(1) Moisture rising up the walls from ground.

- a) All structures are founded on soils
- b) If the soil is pervious, moisture constantly travels through it.
- c) Even in the impervious soil, lot of soil moisture may be present.
- d) This moisture rise up into wall & floor through capillary action.
- e) Ground water rise also result in moisture entry into the building through walls.

CAUSES OF DAMPNESS (cont.)

(2) Rain travel trough wall tops:

- If the wall tops are not properly protected from rain penetration, rain will enter the wall & will travel down.
- Leaking roofs will also permit water to enter.



CAUSES OF DAMPNESS (cont.)

(3) Rain beating against external walls:

- Heavy showers of rain may beat against the external faces of walls & if the walls are not properly treated, moisture will enter the wall causing dampness in the interior.
- If balconies and chajja projections do not have proper slope, water will accumulate on these & will enter the walls through their junctions.
- Moisture will completely damage interior paints of walls.



CAUSES OF DAMPNESS (cont.)

(4) Condensation

- Due to condensation of atmospheric moisture, water is deposited on the walls, floors & ceilings.
- This moisture causes dampness.

(5) Leakage in water closet, kitchen etc.,

(6) Construction defects

- Improper planning
- Lack of proper slope in roof
- Defective pipe fittings
- Improperly sealed construction joints are constructive defects.



EFFECTS OF DAMPNESS

Following are ill effects of entry of dampness:

1. Dampness gives rise to **breeding of mosquitoes** & create unhealthy conditions.
2. **Travel of moisture** on wall causes unsightly patches.
3. It may cause softening & **crumling of plasters**.
4. Wall decoration or **paint is damaged**.
5. Continuous presence of moisture in wall may cause **florescence** which result in **disintegration of bricks, stones, tiles**.



EFFECTS OF DAMPNESS

6. Flooring gets loosened due to reduction in adhesion when moisture enters through the floor.
7. Dampness promotes & accelerated growth of termites.
8. Timber fittings such as doors, windows, Almira, etc, coming in contact with damp walls, damp floors get deteriorated because of warping etc.
9. Electrical fittings get deteriorated, giving rise to leakage of electricity & danger of short circuit.
9. Dampness breeds germs of disease like tuberculosis, neuralgia, rheumatism.
12. Moisture causes rusting & corrosion of metal fittings.



METHODS OF DAMP PROOFING

- (1) Use of damp proofing course (DPC)
- (2) Membrane damp proofing.
- (3) Integral Damp Proofing
- (4) Surface Treatment
- (5) Cavity wall construction
- (6) Guniting
- (7) Pressure Guniting

(1) Membrane Damp Proofing (Use of DPC)

- In this method water repellent membrane or damp proof course (DPC) **between** the source of dampness and part of building adjacent to it.
- DPC may be bitumen, mastic asphalt, bituminous felts, plastic sheet, metal sheets, cement concrete
- DPC may be provided horizontally or vertically in floors, walls etc.

Following general principles should be applied while providing DPC:

- a) DPC should cover full thickness of wall.
- b) Mortar bed supporting DPC should be levelled & even and should be free from projections, so that DPC is not damaged.
- c) At junctions & corners of walls, the horizontal DPC (on floor) should be laid continuous.
- d) When a horizontal DPC is continued to vertical face, a cement concrete fillet of 7.5 cm radius should be provided at junction.
- e) DPC should not be kept exposed on wall surface otherwise it may get damaged during finishing.

(2) INTEGRAL DAMP PROOFING

This consists of adding certain water proofing compounds of materials to the concrete mix, so that it becomes impermeable. These water proofing compounds may be in three forms:

1. Compounds made from chalk, fullers earth, which may fill the voids of concrete under the mechanical action principle
2. Compounds like alkaline silicates, aluminium sulphate, calcium chlorides etc, which reacts chemically with concrete to produce water proof concrete.
3. Compounds work on water repulsion principle. like soap, petroleum, oils fatty acid compounds such as Stearates of calcium, sodium, ammonia etc. When they are mixed with concrete becomes water repellent.
4. Commercially available compounds like Publo, Permo, Silka etc.

(3) SURFACE TREATMENT

- The surface treatment consists of application of layer of water repellant substances on the surface through which moisture enters.
- The use of water repellant metallic soaps such as Calcium & Aluminium Oleates and Stearates are effective against rain water penetration.
- Pointing & plastering of the exposed surfaces must be done carefully using water proofing agents like Sodium or Potassium silicates, Aluminium or Zinc sulphates, Barium hydroxide and magnesium sulphate.
- Surface treatment is successful when moisture is superficial.

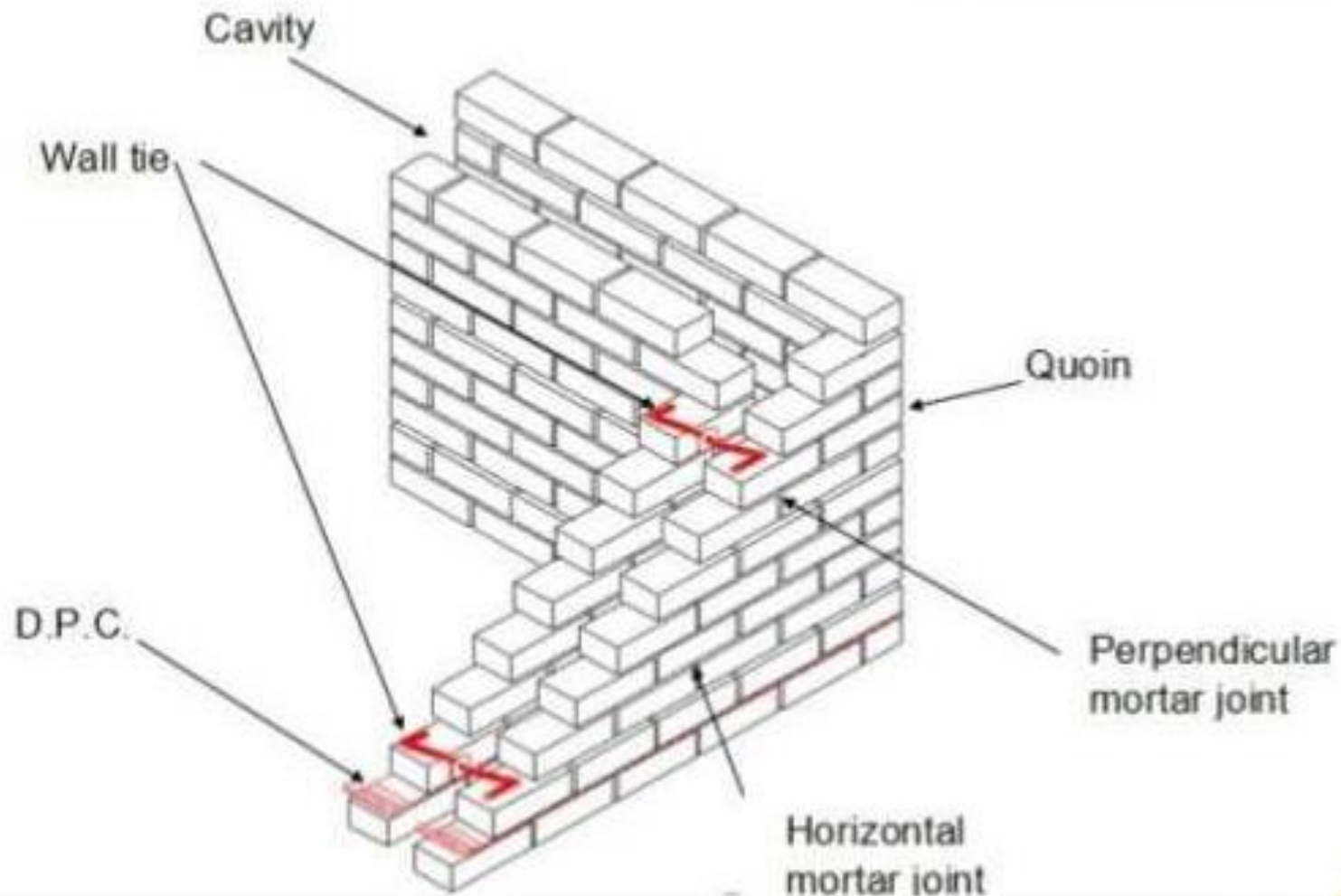
(4) Cavity Wall Construction

- In this method of damp prevention in which main wall of building is shielded by an outer skin wall, leaving a cavity between the two.



Cavity wall insulation is used to reduce heat loss through a cavity wall by filling the air space with material that inhibits heat transfer

Return corner of a cavity wall in stretcher bond including wall ties and DPC



(5) Guniting

- This consists of depositing layer of rich cement mortar by pressure to the exposed surface of wall, pipes.
- Cement mortar is 1:3 cement sand mix.
- Mortar is shot on clean surface with cement gun under 2 to 3 kg/cm² pressure.
- Nozzle of machine is kept at a distance about 75 to 90 cm from wall.
- Curing of mortar is done for 10 days.



(6) Pressure Grouting

- In this method, cement grout is filled in cracks, voids in the structure by pressure.
- Foundation of building are subjected to routing to make water-penetration- resistant.
- This method is effective to control entry of ground water through foundations



MATERIALS FOR DPC

Ideal DPC should have following quality:

- Should be perfectly impervious
- Should not permit moisture penetration
- Durable with life equal to building life.
- Material should be strong to resist superimposed load/pressure.
- Flexible to accommodate the structural movements without any cracks.
- Economical.
- Material should remain steady in its position.

MATERIALS FOR DPC

(1) Hot bitumen:

- This is highly flexible.
- Can be applied with a minimum thickness of 3 mm.
- It is placed on bedding of concrete in hot condition



MATERIALS FOR DPC

(2) Mastic Asphalt

- It is made by mixing bitumen & sand & mineral fillers
- It is semi rigid material.
- It is squeezed out in hot climate or under pressure.



MATERIALS FOR DPC

(3) Bituminous Asphalt:

- It is ready made roll of dry asphalt sheets
- It is laid on levelled flat layer of cement mortar.
- An overlap 10 cm provided at joints.
- The laps is sealed with bitumen.
- It can not resist heavy load.
- It can accommodate slight movement.



MATERIALS FOR DPC

(4) Metal Sheets

- Sheets of lead, copper, aluminium is used as DPC.
- Lead sheet is more flexible.
- Thickness of sheet should be such that its weight is not less than 20 kg/m^2 .
- They are laid similar to bituminous felts.
- Lead sheet is completely impervious, resistant to atmospheric corrosion, can take complex shapes resistant to sliding action.



MATERIALS FOR DPC

Metal sheet

- Lead will have corrosion if comes in contact with cement/lime. It is covered by bitumen.
- Copper Sheets of 3 mm thickness are embedded in cement /lime mortar.
- It has high resistance to dampness, sliding and pressure.
- Aluminium sheets is also used for DPC but not better than copper & lead.

MATERIALS FOR DPC

(5) Combination of sheets & bituminous felts

- Lead foils sandwiched between asphaltic or bituminous felts can be used as DPC.
- The combination known as Lead Core can be laid easily, is durable, efficient, economic & resistant to cracks.

MATERIALS FOR DPC

(6) Bricks

- Special bricks, having water absorption not less than 4.5 % of their weight can be used as DPC where dampness is excessive.
- Bricks are laid in 2 to 4 courses in cement mortar.
- The joints of bricks are kept open.

MATERIALS FOR DPC

(7) Stones

- Dense & sound stones, such as granite, trap, slates etc are laid in cement mortar 1:3 in two layers to form effective DPC.
- Stone should be extended to full width of wall.

MATERIALS FOR DPC

(8) Mortar

- Cement mortar 1:3 is used as bedding layer for housing other DPC.
- Small quantity of lime may be added to increase workability of mortar.
- In water used for mixing, 75 gm soap is dissolved per liter of water.
- This Mortar can be used for plaster of outer walls

MATERIALS FOR DPC

(9) Cement Concrete

- Concrete 1:2:4 mix or 1:1 1/2:3 mix is provided at plinth level to work as DPC.
- The thickness may vary from 4 cm to 15 cm.
- This layer prevent water rise in wall by capillary action.
- Where dampness is more two layer can be made.

MATERIALS FOR DPC

(10) Plastic sheets

- This is new type of DPC material made of black polythene sheet of 0.5 mm to 1 mm thickness.
- Available in 30 m length in market.
- The treatment is cheaper but not permanent.



METHODS OF DAMP PROOFING:-

Different types of treatments are used for preventing dampness in different parts of the building:-

- ▶ Foundations:- This is method of protecting foundations of outer walls. An air drain is constructed parallel to the wall.

The drain is covered with RCC slab, and gratings are provided at regular intervals, horizontal and vertical damp proof courses are also provided.

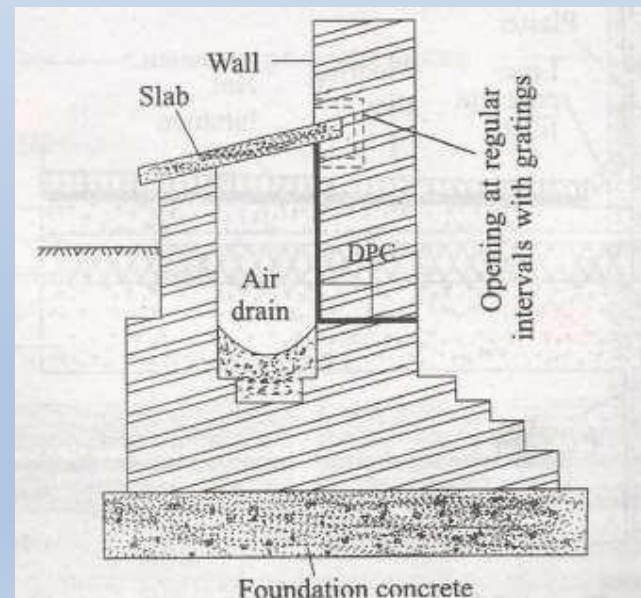
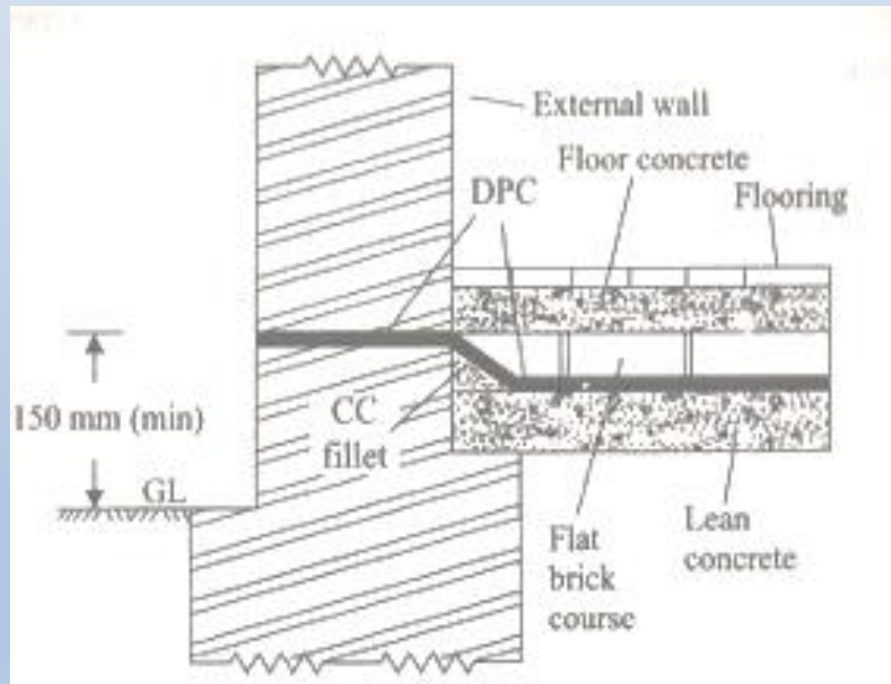


Figure 26.1 Damp-proofing the foundation

► Treatment for floors:-

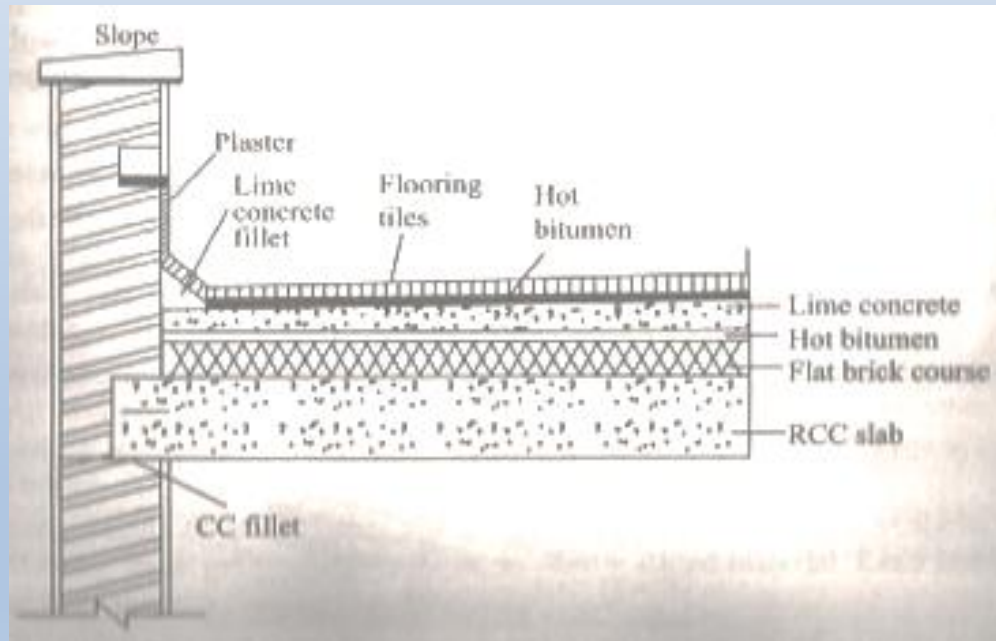
- If there is no damp soil, a layer of coarse sand, 75-100mm thick is provided over entire area under the flooring. Then 1:4:8 concrete of 100 mm thickness is laid. This layer serves as DPC. the usual flooring is provided over this.
- If soil is wet, a membrane DPC is provided over the floor area, over which a layer of flat bricks is laid. The usual flooring is then provided.



Damp-proofing the floor

Treatment for walls:

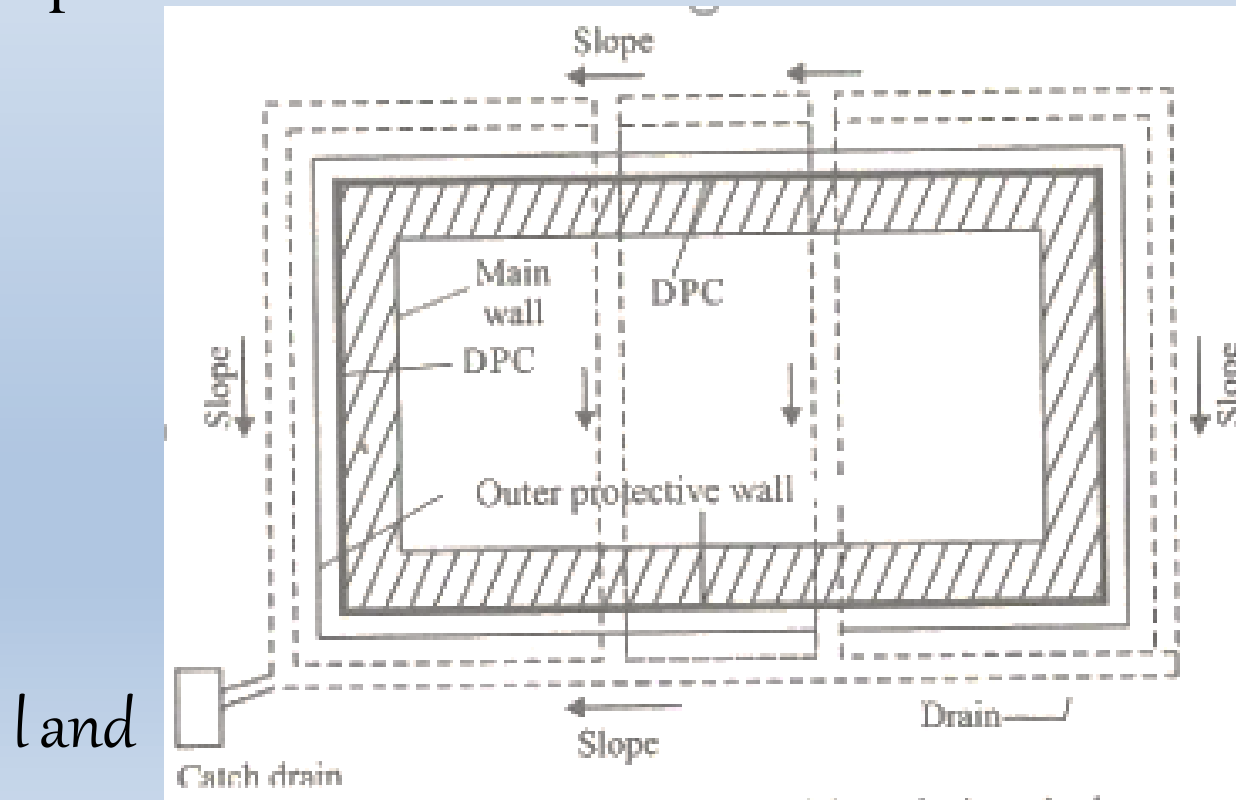
The plinth level should preferably be 450 mm above ground level. DPC should be provided over a concrete bed of thickness 100-200mm. The top of the parapet should be provided with capping over the DPC. The wall also needs DPC at the edge of the roof slab.



Methods of waterproofing basement:-

► Providing foundation drains and DPC:-

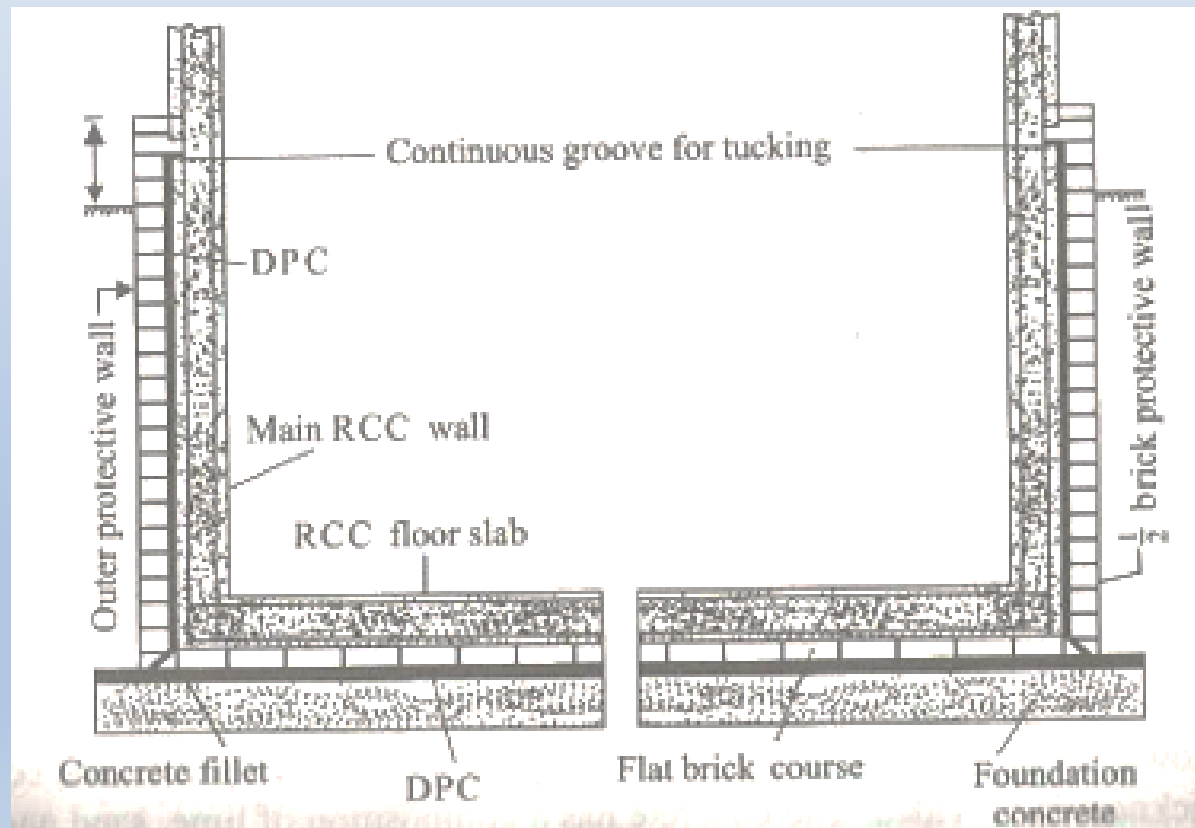
to release hydrostatic pressure, trenches are made all around the building and filled with gravels etc, such trenches may also be required in buildings if the water table is at a higher level. The trenches lead the water to a catch drain. Horizontal and vertical DPCs are provided in the walls and foundation concrete



Methods of waterproofing basement:-

► Providing RCC raft and wall slab:-

If the water table is high, providing a drainage system will not solve the problem effectively. In such cases the floor slab and wall may be prepared right through the RCC structure and DPC is applied on it.



Methods of waterproofing basement:-

▶ Asphalt tanking:-

also known as membrane waterproofing.

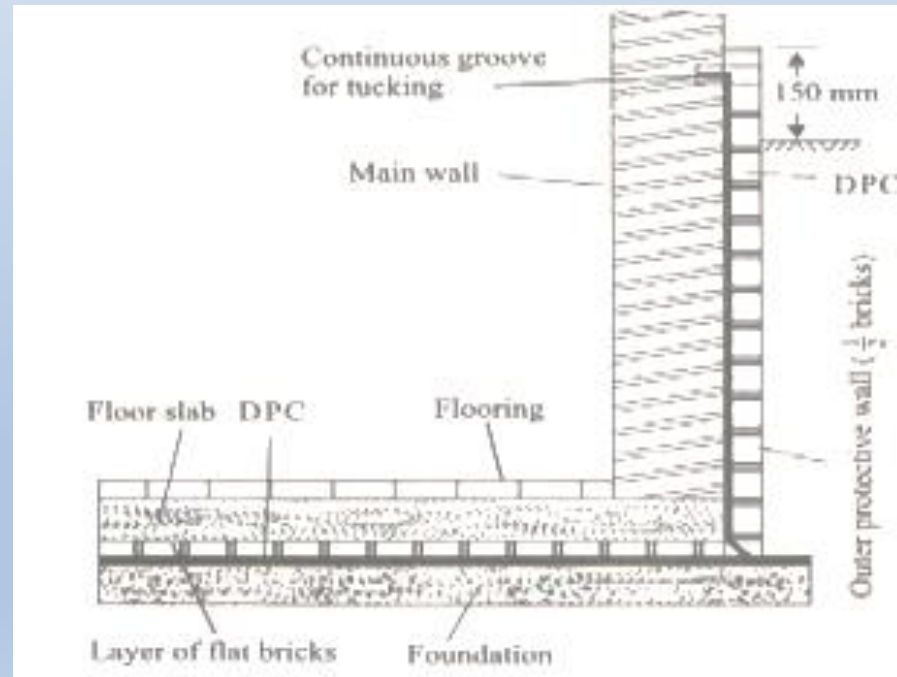
Construction of horizontal layers :a leveled course of mass concrete is laid for the flooring area ,over which a 30 mm thick DPC in form of asphaltic layer is provided a protective layer of cement screed, concrete or a layer of brick work is laid over the asphaltic layer, after which the flooring is prepared.



Methods of waterproofing basement:-

Construction of vertical face:-

A vertical DPC is provided on the external face of the wall. The DPC consist of an asphalt layer of about 20mm built in three coats. This is then protected with a wall of $\frac{1}{2}$ brick thickness.





TREATMENT OF FLAT ROOFS, PARAPETS AND COPINGS

❑ IN CASE OF FLAT ROOFS:-

- 1) LIME CONCRETE TERRACING
- 2) LIME CONCRETE TERRACING WITH FLAT TILES
- 3) MUD PUSHKA TERRACING WITH TILES

❖ LIME CONCRETE TERRACING:-

- RECOMMENDED FOR **HOT AND HUMID** REGIONS OF INDIA.
- LAYING **LIME CONCRETE** AT ADEQUATE **SLOPES**
- APPLICATION OF **HOT PRIME COAT OF BITUMEN** OVER DRIED LIME CONCRETE
- LAYING **SHEET OF BITUMEN** OVER PRIMED SURFACE

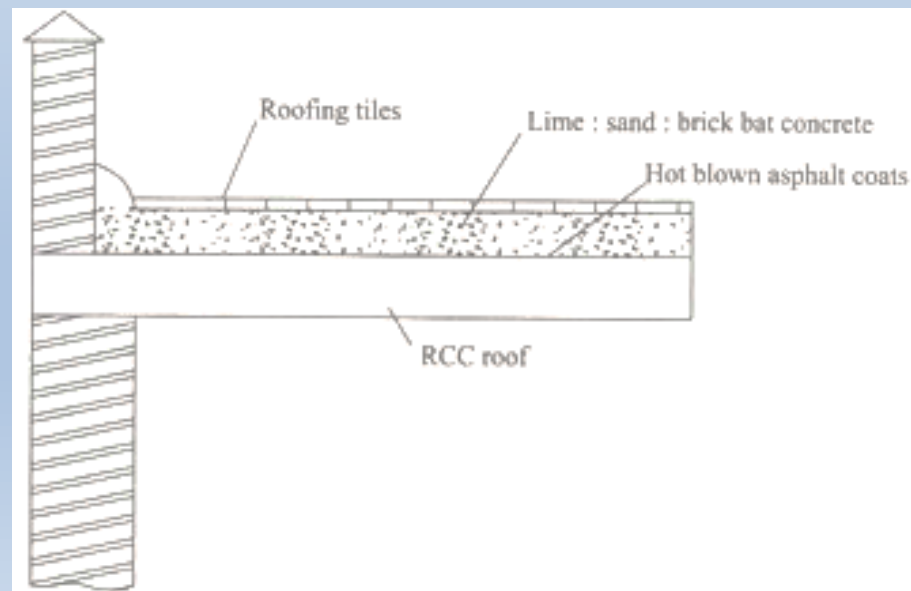
❖ LIME CONCRETE TERRACING WITH FLAT TILES:-

- RECOMMENDED IN **HOT AND HUMID** REGIONS
- ROOF IS USED FOR **SLEEPING**
- ROOF STRENGTHENED BY COVERING **LIME CONCRETE WITH 2 COURSES** OF **BRICK TILES** LAID IN CEMENT MORTAR.

Waterproofing of flat roofs:-

► Lime concrete terracing:-

The RCC roof is cleaned thoroughly and a bitumen primer is applied ,3 coats of hot blown asphalt is then applied over which a specially prepared lime concrete bed of 100mm thickness is provided. The surface of bedding is covered with flat tiles. a convex corner joint is made at the junction with the parapet wall.

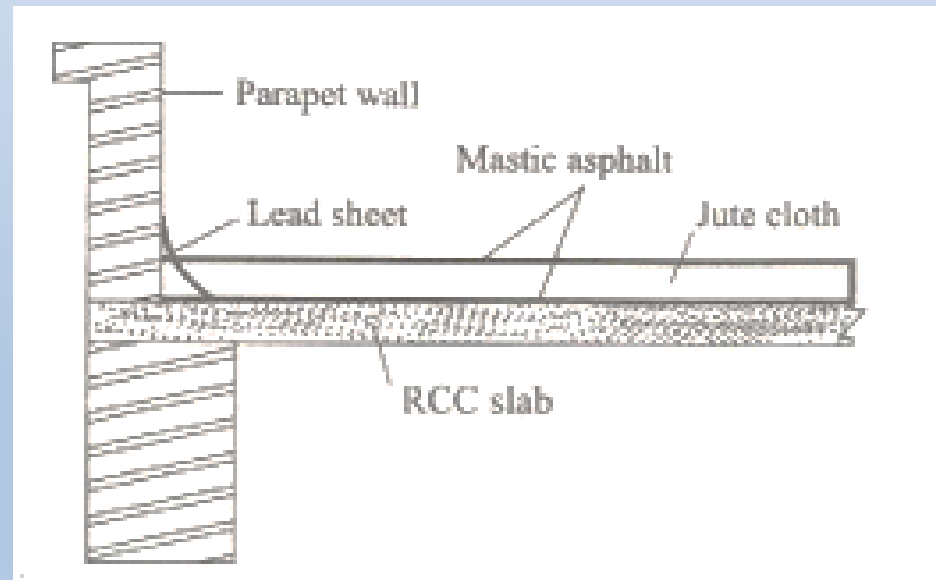


► Membrane water proofing:-

- water proofing membrane may be prepared with mastic asphalt or plastic sheet. It is provided in a number of layers from 2-7. in this method a layer of hot mastic asphalt is applied on the clean roof surface. This is covered by jute cloth and another layer of mastic asphalt is laid.

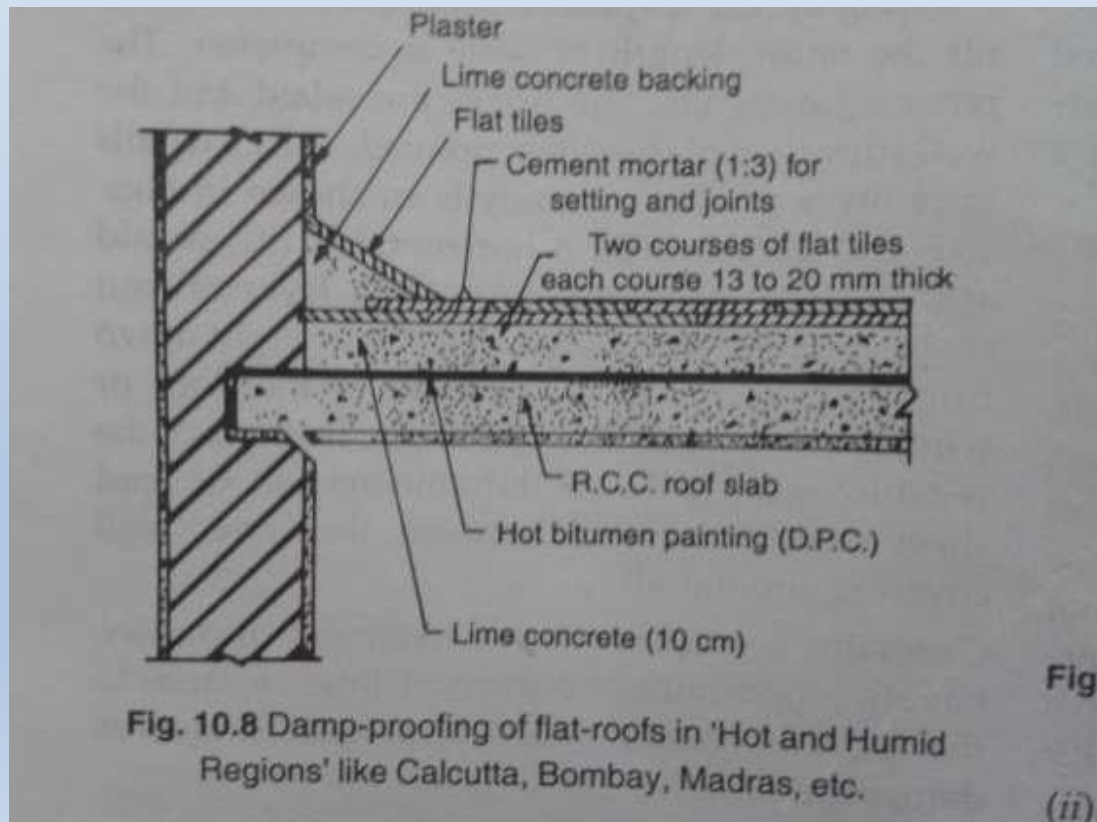
In case of plastic membranes, hot coating is applied with blown bitumen between each layer. The top is usually finished with a course of flat tiles.

At the junction is properly sealed with the parapet. The membrane should extend up to parapet or lead sheets should be inserted.



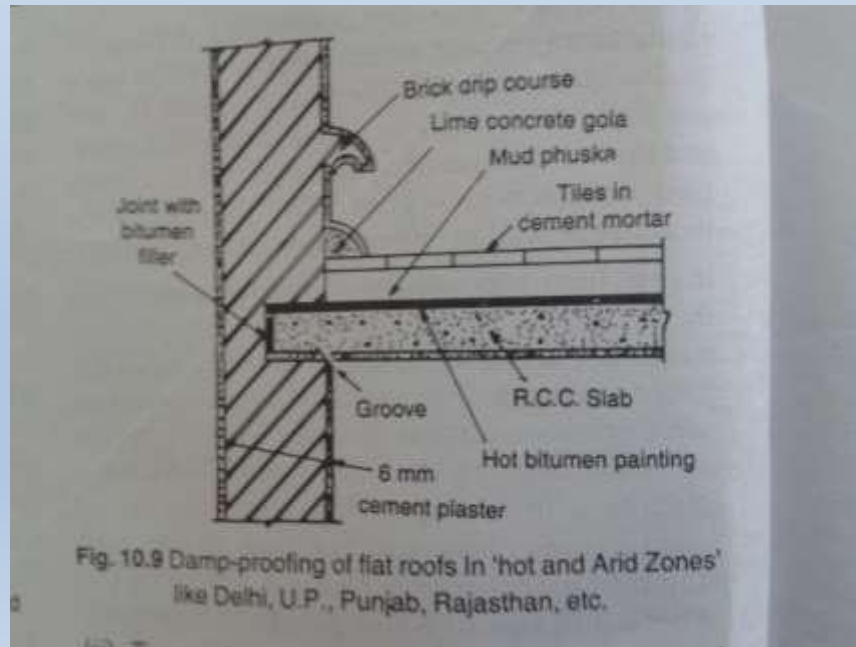
Lead sheets at the junction of parapet and wall for waterproofing

- THE PROCESS OF LAYING DPC IS DONE IN VARIOUS STEPS:-
 - a) LAYING DPC OF **HOT BITUMEN AT 1.7KG/M.SQ** OF ROOF SURFACE.
 - b) SPREADING OVER **HOT BITUMEN**
 - c) A LAYER OF **COARSE SAND AT 0.6M.SQ OF SAND PER 100M.SQ** OF ROOF SURFACE
 - d) LAYING **LIME CONCRETE AT PROPER SLOPE** IN AVERAGE THICKNESS OF 10CM
 - e) LAYING **2 COURSES OF FLAT TILES** IN CEMENT MORTAR
 - f) JOINTS OF TOP TILE IS **POINTED** USING CEMENT MORTAR(1: 3)



❖ MUD PHUSKA TERRACING WITH TILES:-

- RECOMMENDED FOR **HOT AND ARID** REGIONS
- LAYING DPC OF **HOT BITUMEN AT 1.7KG/M.SQ** OF ROOF SURFACE.
- SPREADING OVER **HOT BITUMEN**
- A LAYER OF **COARSE SAND AT 0.6M.SQ OF SAND PER 100M.SQ** OF ROOF SURFACE
- LAYING A LAYER OF **MUD PHUSKA** PREPARED FROM PUDDLED OR **CLAY LIME CONCRETE**
- COVERING THE MUD PHUSKA LAYER WITH **MUD-GOBAR MORTAR(3 MUD : 1 COWDUNG)**
- **FLAT TILES** ARE LAID WITH CEMENT MORTAR (**1 :3**)
- JOINTS **GROUTED**

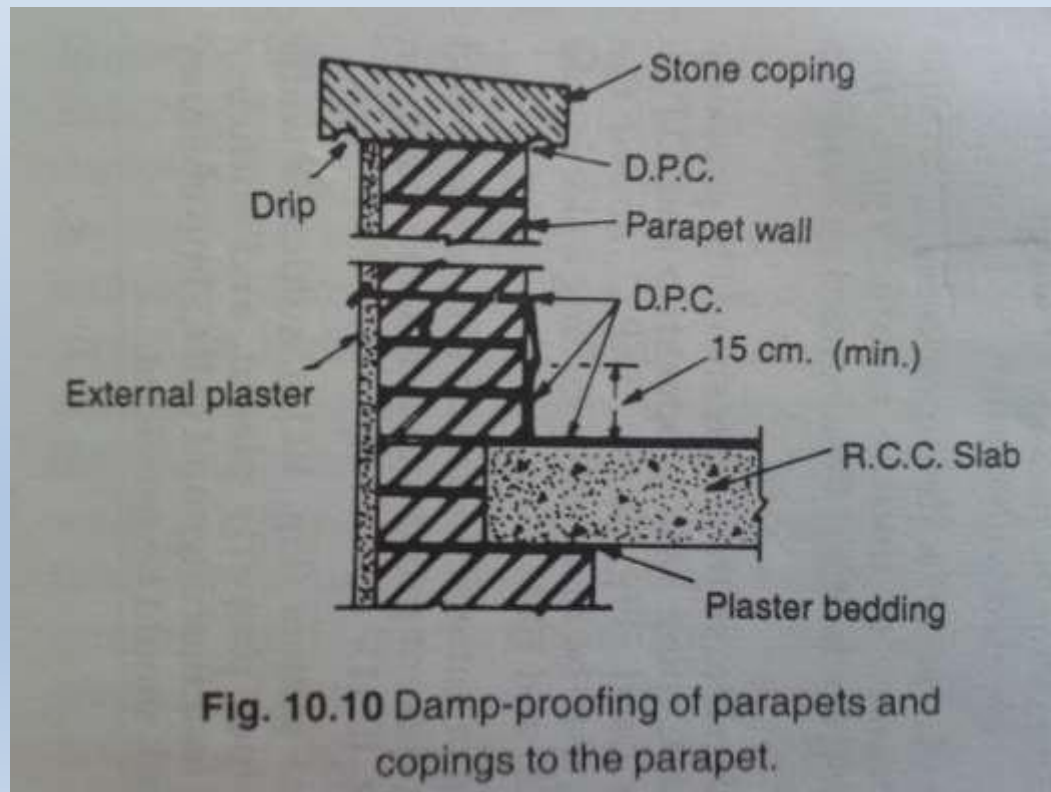


POINTS TO BE NOTED FOR WATER PROOFING OF ROOFS

- 1) SHUTTERING SHOULD BE EITHER OF STEEL OR STRONG WOOD
- 2) JOINTS MADE WATER TIGHT
- 3) RCC SLABS MADE DENSE WITH VIBRATORS
- 4) TOP SURFACE OF RCC SLAB FINISHED WITH CEMENT MORTAR(1:3)
- 5) SURFACE OF SEALS IS CLEANED WITH RAG SOAKED IN KEROSENE OIL AND TREATED WITH 2 COATS OF HOT BITUMEN.
- 6) BITUMEN PADS SHOULD BE USED BETWEEN SLABS AND JUNCTIONS OF SLABS.
- 7) FINISHED SURFACE OF ROOF SHOULD HAVE A SLOPE OF 1 IN 50

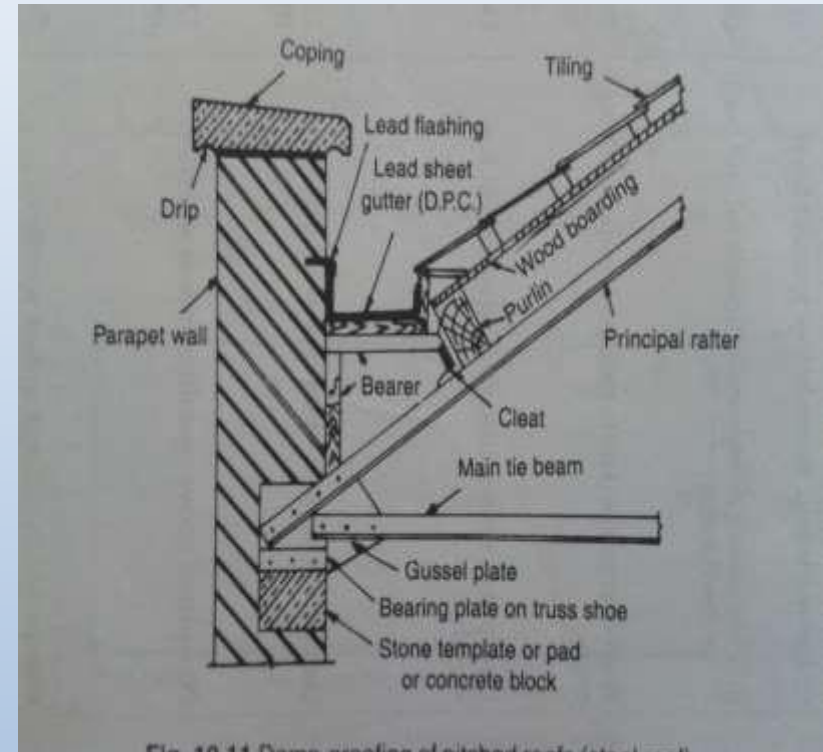
❑ IN CASE OF PARAPETS AND CANOPINGS:-

- **DPC (asphalt) covering** roof extended up the junction against parapet wall atleast upto **15 cm height**
- Dpc laid in **full thickness of wall** including any plaster
- **DPC under copings** are provided where bricks used are Poor quality.
- A **metal flashing** on exterior surface of parapet wall can be provided to attain continuity in DPC.



TREATMENT OF PITCHED ROOFS

- Design and construction of **roof tiles and roofings sheets** must be **taken care**.
- **Roof slopes** must be **sufficient** for a particular building
- **Rain water gutters** must be of **sufficient capacity, water tight** and **capable** of accomodating variations due to **temperature changes** without leakages.
- **Tiles** should be **projected** beyond edge of gutter
- **Lead flashing(dpc)** provided in gutter should be extended up surface of parapet wall and **partly inside** body of wall.
- Parapet wall must be **protected by copings** of **stone or well burnt bricks** with dpc underneath.



Using waterproofing compounds:-

Waterproofing admixtures:-these admixtures are in powder or liquid form. About 2% of powders are mixed while making cement mortar. when the finishing coat of mortar is provided, these compounds seal the pores in the slab and make them watertight.



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