

Aam Aadmi Series - 12

HOUSE BUILDING DIGEST

(Prevention of Dampness)



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Creating Enabling Environment for Affordable Housing for All

This is an attempt by BMTPC to provide useful but often ignored information about multifarious activities involved in house construction and other technical and non-technical matters associated with building materials and construction technologies. The series is being brought out with a specific rationale to reach out to common people of our nation and make them acquainted about building construction. Every individual has a dream of owning a house and through this series which is aptly named Aam Adami Series, we will slowly unravel myths and misconceptions about building construction. The language used here is lucid and simple to comprehend. The complicated technicalities are explained in a parlance which can be understood by one and all.



Prevention of Dampness

A house should be constructed in a manner that it does not allow or prevents or at least minimizes the ingress of moisture within. In other words the building should be dry once it has been occupied. It calls for adequate precautions during construction as well as during its occupation, otherwise it leads to dampness of various elements of the house causing unhygienic environment.

Damp environment is also the root cause of various diseases like pneumonia, rheumatic fever, common cold etc, to name a few. It also precipitates damages to walls, plasters, paints, floors and roofs etc which end up in foul smells and unhealthy living conditions besides being unsightly. Termites tend to grow in damp environment which affect the furniture, clothes, books and documents etc.

Dampness can occur on account of rain which strikes on the exposed surfaces of the house and finds its way within, through the walls and joints etc. It can also occur if proper precautions are not taken in its architectural/engineering design, use of inferior quality of materials, bad workmanship, insufficient supervision, and non adherence to the construction specifications.

It, therefore, becomes essential that all the necessary measures should be taken to prevent dampness from entering the house. These measures start from the design stage and have also to be undertaken during construction and subsequent occupation. Accordingly the house should be maintained properly and the defects rectified as and when noticed.

The treatments given to prevent leakage in a house are generally termed as water proofing, whereas treatments given to keep the walls, floors and basement dry are termed as damp-proofing. The house owner is advised to seek the help of the Architect/Engineer for carrying out water-proofing and damp-proofing in the house.





Defects Caused by Dampness

The defects caused by dampness can broadly be summarized as under:-

- a) Growth of termites
- b) Occurrence of efflorescence which ultimately results in disintegration of bricks, tiles, stones etc
- c) Softening of plaster
- d) Bleaching and flaking of paints with formation of coloured patches
- e) Corrosion of metals
- f) Deterioration of Floors and Roofs
- g) Deterioration of electrical fittings
- h) Rotting of timber
- i) Breeding of mosquitoes
- j) Unhealthy living conditions



Dampness in Walls

Sources of Dampness

Moisture absorption in the structure of the house is one of the chief causes of dampness. It may occur on account of penetration of rain water or on account of defective construction.

The coarse and granular nature of building materials results in the moisture finding an easy access through the voids therein and this aided by capillary action assists the moisture to travel in different directions. Moisture may find its way to the interior of the building



Dampness in Ceilings





either through the foundation and plinth, walls, chajjas and floors or through the roof.

Moisture can also come from leaking pipes, wastes or overflows, rain seeping through the roof on account of cracks or defective joints, rain water penetrating around door and window frames or a leak through fixtures and joints.

Broadly dampness can occur in a house on account of the following reasons:-

- Dampness rising through the foundations
- Splashing rain water on the walls
- Penetration of rain water through unprotected tops of walls, parapets etc
- Inadequate slopes in flat roof
- Defective terracing on roofs and improper rainwater pipe connections
- Defective junction between roof slabs and parapet walls etc
- Condensation of atmospheric moisture
- Leakages in wet areas of a building like kitchen bathroom, WC etc

Methods of Damp-Proofing

Building science has come up with a number of methods for the prevention of dampness in a building. These methods can broadly be classified under the following heads:-

- Membrane damp-proofing
- Integral damp-proofing
- Surface Treatment
- Guniting





Membrane Damp-proofing

Membrane Damp-proofing consists of providing a layer of water repellant material or a membrane between the source of dampness and the element of the structure. This type of a layer is generally known as damp proof course or DPC. It may comprise of materials like bituminous felts, mastic asphalts, polymers, plastic or polythene sheets, cement concrete etc.

Integral Damp-proofing

Integral Damp-proofing is a process of making certain building materials impervious such that the water is unable to penetrate through it. This generally involves adding of specified damp-proofing compounds in cement for the concrete or mortar mix etc. Such compounds are available in the market in powdered as well as liquid form. The quantum of water proofing compounds to be added in cement depends upon the manufacturers' recommendations. Generally one kilogram of such a compound is added per bag of cement.

Surface Treatment

Surface treatment consists of filling up the pores of the surfaces which are subject to dampness. Since bricks display the property of porosity, surface treatment in the form of plastering is usually resorted to prevent the dampness. One of the commonly used plasters is the lime-cement plaster which consists of cement, lime and sand, mixed in proportions of 1:1:6.

Brick surfaces or even plastered surfaces can be provided with water repellant paints which are quite effective in protecting the building against the ravages of heavy rainfall. The house owner is advised to discuss the issue with the architect in order to adequately protect the walls from the ingress of moisture.





Guniting

Guniting is a process of providing a water proofing treatment in a house by way of deposition of an impervious layer of rich cement mortar over the surface to be waterproofed. It is usually carried out in basements to



Guniting in Progress

prevent ingress of ground water into the structure. The process is quite costly and is carried out by spraying of a mixture of cement and sand under pneumatic pressure using a machine called cement-gun.

Guniting is also done on other surfaces like floors etc to provide an impervious layer below. It is also done for rehabilitation of existing structures, retrofitting of weak structure etc.

Damp-proof Treatment in Houses

The process of providing damp proof arrangements in a house commences from the planning stage itself, when the specifications are being drawn up. The measures to be taken are largely dependant upon the site conditions, climatic conditions and the budget of the house owner etc.

The measure to be undertaken during construction of a house includes the following:-

- Treatment of Foundations and Plinth
- Treatment of floors
- Treatment of walls
- Treatment of flat roof
- Treatment of parapets





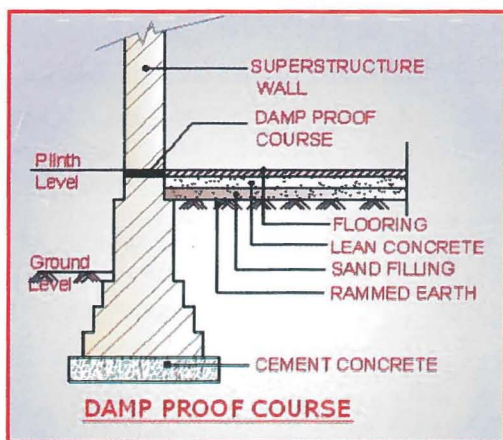
Treatment of Foundations & Plinth

The treatment to foundations is dependant upon the ground water level on which the building is to be constructed. Precaution should be taken to provide the plinth level of a house above the level of the road in order to prevent the surface runoff from the road entering into the house.

The requisite characteristics of a healthy site for house include a dry, porous, permeable soil; a low and non-fluctuating ground-water level, and a soil retaining very little dampness which is free from organic impurities. Exposure to sunlight, and free circulation of air, are also a requisite for prevention of dampness.

Damp Proof Course

A Damp Proof Course (DPC) is provided all along the plinth level of the house to arrest the ingress of moisture from the foundations to the superstructure walls. Provision of DPC includes cleaning up of the horizontal brick surface at the plinth level, applying a hot coat of bitumen and then laying a 40 mm course of cement concrete 1:2:4. The superstructure walls can be constructed over the DPC.





The damp-proof course may also consist of asphalt, sheet bitumen, a double course of slates in cement, or stoneware slabs specially made for the purpose.

Treatment of Floors

In areas where the water table is usually low, the normal methods of providing floors at the ground level are adopted. However, in areas where the sub-soil water level is high, it is advisable to provide DPC in the form of a flexible membrane like bitumen felt etc below the floors at the ground level.

Treatment of Walls

Superstructure walls are most vulnerable to ingress of moisture as they stand totally exposed to rains. This is primarily on account of the water absorbing capacity of the bricks and seepage of water through the mortar bond and plaster. As the water travels from the outer to the interior surface of the wall, they end up becoming damp.



Unightly Damp Wall

This leads to unsightly appearances, peeling of plasters and paints etc. Dampness also results in unhealthy living conditions, which is harmful for the occupants of the house. Generally, the walls of a house are liable to become damp by virtue of:-

- a) Water rising in them from the damp earth and foundations
- b) Rain falling upon the exterior of the walls
- c) Leaking pipes and other connections
- d) Water seeping through the exposed top surface of the walls





The water rising from the damp earth or foundations is prevented by the provision of DPC at the plinth levels, whereas exterior walls can be protected by providing an interface like plaster or paint etc. Leakages from the pipes or fittings etc can be on account of improper jointing, which should either be taken care of during the construction stage or should be maintained properly at the post construction stage. If proper plastering is done or other such adequate measures are taken to cover the exposed top surfaces of the wall, seepage can be prevented from entering the walls.

In any case, in order to prevent dampness from entering through the walls of a house, it is necessary that they should be constructed of sound materials as porous bricks and weak mortar readily absorb moisture they come in contact with. Along with the materials, the workmanship should be proper and the brick bond be laid properly and the mortar joints properly staggered. Finally, curing of exposed brickwork and plaster should also be carried out for the required duration.

Normal Precautions

The normal precautions for prevention of dampness in walls include pointing, plastering and painting on brick surfaces. In areas subject to high rainfall, it is advised to provide cement plaster in proportions of 1:4 mixed with water proofing compounds. Such compounds are available in the market and have to be mixed with cement in the recommended proportions. Another way is to paint the plaster with water proof cement paints.

In addition, the window sills should stand out beyond the face of the wall, and have a small groove on the underside of the projection. This groove breaks the run of the water towards the wall. The shades provided in the house should span beyond the width of the door or window. This shade should also be provided with a groove at its underside to break the path of water.





Treatment of Flat Roofs

Flat roofs are more prone to ingress of dampness in a house and due care has to be taken in providing a water proofing treatment on them. The treatment has to serve a twofold purpose which includes water proofing as well as thermal insulation.

Rain water should not be allowed to stagnate on the roof and accordingly proper slopes and rain water pipes should be provided to drain out the water effectively. Normally a slope of 1:40 to 1:60 is provided for RCC roofs.

These slopes can be provided in the water proofing treatment proposed to be provided over the RCC surface. Further, for every 30 sqm of roof area, one rain water pipe of 10 cm dia is expected to be adequate. Hence if the roof area of the house is 120 sqm, four down pipes of 10 cm dia would be required to drain out the water from the roof. These pipes have to be provided at such places on the roof which would enable the entire water to drain out in an effective manner.

On a flat roof, water proofing treatment can be provided in a number of ways which generally include the following:-

- a) Laying of Bitumen felt
- b) Lime Concrete Terracing
- c) Lime Concrete with tiles
- d) Mud Phuska with tiles
- e) Brick Coba Treatment
- f) Chemical Treatment





Laying of Bitumen Felt

In this case the roof slab surface is first cleaned and surface is painted with hot bitumen. Layers of bitumen felts are then laid over it. Depending upon the type of building and climatic conditions the treatment of felt may be in four, six or eight courses. In moderate climates a four course treatment is considered adequate. On the final layer of the felt, bitumen is painted again and pea sized gravel or grit is spread to get the desired surface.

Lime Concrete Terracing

Lime concrete terracing is best suited for zones having hot and humid climatic conditions, especially those close to the sea. In this case, a 10 cm average thickness of lime concrete is directly applied over the roof surface,



Neatly Finished Tile Terracing

providing adequate slope for draining out the water. The surface is then allowed to dry and a coat of hot bitumen is then applied. If need be bitumen sheets are also laid over the surface so obtained.

Lime Concrete with Tiles

Such a type of water proofing is usually provided if the terrace is expected to be used by the occupants for sleeping or other such purposes.

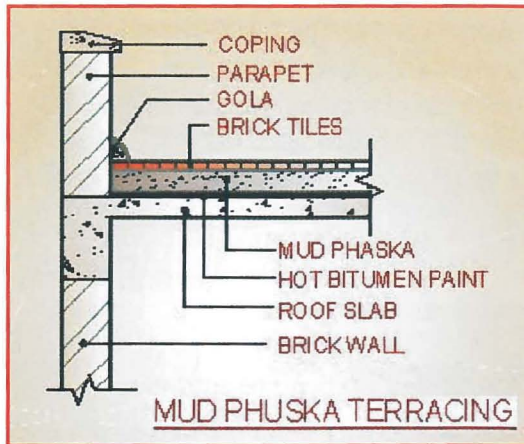
In this case, the top of the roof surface is first painted with hot bitumen and a layer of coarse sand is spread while the bitumen is still hot. Lime concrete layer of average 10 cm thickness is then applied providing the slope therein. The layer is then compacted and two courses of tiles are provided, with the joints being pointed in cement mortar 1:3, to get an even surface.





Mud Phuska with Tiles

Treatment with mud phuska and tile is best suited for areas in hot and arid regions like Delhi, UP, Punjab etc. where the annual rainfall does not exceed 1000 mm.



The treatment normally consists of painting the roof surface with hot bitumen followed immediately by spreading coarse sand, while the bitumen is still hot. Mud phuska treatment is then applied which consists of puddle clay mixed with straw (bhusa). The soil for mud phuska should be free from gravel and coarse sand, vegetable matter and fine kankar particles. The soil shall also be free from harmful and efflorescent salts.

The surface so obtained is plastered with a mix of clay and cow dung in one or two coats. Tiles are finally laid on the plastered surface and the joints are grouted with cement mortar 1:3 to get the required surface.





Brick Coba Treatment

Brick Coba treatment is suited for areas which have moderate to heavy rainfall.

In this case the roof surface is first cleaned and a thick layer of a mixture of cement and acrylic based chemical is first laid. This is followed by providing a layer of brickbats in cement mortar 1:4. After curing the layer for about two days another coat of brickbats in cement mortar 1:4 is provided. On this surface a thick layer of cement mortar 1:4 is provided which is finished smooth.

It is advisable to mark squares on this surface of typical dimensions 300x300mm. Finally curing is carried out for about two weeks before putting the terrace into use.

Chemical Treatment

Roof terraces can also be treated for waterproofing by providing chemical treatment on the surfaces. It can also be used for waterproofing of concrete and cement-sand mortar in basements, water retaining structures, external plastering, bathrooms and balconies, water tanks, sumps and drains, etc. The method of application, however, varies with the location at which waterproofing is to be provided.

The chemicals are usually in liquid or powder form or in the form of a membrane. They are available in the market and are to be used as per the recommendations of the manufacturer.

As far as the liquid/powder is concerned, the same are available in the form of surface applied treatments or admixture technology. The former is to be applied directly on the roof surface and the later to be mixed with cement as a plaster on the concrete surface. Products are also available as admixtures to be mixed in the





concrete being used for the roof slab. Normal insulation/water proofing layers are then provided over the surface so obtained.

Another type of chemical waterproofing is done by providing a chemical membrane. In this case a five layer or a seven layer treatment is provided, depending upon the average rainfall in the area.

Typically, a five layer membrane treatment would consist of the following:-

- a) Application of first coat of bitumen primer
- b) Providing a coat of bonding material
- c) Laying of Atactic Polypropylene modified Polymeric membrane
- d) Providing another coat of bonding material
- e) Providing top layer of surface finish, say brick tiles

The surface on which the treatment has to be applied has to be cleaned properly before application of the treatment.

The house owner is advised to have the opinion of the Architect/Engineer before going in for chemical waterproofing treatment for roofs.

Treatment of Parapet and Roof Joint

Water usually tends to seep through the joints between the parapet walls and the roof. Adequate precautions have to be taken as otherwise dampness will occur on the wall surfaces as also the underside of the roof slab.





The treatment in this case can be provided as per the normal water proofing methods carried out for the flat roof. In cases where lime concrete terracing is carried out, a 15cm half round gola of lime concrete is provided at the junction of the roof and parapet. Where asphalt layers are provided, the asphalt layer is turned up into the parapet wall for at least upto 15 cm, thereby covering the junction of the roof and parapet.

Parapet walls require careful detailing. At the top of the wall it is good practice to provide a weathered coping. Ingress of rain water from the top of the parapet can be restricted either by coping or providing a water proofing course.

Khurra

Khurra is an essential feature for allowing the water flowing from the roof to flush out, thereby preventing the rain water to seep into the roof slabs. It is a depressed portion in the roof just before the outlet of rain water pipe. A khurra is generally 45cm x 45cm in size.

Khurras are constructed before the brick masonry work in parapet wall is taken up and is normally provided in cement concrete 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate) of 5 cm thickness or other mix as may be specified by the Architect. The concrete for the khurra has to slope uniformly towards the rainwater outlet.

A thin membrane in the form of plastic sheet or aluminum sheet etc is provided before laying the concrete for the khurra. The top surface of the khurra is kept lower than the level of the adjacent roof surface. The sides of the khurras and sides of the outlet openings are well rounded.

The house owner is advised to discuss with the Architect regarding the provision of khurras in a house.





Waterproofing of Wet Areas

Wet areas in a house are those areas which are likely to get wet during its occupation. Typically these include bathrooms, toilets and kitchens etc. In the kitchen the wet area is largely localized as water gets directed to a specific area. Toilets and bathrooms are different in that considerable quantities of water are consumed and flow through them, each time they are used. Special water proofing treatment is therefore required in such areas.

In areas where a WC seat is to be provided the normal floor slab is depressed to the specified extent and adequate water proofing treatment is done on the horizontal and vertical surfaces of the depressed portion.

The horizontal and vertical surfaces of slab concrete are hacked and cement slurry, preferably prepared with a water proofing compound is first applied. Cement plastering in proportions of 1:3 is then done, with water proofing compound mixed in the cement.

On drying of the surface, specified quality of bitumen is applied on both the horizontal and vertical surfaces, followed by sticking a PVC sheet on the surfaces. WC seat is then fitted and the filler material is placed around it upto the desired level. Base concrete is laid thereon and normal flooring is then done over it. This floor level is kept slightly below the level outside of the WC to prevent the water from the WC to spill out.

In the bathrooms, normal waterproofing measures are taken and in addition, tiles are provided upto a height of seven feet above the floor. This prevents the splashing water from dampening the wall surfaces. This treatment is termed as 'Dado'.





Conclusion

Occurrence of dampness in a house is common if adequate precautions are not taken during its construction. Dampness leads to unhealthy living conditions, unsightly patches on walls and ceilings etc and it also leads to an increase in the cost of maintenance. The following measures would go a long way in preventing dampness to enter into the house:-

- a) Provision of a Damp Proof Course (DPC) at the plinth level
- b) Adequate water proofing treatment at the roof levels
- c) Provision of parapet walls with coping
- d) Providing 'Gola' at the junction of roof slab and parapet
- e) Provision of khurra for proper draining out of rain water from the roof
- f) Providing adequate number of rain water pipes to drain out water from the roof
- g) Provision of water proofing treatments on the depressed portions of the slabs in wet areas.
- h) Proper jointing of pipes.
- i) Jointing the door and window frames adequately with the walls to prevent seepage of water.
- j) Provision of sunshades with grooves along the edges





- k) Use of good quality materials for construction and good workmanship
- l) Inspection and proper maintenance of the house

The house owner is advised to discuss the issue of prevention of dampness with the Architect, Engineer as well as the contractor responsible for construction of the house.



This is the Twelfth of BMTPC 'HOUSE BUILDING DIGEST SERIES' for creating awareness about construction of a house.



BMTPC

The Building Materials & Technology Promotion Council (BMTPC) was setup in 1990 as an inter ministerial organisation under the Ministry of Housing and Urban Poverty Alleviation to bridge the gap between the laboratory research and field level application.

VISION

BMTPC to be world class knowledge and demonstration hub for providing solutions to all with special focus on common man in the area of sustainable building materials, appropriate construction technologies & systems including disaster resistant construction.

MISSION

To work towards a comprehensive and integrated approach for promotion and transfer of potential, cost effective, environment-friendly, disaster resistant building materials and technologies including locally available building materials from lab to land for sustainable development of housing.

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