BUILDING DIGEST

CENTRAL BUILDING RESEARCH INSTITUTE INDIA

DAMPNESS IN BUILDINGS

Dampness in buildings is a serious defect not only affecting the durability and appearance of the building but also causing damage to decorations, furniture, books, clothes, etc. and is highly objectionable on grounds of health and comfort of the occupants. Dampness may appear in various parts of a building but the most serious ones are in the walls, floors and roofs. The various causes of dampness and their remedial measures have been discussed in this digest.

Causes of dampness

Dampness in walls may be due to capillary rise from foundation, direct penetration of moisture through the joints in the exposed wall surface, junction with roofs, projecting features, leaky pipe fittings etc. or through condensation under certain weather conditions. The most common causes are (a) defective or no damp-proof course, (b) defective solid floors, (c) porous brick work or renderings, (d) incorrect levels of earth or path ways, (e) defective sanitary and water supply fittings, (f) inadequate waterproofing of roofs, (g) defective parapets, (h) insufficient ventilation. While in new construction it is necessary to take proper preventive measures in design and construction, in existing buildings, it is essential to first investigate the main causes of dampness before the correct and effective remedial measures can be adopted.

General principles underlying damp protection

Water in liquid or vapour form can penetrate most building materials such as brick, mortar or concrete. Protection against damp, therefore, consists firstly in reducing the cause as much as possible and, secondly providing material and construction which prevent or atleast mitigate the ingress of moisture to the desired extent. Satisfactory preventive measures can considerably reduce the need of protective measures, although both are often used in conjunction to obtain the desired performance. Table I summarises the measures commonly provided in a building.

TABLE I

Source of dampness	Preventive measures
Walls	
(a) Junction of wall with foundation	Damp proof course, suitably detailing the construction features at the plinth level.
(b) Surface of wall	Proper selection of walling unit and mortar, proper rendering, suitable orientation, generous overhangs at roof and Chajjas.
(c) Junction of wall with roof	Roof overhangs, drip courses and proper water-proofing of roofs and junctions.
(d) Condensation	Proper ventilation, vapour barrier incorporated in the wall, absorbent wall lining.
(e) Faulty pipe fitting	Isolation from walls, facing socket ends to direction of flow and anti-choke arrangement. Proper jointing, provision of inspection traps.
Floors	
(f) Junction of foundation with floors	Provision of mastic (bitumen mixed with sand) round the perifery of sub-base concrete in floor.
(g) Faulty levels or earth banking	The earth or other material must be removed. Avoid nearby flower boxes or similar beds against the walls.
Roofs	
(h) Junction of parapet and roofs	Provision of d.p.c. at vulnerable points.
(i) Junction of chimney stack with roof	Provision of flashing at the junction.
(j) Leakage through roof itself.	Proper water proofing of roof (vide Building Digest No. 29).

Dampness from foundations

By far the greatest source of dampness in walls is by capillary rise of water from the foundation. This can be recognised by the appearance of fairly regular lines of discolouration proceeding from the bottom to the top. The most effective means of arresting this is the provision of an effective damp-proof course at the plinth level. Provision of a d.p.c. has now become a common practice in new buildings. But the usual practice of providing a layer of dense concrete only does not effectively stop capillary rise of water. Various integral water-proofing compounds available in the market under various proprietary names have not proved very successful to check the capillary rise of moisture, while bituminous felts, polyethelene sheets and aluminium foils have proved effective.

Defective or non-existence of d.p.c.

Various methods have been suggested to deal with defective or non existent d.p c. in existing buildings. One of the suggestions is to render the affected walls internally with water-proof renderings. These should be carried from the base of the walls to atleast 60 cm above the level of the dampness, and atleast 1 m along both faces of any internal walls abutting the walls affected.

More effective solution is the insertion of damp proof courses in existing buildings. The old practice of underpinning the building for such insertion is both costly and cumbersome. An alternative method has been successfully tried at the Institute. It consists of cutting the wall through a suitable joint by means of special saws in stages and inserting bituminous felt d.p.c. in the slot. The major snag in adopting this method is the non-availability of the saw in this country. The Institute has fabricated two types of masonry saws capable of cutting through mortar, bricks and concrete, which can be easily manufactured in India.

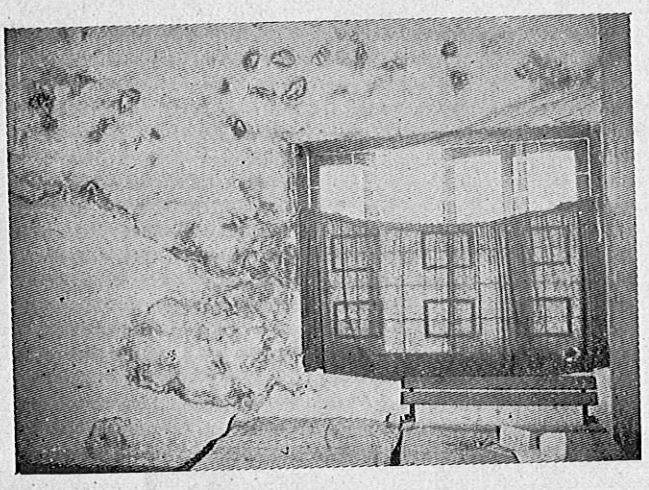

Fig. 1. Dampness through walls

Dampness through surface of wall

Most walling units like bricks, concrete blocks etc. are porous. Though some kinds of building stones are relatively impervious, the mortar with which they are laid are pervious. Hence there is every chance of a direct hitting rain to penetrate the wall particularly through the joints unless some preventive measures are taken. Decorative features and painting also act as moisture traps if not detailed properly. A judicious selection of mortar for different types of walling units can reduce damp penetration to a great extent. Suitable masonry mortars have been recommended in Building Digest No. 26.

A number of preventive measures have been suggested to minimise the dampness through walls. These are described below.

Water proof renderings

The external treatments consist of pointing the joints, plastering of the surfaces or lining these with stone veneers. Internal treatments consist of rendering and wall boarding on battens. Surface treatments comprise paints, oils, waxes, soap and silicate solutions and cement water proofers.

Pointing should be done in such a way that they slope outwards and not inwards. For plastering the aim should be to ensure quality of work, thorough surface preparation, adequate keying and final curing. Keying depends on the type of surface and requires proper hacking and raking of joints, metal lathing or the use of integral type bonders. Curing is often overlooked and yet it is absolutely vital to successful work. Plasters of rich cement mortar finished smooth are generally unsatisfactory and cause crazing and cracking. Gauged mortars (i.e. cement-lime-sand) and pebble dash or rough cast finishes give better performance. Tile or slate hanging is seldom resorted to in India, though it is often the only practicable solution for protecting unsatisfactory walls subjected to severe exposure.

Internal treatments cannot eliminate dampness but may reduce it to an acceptable level. Gauged mortar plasters offer the best compromise for protection and decoration. Internal plaster, may consist of one or two coats for best results.

Surface treatments

Surface treatments are adopted either as temporary measures or for remedying defects without changing the appearance. Most of the treatments require frequent renewal. It is inadvisable to apply a protective coating that is completely impermeable for the reason that it does not allow the structure to breathe. These may do more harm than good by retarding evaporation of moisture which finds its way through an unprotected path. This is more important in the older structures and where there is possibility of efflorescence.

The commonly used paints are cement based or synthetic resin emulsion based, like polyvinyl acetate emulsion paints. These are usually applied in two coats so that sufficient thickness is obtained. Proper preparation of the surface before application and adequate curing of cement based paints should be ensured. Where existing paints are to be covered special precautions must be taken to ensure an adequate key with the new application. This is particularly important where distempers, lime wash etc. are present.

As a temporary measure external brick masonry can be treated against moisture penetration by giving three alternate coats of 5 percent soap solution and 1 percent alum solution. The process has the advantage of being cheap and of using indigenous materials which are easily available. To get the best results it is necessary that the atmospheric temperature does not fall below 10°C during the time of application and the solution should be hot when applied.

Non-decorative water-proofers comprise mainly of silicon preparation. Silicone treatment of masonry is claimed to have the advantages that they convert a high degree of water repellancy, they leave masonry unaltered in appearance and they have a life of five to eight years.

However, sufficient experience of the use of this material in India is not yet available.

Dampness from roof

Dampness from the roof is mainly due to a leaky roof or defective roof junctions (Fig. 2). Water-proofing of roof has been dealt with in detail in Building Digest No. 29 and the adoption of the suggestions made therein will go a long way in preventing dampness through roofs. If the causes are other then a leaky roof the preventive measure may include (a) repairs to roof junctions (b) insertion of a damp-proof layer below parapets and (c) providing additional drip courses.

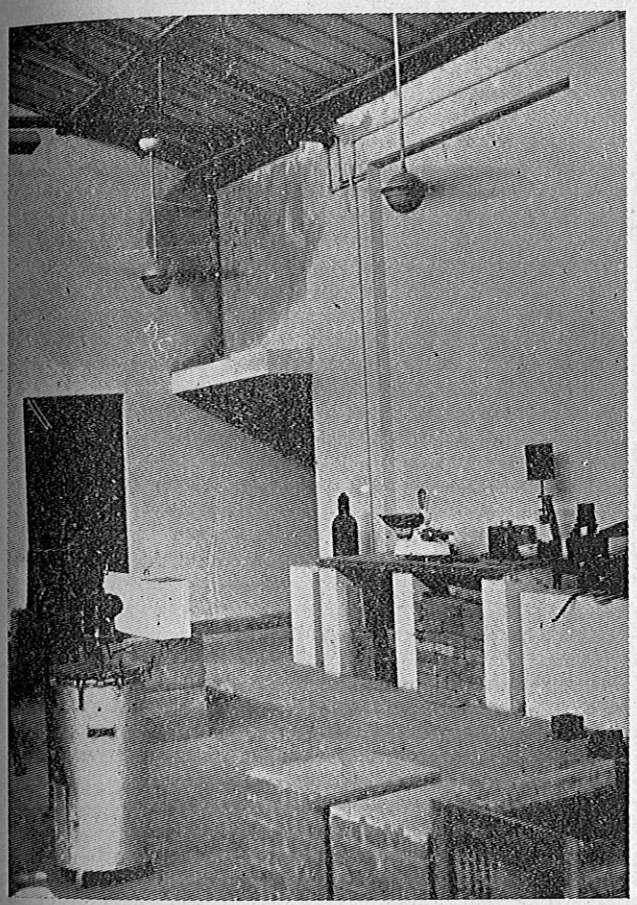

Fig. 2. Dampness at junction of wall with roof

Dampness due to condensation

A frequent cause of dampness, particularly in cold climates, which is often confused with rising damp, is the effect of condensation on wall surfaces. This can also occur in combination with rising dampness, which tends to confuse the issue. Generally speaking condensation can occur in all types and ages of buildings where there is hard non-absorbent internal surface and inadequate ventilation. Condensation is also related to high humidity and lack of temperature changes at the surface. Lack of ventilation is a construction problem, but humidity and temperature conditions can be created for by altering the physical state of the affected surface. There are two common treatments for non-absorbent surfaces viz. lime setting coats and gypsum plasters both of which provide an absorbent surface.

Lime setting coats

In conditions of severe condensation the treatment should include a float of lime mortar of one part lime and three parts sand gauged with plaster of paris, followed by skimming with a mix of three parts lime, six parts sand and one part plaster of paris (to be added at the time of using). In conditions of moderate condensation it is only necessary to use the skim coat. Permanent decoration must be delayed for 12 months.

Gypsum plasters

For conditions of moderate condensation single coat work may be done using anhydrous or board finish proprietary plaster in 6 mm thickness. In more severe conditions two-coat work can be applied. The chief advantage of gypsum plasters is that decorative finishes e.g. oil-free distempers etc. can be applied when thoroughly dry.

Dampness due to plumbing defects

Dampness arising out of plumbing defects may generally be recognised by irregular lines of discolouration and dampness encircling the source of leakage (fig. 3). In case of slow leakage, the effect may be similar to that of direct penetration through wall surface. As this is generally due to constructional defects the correct remedy should be to locate the defects and rectify them immediately.

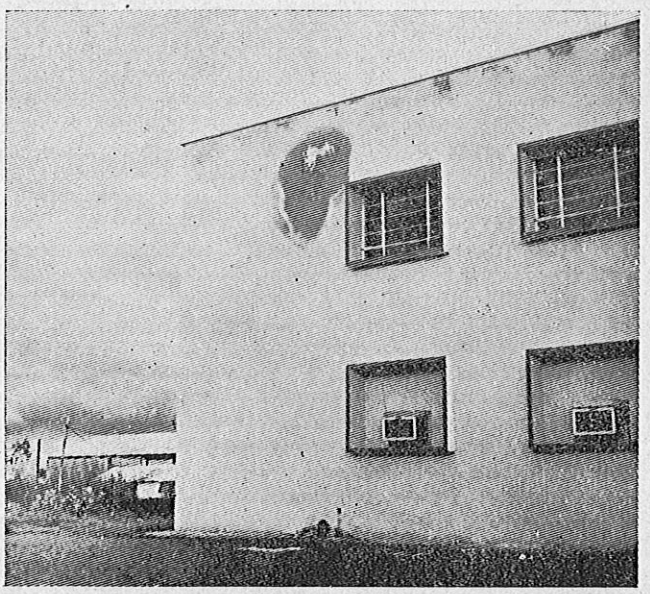

Fig. 3. Dampness due to faulty pipe fitting

Dampness from junction of walls with floors

Internal dampness arising through the medium of solid floors is generally due to faulty construction or

defective material in the floor. Constructional defects are mainly due to faulty inclination of the filling for the base. Use of fine material in the sub-base allows capillary rise of water and to prevent this it is desirable to use coarse gravelly material or use damproof membrane below the floor in the form of bitumen or polyethelene layer and provide mastic (bitumen mixed with sand) round the perifery of subbase concrete in floor.

With solid floors the method of construction should be related to the proposed floor finish. Rising dampness must be eliminated when completely impermeable finishes like lino tiles, vinyl strip and tiles etc. are used as the condensation taking place beneath the floor finish is liable to attack the adhesive and result in the lifting of tiles. When permeable finishes like cork, wood or composite type are adopted the vapour has the opportunity of evaporating and is therefore unnoticed.

The ideal method of construction is provision of a suitable water-proof membrane in the construction of the floor.

When a d.p. membrane is found to be ineffective, usually the fault lies in its position or extent rather than in defects in the material. It may be by-passed in some way, as by a coat of rendering or by pointing or it may not be properly joined to adjacent d. p. c. or membranes. In new buildings attempts are often made to hide the d. p. c. with the intention of improving the appearance. This practice commonly defeats the purpose for which the d. p. c. is provided. Figure 4 shows the appropriate linking of damp proof course in wall with damp proof membrane in solid floors.

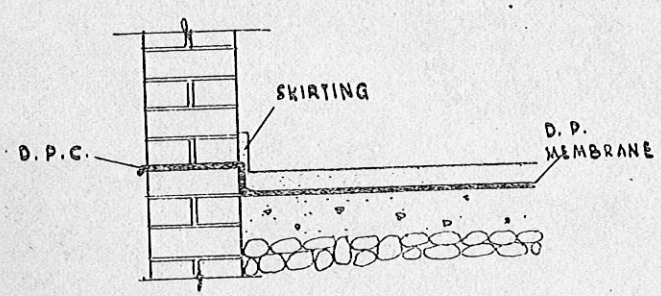

FIG. 4

Damp Proofing in wall

With all-in-concrete floor it is essential to use well graded aggregates specially which should be of the coarser type. The water cement ratio should be at a reasonable minimum say 0.5 and the curing of the floor should be done for atleast seven days. A reasonable period has then to be allowed for complete drying out before application of any adhesive.

There are Indian Standard Codes of Practice for laying mastic asphalt floors (IS : 1196-1958), rubber floors (IS :1197-1959), cement concrete flooring tiles (IS : 1443-1959), linoleium floors, (IS : 1198-1958) magnesium oxychloride composition floors (IS ; 658-1962) and *in-situ* terrazzo floor (IS : 2114-1962). The specifications laid down in these codes if strictly followed will go a long way in preventing dampness in floors.

Dampness due to faulty levels or earth banking.

This is a common occurence when enthusiastic gardeners, for example, build flower beds against the wall above the d.p.c. level and even construct garden paths or garage foundations above this level. The remedy is to remove the earth and render the wall to whatever height necessary with a waterproof rendering before replaclng the earth.

Dampness at junction of parapet and cornice with roof.

Parapets suffer severe exposure as they are high up and exposed on both sides and are therefore liable to be much wetter than normal walling. For this reason, a parapet more than a few courses high should be separated from the wall below by means of a continuous d.p.c. terminating at the face of the wall in a metal flashing as shown in fig. 5.

DAMP PROOFING AT PARAPET

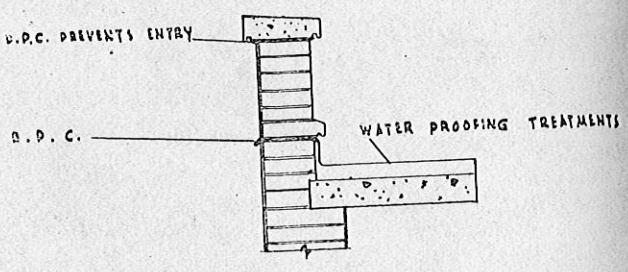

FIG. 5

The parapet itself is usually protected by a coping, which is often considered sufficient to prevent downward penetration of rain. However, there are few, if any, materials that will not develop cracks—usually at the joints between units—when exposed for some years on the top of a parapet. The d.p c. shown in the figure immediately beneath the coping is intended to guard against penetration through these cracks.

Cornices and other features projecting from a wall should be themselves impervious or should be provided with an impervious covering. Large areas may be covered with asphalt or layers of bitumen felt. For small projections, a simple strip metal flashing may be preferred.

Dampness at junction of chimney with roof

Chimney stacks may provide route for moisture penetration unless adequate precautions are taken. For a chimney at or near the ridge, and extending slightly above it, good weather protection at the top is sufficient in all but very exposed positions. When the exposed part of the stack is high a damp proof course is advisable where the stack emerges from the roof.

Other causes of dampness

There are a number of other minor constructional defects which may lead to dampness in walls. A few examples of faulty constructions commonly met with are :

(a) Outlets for water passing through the wall permit the moisture to gain access to the wall.

(b) Joint between the wall and the door and window frames permits access to moisture. Shutters on rain-ward side are made to open inside the room.

(c) *Chajjas* have inadequate projection or do not shed off the water readily.

(d) Ventilators placed near the roof do not have any *chajja*.

(e) Water falling off the balconies or roof outlets is allowed to fall freely instead of being led away in down pipes.

(f) Parapets have flat copings or are plastered on both sides, thereby preventing evaporation of moisture that may find its way in the parapet.

(g) Rainwater or service pipes are embedded in walls with inadequate or no provision for inspection and repair.

These defects can be avoided by taking proper care during construction.

Conclusion

The problem of dampness in building requires a systematic approach to determine the causes of leakage; the source from which moisture is derived and measures which are likely to prove effective. Once the cause or causes have been established beyond doubt one or a combination of more than one of the remedial treatments described in this digest are expected to provide a satisfactory solution. The preventive measures suggested when adopted in new constructions will go a long way in preventing dampness in buildings.

There is a demand for short notes summarising available information on selected building topics for the use of Engineers and Architects in India. To meet the need this Institute is bringing out a series of Building Digests from time to time and the present one is the 34th in the series.

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