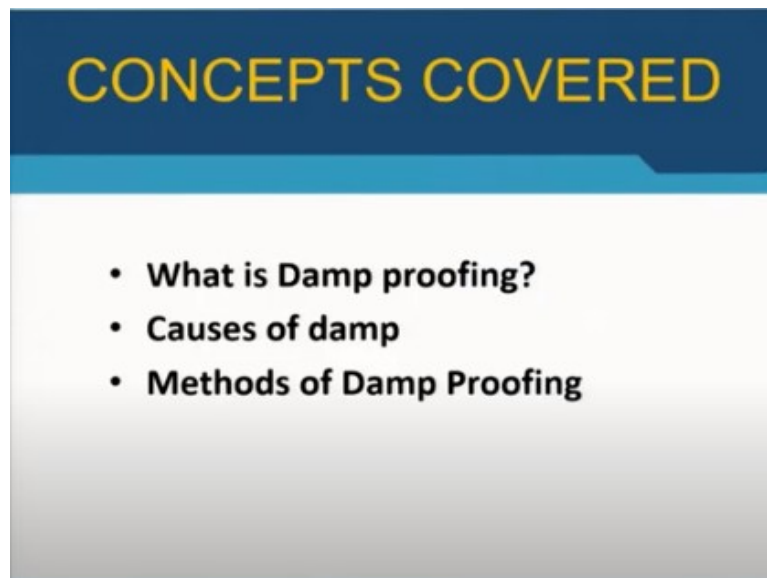


Building Materials and Composites
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Lecture - 31
Damp Proofing

We are going to start module 7. We will be discussing on damp proofing and insulation in this module. If we can cover we will try to put in something more and then we will finish with module 8. Maybe there is some little change as it was discussed in the very initial lecture. So let us start with damp proofing and insulation. For this lecture (module 7 lecture 1) we will discuss on damp proofing.

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Now coming to damp proofing, all of you are quite aware of the term ‘damp’. It is a physical thing which you can see when it has already happened. It is not like the patches on a wall or on a floor or on a corner or at a particular location, which you can just wipe it off. It is a phenomenon that is happening, which takes a long time to be visible to an expert or to the habitants of the building when maybe it is too late to mend or correct it.

So as architects we need to know that where the possibilities are or which are the possible points which can cause damp. And then finally, in this first lecture, we will just mention the various methods of damp proofing.

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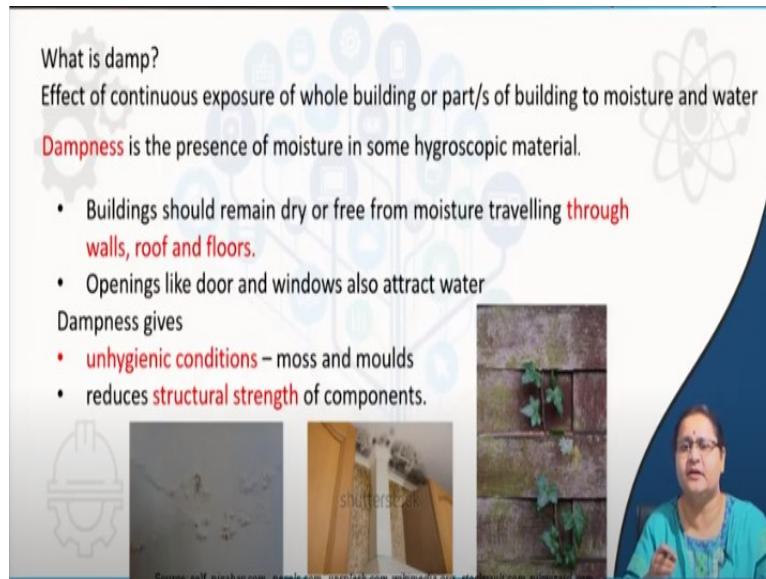
What is damp?
Effect of continuous exposure of whole building or part/s of building to moisture and water

Dampness is the presence of moisture in some hygroscopic material.

- Buildings should remain dry or free from moisture travelling **through walls, roof and floors.**
- Openings like door and windows also attract water

Dampness gives

- **unhygienic conditions** – moss and moulds
- reduces **structural strength** of components.



So as you all know that all building materials are capable of absorbing water. The target is to make our building as impervious as possible. But, as you remember, in our very first module, we had talked of brick which actually absorbs up to 20% water. Again we have wood, another building material which also absorbs water. We are looking into constructions where brick is mostly used foundations.

So water is bound to enter buildings if we are not protecting it. So what is damp? Damp is the effect of continuous exposure of a whole building or parts of building to moisture and water. What we see is the effect of damp. Dampness is the presence of moisture in some hygroscopic material (water absorbing material). So brick, wood are hygroscopic materials that can absorb water and will be prone to damp.

Earlier we have discussed how concrete is made. The key ingredients are coarse aggregate, fine aggregate, and cement and it is very much consolidated which make it non-porous. Hence entrapment of moisture or entry of moisture is very difficult. So concrete unlike brick or wood does not absorb water. Here you see some pictures where actually you can understand that damping is happening.

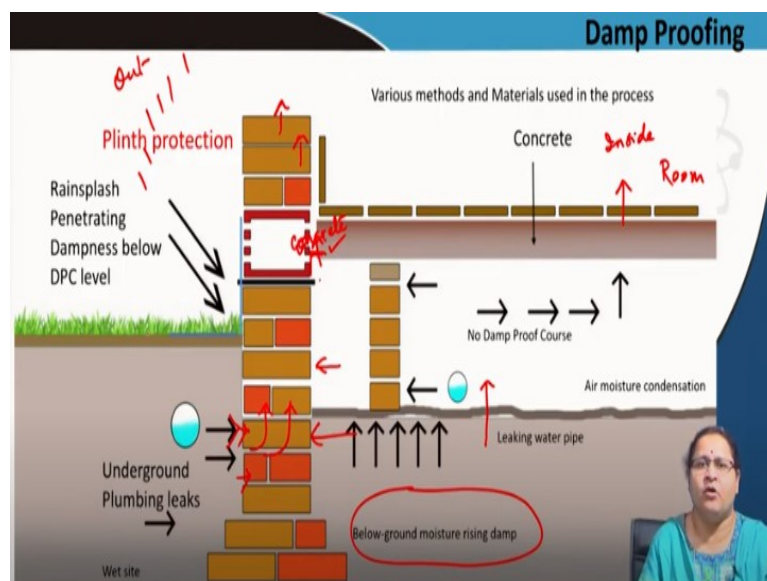
Even due to moist conditions trees, plants can grow. Mosses, algae can grow, which is very much unhygienic. We have to keep our building as dry as possible, but also we have to keep our building open to atmosphere. So if the atmosphere is having lot of moisture, the choice of paint should be such that it will protect the building from

moisture entry. It cannot be stopped completely. You can only take precautions or measures when you are constructing a building.

So these unhygienic conditions may lead to respiratory problems of inhabitants, moist interiors that may lead to unhealthy conditions, particularly child and old people will be mostly affected. If it is entering into the structural systems, it may ruin the concrete as you have seen when we discussed ferrous metals. So the structure may get degraded. So we have to be very careful.

We have to close all openings. That does not mean we will not have doors and windows. They will always attract water, but if it is a heavy shower, then you have to close the doors and windows to avoid entry of water. But those are known points where from water can enter, where one can take an action. But there are various points where one cannot take action and preventive measures are to be taken when the building is being made. Let us discuss that.

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So this is the foundation of a building. This side on your left, it is outside. The other side is the inside of a building. So here this a lot of rain etc., is happening. Below ground there is the moisture in the soil. Gradually the groundwater may increase affecting the building foundation. There may be underground pipes as you can see, much below the inside of building which is not recommended.

And there may be leakages on these lines, which may again affect the wall creating some pressure on the wall and the moisture tries to move up gradually through capillary action. So it may enter from this side, it may enter from outside. But this concrete mass or the floor will not allow it to move further up. The flooring is the room or the habitable space.

But the external wall is continuing. So if this wall continues to carry the moisture upwards, the entire external wall will get damaged by the moisture which is getting in through the underground. So you have to stop the entry of moisture at such a point where from it would not further go up.

So just below the tie beam you see there is a black line. So if you can check the entry of water at this point, because this mass is again concrete. That is a tie beam which is made of concrete. So there is no possibility of water entry or moving up beyond the concrete layer. So if you can stop the entry here at where the black line lies, you can check the water entry.

You cannot avoid an underground plumbing leak. Even if it is a dry soil, your building services will be going just besides the building. So your building may experience some failures of the plumbing lines, sewer lines, which can also create similar pressure on the wall surface from outside or maybe from inside. All these may lead to entry of water to the building.

It may also happen that when there is a rainfall, your building façade, which is the external wall, is continuously experiencing that rainwater. So if you are not putting a proper jacket or wall covering, the wall will also get drenched.

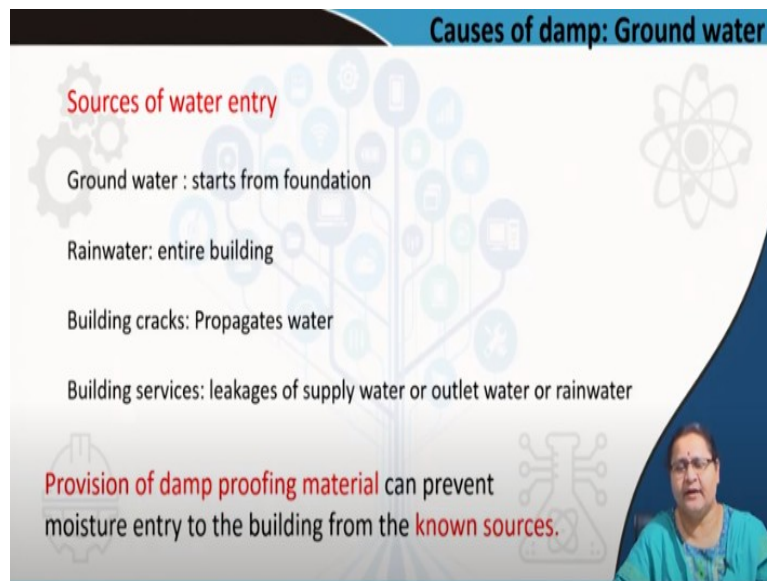
The water which is accumulating say in a waterlogged area, there are chances that the water may be entry to the building up to that height of the plinth level. Even if there is water logging just below that level, you need to protect that outside wall from the accumulated water up to the plinth level.

So we are concerned up to the plinth level the water should not get accumulated nor the water should not destroy the outer wall, which is at the periphery of the building.

So we need to protect that. So these are design details, which are also taught in design classes, we need to know is what this black line is. What is this blue line doing the plinth protection?

Is it concrete? Is it something impervious? Obviously, things should be of such kind. So we will have to know each of them and how it has to be applied.

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So let us come to the sources of water entry. So groundwater, as I told you, is one of the most common ways, which we need to check from the very starting of the building construction that is the foundation. Next we have the rainwater, which the entire building is facing. It may face during a particular season or it may be throughout the year or it may be a dry area.

Therefore we need to have proper measures taken to minimize the effect of rainwater. In Indian context if we look in the plains, we do not have much sloping roofs other than the rural areas or the low height buildings. We have mostly high rise buildings apartment blocks where the roof is flat. The rainwater gets accumulated in the roof also. Hence proper drainage is required for rainwater from the roof.

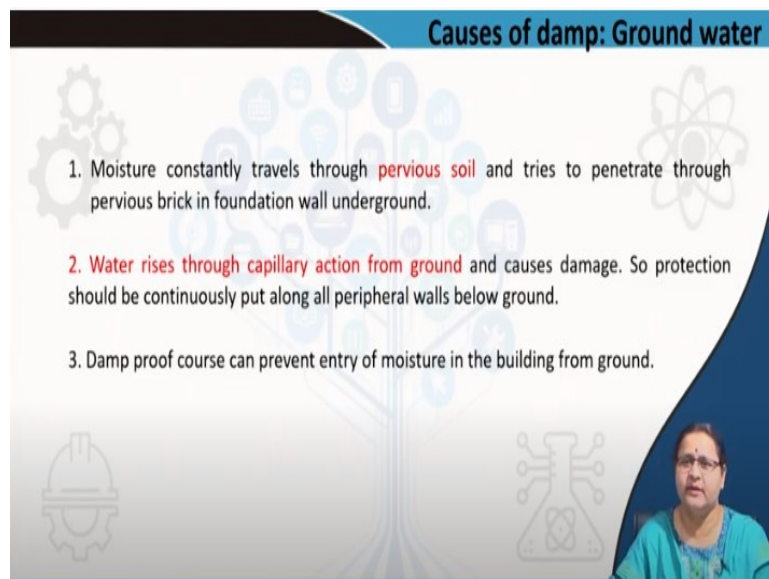
That means the roofs need to have proper slopes towards the rainwater pipes etc. Another point of concern is the external building cracks. These cracks occur because of settlement, structural failures, some unforeseen damage. Typically after the brick

layer, you have a plaster layer. With the crack or the damage, a portion of the plaster may come out.

Or there may be gaps in the wall such that water can enter or propagate through it. Such kind of entry points becomes the vulnerable point for building so far as damp is concerned. And last but not at all the least which we either ignore or never register or even overlook is the building services. Leakages in various pipes like the inlet pipe, outlet pipe, rainwater pipe any kind of lines, roots, leakage in that leads to damp.

Provision of damp proofing material can prevent moisture entry to the building from these known sources. So our objective is to identify those points where from we can minimize the chances of damp to be propagated inside the building and we take measures for controlling that.

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Causes of damp: Ground water


1. Moisture constantly travels through **pervious soil** and tries to penetrate through pervious brick in foundation wall underground.
2. **Water rises through capillary action from ground** and causes damage. So protection should be continuously put along all peripheral walls below ground.
3. Damp proof course can prevent entry of moisture in the building from ground.

In case of ground water, moisture constantly travels through the pervious soil and tries to penetrate. Water rises through capillary action from ground and causes damage. So protection should be continuously put along the peripheral wall below the ground. Damp proof course is one such measure. In next lecture we will discuss what the materials that are involved are.

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Causes of damp: Rainwater

- Rain **travels through wall surfaces**. Heavy showers of rain may beat against the external faces of walls and if the walls are not properly treated causes damp.
- If the wall surfaces are not properly protected from rain penetration, rain will enter the wall and will travel down.
- **Leaking roofs** will also permit water to enter.
- **Improper slope in balconies and window chajja** may lead to accumulation of rain water. Prolonged accumulation will lead to damp.
- External wall to be protected **up to plinth level** protection against rainwater accumulation outside building.



But, today we will restrict to the causes. What happens if it is a very heavy shower? The rain may beat against the external facades and eventually it will enter into the building. As I told you walls, doors and windows are the entry points of water. But one can take care of such water. But if the building has cracks, it can let the water pass through it. Water can directly create the damage as it is very difficult to dry out that trapped in water.

So you need to protect the external wall by application of some proper paints and allow the water to travel down. Now this water may be trapped on the roofs if there is improper drainage. So these may lead to leakage from the roof. So if the rainwater trapped in the roof for longer period of time, it may gradually damage the rooftop or the topmost ceiling.

The damp will be visible when it has already percolated inside. Now the ground water is also continuously trying to enter. But many times, the bottommost floor is not the structural floor. But the roof top is the structural floor as it has reinforcement. Usually the bottom floor may be made of plain cement concrete. It does not have reinforcement in most cases.

But if the reinforcement is damaged, then the structure becomes weak. So it is very important to have a proper damp proofing at roofs. One has to be very particular on the slopes at roof, at balconies, which are semi open areas, on window chajjas where the water should drain off. And obviously prolonged accumulation due to dust and

dirt leaves getting entrapped chokes the roof drains which becomes the cause of damp.

The external walls of the building needs to be protected up to plinth level against accumulated rainwater in the surrounding areas of the building.

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Now let us move to the leaking service lines like the Inlet water line. We have very well understood in design about the wet and dry area. So wet area means they will have inlet water lines, water supply lines coming in. Obviously, when there is inlet water line, the outlet water line will also be there. So all the areas like kitchens toilets, pantries, wet utilities and whatever may be the building type residential, hotel, airport one has to be very careful on the leakages on these kind of lines.

You all know sometimes the traps of the fixtures are embedded in the floors. So leakages in the traps, at the joints can also lead to damp. It can also lead to entry of moisture, that is, it allows entry of moisture into the structural floor. One needs to be very careful while handling leaking fixture traps. Another point is there is improper drainage of air conditioners in the building.

So the water that comes out from the air conditioner needs to be properly drained. Otherwise, it may also lead to some kind of a localized damp and causing damage to the structure. The rainwater pipe connections at the roof also help to create damp in

the building. So just by seeing, when you become an architect, you must be able to identify what is the reason behind a particular damp.

And nonetheless, you have to take action. So what we discussed earlier that is our known enemy, that is the groundwater and the rainwater can be taken care of when we are actually designing the building or executing the construction. But these lines that are the leakages from service lines, one has to be very careful, identify them and maintain the building regularly to avoid damp being happening from these points.

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Let us discuss on the methods of damp proofing. As I told that to restrict water coming from groundwater, you can have a continuous kind of layer to prevent the moisture to move up. Sometimes you need to have integrated damp proofing. Sometimes it may be a surface treatment. You may have cracks where you may require to fill in some kind of damp proof material.

All these can be done through guniting and pressure guniting. There are cavity walls which can help in segregating from the outside from the inside. So we will try to understand all these six methods of damp proofing in our next lecture.

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Ill effects of dampness

- Dampness gives rise to unhealthy conditions.
- Entrapped moisture causes unsightly patches.
- It may cause crumbling of plasters in patches.
- Efflorescence in bricks and stones.
- Flooring tiles get loosened due to weakening of adhesion due to moisture.
- Electrical fittings get deteriorated, leakage of current and short circuit.
- Entrapped Moisture causes rusting & corrosion of metal fittings.

So we can summarize by stating that damp gives rise to unhealthy and unhygienic conditions. But how can we understand that a place is getting damped? The entrapped moisture can give some clue through its unsightly patches. So you can register that a building is experiencing moisture inside it. When such patches start forming you see suddenly a plaster piece comes out and falls.

It may be because of other reasons too. There may be structural reasons, failures etc., but you must get a hint that one of the probable reasons could be moisture. Similarly, if you see some bricks experiencing the efflorescence, that is the salt patches coming out, then you must immediately get a thought of that the building is experiencing damp from some other point.

So if you are curious to know, if you are having the training, if you are having the expert eyes, you can find out what is the source and you can immediately correct it with the different methods which I have just talked about. Floor tiles may get loosened due to weakening of adhesion and that is because of moisture.

In case of plywood, we saw that plywood layers can come out, veneers can come out just because the adhesive can get loosened because of moisture. Similarly, the floor tiles can also come out. This you will experience mostly in areas like washrooms, kitchen tiles, dadoes where from the waterlines pass. So any leakage inside the concealed pipe will be reflected in loosened tiles.

Electrical fittings can also get deteriorated. When there are leakages of current and short circuits in gadgets, which can be felt by touching it, gives an indication that the building is getting damaged or getting ruined by moisture. So I have shown you pictures when we talked about corrosion, the entrapped moisture can cause rusting, corrosion of metal items and portions of concrete may also fall off.

So these are the ill effects of dampness and also these are the clues to keep you aware that the building is experiencing damp. Thank you.