Building Materials and Composites
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Lecture - 32
Damp Proofing Methods and Materials

So we are in the second lecture of module 7. We started with damp proofing and we thought of covering damp proofing and insulation in this particular module. And I also mentioned that we may cover some more depending on how much time we get. So let us carry on with the second lecture on damp proofing methods and materials. So we had closed the previous lecture by mentioning the different methods of damp proofing.

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And now, we will actually elaborate on each of them. So the content is particularly the specific methods and the materials in details.

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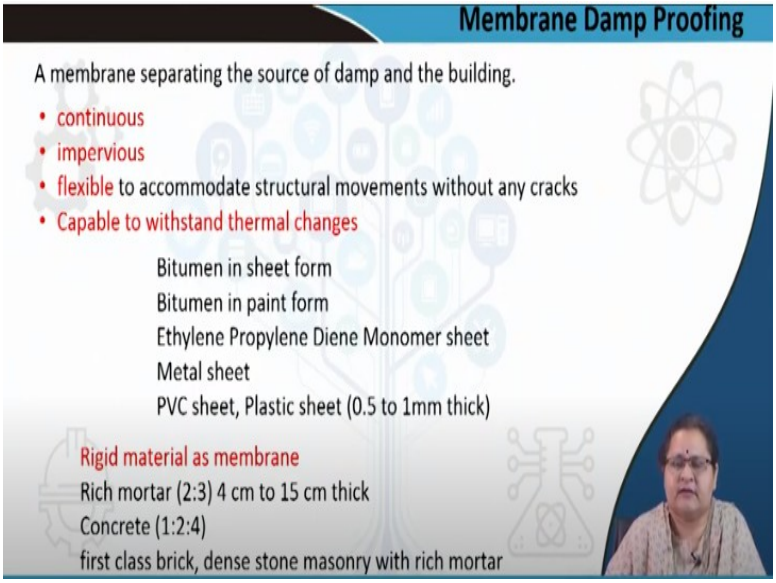

The first method is membrane damp proofing. By membrane we mean a thin member, which will be spaced in between and will not allow the damp or the water or the moisture to percolate inside of a building. So it may be placed between foundation to stop groundwater from trvaelling to the upper part of the superstructure from the substructure.

So if there is a small gap, the moisture will pass. Hence, the first condition is the membrane should be continuous. It is very difficult to get continuous surfaces for longer lengths. So there may be a joint required. And if you remember we had understood laps in tiles. We have to plan for sufficient overlapping, so that the moisture does not enter.

The membrane should also be impervious. These terms were discussed earlier in the previous modules. Impervious means it would not allow any water or anything to enter. Here the water itself is the enemy and we are not going to allow water to enter. It must be flexible because any kind of structural movements, such as expansion or contraction of the mother material on to which it is applied will lead to its expansion and contraction.

So the material should be flexible enough to move or to change place without any cracks. Also it should be capable of taking thermal changes. So in different climatic conditions where there is a variation in temperature like in summer and winter seasons or there is difference in day and night temperatures. So it should not

disintegrate or degrade very soon. It should have a long life because it will be actually irreplaceable from that place in certain cases.

So it should be withstanding thermal changes. What could be the materials that can act as membrane proofing? One could be Bitumen in sheet form. Bitumen with sand together and asphalt flooring you will get in sheet form. Bitumen in paint form. So a thick paint around 3 millimeters can be applied and it can give that impervious, continuous, flexible, thermally acceptable material.

Other materials which have come presently is ethylene propylene diene monomer which is short is known as EPDM sheets. We also have seen use of plastic sheets which are very cheap. PVC sheets are also behaving similar to that of the EPDM sheets. EPDM sheets have a longer life compared to PVC sheets. We also can depend on metal sheets. The metal sheets are to be applied in a sandwiched form, inside some material to make the entire structure waterproof.

Other than these so called flexible, impervious, continuous materials, which may be obtained in either sheet form or roll form etc., we can have rigid materials as a membrane. Like rich mortar with a composition of 2:3. It implies 2 parts of cement with 3 parts of sand. They vary from 4 to 15 centimeter. That is almost like a plain cast slab or a concrete slab. With a ratio of 1:2:4, you can use as a rigid membrane.

Therefore concrete acts as a membrane damp proof layer. Similarly first class bricks, dense stones without any cracks or porosity, with or without rich mortar as plaster can also be considered as rigid material as membrane damp proofing. So if your external wall is made of very good quality brick or stone, which absorbs very negligible amount of water and are dense in nature, then you may call it as a membrane damp proofing.

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So let us see how the conventional material that is bitumen sheet is being applied. You can see the picture where a person is actually rolling out and there is a fire burning underneath. So this fire is helped to melt the bitumen so that the bitumen sheet gets stick to the surface onto which it is put.

So you can understand this is a rooftop and to make this flat roof totally waterproof, it is torch applied or kind of pasted, because it is going to experience or get the entire rainfall on it. So this entire sheet is locally molten and it is pressed on to the surface. These rolls are having a fixed width.

So it will obviously have overlaps as you can see there is a line. When one layer finishes the other layer should overlap on top of it and it should be in the direction of the slope. You have to remember that too. Now here in the other picture, you see the person is actually fixing the bitumen sheet with torch application after a 90 degree turn and it is being put on the other side.

This is also at the roof and it is also torch applied and no water should enter. You can here see the sharp lines where it is ending. While application, one has to remember of these particular points that rolls are to be overlapped properly with around 10 centimeter and that will avoid water entry.

Joints and laps should be sealed with hot bitumen by torch application and direction of slope should be remembered also o that the water flows in the direction of the rain

water spout. You see another picture where a membrane damp proof has been put all around the foundation. So this is the membrane damp proof which is separating the foundation from the superstructure.

There is another picture which is showing the application of the membrane damp proof at the foundation.

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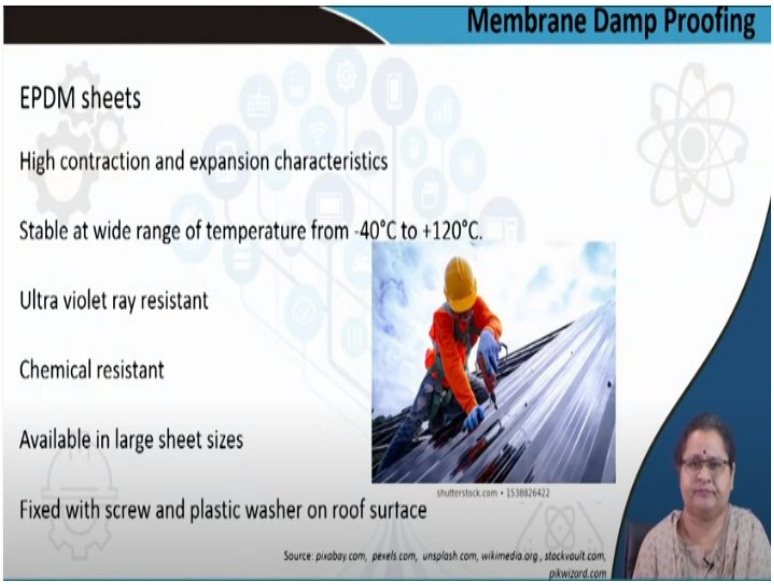

We also see the application of EPDM sheet. EPDM sheets are available in large sizes. As the bitumen felt was available in 30 meter length, but it had a fixed width of one meter, EPDM sheets may have widths around 10 m x 10 m or even larger. So the problem with it is fixing the membrane on the entire surface. You have to fix it at certain points.

So that is done by fixing screw and plastic washers on the roof surface. These plastic washers prevent the water entry through the holes created by this screw; that is the principle for any kind of screwing system of the roof. So you have to put a washer. But the important point is these are stable at a wide range of temperature. You may see it can withstand temperatures from -40^{o}C to 120^{o}C. It is resistant to ultraviolet rays of the sun.

So if it is kept exposed for years together with a very wide difference in temperature, this kind of sheet will stay. It is also not having any chemical reactions.

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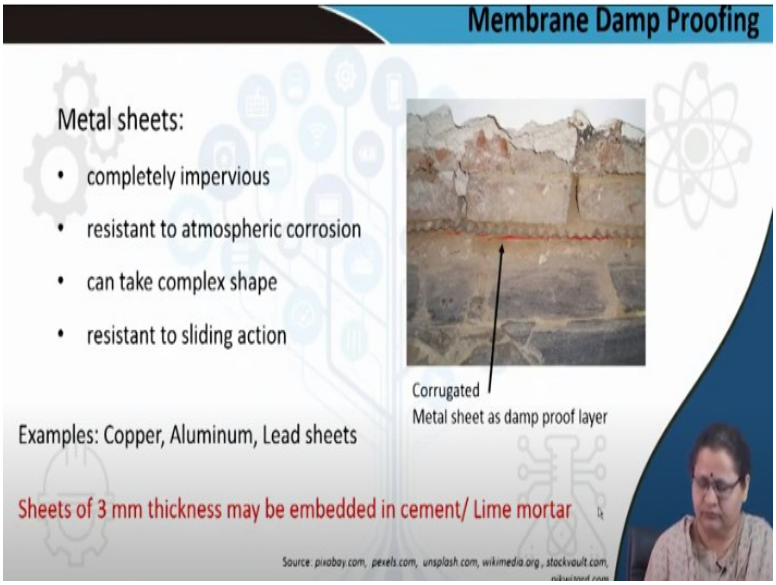

The next item is metal sheets. You can see in this picture that the metal sheet has been corrugated and applied in this particular zone. So this is the wall. This is where the corrugated metal sheet has been inserted when the slab was being cast. This makes it completely impervious, resistant to atmospheric corrosion. Many non-ferrous metals like aluminum, lead and copper are usually taken.

We are not going for ferrous metals in specific because if they experience some damp, that may get ruined. And it may be a flat metal sheet or a corrugated metal sheet. So this kind of metal sheet also helps as a membrane damp proofing.

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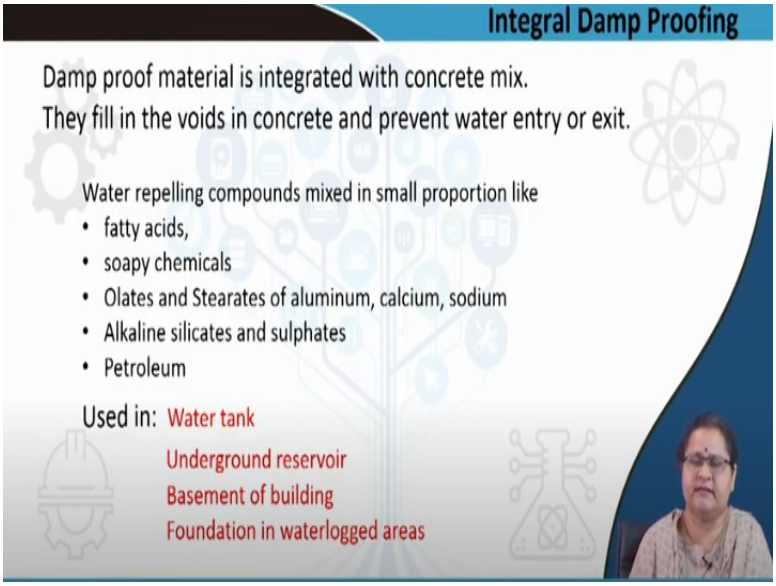

Now we come to the next type of damp proofing which is called integral damp proofing. Integral means integrated with the material. It is usually added in the

concrete mix or the mortar mix, when it is a case of plastering. These materials are usually soapy materials. That means it will be repellent to the water. They actually enter into the voids of the concrete and eventually prevent water entry or exit from a system.

So they are water repelling compounds like fatty acids, soapy chemicals, olates and stearates of aluminum, calcium, sodium, alkaline silicates sulfates and even petroleum. So these are required to be added in fixed amount. If you add more of it, then disintegration of the mother material may happen similar to that of plasticizers. Therefore adding more of these compounds can make it worse.

So the containers contain the specific amount that is to be added either to the concrete mix or the mortar mix and you have to abide by that. They are mainly applied in water tanks. So a leaky water tank would not be visible if it is made of concrete. Presently the water tanks are of plastic i.e. Sintex tank, but underground reservoirs continue to remain as concrete structure.

Since there is possibility that ground water may enter into the reservoir from outside and might adulterate the fresh water, so groundwater reservoirs or the concrete holding reservoirs should have damp proofing integrated within when it is made. The basements of buildings which are not for habitable use, but are mainly used for parking and building services mainly, should not have lot of moisture embedded there.

When the foundations are built in a waterlogged area, in a marshy area, there you need to have the use of integrated damp proofing.

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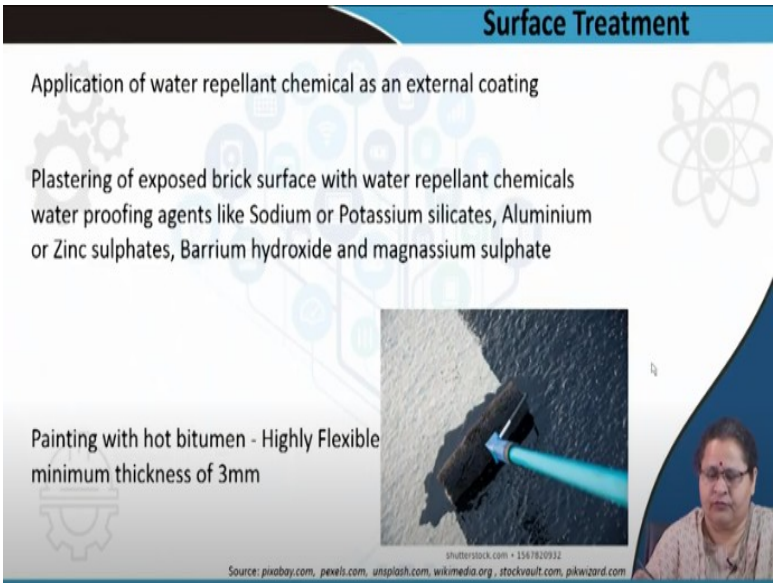

Surface treatment is also another way of damp proofing. When everything is done, it is not that you cannot make it further damp proof. You can add water repellent coating. So the coating may be of the similar materials which we discussed during integral damp proofing.

So plastering of exposed brick surfaces with water repellent chemicals, waterproofing agents like sodium or potassium silicates, aluminum or zinc sulfates, barium hydroxide and magnesium sulfate may be used for the surface treatment. In fact hot bitumen paint can also be applied as surface treatment. This helps in waterproofing. It is done even for metal surfaces.

It should be of a minimum thickness of around 3 mm and it can give a impervious and water repellent coating on top of the mother material or the material which you want to protect.

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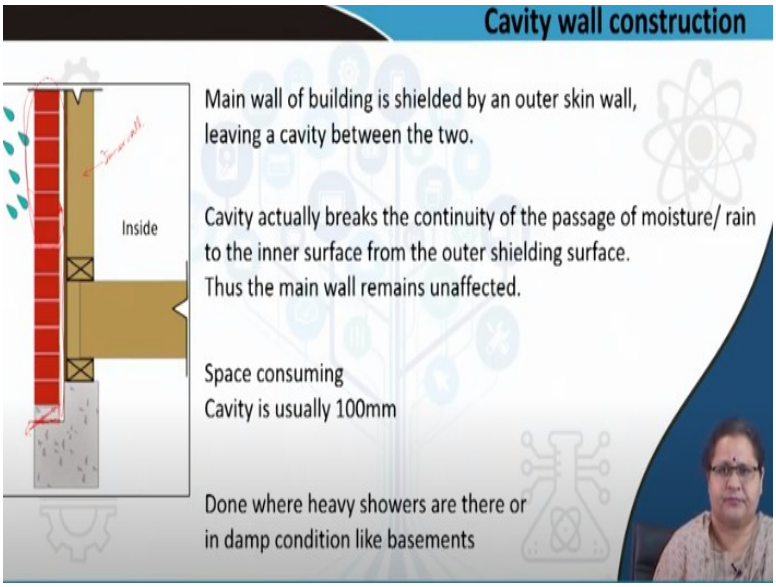

Now we come to the cavity wall construction. What is cavity wall? If you look at the picture, there is a main structure and then the red wall here. This red wall is an additional wall that has been planned and made just in front of the main wall where the outer skin experiences a lot of weather action like rain, or some moist condition. Some of the water can even seep in but will get trapped into this cavity in form of moisture or in form of water.

There is a hole or a gap through which this moisture can actually escape. So it does not affect the inner wall. So the inner wall remains unaffected although the building is experiencing a lot of water or moist condition. So if continuous heavy showers are there particularly areas like basements will be prone to damp conditions, you can actually plan for such walls. But there is a problem.

It will take a lot of area. There is usually a gap of 10 cm provided between the two walls and that has to be maintained. Hence, you actually lose in area. It is space consuming and the cavity is usually 100 mm wide.

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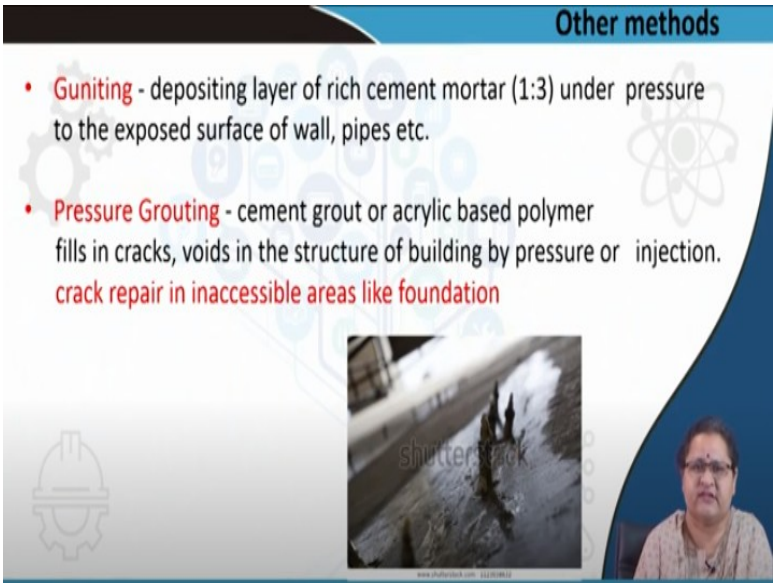

Now we also need to know some methods which are to be adopted when there is a crack already, through which water can enter. To overcome this, the building needs to regularly visited or maintained. Otherwise these will become very vulnerable points of decay. Now how do we check those points? These can be checked through the guniting process.

Guniting is depositing a layer of rich cement mortar under pressure to the exposed surface. It may be wall, it may be pipes, it may be a concrete surface when actually there is a crack. So you are pushing in the rich cement mortar, which we have seen in membrane damp proofing. It will act as a barrier for the moisture to penetrate through those gaps. So you are actually filling in the gap.

Now how can these cracks happen? It can happen due to structural deformities. It may happen due to some leakages inside the building. So one has to monitor the building where it can happen. They have to be looked for and then take such action. Similar is the method of pressure grouting. You can see in this picture there are some points where from the pressure grouting is done.

So these are the points through which injection of acrylic based polymer or cement mix is pushed in to repair or fill the crack. So usually they can be done in inaccessible parts like foundation, some portions where one cannot reach or that if the crack is quite deep and is out of reach. In such case you can actually do pressure grouting and repair such locations so that further damp cannot penetrate.

Some damage may happen, but continuous exposure to sunlight can help escape the moisture which was trapped in. So through these slides actually we could bring to you the different types of damp proofing. Now damp proofing is very important and damp proofing is part of building maintenance, maybe not as a part of building material.

But yes, if one is very careful, when the building is in the construction phase, if you apply the techniques at right places, then you may get eventually a building which will not require maintenance for a longer period of time. So one has to be very careful on which are the vulnerable points, that may become the sources of damp.

So once you know the sources of damp when you are in the process of construction, you must recommend these damp proofing and which type of damp proofing will be appropriate for that area. And as I told you, guniting and pressure grouting these are corrective measures, which can be done at a later time.

But eventually if you are taking steps from the very beginning, the building may not experience any damp structure and you can get a damp free structure for a long period of time. Thank you.