Building Materials and Composites

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Lecture No - 23

Precast Wall Panels

In today's lecture we will be covering Precast Wall Panels. Precast Wall Panels after the CMU's and the AAC blocks and the pavement blocks, we will see these are much larger in size, this we had talked earlier. it may cover between two floors like one floor level to the other floor level. So, here you cannot do it humanly and hence labour becomes a secondary issue rather machine comes in the forefront. (refer time: 01:07)

Here we will be discussing the precast wall panels, the characteristics and ingredients, the fixing details and also the other kind of panels the EPS that is expanded poly strain panels, the large panels, large concrete panels and then, wafflecrete which are being used. The puff panels are also there but these are mostly made from concrete. (refer time: 01:30)

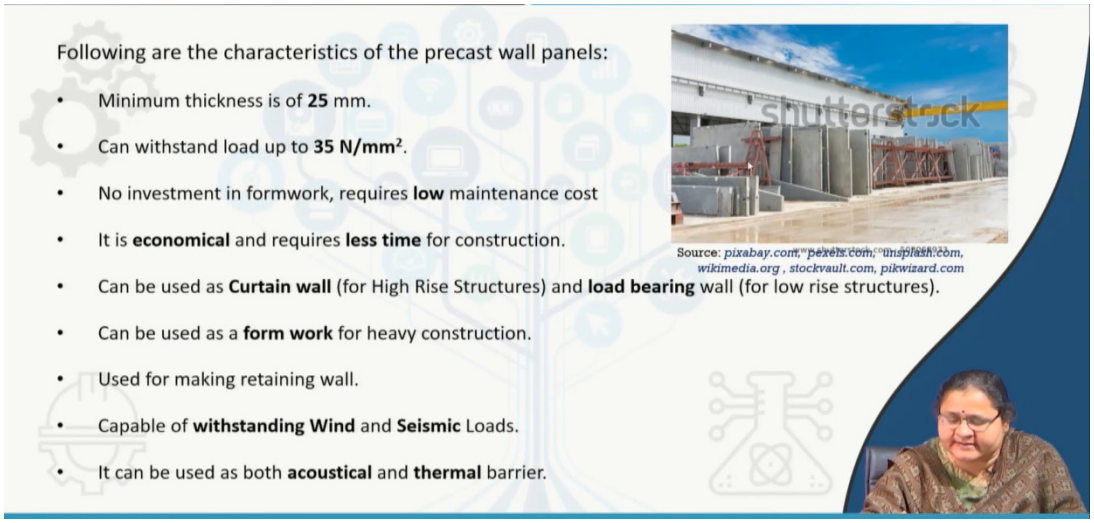
These are in dimension related to their thickness. If you are planning for something very thin, 45 times of that will become the thickness, when it is flat. If you have corrugations it will be 40 it will be 45 times when it is corrugated and this is kind of thumb rule. So, if you have some 30 millimetre thickness so 30 cross 48 will become the size or available dimension. Usually the composite panel varies between 95- 180 millimetres.

Composite refers to there will be two panels with a central space which may have a void or maybe filled with some material to hold it together. These panels are separated from each other. But anyway if you are not looking for thermal comfort, you can even work with a single layer or a single panel. So, something around 1.5 meters by 1.5 meters will be its dimension, if it is 30 millimetre.

So, something around 360 millimetres or thick panel will be having a 3 meter by 3 meter size without any corrugation. And any damage to such thin wall can be repaired. So, if it is a factory environment, you can actually set in thin single panels one after the other and have a floor to floor coverage and in case one is getting damaged you can replace one and you can use another one. Yes, it is intensive. You have to again bring in the machines etc but it is not that you cannot replace it.

These walls are usually used as filler walls within a structural system so, you may have a beam column system where these walls will go and just rest. It is completely dry unlike the CMU blocks or the AAC blocks which we had already covered so they may start or initiate from on sitting on the floor beam or special members called cleats. (refer time: 04:23)

You can see here in the picture which I had shown earlier also that various sizes of panels are waiting from this end to this end you can see various sizes. Here you can see assemblage of different sizes in one or two you can see some openings also. So, these are all produced from the factory with the specific order given. It will be between the floor to floor height the dimension of the doors windows, the panel number where it will be done.



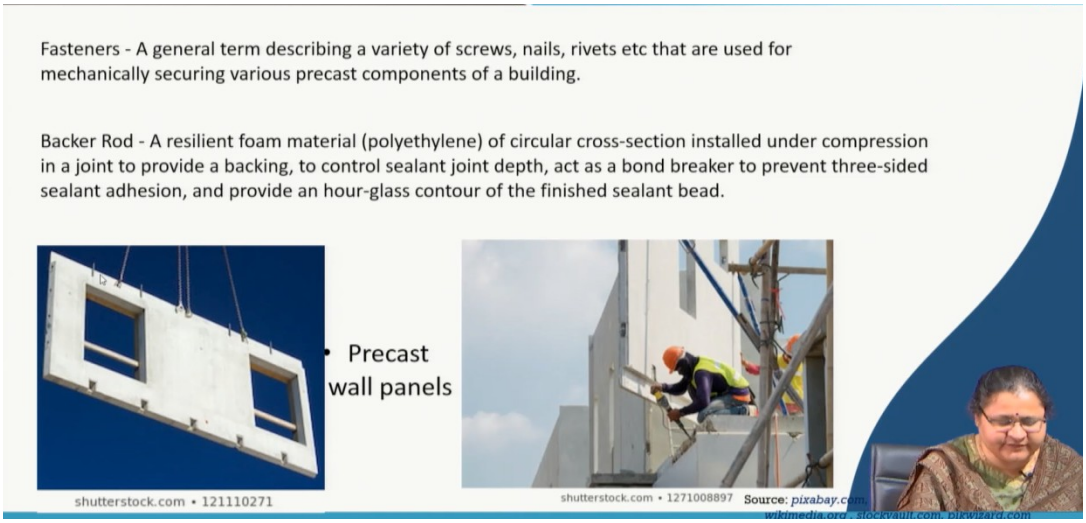
So, a total schedule like you prepare a door window schedule a panel schedule has to be made, prepared and it has to be tagged with the drawing like x axis and y axis we have a b c d e f 1,2,3,4. So, every panel will have a number and which panel will sit where it has to be followed with the drawing. So, the skilled person should know which panel to take and lift it and put it in which location which after which like the adjacency of the panels are to be known.

So, this is very crucial you require skill labour one should be able to read the drawing and find out the right one. So, all panels will come with their numbers on site these can withstand a load up to 35 Newton per millimetre square and there is no requirement of form work. It has very little maintenance cost. It is very less labour-oriented because these are already made by labour intensive process in a controlled environment.

And as I told you when it is a non-load bearing wall it is a curtain wall. It is a curtain wall for high rise structures these are preferred. Underground structures where you require the wall, basements below the earth you require to retain the wall. We usually go for concrete walls. Instead of going for cast in situ concrete you can actually assemble the panels one after the other and create the wall of the basement.

What is important, the joints so we will come to that. These panels are further capable of withstanding wind and seismic loads because they are large in size and they can be acoustical barrier as well as thermal barrier, when they are having a composite nature. That is two walls together with an air gap or filled in with EPS or glass, wood, etc.

So, we move to how they are fixed as you see a clearer picture. You can see a lot of points are there for anchorage. And also you can see some rods are popping out. So, these rods when they are popping out in this picture on the lower end you can see there is a place to receive that.(refer time: 08:03)

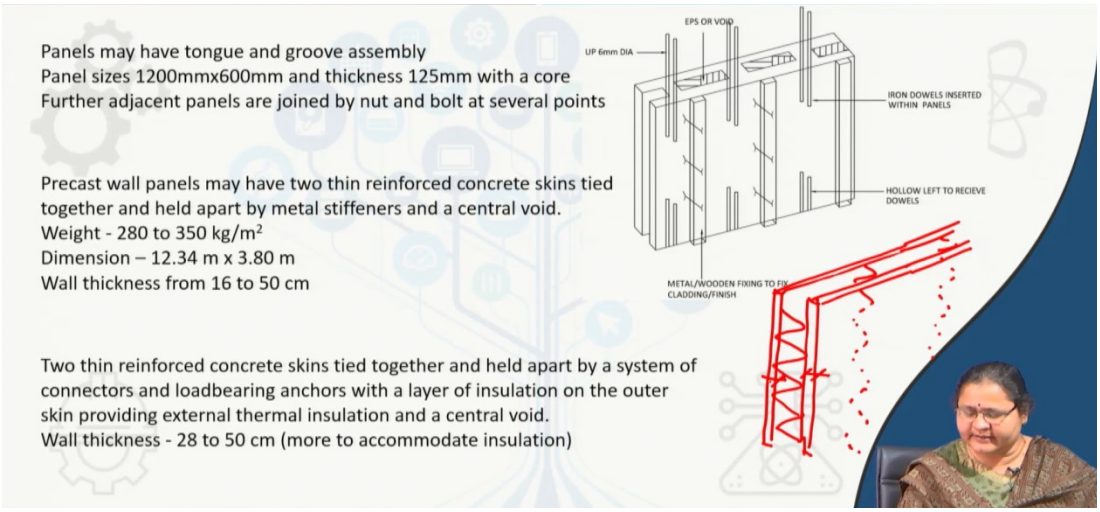


So, the panel below it will be at these points, with these projections outside. So, there is a dowel system there is a drawing after this. So, I will go to that also. So, you can see here they are anchored at several points to lift it. Again there are dowels, projected out to rest on the previous one, to receive the upper panel. So, this one will go and sit on the dowels left below it other than that there is the backer rod which I was discussing in my previous lecture when I explained the CMU block being assembled with an iron or a steel column.

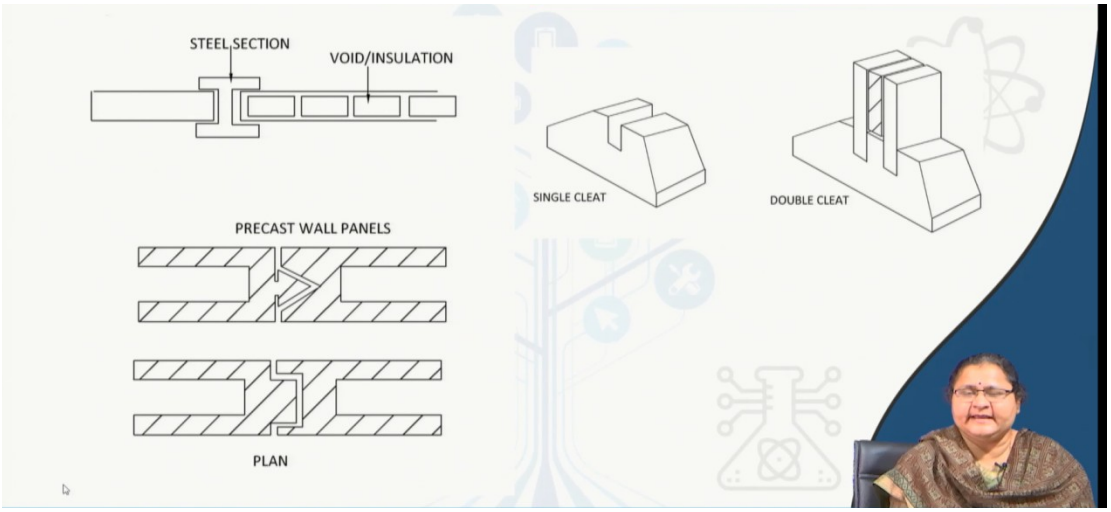
So, there was a provision or a gap through which water air would have entered. Here also when two adjacent blocks are sitting you have to seal that joint. You cannot use mortar no one can go and put mortar for a three meter length. So, there also you need to have a dry seal. Here you can see the person above whom the member is actually hanging and it has to be put in position by this person so he is trying to drive this thing into these holes.

So, this has to go and get set there. So, this person has to be skilled on his job other than this backer rod ceiling etc., the fasteners are being used the screws, nails, rivets, etcetera., they all refer to the mechanical processes which may be required to tighten the panel in position or keep the panel in position. (refer time: 10:06)

So, here you see a schematic drawing these are the dowels. So, dowels are embedded when it were it was made and these are the slots which are kept to receive the dowels. So, these are hollows left to receive the dowel. On the upper side it is the dowels projected up so they will go on which further the above member will rest. So, inside you can see void what more you can see you can see a notch. Sometimes, if it is quite thick, you can have a tongue and groove joint. So two members can slide one inside the other. (refer time: 10:45)



So, you can have something like one moving into the other one member, moving into the other member. So, here you see there is a tongue and groove kind of joint here, as well as here, simpler the better, so you can assemble it this way. You can see some members or called the spacers which can be in this form, holding two skins or two precast members with the required gap. So, this kind of spacers you will see is separating the two members.

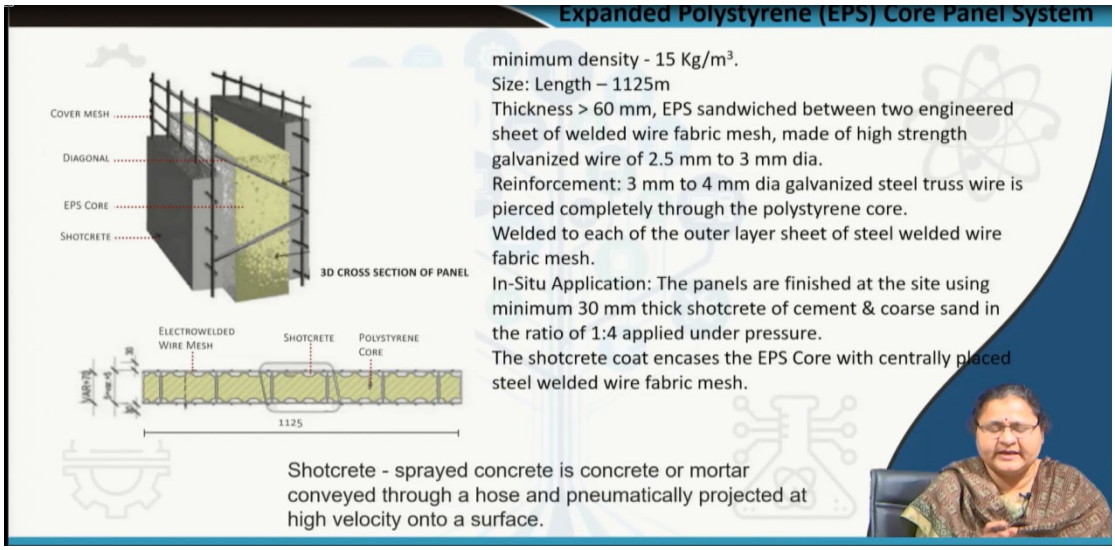


So, there may be another spacer at interval there may be another spacer after some time inside and it is totally thorough hollow or else it could be filled in with some glass wool or EPS. The full form is Expanded Polystyrene. We will come to that. So, various thicknesses of individual panels together hold in position by spacers can be cast and brought.

Here you had seen the joint. If it is a steel section, your entire panel could rest inside the steel section. So, there is no groove here. So, it could move into that. So, if it is a heavy section this kind of panel can enter here. Coming to the cleats, how it rests on the floor. These are cleats these are supports made with concrete onto which the panel is resting So, panel will be passing through this and it will be resting there may be another cleat after some time.

So, this interval this overran etc is to be calculated out. Here also you see this is a double cleat, so there is a double notch. So, there is no possibility of movement of this member. So, this is the panel sitting. Here I have drawn that here that. Here it is already made so it is a double panel within a double cleat. So, it is resting on the floor. So, hope you understood the phenomena. Apart from this, you require to know the sealant which I have told you are sealing with a backer rod and the sealant all along the joint which is experiencing the external environment.(refer time: 13:39)

This is expanded polystyrene core panel system this has been developed lately by BMTPC in India. The Building Materials Technology Promotion Centre and you see here the details are given here. The density, the size, the thickness, etc what you see here, what comes on site. It is the mesh which is with EPS and this mesh is hold by spacer you can see this rod diagonal. So, this mesh on both sides and this spacer passing through the EPS is holding the mesh together in position.



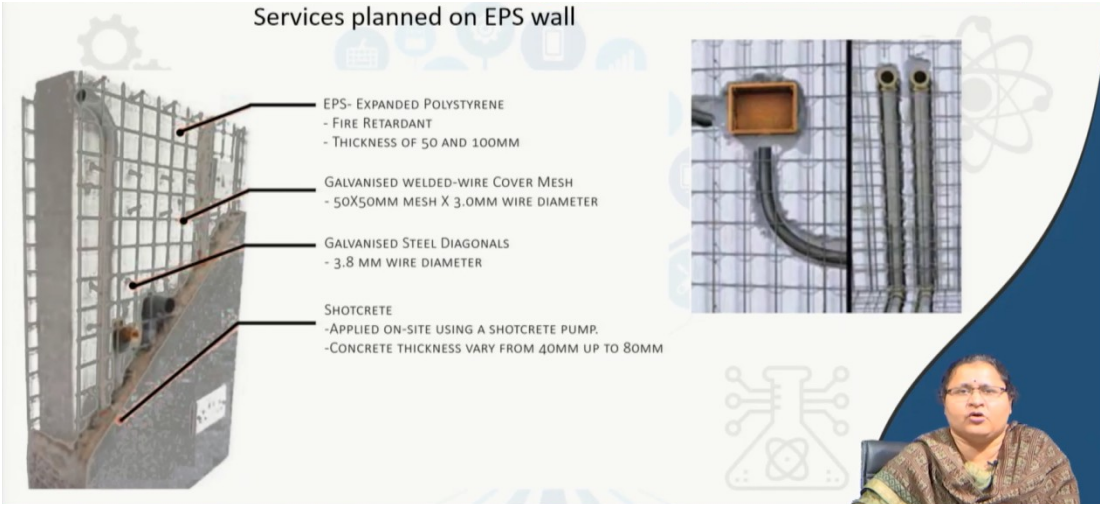
On bringing this to side, what is done? This concrete is being applied locally on site that is called short crate. It is very thin layer 30 millimetres it is spread concrete. So, it is not a wet process what we usually do with cast in situ. It is a nozzle pneumatically, it is projected on

top of this mesh which is almost a six millimetre by six millimetre rods and this is creating the wall. So, it is partially prefabricated.

But yes, one has to know how to spray this concrete which is called short grit. So, remember the term shotcrete, it is spread concrete or mortar conveyed through a hose and pneumatically projected at very high velocity onto surface. So, this reinforcement helps to make it stiff and it forms the wall. (refer time: 15:37)

When you are planning for all these precast items, you have to remember the service lines. You cannot forget or neglect the service lines. Is it easy to work on top of a precast member? is it easy to nail, easy to cut a chase to put your service line as considering you as architecture student, students from architecture you may have covered the services part or you may not. But these require lot of conduits that are to be drawn.

So this EPS or any hollow section may allow you to plan for the service lines but if it is not planned for it becomes a problem for the entire process. Here you see on this EPS section all the service lines are being made and only after that leaving the openings for not to be sealed if the shotcrete is being applied. So, this is partially taking care of the service lines. So, any precast panel, as I had told you a schedule has to be made through whichever the lines are moving are to be drawn earlier. (refer time: 17:13)

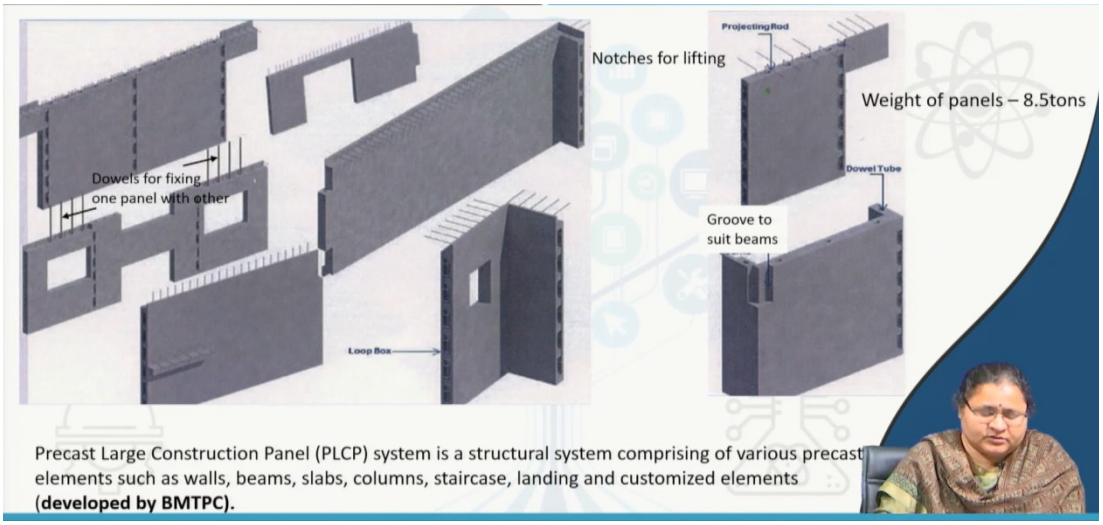


And provisions are to be made for the routes to move so that is the major drawback of precast unit system all mechanical, electrical, plumbing together usually called as MEP. The MEP services have to be designed beforehand as it would not be possible to create openings in future. Moreover any expansion program should be considered. So, any future planning should be incorporated as concealed fittings, provision for groups, block out should be made in the casting mode.

Openings not only for present requirement, but as I told for future are to be accounted. Rain water pipes, electrical lines, sanitary lines, waste water, supply water, all to be included even doors windows and other openings are to be finalized beforehand as they are to be provided to the fabricator and necessary actions would only be taken if the drawing reaches them. So,

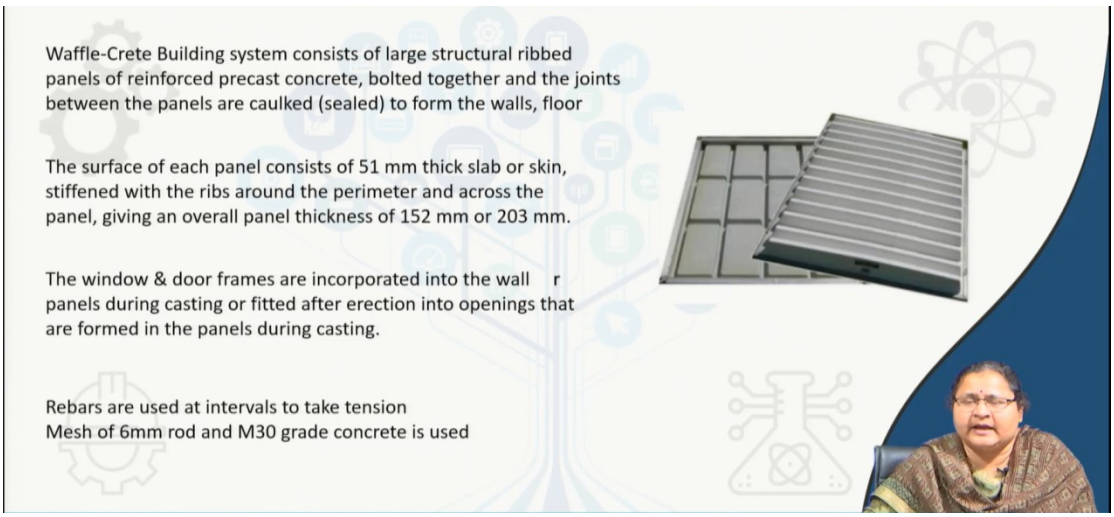
everything is to be pre-designed, which is the major drawback, particularly of such precast items. (refer time: 18:32)

This is large precast panel. So, you have precast large construction panels. Here you see even the bends are there, even two openings are there, it is a connected, you see the dowels are left which will go and be received. This has also been this developed by BMTPC. You see here at this end groove to suit beams. So, it may be received by a beam it may receive a beam also which is precast which we will discuss in our next lecture.



You can have projecting rods to receive a floor slab. So, till now we were discussing the panels which are sitting on this structural system. But here, we can see there are provisions of plugging in beams, columns receiving them and you can actually carry on. Wafflecrete is another unit which you can replace, these are ribbed panels reinforcement is inside it. (refer time: 19:37)

And you can actually use these similar to the panels. So, some dimensions are given here for as a reference. These are having rebars at an interval to take tension and they are corrugated kind of wall members. Usually m30 grade concrete is used for casting this. So, if you carry on if you remember GFRG, glass fibre reinforced gypsum, there in gypsum, glass fibre was used to make it strong in tension and walls were made out of it and it was a hollow unit and in each hollow we could strengthen by pouring concrete to receive the sanitary fixtures whatever.



So as a need of the hour we need faster construction technology into our building system, less of energy consumption and we need to switch over to such kind of construction systems. We have switched over till we could like the CMUS and AAC blocks are now much into practice. But we could not, we cannot move further ahead unless and until we have skilled labour to manoeuvre these mechanical equipments, mechanical methods, so a training is required.

We have to have the skill set on our labourer's side. Once we can do that, we can actually take a leap in meeting the demands which are really important, particularly, in the housing sector. Maybe we can go for faster constructions. Walls are very important it is the covering item. So, more we can actually use the labour intensive part, the time consuming part, the weight construction methods we can just go away with.

So, these will help us to move forward towards meeting the challenges or meeting the shortages. So, with this walling unit and the previous lecture, we had covered the walling part. So, next lecture, we will be moving to the flooring part and then, further into the beam column systems. Thank you