Structure, Form, and Architecture: The Synergy

Prof. Shubhajit Sadhukhan
Department of Architecture and Planning
Indian Institute of Technology, Roorkee

Lecture – 09
Factors affecting the Structural Forms

Hello everyone. Welcome back to NPTEL online course Structure, Form and Architecture: The Synergy. Today, in lecture number 9, we will be discussing on Factors affecting Structural Form. In earlier lectures, we have seen that structural form also referred as structural system and definitely there are a number of factors that will influence how will you pick up a structural system.

And in last lecture, we have seen how structural form transform from history prehistoric age to the modern and even at the age of parametric architecture how it transform. So, depending on different factors like structural form will also differ. So, our focus in this lecture will be to understand those factors. And I will also give you some of the examples in those factors how it can be a influencing factor to determine the structural form. So, let us start.

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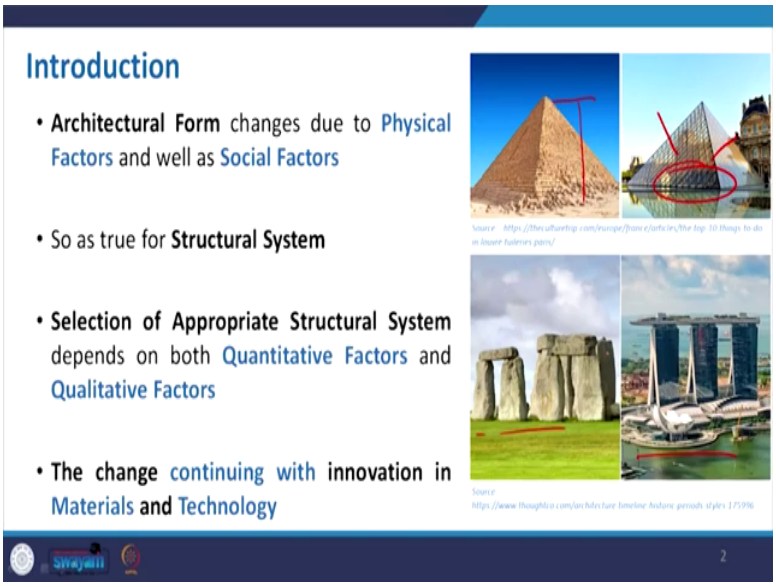

So, basically structural form or before that the architectural form that actually changed over time and due to some physical factors and as well as some social factors. So, earlier the technology was not much known, not that much material was available or methods of construction was not that much advanced.

So, people they built their shelter or any structure architecture based on the available materials mostly stone and they used like that already we have seen in the last lecture that they created some megalithic structure made of stone slab, then post lintel and then basically these are some physical factors that influence it. But at the same time there are some social factors.

We have seen in like later in gothic or byzantine, so depending on the social aspect say for example, if we take example of pyramid, so it is a huge monumental scale and the main

reason to showcase it at that scale is basically show the power of the king. So, like that in some of the you know historical examples there we have seen this you know the emperor they created monumental structures. So, as true like in India we have Taj Mahal, so it is a very beautiful structure, but again the scale is very huge.

So, there are some social influence also and then time to time. Whenever the emperor change from one to another there is a certain change. We have seen in Islamic architecture the use of different domes and then different arches pointed arches and then later on like also we have seen the transformation to the modern building the frame structure.

So, physical factors as well as social factors they like influence the architectural form and so as to the structural system because we cannot make much difference between these two because whenever something has been thought in mind and to bring that into reality so structural supports structural design was made with available resources and that transform over the time.

Then selection of appropriate structural system, depends on some quantitative and as well as some qualitative factors. Quantitative factors like which can be miserable, say for example, the load. The very basic requirement to design structure is the load calculation.

So, it is pure mathematics where we take into account different you know dead load, live load, and all lateral loads, we also take their probability because already we have seen that actual load calculation is not that much you know possible because of like uncertainty in those because when you consider the seismic or wind, so it will not be same all through. So, there are some probabilistic approach by which we calculate the load. So, this is measurable so, that can be.

Again, the factors like the cost we would like to spend on making the structure. So, if we just have some limitations, so we cannot really go for very high quality you know like finish for our building. So, then we should have to compromise with some maybe some low rise structure or so, this is another factor. Then other quantitative factors may include your like

calculation for the wind speed, then the temperature variation, then expansion of the structure.

So, these are like quantitative. Now, come to the qualitative aspect. So, basically that start with already we have discussed much on that that is the architectural quality and concept. So, there is a visual quality that we want to bring it, whether it is organic or we go for some ornamentation. So, these are some qualitative aspect, giving emphasis on the aesthetics of the building and how we make it with the help of structure. So, both are very important factors.

The change continuing with innovation in materials and technology. Earlier the available materials probably was wood mud stone, later on we have seen that instead of stone they started using brick and then lime water as a binder, then after that it is a cement water after invention of cement and then concrete and nowadays even beyond that. So, even nowadays we also are talking about nano carbon materials which will have more strength. So, we will come to that in detail.

So, here you can see that two examples side by side one is the pyramid in Egypt and the other is Lucas Museum. So, this transformation of the structural element that put in too. So, one was made of limestone stack. One after another other is the steel and glass.

So, basic form the overall concept to create a pyramid shaped structure is fulfilled, but definitely. You can see that how much space you can get inside and how much openness being created in this, ok. Even the scale has changed you can see this and this compared to that, though the pictures are looking pretty similar, but scale are different.

So, as true with this. This is the stone hinge at the prehistoric age and this is a building in Singapore. So, basically the concept, visually if you see the form it is pretty same, but application of structure element like where it is just initially the post lintel kind of structure, now the frame structure and then supported with some cantilever and heavy you know mass at the top, so there are something like that.

So, depending on the innovation of different new technologies and again the materials that change the decision to take upon for a structure to create the architecture the way we want. So, in this slide I just summarized the basic factors which will determine the structural form or the system. So, because like when we discussed about the structural form we discussed that basically in a building which is more dominant form that is the structural form, the dominant structure will depict the form. But one building may have multiple of such, so it is better to say the structural system.

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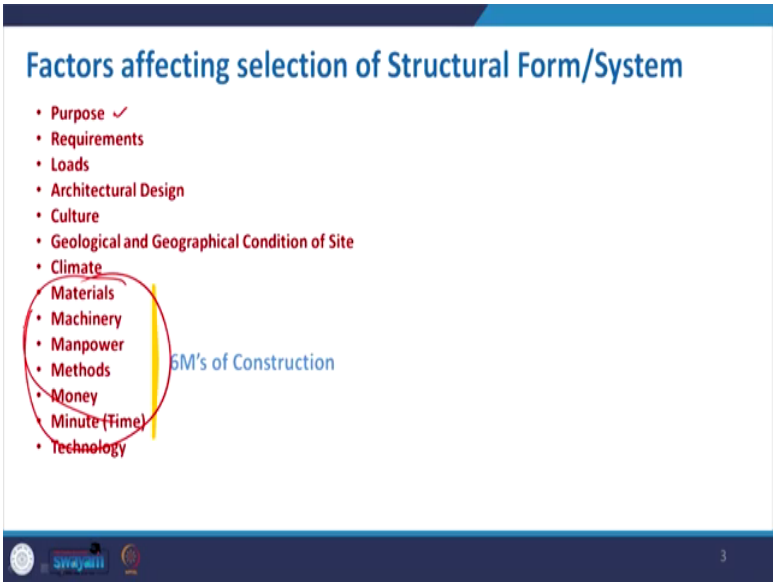

So, here one is the factor is the purpose. So, again the requirements, then loads, then definitely the architectural design. So, when we talk about architectural design, so also that includes the visual quality, the concept that we are really looking for, then the culture that

also influence the structural system and architecture as well. Then geological and geographical condition of the site where the building will be erected.

Then the climatology is one of the most important factors to determine the structural form. Then we have materials, machinery, manpower, methods, then money, the cost actually, this refers to cost of the construction, then the time duration for the construction and the technology.

So, we can again exchange this list further, but definitely to decide upon a structure only one factor will be the crucial it is not like that. So, there are multiple factors that act together to take upon a decision, but here we will try to see each of this factor how it can be with some examples and also I suggest you to you know extend that least, so that the understanding on this particular lecture will be much more clear.

Now, one thing very interesting that I have you know put here that is this particular materials, machinery, manpower, matters, money and minutes. So, these are basically considered as 6 M's of construction management. So, these are also very you know important aspect to decide upon how we will get the structure to be to be built.

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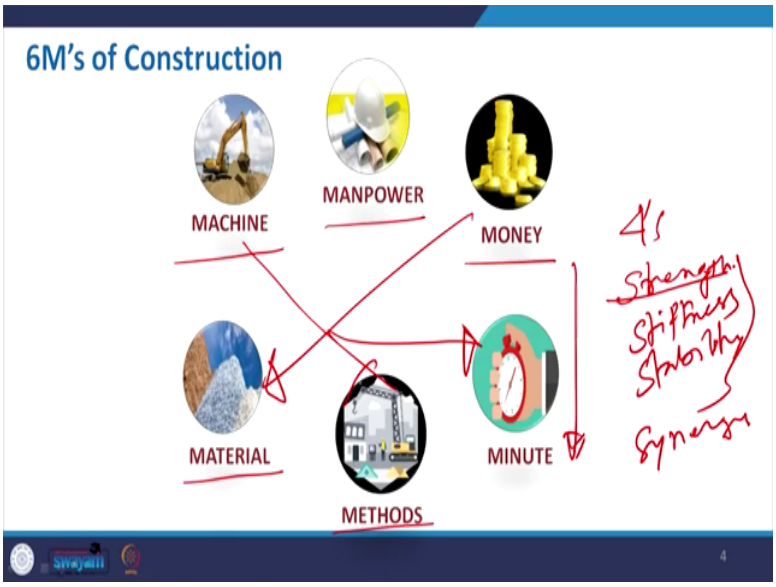

So, let us move to these 6 M's of the construction. So, here like not in particular order, so we start with the material. If material is available it is having the strength and we also know this 4 S of structure. So, let us recap that what was that. So, first is your basically the strength, then you have stiffness, then you have stability, and then along with that we got the synergy.

So, this strength will be determined by the material used in the structure. So, it is the property which will prevent your structure from breaking. So, based on that like we considered rock is a was a very strong or having good strength, but the main problem was like with the thickness of that rock we could not able to create like huge interior space or that was difficult.

Then at this time when the land cost is so high and we all are looking for like creating more space. So, thickness of the wall is become a area of research where we can reduce it further and further, so that without compromising the strength overall resistance of the structure we

can use much interior space. So, material that started with mud wood and then it is become the brick machinery, then the concrete structure, then the steel structure and again it is a like continuing with some more materials in the construction field and day-to-day we are using that to make our construction fast, maintain the quality and also durability.

Then machine is another important factor like for a small like you know building, earlier people used to build at their own, so make the frame and all. But now, if you consider the construction of a high rise. So, height of say about say your almost say 100 storey building, so 100 even more storey building. So, to reach that particular part and is a like it needs some good machine which will act really with precision, so that it can be easily completed with due course of time and with the proper quality maintenance.

Then about the manpower that includes everything starting from your the designer, architect designer, structural engineers, then your service engineers, even I the construction engineer then you have your labors. So, all together they are very much useful component of the construction management. If you have good architects having good skill to make something really great, so that will also depend like how you can get a structural design and all. And sometimes with lack of knowledge or lack of those facilities we have to compromise our structure.

Then the another one is your methods. So, how you will do it? Whether you make it on site, many a times it is referred to cast in situ and then also sometimes nowadays we can go for prefabrication. We make in off site and then we just go and plug that and that is a plug and play concept that is been there.

Then money is very important. If you do not have money then we can only imagine we cannot really bring that into reality. So, the way we you know visualize something to be built. So, that also need some investment the money. So, earlier like we have seen the wealth was there with the impair, so they get those huge structure, but nowadays like even with you know having less money or so, we will just try to build at that cost.

So, it has a strong relation with the selection of the you know design and as well as the execution and that also having relation with the material, the finish, it may be a cement finish in a residential building or it may be a like some high quality marbles or onyx as if finish material.

Then time that referred as a minute is very crucial. Nowadays where the demand of housing is more specially in like I take example of India, so here we need some fast construction and that has to be erected very fast with that. And with the help of this good quality machine and the right method that will really save time without compromising the quality. So, these are something that referred to the construction.

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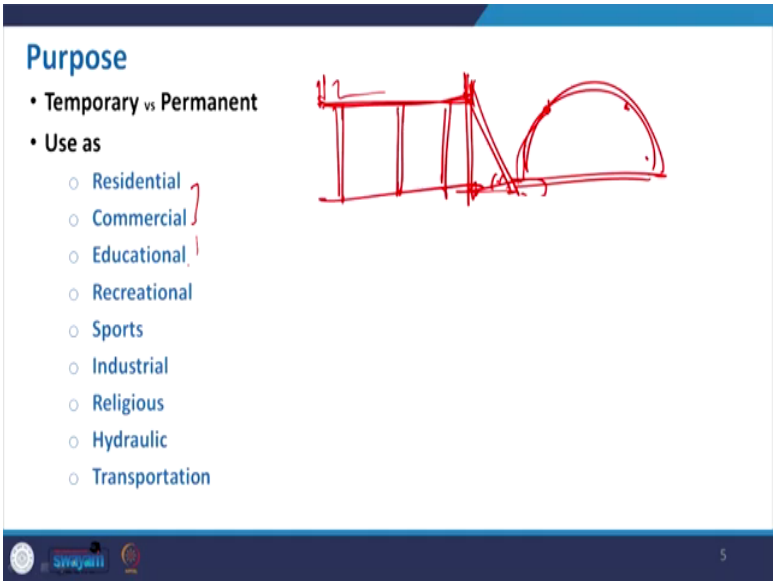

Now, we move to the purpose. Now, purpose of making a structure it may be a temporary one or permanent one. What is the temporary one? Temporary structure is basically like we

referred to the formwork. Whenever we construct any building, so in order to support the concrete when it is poured on the you know temporary structure that is the your shuttering and that is being supported with some props and then sometimes to backup it will get some you know some racking.

So, that it gives some initial support strength and this can be one of this temporary structure. The purpose is to make it temporary after this concrete will get it setting then will remove this structure. So, this is also very important and has this has to be design also adequately. So, that it can carry that load to the desired level, maybe like for the concrete its recommended to be 28 days minimum with proper curing and all. So, this is one.

The other maybe it is just for a function. So, it should be portable. So, there is a convention or there is the some function going on. So, now, open field we can create some you know hangar type structure for different purpose and then we just can remove it when the function or the activity got over.

So, for that also definitely the structure should be light enough, so that it can be easily handled and also it should be designed properly, so that it can you know that logistic of that will be easy. So, the parts and parcel of that should be easily plug and play kind of you know mechanism where we just can create it and once the purpose is solved we can remove it.

Then other temporary structure, I can give you example of the site office. So, for a huge construction, so there should be a side office or maybe for the staying of the labors working there. So, these are something. Now, for like permanent structure that is basically all the buildings, like it may be categorized as residential, commercial, educational, recreational, then sports facility like stadium industrial like the plant and warehouses.

Then religious like temple then mosques, churches. Hydraulic means the creating the damp and other thing, then the transportation relates to the bridge, airport, like stations etcetera.

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So, here basically you can see the temporary structure one that I refer the site container office. So, basically this is very simple structure and this can be just plugged and can be used. So, that can be easily transport from one to another the container type. This is something we call it the flying shore.

So, basically this being used for the you know building having some you know lean towards outside and like deteriorated building; to give the support additional support from the outside, so that it will not collide or it will not fall on this. So, these are some temporary structure.

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Come to the permanent structure. So, there are many examples. So, I have referred some of them in each category. So, also like we have the bridge and all. So, basically in this case this purpose like it is to be used for say residential purpose. So, we will go with some anthropometric dimension that we need this much area for the kitchen, this much for the toilet and we optimize it.

For the bedroom and it all been decided based on the furnitures that will put into that building or that space. Basically that way in bedroom or normally we will expect a bedroom in the you know side table and all. But the this will change when we go for a stadium. So, stadium may be a like capacity of 50,000 spectators. So, there that should be something where no obstruction should be provided and all.

We have seen some examples like one stadium in Munich and there are many cricket football stadium across the globe, where we create their structure, very light structure the shade to protect the our spectator from the excessive heat and also from some brains and etcetera.

For recreational, then when we go for the museum and other thing. So, we have different features, then the structural form that will be more you know opaque and we go for that. And scale will also change, for this auditorium and multiplex if you go there, so height is double height triple height. So, for that probably the normal beam column that we used in residential building may not work. So, for that maybe the other TRAS system or maybe space frame will be used.

So, this purpose for which purpose we are making our building and structure that will also determine. So, it will also relate to the span, how much span we require, then the height of the structure, the impose load calculation will differ whenever we go for a you know assembly building or there will be more gathering. In a residential building per floor maybe the average occupancy will be 5 or 6 depending on the family size, but for those areas, so there will be more footfall and we need some area for that.

Then scale, then spatial arrangement which is very important and it will change when you move from your residential building to you know other kind of buildings. And this list can be again continuing.

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So, here you can see the Petronas Tower which is a commercial and business type building. Again this is a something where you have to go with some different kind of structure. So, here it was used as a tube structures. So, we will come to that when we discuss about the high rise building. So, basically there we create the form in a you know tabular form and then use of steel to this is a greatest tent and we can get it. So, that is also true for the stadium where we have to make this is a cover stadium.

So, you can imagine this span, so this span to be covered. So, our structural decision will be change from what we normally you know used to think for the residential building. Now, the requirements; based on the purpose one purpose is done that I want to build one auditorium then we have to frame the requirements about how much area is required, what should be the height for that, then the span required for that and the overall form.

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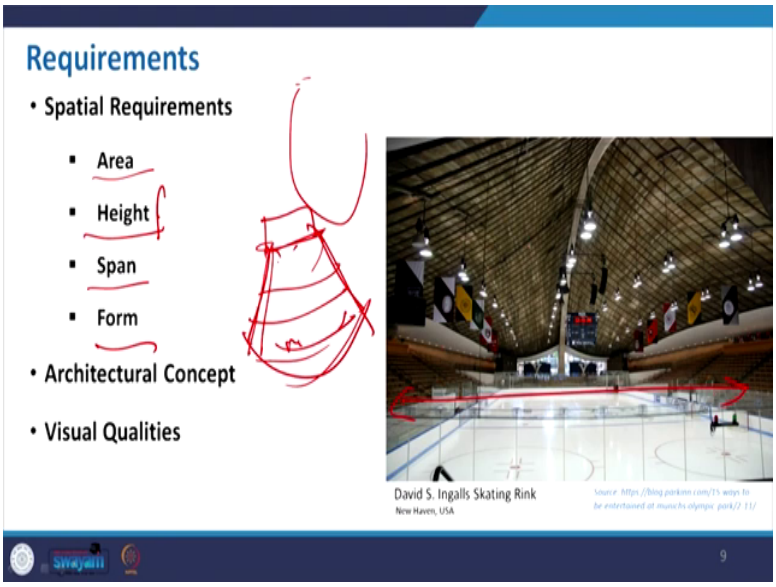

So, to maintain the acoustics another you know other criteria the form of auditorium will have something. So, create the view, so most of the you know auditorium or something should be like you know getting a view. So, the shape will be something like that maybe the elliptical. So, creating those kind of structure and also the height should be that much enough, so that if you have second tier from there also you can see the performance. This is one example of the ice skating rink that we also have seen in earlier presentation.

So, here the main reason to put this picture to show the span. So, this span is very huge, the area. So, that your structure you know the roofing system will be little bit light and it should go with something like, it can be a cell structure, it can be made of a TRA, not a flat roof and heavy structure and that should be supported at the end of this span.

Then also the requirements fit with the architectural concept like visual concept, how you have to make it open or the opaque say for museum, window stadium, that are more opaque rather than transparency that maintained in the airport. Then the visual quality also will play of that thing that how you will make it this building. So, the light weight type or heavy type, so that will also be the requirement based on that we will decide the structure.

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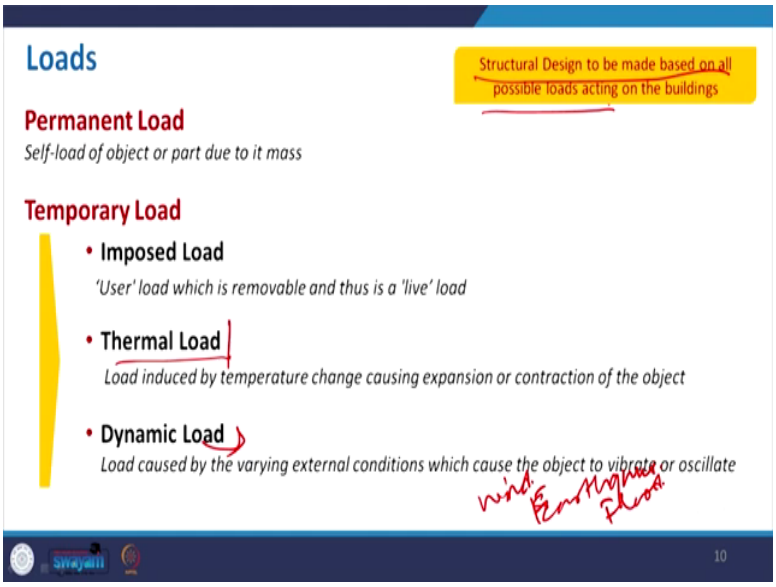

And this slide is very important though it is a repeat slide, but the it is very important in this case the load. So, load started with the your date load that is the self weight of the structure as well as the live load, the imposed load, the load of people, load of furnitures. And then there are other like temporary load that is your thermal load due to the you know heat gain from the sunlight. And then the dynamic load refers to different movement of buildings due to some lateral force the vibration and oscillation, so specially refer to the wind and your earthquake.

And then it also sometimes the flood load we have seen, when we discussed about different loads on structure that how like flood and seismic they really you know put some impact on the structure. So, depending on that load calculation we will also think about the structure. And it has relation, like not any single factor is solely responsible to determine the structure. So, it is basically like combination of meaning. But in this case loads will determine the structural design and like basically all possible loads on the building.

So, if you want to make a building in coastal region where wind speed is considerably high, so you have to take special care of those form which will really be you know going with the aerodynamics and other kind of things, so that you can reduce the impact of the wind and your building can resist that as well.

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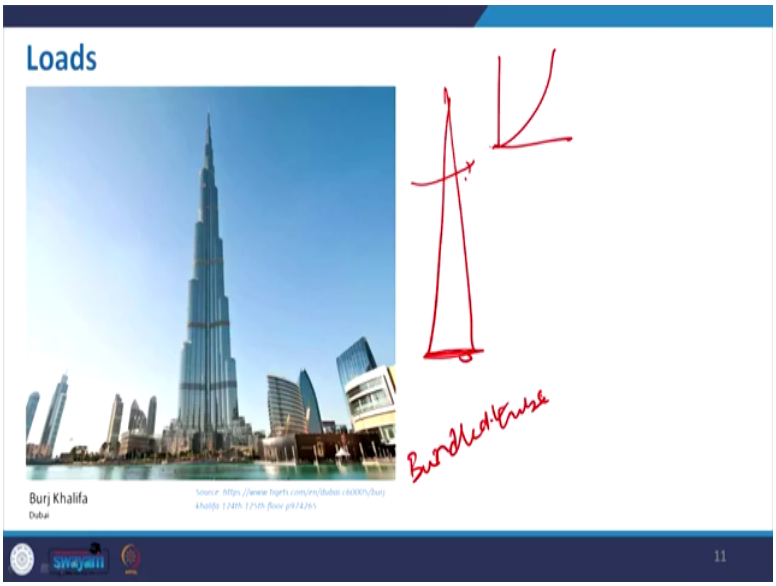

So, come to the loads. This is one example the you know very high die structure. So, if you see that again it is a structure made of bundle tube, so multiple such tubular form being used here. And if you see the shape of this it is basically in a conical form, and the main reason that we discussed several times that when you go up, so wind load is basically increasing. So, we have to reduce that particular part.

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And now we just go with the design. So, design includes all architectural design and then the structural design. So, then it will maintain the concept and the visual quality. It may be very simple structure, that we can see very you know simple form being taken and we just execute with the material we have, very simple post lintel, a post beam structure. Even this is a modern building, but very simple with the some steel frame and then use of glass and other material. But it may be complex like this one in the museum.

The Guggenheim museum in Bilbao, so basically here it is a showing some (Refer Time: 28:03). So, parametric architecture being used, so mathematical calculation, complex decision was made to make this structure. So, how it changes, based on the concept and visual quality to bring into the reality how designers they have come up with the structure. So, basically the structure arrangement changes because of the design.

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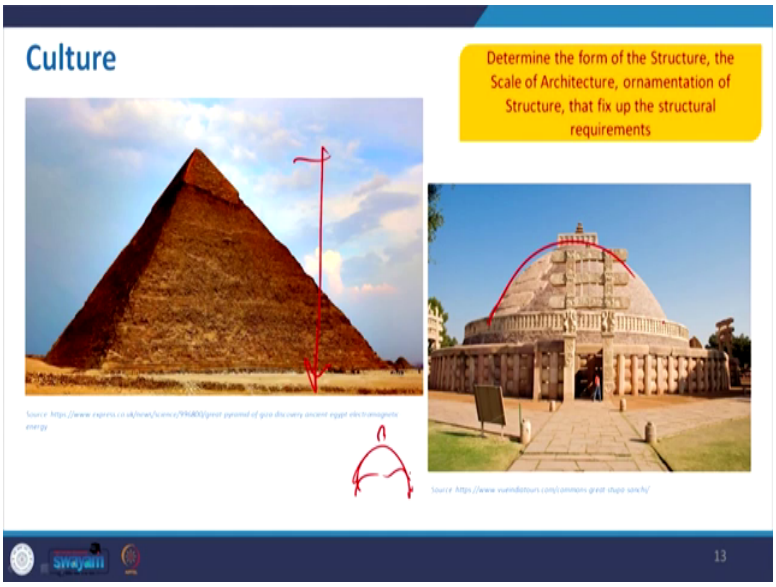

In the culture as already I mentioned the pyramid was to show the greatness of your (Refer Time: 28:37), so this is very huge gigantic structure. And also they had a belief on the life after death. So, for that they preserve the mummies inside and they create this huge monumental structure into this.

So, as to in Indian case were like also we determine the form of the structure, the scale of the structure. So, this is basically the stupa, again showing the greatness and across this you know

place the stupa will form this particular you know considered to be the head of Gautama Buddha.

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Now, that is also very place to place, this is a typical you know Chinese form of architecture where pagoda being used and the roof is being some treated with some more ornamentation if you see in the column. So, basically if you link this is a post lintel kind of structure, but the roofing and the ornamentation that differs it in a great way and here the use of the onion dome in these and the you know all these contrast the use of your stone.

So, everything will change on the culture, so show the trans, like the brightness of the structure. So, that being reflected with your cultural form.

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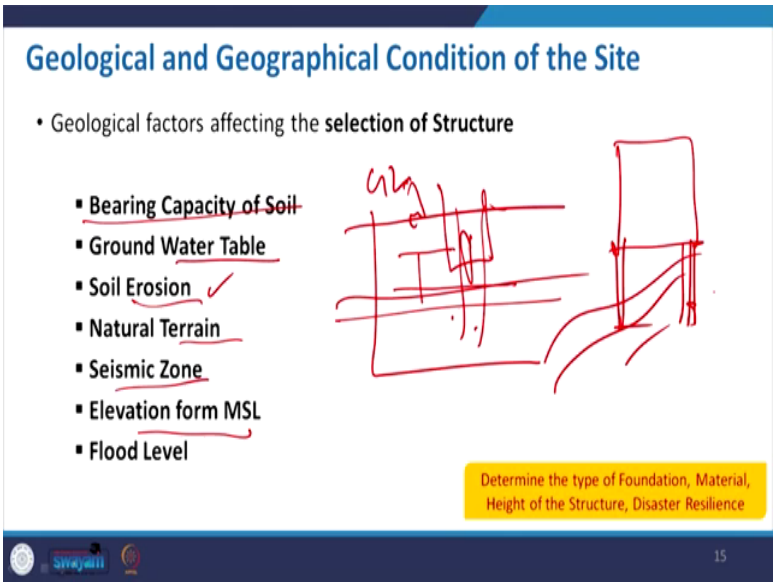

Now, come to the geological and geographical condition of the site. It will basically give the soil characteristics the bearing capacity of soil by which we will determine the foundation type. The groundwater table like the water level below the soil. So, if this is your ground level, so like what is the level. So, that for the boring we dig up to that position, so that we can get water. So, if the water table is so high, so some type of foundations will not be fruitful because when you go for excavation water will come out.

The soil erosion, normal in hilly region the soil erosion landslide is becoming a problem. So, for that different kind of structure treatment to be done. Natural terrain will also depend on like how you will go with the structure. Then if your structure to be made in seismic zone, so special care should be taken so that your structure can resist on that.

Then the elevation or the flood level of the area, so that will also determine like how much water accumulation will be there and accordingly you will decide because in that video we have seen that how the flow of water totally collapse a building. So, for that may be like you have to make your structure little bit tilted so that water can easily pass through and not create some suction or negative pressure on the surface.

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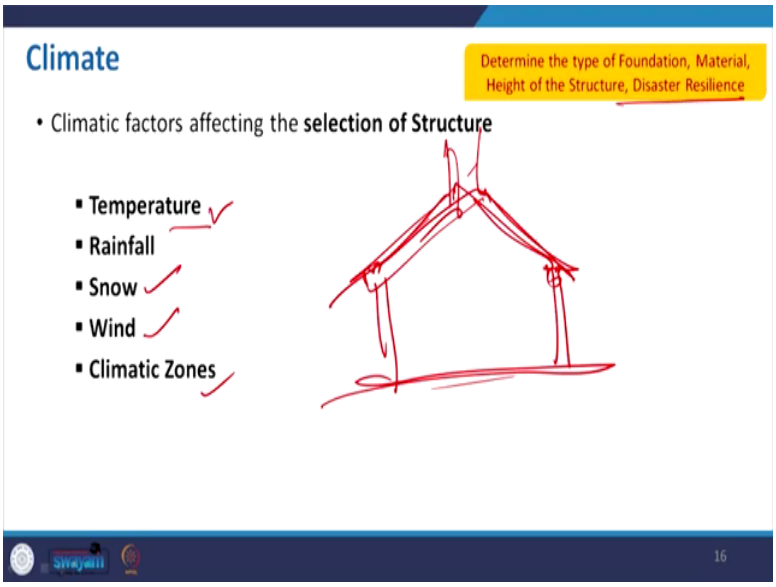

Climate plays the important role again, with the temperature variation and all and then the rainfall, then user snow, wind and different climatic zone. So, based on that it will also determine the type of foundation, the material, the high top structure, and as well as the disaster resilience. Because of the excessive rain flow on your structure maybe very weak of the water accumulation at the bottom of the structure. So, we will also create some additional

load and rain load that we have discussed. So, for that reason the structural form to be decided accordingly.

So, normally where you know we have like high density rainfall, so there we normally prefer a pitch roof rather than the flared rood because you know water can easily pass through that will not really you know accumulate and create excessive load on the structure and so as true for the cold climate where we will go for this kind of pitch roof.

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So, here if you see this example here it is a pitch roof made of the concrete tiles. And in this the purpose to make it like with this, like again we go for this you know heavy wall or the cavity wall, so that can maintain the temperature, but along with that the slope will also help to you know you know runoff the snow when it is melted due to the you know sunlight or heat and this is to be used in the rainy areas.

So, this is another form which is considered to be good for you know the area where wind is predominant. So, in western part we have seen the effect of tornado or typhoon, so huge wind pressure to be created. So, this kind of you know structure normally you know not getting that much affected with high speed of winds, so because of this aerodynamic nature. So, as we know the design of the plane also act like that.

So, basically to cut the gear it can pass through, so this is one shape that can be opted. So, structural variation according to the wind and other rainfall and snow fall we have seen that how the structural form being changed and definitely to create this kind of form, so we need adequate shuttering, so temporary structure to be designed in that and again it should be go with something like not flat, again it is not pitch roof. For pitch roof there may be a case of uplifting, but here it may be a cell structure, so it differs.

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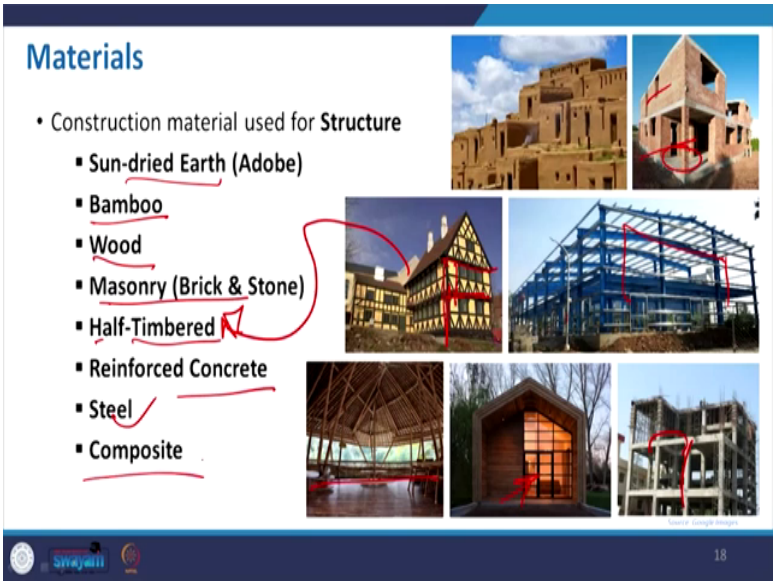

Come to the materials. So, here the materials like over the period lots of material being used. So, it may be just the sun-dried earth or we call it adobe. So, here it being used and normally in rural areas now also in India, we used it with little bit mix of the cement to give the more strength. Then it can be simple brick masonry where weak pillars being used for normally earlier people used to make it with like the load bearing structural concept, then bamboo structure being when used to create some beautiful you know piece of architecture.

Then wood being used in many of the cold region, so that it can maintain the you know temperature difference and all. Then machinery can be brick of stone. Then half-timbered being used in some of the areas where basically the frames are being made with some wood and the you know gap being filled up with the brick and stone sometimes. So, you can see this example of this half-timbered you know material. Then reinforced concrete being used for you know multi-storey building and then the steel frame being also being used.

So, for high rise we go with some composite structure and as we already talked about some advancement in the nano-carbon materials and we are doing research on that. Like people really focus on how to reduce the thickness and can also go for high rise without compromising the other factor.

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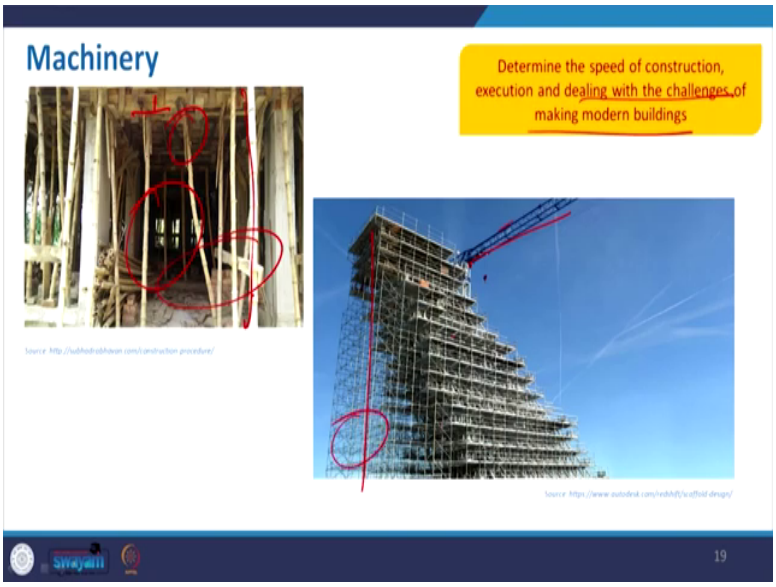

Then the missionary plays an important role. It will determine the speed of construction, then execution and detailing dealing with the challenges of making modern buildings. So, earlier like for the low cost construction or earlier people used to you know have this you know wood baton and then the bamboo as a props to support the structure.

So, it has some limitation. We cannot really go with that for them high rise building, and in this picture you can see this is a very very you know design scaffolding system to support the structure along with the crane. So, machinery the invention on that people can go high rise, they can maintain it, maintain the precision and also it is the timely construction.

Along with that, using this kind of thing will have very little life. Though the cost of steel scaffolding is initially high, but that can be reused for the several times, but here like most of

the cases will after certain use we have to discard it. So, machinery also changes this you know the structural form that we can achieve.

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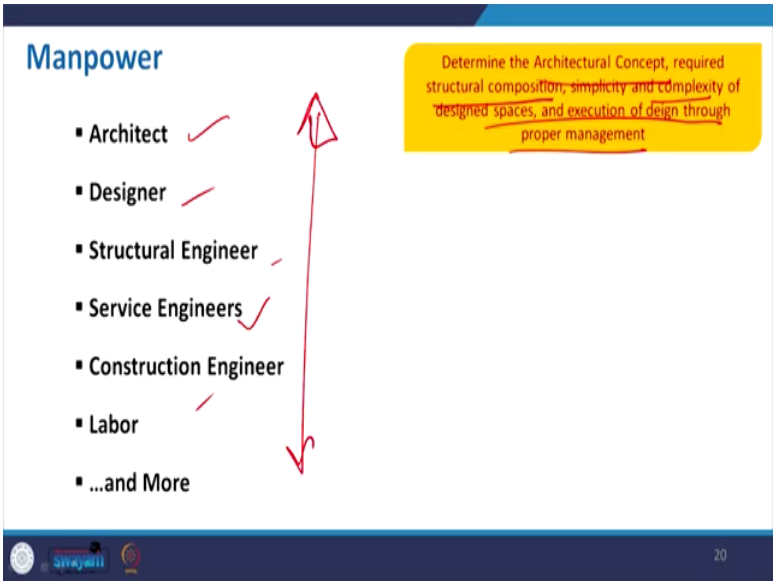

The manpower already discussed the architect, designer, structural engineer, service engineer, labor and more. So, depending on their coordination and all, so one can really go up to a huge and very beautiful structure. So, determine the architectural concept required and then also determine the structural composition that people want that also feeds some of the services that your building wants.

Then also maintain whether we go for a very simplistic structure or very complex structure and then execution of design through proper management. So, whenever you have a good team so you can take up this particular challenge to do something really you know great. So, any complex design can also be achieved with a good team and good manpower.

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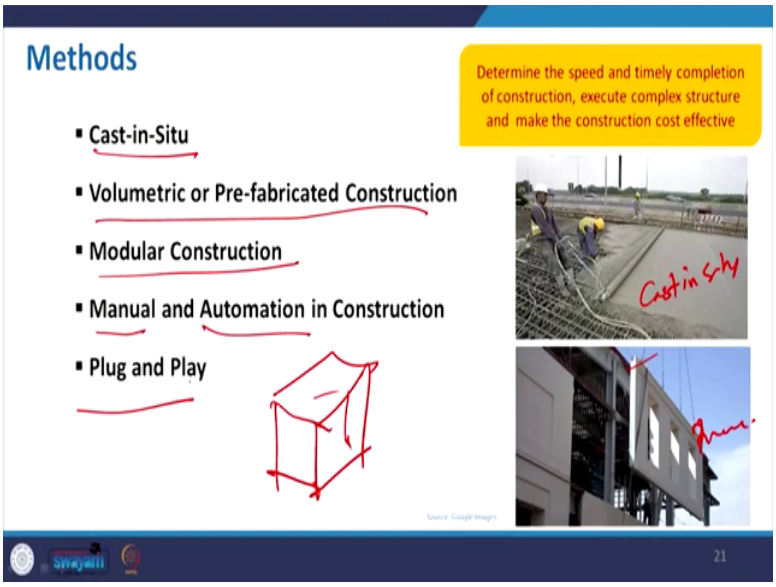

The methods of that is like it may be the cast in-situ. Then volumetric prefabricated construction where the module been made. Say for example, you want a toilet block, so it is fabric get it off site and then transport and fit it. Then modular construction, as we mentioned it is pretty same where everything is you know in module that can be done. So, here you can see this is the example of the cast in-situ and where this is basically your prefabrication where you can see that with the crane and other thing you just fit it plug it.

Then also the manual and automation in construction. So, if we go for automation, so using robots and other you know machinery that can speed up this particular project and also execute the complex form because determine those complex joints and all with you know manual intervention sometimes cannot give the exact quality, so it is done.

And the plug and play already I have mentioned, so that it will speed up your thing very quickly. And nowadays in being practice also like the whole house being fabricated and then put one after another as per the demand, so that within very you know stipulated time we can get those you know structure.

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Money is basically it leads to the cost of material, what should be the finish, how much you pay for the man power and then the machinery. This is one of the structure and this is a research from IIT, Madras. So, they have used some glass fiber GFRC, so Glass Fiber Reinforce Concrete. So, it can be a low cost architecture, but it has limitation to a certain height, so that can be achieved.

But along with the when we want some luxurious hotel of this kind this is the Atlantis from you know palm islands. So, here the finishes even the interior if you browse through, so you

will be amazed with this particular feature, but definitely the cost you have to make a trade off like how much cost you have, how much money you have, and how much cost you can really afford to get the structure.

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Again the time of construction, definitely when you go for a speedy construction it will be very prototype and it will be repetitive in form where for getting something complex you need some time to build it. So, if you do not have time then definitely getting some complex structure will be difficult because such project can take up some points because each point there will be some decision and then definitely it has impact.

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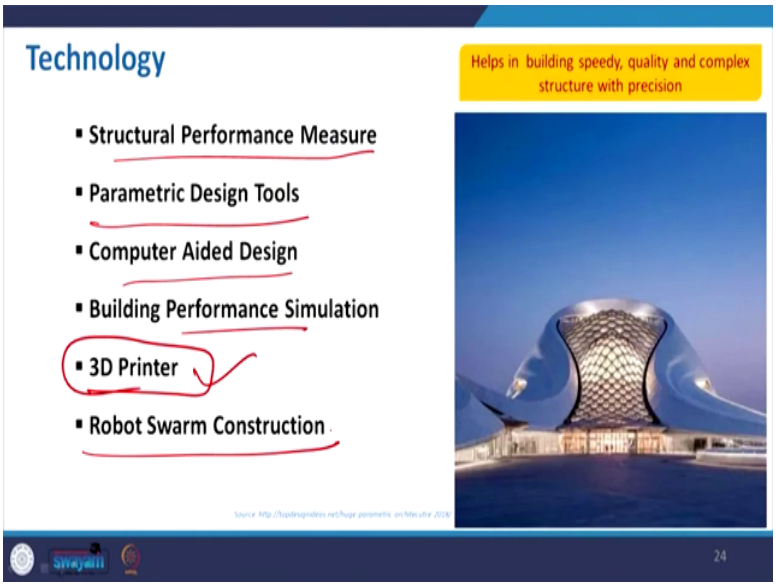

Then come to the last point here that is the technology. So, now, basically nowadays we are having some simulator and some good software which will say us that the decision on the structural system, how it will act on different kind of loads and basically how it will resist it in due course of time. So, different structural performance measures been taken before execution, so that it will give us the right selection of the structural composition.

Then the parametric design tools being used the software helped us to maintain the quality. Computer aided design come into picture, so that we can think beyond some box. And then the building performance simulation that how your building how your design structural act with wind and then seismic. So, there are different testing facility which will help you to decide upon the structure based fitted.

And this is age of 3D printer, even the 3D printed buildings being made in some of the cases in experimental basis. So, which will give you the precision and timely construction. Then the use of robot, in construction where manual intervention will be less, so a robot will act as a machine can put up the blog and fix it with precision with the program. So, that will also reduce the error in construction and can help you. So, how and this is continuing.

So, days to come, we will have technology where we can go even further we can create more you know special structure with some you know advanced material and with the help of this technology.

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So, here this is one example of the 3D printed house, mud house and you can see how it looked out. So, it is a perfect finish and that been done with the printer. And here is some automation being shown how like the structure and other part like how here you can see the

concreting being done with like there are people who are observing it to control it and the robot is creating itself. So, it can make your structure faster.

This is not the only gain, along with that it will also maintain the quality of construction. So, definitely with this like we can take up on a decision like how should we go. If we have this kind of infrastructure technology with us we can think beyond a very conservative way of looking into structure. So, we can design with softwares, we can get advantage of good materials having good strength and we can go up.

So, basically here like if we go the summary, so there are factors, n number of factors that you know influence your structural you know form how to take a decision on the structure. So, there are some qualitative factors and then you have also quantitative measures, like your loads and other things will come into that here. Basically the concept visual quality, so they that they are coming into that picture.

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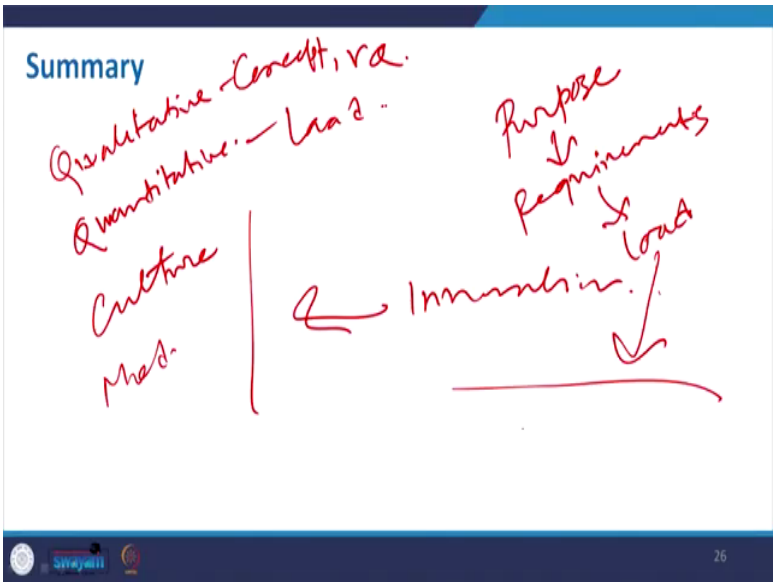

So, again we have seen the effects of culture how over the time people they have used it, like when they preferred on more on art form and other thing and they want their structure to be ornamented. So, we have seen in your Romanesque and then Gothic, and then even in the byzantine period and then in the modern architecture with the minimalistic thing, so that whole approach being transferred to the structural system and the decision. And along with that the support of the innovation in materials, that help us to bring some world class architecture nowadays.

So, I hope that this will definitely help you to get some idea about the factors, and definitely when you are going to take a decision on your architectural design or any building you want to construct with the proper structure. So, you focus on the purpose of the building and so that will also determine the different requirements, and then from requirements you calculate the load, probable load on it and then the design solution, based on the available money, the

budget, material that you have that you can use and the technology available to you. So, overall that will give you a comprehensive approach to take a decision on the structure.

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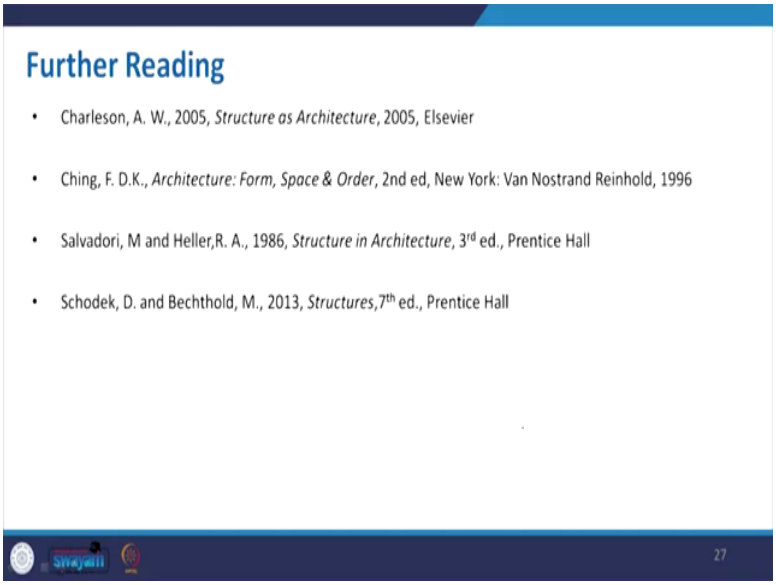

So, with that I conclude here. These are the same reading materials. So, next lecture will be very much interesting and there will take some lesson from animal's architecture, from different birds and different creatures, so how they build their shelters and how we can get some idea out of it. And definitely before I end up this, I again thank you all for taking part in it.

Thank you.