Modern Indian Architecture
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Lecture 37
Search for a New Architecture - Part 2

Hello students, we once again continue with a study for a search for a new architecture. In this series, we are looking at the developments that are taking place in the 21st century Vis-a-Vie architecture in India. Last time, we saw some works of Sanjay Puri and we saw how traditional knowledge systems are being married to contemporary technologies.

And we are coming up with very amazing new ideas to use these traditional systems in our modern buildings today. And to give us the best results are rather very good results with regard to energy efficiency and thermal comfort. And that kind of modification is taking place.

So, we saw that through the works of Sanjay Puri and one of the elements that we were discussing last time was the use of jaalis and the use of courtyards for example.

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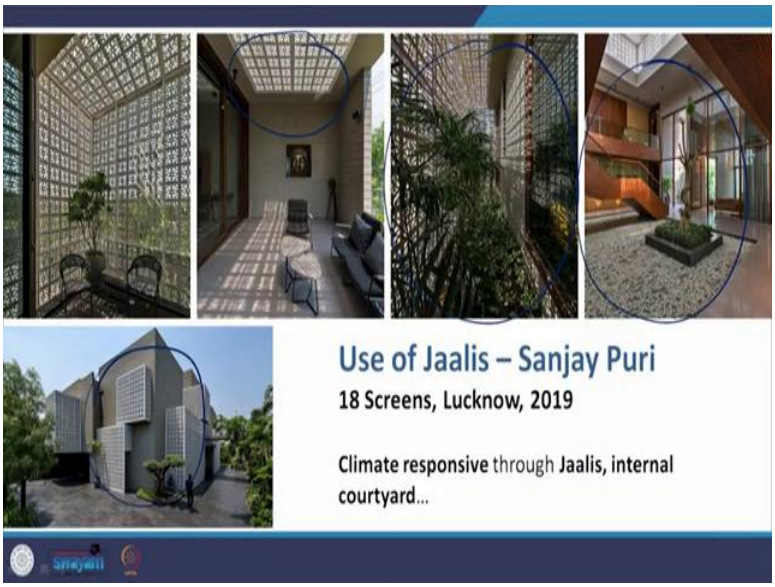

So, here in the slide, you see, this is a house called 18 screens in Lucknow 2019, designed by Sanjay Puri, this has both the courtyard and again it has got this jaali work, which is also been designed computationally just as it had been done for 72 screens et cetera.

Because this kind of arrangement of jaalis is simply cannot be done empirically. It requires a computational analysis to do it. And in this case, the jaalis is also acting somewhat like a

pergola to produce the glare coming from the top and also allowing this perforation in the roof so that the diffuse light comes through.

Now, he did not brought this idea into the stone house in Mocha, which is still upcoming with the use of traditional design materials use of terraces in semi open spaces and jaalie to protect the building or the interiors from sandstorms.

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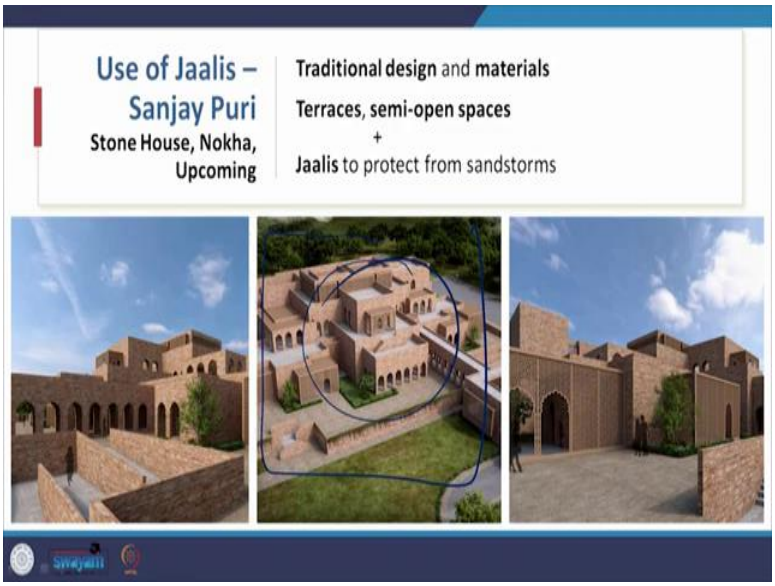

As you can see, this is typically traditional architecture. And this architecture has been brought in. We see that together with the modernist block form what you see here in this building. So, again, it is a marriage of traditional architecture with modern architecture, something that is the basis of critical regionalism, but this is critical regionalism in the 21st century, where technology is playing a very important role.

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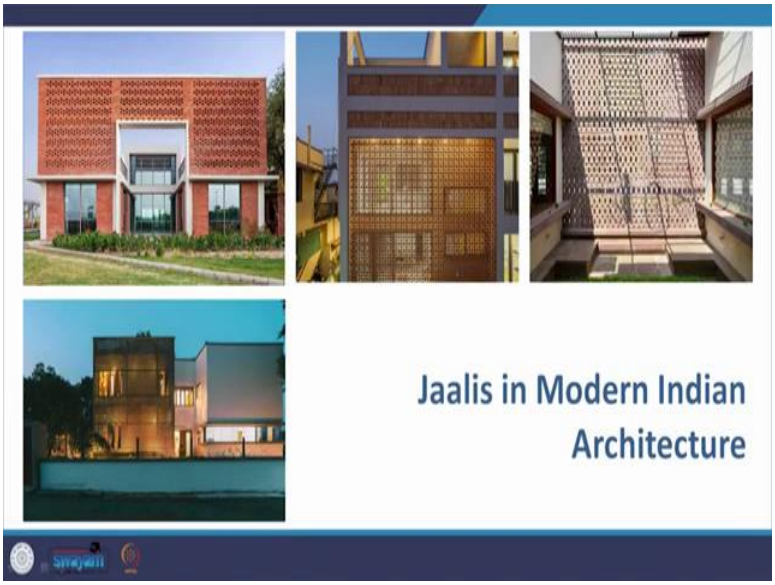

Now, the the adding of jaalis or sun shading devices, courtyards, etcetera, is not done simply empirically, but computationally, this is some of the other jaalies if you see modern Indian architecture today. So, it is a vernacular or a traditional element in modern architecture.

These are some other examples. And as we see, as you can see on the internet, or read through literature, these kinds of houses are coming all over the country, where use of exposed brick and concrete use of traditional features like jaalis and verandash and sun shading devices etcetera, are being used by so many young architects in a much more methodical manner.

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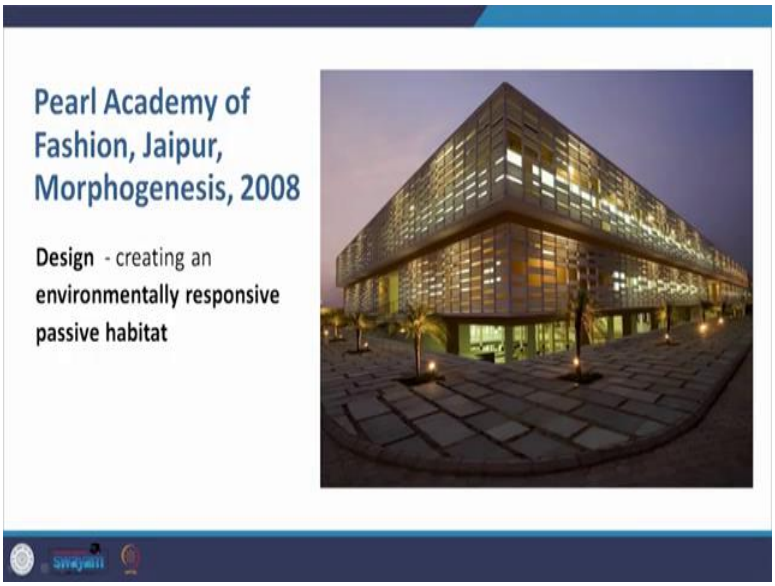

One very iconic example is that of the Pearl Academy by Morphogenesis, in 2008, this design was created to give an environmentally responsive passive habitat, or a passive microclimate conditions within the building. And it is a typical fusion of traditional building knowledge with contemporary cutting edge architecture.

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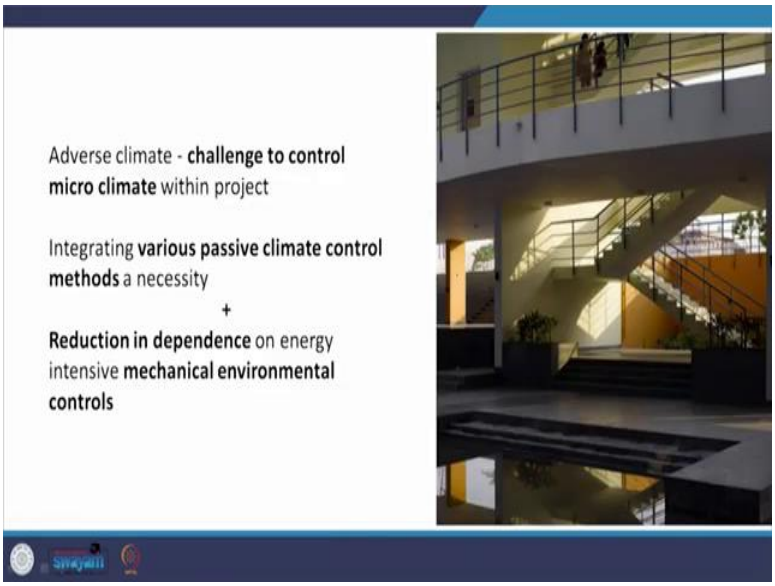

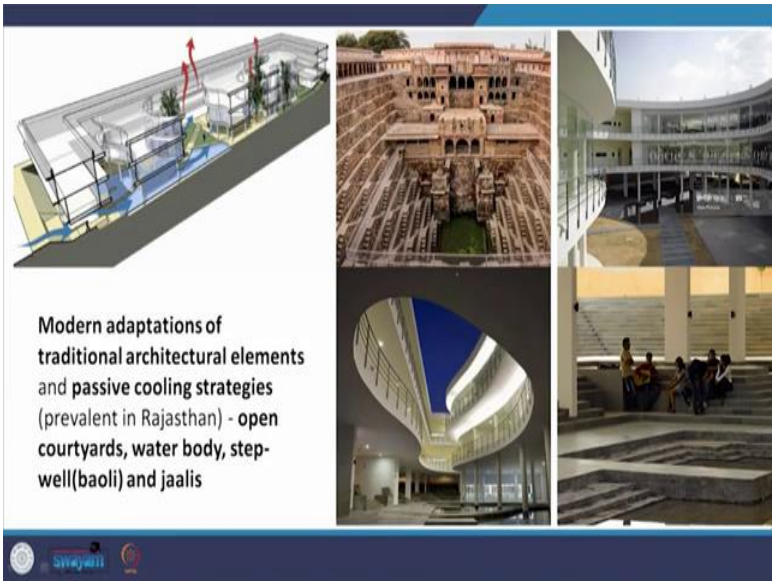

So, the adverse climate that is there in the city is a challenge. It is a challenge to control the microclimate within the project. And to integrate the various passive climate control methods became a necessity in this hot and dry climate. And they also required to they were also required to reduce the dependence on energy intensive mechanical devices. And therefore, this modern adaptation of these traditional architectural elements and passive cooling strategies, like open courtyards, water bodies, baolis or stepwells in jaalies are all here.

For example, here the waterbody that you see and I will talk about, again in a little more detail, this leads to evaporative cooling does cooling the courtyards and the cold air then enters one of the corridors the simply load corridors as you see here into the building.

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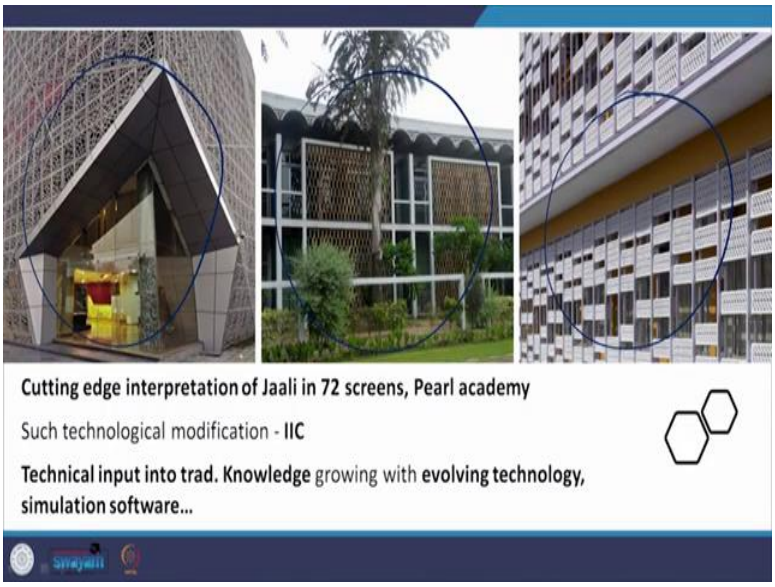

Moving ahead, this idea of this cutting edge interpretation of the jaali that we saw in the 72 screens project last time or when we see it in the Pearl Academy this time, when we see the Pearl Academy this time, this technological modification was also used by Stein in the India International Center we discussed this project earlier.

Only difference is that the technical input into the traditional knowledge systems is growing with evolving technology with simulation software's et cetera. So, whereas this bit service purpose quite well, these buildings are more efficient and at a time in this 21st century, when this has become a critical issue for us to save energy and thus save carbon emissions.

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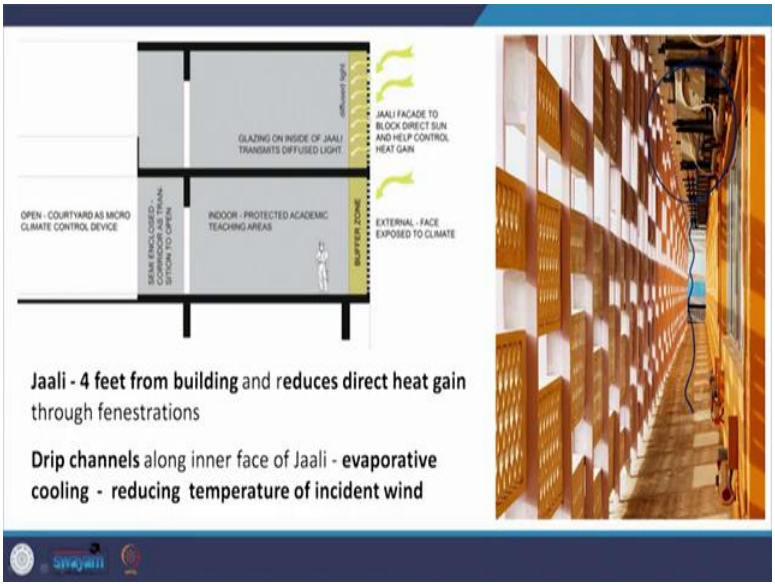

So, the density of jaalis used in the Pearl Academy has been developed using these computational shadow analysis based on the orientation with facades and is completely wrapped around the building. So, based on the facade, the jaali has been designed computationally. And it is a complete envelope just as we saw in the 72 screens.

The other thing is what was done in 72 screens. Also, that there is a gap between the outer wall and the jaali and the 4 feet gap from the building reduces the direct heat impact on the outer wall or the exterior wall, moreover, the wind coming from outside passing through the jaali, there is a condenser provided here, which results in water vapor suspended in this era, there are drip channels. And this results in the breeze of the wind passing through the water vapour leading to the evaporative cooling, reducing the temperature of the incident wind on the exterior wall of the building.

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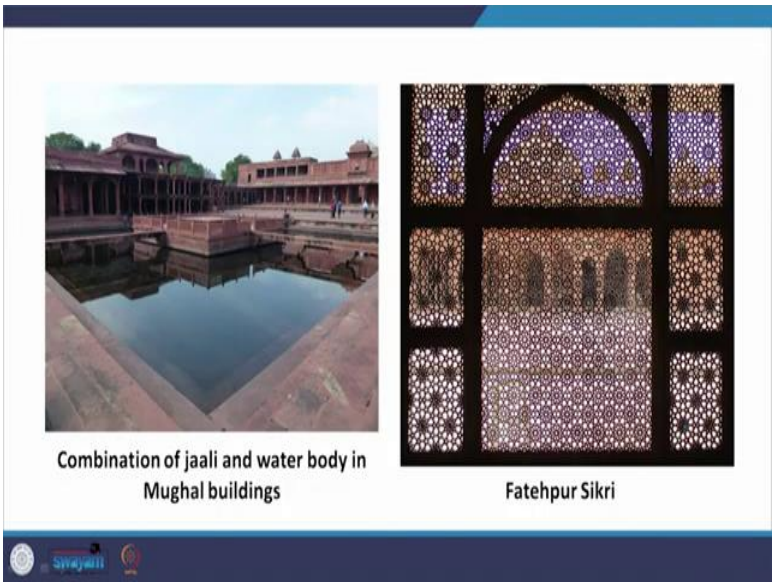

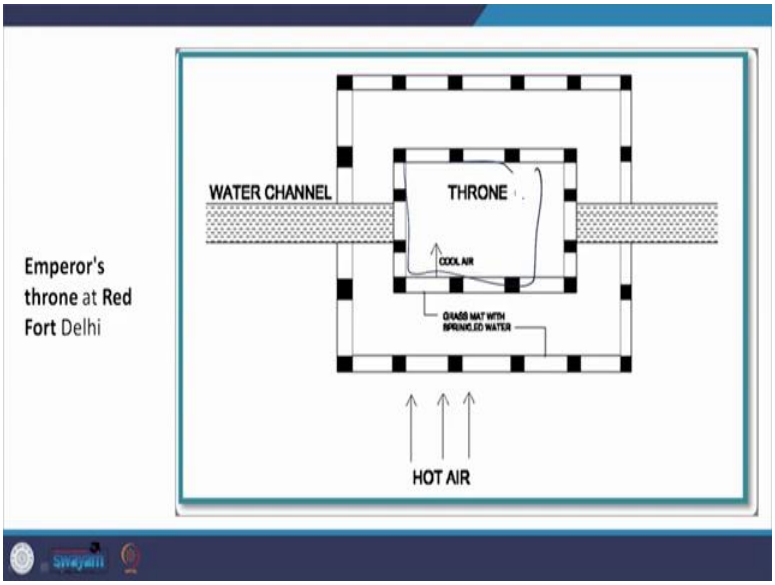

Now, the combination of jaalis and water bodies were there also in Mughal buildings, for example, in Fatehpur Sikri, and it is a very simple principle that you have the Jaali, the wind flows through the smaller purchases of jaali, the velocity of the wind increases, then passes over water body and enter into the single loaded corridor or the veranda and then into the interior into the rooms.

And thus the cool air flows into the rooms or so this was a process that they would use. Another example, which is the Emperor's throne in Red fort in New Delhi, where the throne has a water channel flowing underneath it. It is about the jaali work around it. So, the hot air passes through the jaali, then there is a grass mat underneath.

And so this air cools down and there's a grass not underneath the throne, which is sprinkled with water. So, that evaporative cooling takes place. And he is in a very confined microclimate of a cool area.

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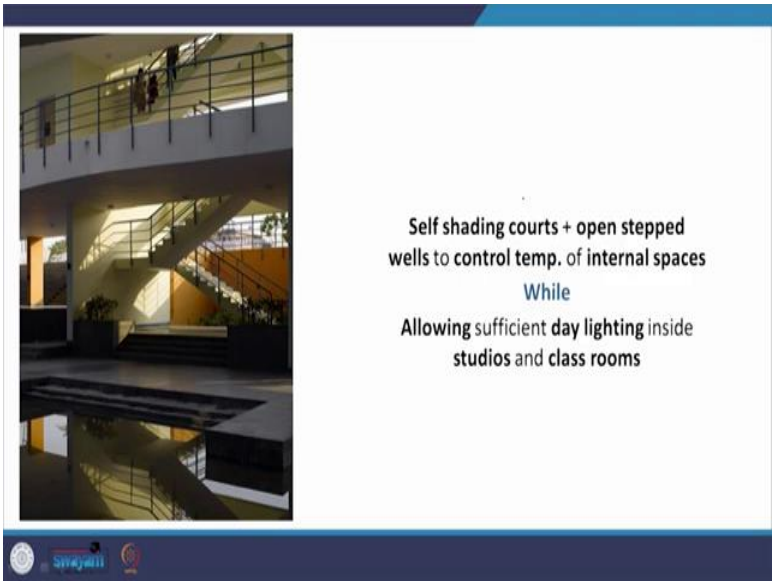

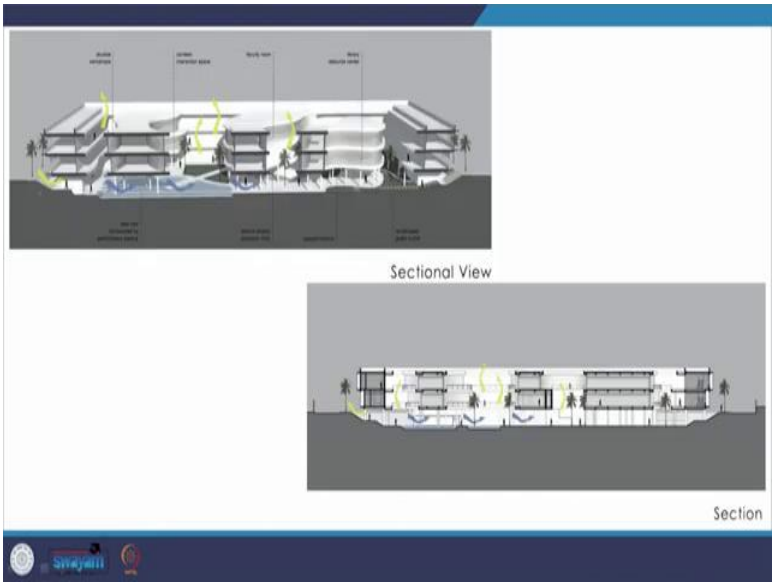

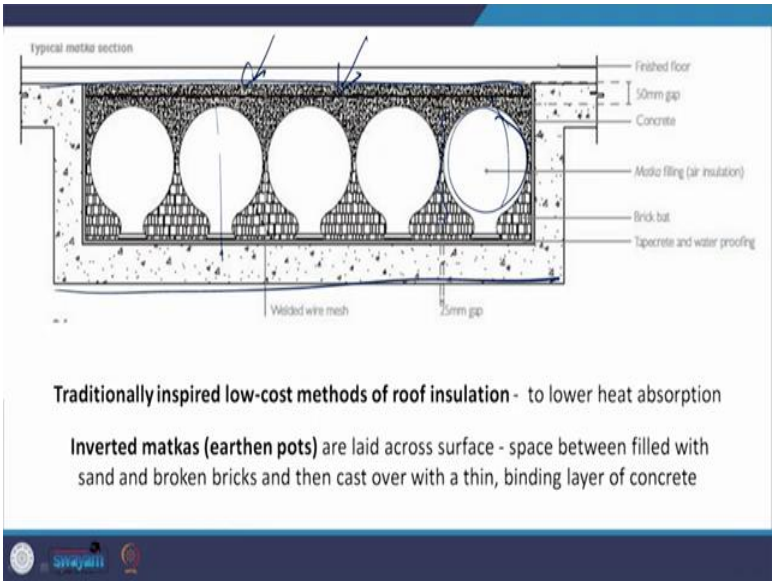

Now beginning to the Pearl academy, there are the self shading courts and open step wells, so bodies that have been created to control the temperature of the internal space. The other important purpose of the courtyard is that it allows for this diffused daylight not the glare of the sun. But diffused daylight, which is needed for the studios and the classrooms to flow into then.

So, entire building is raised on streets of Pilotis. And the raised underbelly creates a natural thermal sink because of the, because it is cooled by these water bodies that you see here. And this is, like I said leads to evaporative cooling. And that cooled air then flows from the single loaded corridors into the building.

This is a section that is showing how the process of evaporative cooling is taking place. Another thing that they have done and this is an idea that was also explored by Antonin

Raymond in the Golconda ashram, the first modernist building in India, if you remember, I told you that he had made these bots on the top floor on the roof of the building. And there is also a jaali attached to the bot.

But because of that, there was an air gap created because of this bot. And the sun rays, the radiations the sun falling directly fall on the roof with on the bot and thus that would create an insulation and then radiation would not penetrate the roof. As you know that maximum solar radiations penetrate in a building via the roof, so here also what the architects have done is they have taken a very traditional principle of using matkas.

These matkas are earthen pots are placed upside down and thus they create an air gap and then they are filled the space around it is filled with sand and broken bricks over this a thin binding layer of concrete is cast. Because of this, when the sun rays fall they have this air gap to contend with. And they are not this, this creates a very good insulation layer between the roof and the rather the, this, the stop the roof of the of the building, and then over that this layer.

Now, again another idea that I would like you to recall is what has been used in the Sangath by BV Doshi, in which the Barrel vaults, several things have happened, I am just repeating that so is to, you can recall those ideas. First of all, he is made a subterranean structure. And we will look at another subterranean structure. But in a cold climate in this presentation that is in what you would call a more of a composite era, hot condition a tropical condition.

So, there, it is subterranean structure. And then there is this bottom bot, the bottom bot has got these half terracotta cylinders. So, after this, it will casting for cement, then the half terracotta cylinders have been mounted on it, then it is covered over but are the broken ceramic tiles or mosaic tiles that I told you is called the processes is called Tricandis.

That also appeared in the works of Antoni Guardia the end of the 19th century in the art movie movement in Europe. So, that some things are happening simultaneously, the subterranean structure is acting as a natural insulator, the tick earth all around it, is acting as a natural insulator.

Secondly, because of this Barrel vault with these Urban, these half cylinders creates an air gap. And thus the radiations cannot go directly over that or the ceramic tiles which actually reflect back the radiation. So, that is an added benefit. There are other things for example, the

water flowing in the side, there is a water channel flowing on the side, and that adds to the overall cooling down of the microclimate in the building, that is Sangath.

So, the sun also is not coming in directly. But between the Barrel vault there are these openings and diffused light falls into the subterranean studios. Another advantage they did was that they have cut it out on this side. So, that can be used as a storage because the words became very thick, being subterranean. I am just recalling these ideas again. So, that you can connect all these ideas together.

So, the different architects are doing these different strategies. The only thing that has been added in the 21st century in this critical regional model of climate responsive building is the idea of competition, that everything is being assessed numerically. And everything is not done in a hit and trial manner. But it is assessed as a simulated very clearly and then it is executed on site. Now these traditional elements with cutting edge technology, the other things that reduce this energy efficiency has been a prime concern.

So, they are having 100 percent self sufficient captive power, along with 100 percent water supply, because they are using rainwater harvesting, and they are also recycling waste water. So, these ideas are now becoming a regular feature in many, many buildings today, institutional buildings, particularly corporate buildings are using these ideas to make their buildings more green or sustainable, energy efficient, passively comfortable, and even residential independent houses.

There are a lot of clients so very aware of these ideas. Of course, it is being used in residential projects. Many of these ideas to reduce energy, we say we both embodied energy and operational energy, but ideas are being used. So, this is something that you must focus on as a part of your study. It is not an area that you can neglect now.

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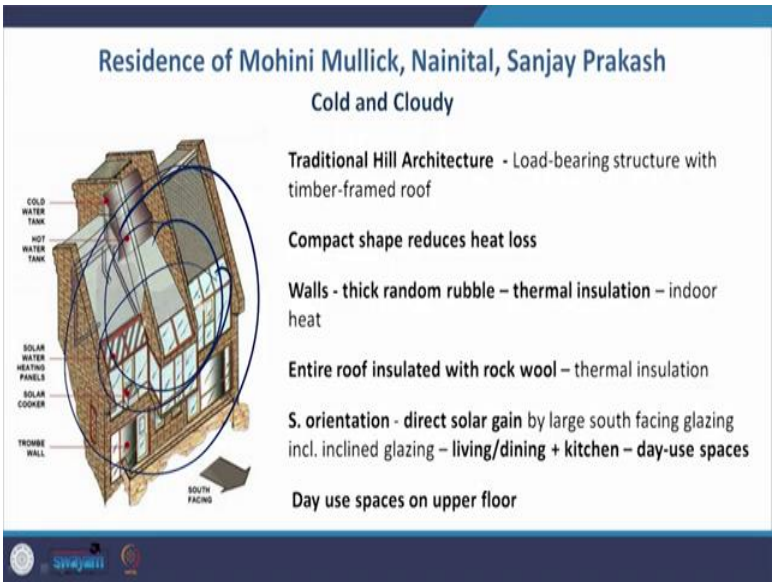

So, this is the house I was talking about this subterranean structure has been used in a cold climate in Nainital. This is a house of Mohini Mullick by Sanjay Prakash, in a cold and cloudy area. Traditional Hill Architecture, it is a load bearing structure with timber frame roof and it is a very compact shape to reduce heat loss. The water are, the walls are made with thick random rubble masonry to increase thermal insulation and to preserve the heat inside not let it go out.

So, just the opposite happens in cold climates versus hot climates or composite conditions. And that is there we want to keep out the heat. Here we want to retain the heat. So, in both the cases insulation serves the purpose in that case, it keeps out the heat here it helps you retain the heat.

So, the entire roof is also insulated with Roku now, what is Roku? Roku is made out of volcanic rock material like basalt or belamite and it is mixed with wastes of iron ore et cetera. So, a lot of sub slab, lot of such waste comes out from our industries from our I think the steel plants et cetera. And then, that waste is very damaging to the environment.

So, what Rock cool is created is that that volcanic material, now volcanic rock is approximately 15 percent of the the earth the rocks are the content. So, there that material is abundantly available, along with that this waste materials is also abundantly available. So, that is combined together to create this insulating material called rock cool.

So, that is being used here. So, the advantage is we are reducing waste by using it in this manner. We are recycling it. And thus and also we are serving the purpose of insulating the building.

Now the south orientation, this view that you see here actually shows you the south orientation. And here this direct solar gain through these so the entire facade on this side is glaze to bring in maximum sunlight into the building. Now see the reverse is happening, there in hot conditions, I would go in for jaalis, I would be going for sunshades and louvers, et cetera. To keep out the sun. Here it is fully glazed to bring in the sun. But this is similar to what happens in cold area, cold regions like Europe, for example, where, right from the early part of the modern movement, they have been using extensive glass.

In fact, the one of the great advantage is of the developments that were brought in by Courvoisier and music sector was this only that they could have this entire facade free of load and thus you could create it entirely of glass you could have broken windows, you could have complete glass and you could pull in as much amount of sunlight as you want to bring into the building. And this is what is happening here.

Not only is it coming from the the facade, the vertical facade, but even this part is inclined to pull in more sunlight into the building. That is the living area and the dining area the kitchen area, which is the daily spaces are on this side of the building. And this is on the upper floor, the upper floor of the building and day use spaces.

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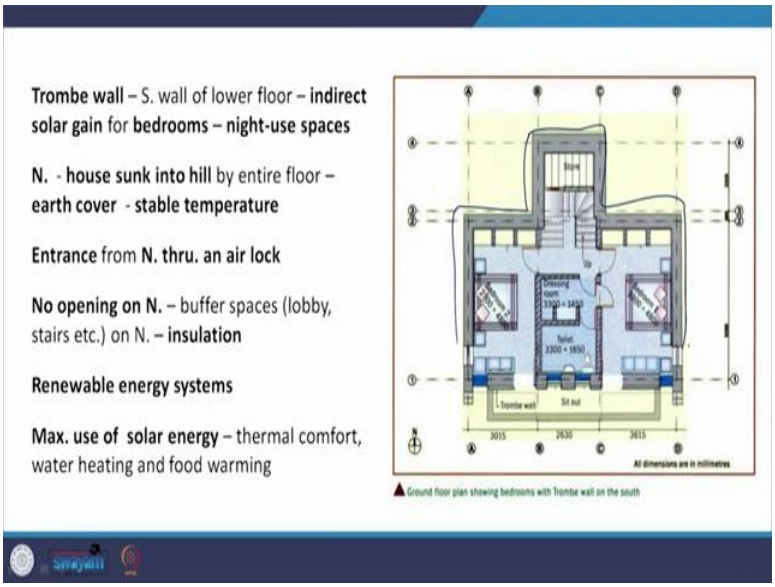

Now, when they go to the lower floor on the lower floor what we find is towards the north side, it is sunk into the hill. So, here it is the entire floor this has got an earth cover on this side. So, that serves as a fantastic insulator. On the south side, where on the above upper part there was this glazing on the lower part we have the trombe wall, which also serves for installation. And you can read more about trombe online, there is ample literature available for details of Trombe wall design and construction.

And the entrance of the building is through an airlock from the north side airlock is serves the purpose of a mechanism where the building is completely sealed at the point of the fenestration in this case a door for example, and when we close the door, no heat can escape out of the building now, there is no opening other than that on the north side.

So, also on north side he is provided the buffer spaces of lobby and staircases et cetera to add to the insulation. So, everything the architect is trying to do on the north side to increase insulation the earthen, the earth wall, the the airlock and more fenestrations otherwise, and the buffer spaces are provided on that site. Also renewable energy systems have been used and they are using maximum of solar energy for thermal comfort, water heating and food warming, which is needed for a building like this.

So, in this part of a night use spaces, like the bedrooms. Now let us come to another building with a very strong concept of energy efficiency in a composite climate of Gurgaon the American Institute of Indian Studies, Vinod Gupta here again, it is a part of critical regionalism with tradition in architecture and modernism, but the diverse spaces of tradition in buildings, gardens and courtyards and verandas and passages is all there along with normal rooms.

Now, the open and covered spaces are very significant in traditional Indian architecture, because they help in controlling and helping us to work along with the climatic conditions. What modern spaces are required for modern buildings and that is a concept. We have been repeatedly say that we cannot do away with the modern part of these buildings because we leave those buildings today.

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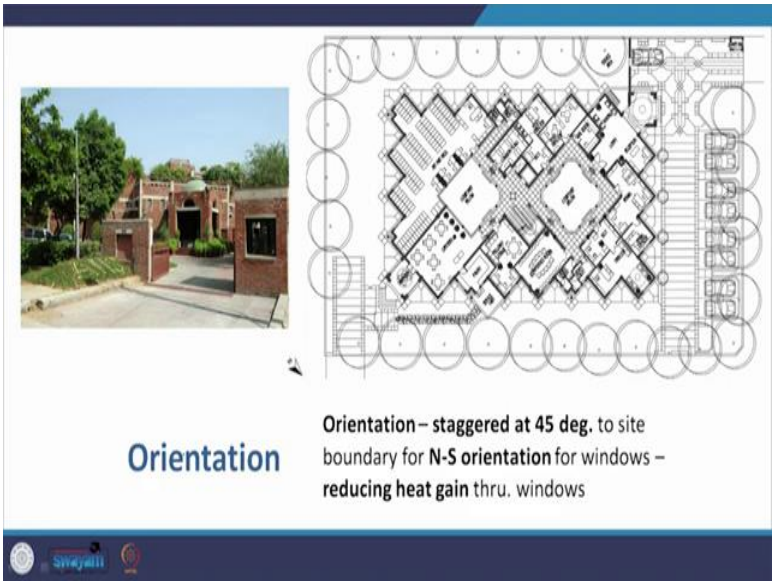

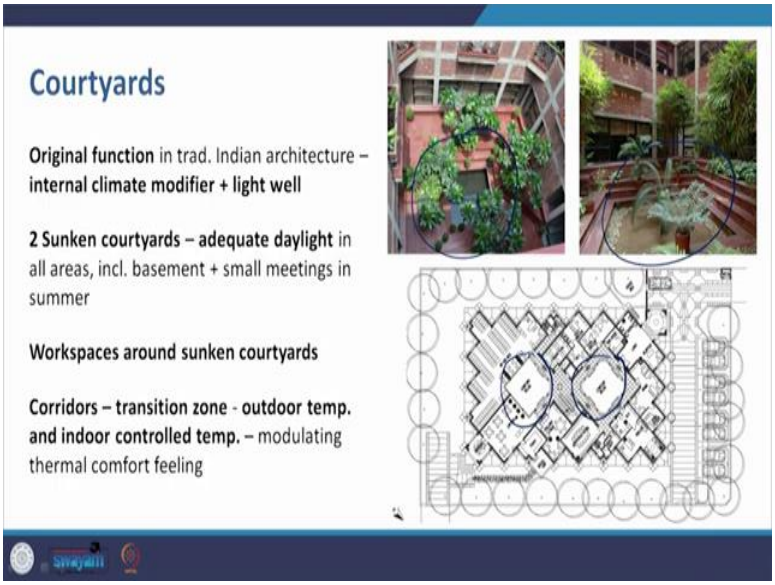

So, here we have admin research facilities and libraries etcetera. So, from the outset, the idea was that it should be an energy conserving and environmentally friendly building, let me point out here also, this is a boom becoming more or less a necessity in lots of projects, including skyscrapers, which we will be, which you have seen before this, that we have talked about, for example, a skyscraper we have talked we have talked about green concepts in using skyscrapers.

So, here are the exposed brick finishes here. We will start with walls which lead to mutual shading, as you can see here itself, that ritual shading is happening, then the entrance on the entrance, it seems as if the building is single storied. It will be interesting happens on the inside, actually, it is double height space. So, you got down as you enter in there are sunken courtyards and the building come into multiple floors.

Now, the orientation of the building is inclined 45 degrees to the site, so that we could get a north south orientation, so that we could reduce the heat gain for the fenestrations of the windows. The courtyards original function in traditional Indian architecture is for the purpose of bringing in light and to work to modify the climate to the internal climate can be controlled, cooled down, for example, in hot conditions, so there are 2 sunken courtyards have been provided. And you can see them in this picture these are 2 sunken courtyards which bring in adequate daylight into all areas, including the basement this is this because this is all sunken.

So, they are bringing in light deep into these areas. And small meetings can be held in these courtyards in summer, when I look at these spaces, I am drawing to them because of the greenery, the water and the whole picture of being a very cool and shaded space. So, the Workspaces are arranged around the sunken courtyards. And the corridors work is a transition zone. Because from the outdoor temperature that we see, we first come to this transition space of the corridor. And then we go indoors. And this is true for all buildings that have got courtyards and they have got corridors and then they have rooms on one side, there is a courtyard, the courtyard and the room on the other side.

So, this is true for all of them. But in all of them the corridor serves as a transition zone. So, there is no abrupt change of temperature from outside to inside. It is a transition.

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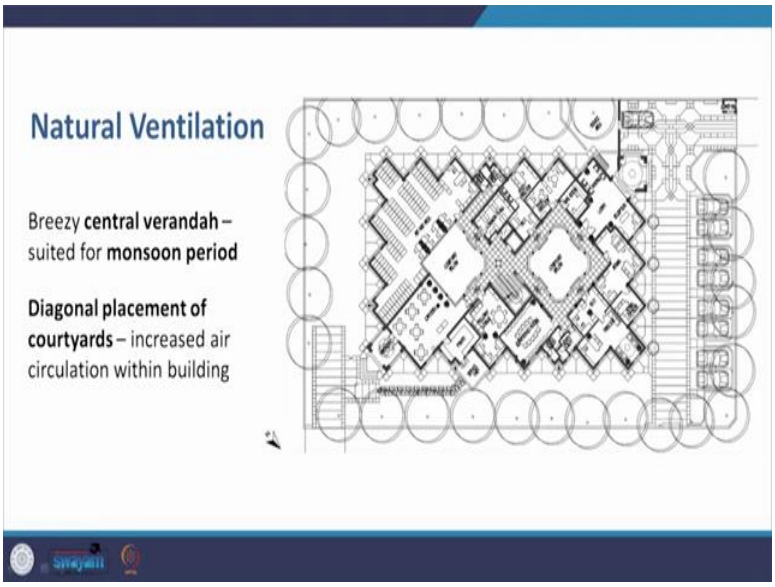

Then there is natural ventilation, the breezy central veranda brings in breeze which is suitable for the monsoon period. When I talk of the monsoon, I am reminded of the Kanchenjanga building because there also they tried to capture the breeze to pull it deep into the house. The way they designed the sky gardens that is what it was intended to do.

Now while I am repeating these examples is so that we can connect the dots between these ideas been explored the different architects the diagonal placement of the corridor helps in increasing air circulation within the building.

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Now there are the sun shading of the windows and this is also very interesting how they do bring in daylighting in the east west face because of the the the the sharps and they would get the small slip like windows and these windows roll normal glass the glass bricks.

So, the light that filters in is a diffused light coming inside that you see here. It is not glare it is diffused. Also, heat does not come in. Then we have light shelves. What are light shelves, light shelves are basically sunshades over a window which have got ceramic tiles which have been laid on them. So, what happens is that when the sunrise fall on this, they also create a ventilator here in the building. So, when the sun rays fall on the sunshade, one is it prevents the sun rays from impinging on the window.

That is the purpose of the sun shade. But the windows will reflect the sun rays back through the ventilator into the room like this, into the room like this. So, as you see here, there is a sun there is a light shelve from the outside that is a sunshade, which is layered with the ceramic tiles, that light is being reflected back on the inside. And you can see this lit up, roof, the ceiling and that light is then lighting up the room.

So, no artificial light is needed during the day because of this process. Is not it so interesting. Such a simple thing. Now, please understand one thing and I will make a lighter here, light shelves must be used very carefully, there are several designs for light shelves that you will find online or in books, and they have to be very specific to the need that you have in a particular building.

So, because the pros and cons must be weighed not only for this, but for all the technologies we are talked about, it is not like, if the technology is working in X building, it will definitely work in why they have to be balanced out and how that will fit into the the design or the problem that is in front of you.

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The terraced garden on this building is having these modern pavilions so that they can have large gatherings in winter beautiful sun, but the other thing is the terrace garden also serves to insulate because of this it cools the, it prevents the sunrise from entering getting into the building.

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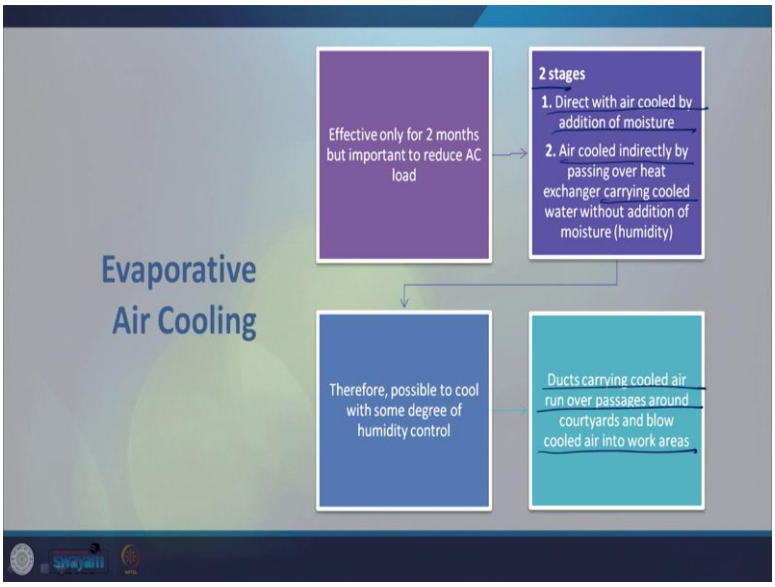

Now, there is also evaporative air cooling, which means now it is only effective for 2 months, because why are they using the idea of evaporative air cooling to reduce the overall air conditioning. So, what do they do? There are 2 stages in that one is so both of these ducts laid along in the corridors, which are opening into the rooms and this cold air through evaporative cooling is pumped into the rooms, ducts are carrying this cooled air, which are running along

the corridors of the passages around the courtyard and they blow the cooled air into the work areas. Now how how does it happen? First is it is done with direct with air which has been cooled by the addition of moisture.

Now, I cannot be, I cannot be doing to describe the whole system to you, you will need to have a deeper study of that. But I am going to tell you the concept. The second idea is that the air is cooled indirectly by passing it over the heat exchanger of your system and that is carried, that is carrying cooled water and this is not having any moisture content in it. Therefore it is also so we can do two things.

We can have humidified cool air pumping, or we can have dehumidified cold air content, it is possible to cool the rooms with some degree of humidity control. But active controls are needed.

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For example, in the archives it temperature has to be maintained at 18 degrees Celsius before air conditioning is needed. And there are other associated areas, for example, the library that we need air conditioning, this to reduce AC load in these areas where it is a necessity. These special places maybe for example, are provided in the basement. Along with all this solar water heating is also used for cafeteria and stuff quarters.

Now, I would not directly put it in the slide for active control because this is more of a passive exercise, you are taking the sunlight, and you are using that for heating purposes. So, predominantly, the active control is associated with the air conditioning that they do. But they

are also they have been very sensitive in their design by providing the spaces that need this kind of air conditioning in the basement.

Can you imagine how much work has to be done on the design of the building also to be able to exercise all these passive controls. That is why I am repeating by simply putting these passive devices will not solve the problem. A lot of architectural design effort has to be made into the overall design of the building in the way the building or overall form has been created. The way it has been oriented the way the spaces have been laid out in the building. Every aspect of the building design is not only going to be governed by functional, which is the predominant idea of modern architecture form follows function.

So, function is the basically the most simple often, but then in this function has also been added the idea of energy efficiency and along with that comes a thermal comfort through passive means. So, that function is not just restricted to basic functional layout, but these ideas have to work badly.

That is why today we have teams working, we do not have a single person who is like, these consultants off, like we have structural consultants and we have interior designers and all coming pulling in the effort between the building these energy consultants, even seismic safety consultants have to also come into the team right from the outset of the design.

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Very interesting buildings also coming up in Gurgaon. Again, one of the genesis of this company, this this form is doing very interesting work with regard to passive design. And that is called the GYS vision.

It is not completed, it is been constructed. And it is a stack of cuboidal volumes. Each cuboid is on a bungalow scale. And there are a set of attached open spaces with that keyboard and well, these open spaces in one of the 3 towers that you see here, this tab, this one tab that you see here is called iconic towers.

The iconic tower has got the sky gardens which are spiraling along the entire building, the other 2 towers are more what you might call a mutate, they are more regular, they also have these they also have this system of proper climatic orientation, climate control, et cetera, look at those ideas.

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So, here is a site strategy, everything has to be worked out what is the site strategy, there is a central sample code and the toggles have been so aligned or so put together that the sunken code falls into the inner shadows zone. And thus, a microclimate is created within the heart of the site.

So, much so that the assessment says this will be a usable space even at 45 degrees Celsius in the afternoon, as an outdoor public space. We wait and see because it has not yet been completed auditing. The post occupancy audit has not been done, but this is the idea that has been mentioned.

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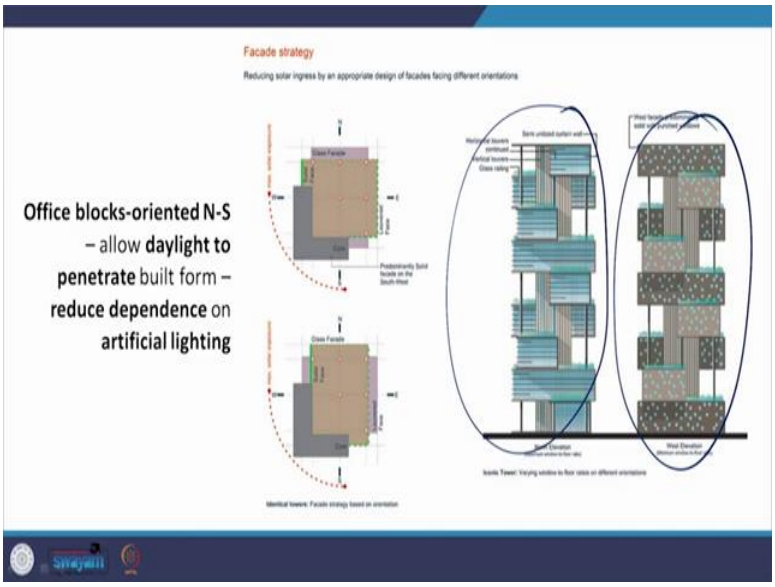

Now the office blocks are oriented north south to allow daylight to penetrate into the building and reduce the dependence on artificial lighting very standard idea that is explored here. And as you can see, what are these levers that have been horizontal levers and vertical levers that have been provided, for example, on the north elevation, but in the West is only small punctures that have been given.

When I look at this, I am reminded of a design of a house called Maison Bordeaux, by Rem Koolhaas where he had created a massacre look at this pictures, it is just a visual comparison, I am not talking in terms of the climatic impact.

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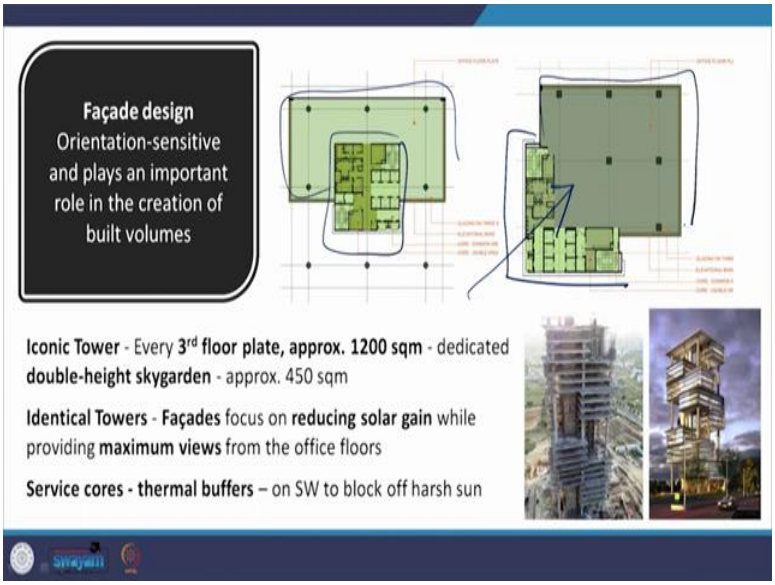

Now, the facade design is orientation sensitive and plays an important role in creating the built volumes. And for example, the iconic tower every third floor plate is approximately 1200 square meters and out of that, there is a double height Sky Garden which is approximately 450 square meter. So, here it is, this floor, this is the floor and then you have the skydiving which is attached to it, as you can see here.

Then the identical towers to other towers, they have their facades which are focused to reduce solar gain, while providing maximum view. So, what they do is that the service core is provided on the southwest side here, where we will be getting the maximum hot sun as the sun moves towards the late afternoon and early evening time. And therefore that sun is completely blocked. And then we are getting these views on this side.

So, that is the way the entire organization of the plan has been done keeping this climate control in mind. This is how the Sky Garden would look. These are some of the views of the Sky Garden. This much part I believe is already been constructed.

This is the sunken courtyard. And these are the views of the, this is what the sky gardens would look like series of strip sky gardens throughout the building.

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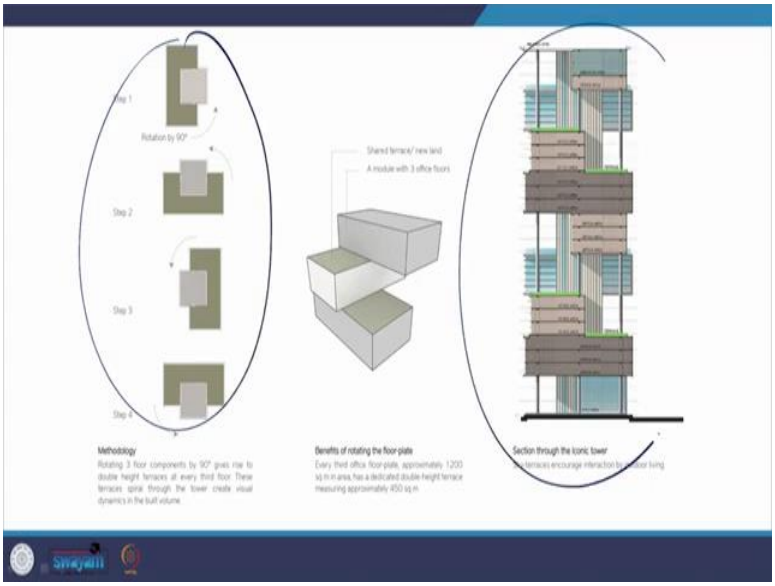

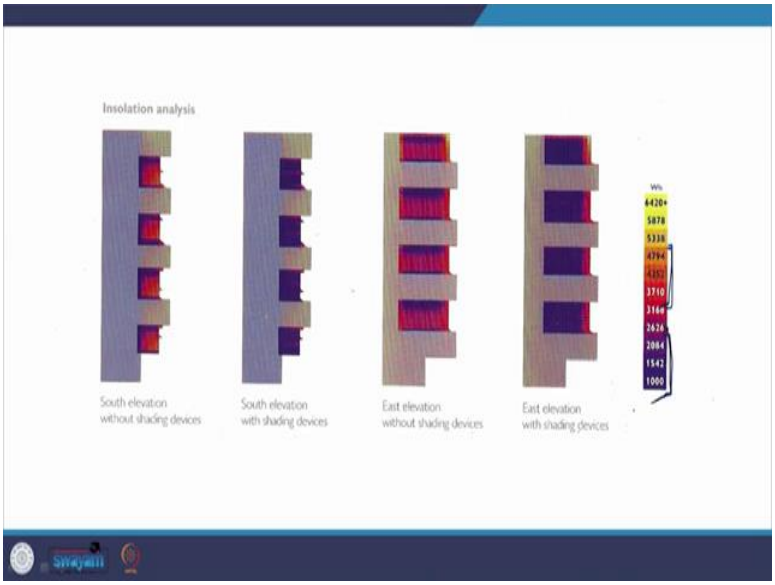

And this is how the rotation of the volumes has been done. So, you can we, can read the slide how the massing has been done in the iconic tower and the step gardens have been created. Now there is also the, this slide actually indicates the amount of background work that is being done to make the buildings thermally comfortable, insulation analysis.

What is it? It just talks about the amount of solar radiation that can be penetrating into the building. So, what is the analysis showing us, that if we have the south elevation without the shading devices, then the amount of insulation is in waters as you can see the color is rated to be somewhere in this zone.

But when the shading devices, the insulation decreases to somewhere in the zone. Similarly on the east elevation again, you find that without the devices, it is on this higher range and then when the devices approx it comes down in this range.

So, this is showing that the design of the insulation devices has played a very important role in reducing insulation or solar radiation penetration.

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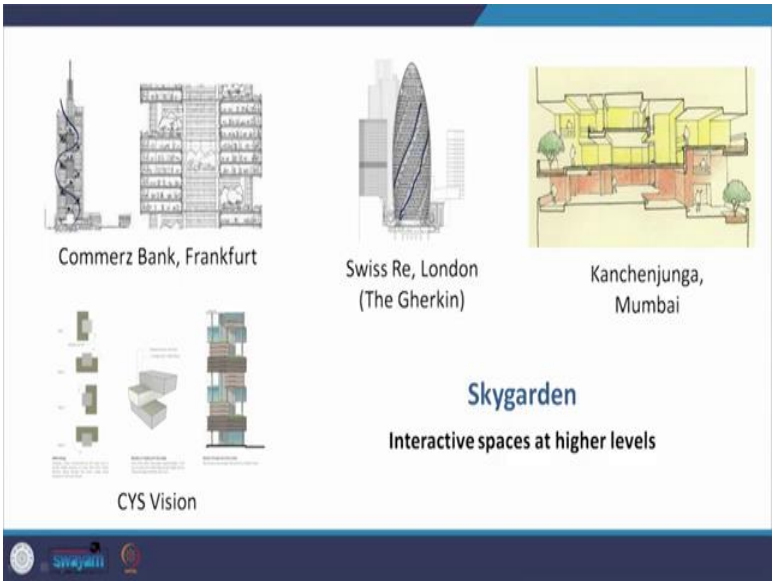

Now the idea of the Sky Garden is not unique to the GYS vision. The same idea was only explored in the Commerce Bank in Frankfurt by Norman Foster, we see the sky garden spiraling up the building. And then the same idea was again explained by Norman Foster in the Swiss Re, the Gherkin in London.

So, this has these internal not actually gardens, but there are these there is an atrium and there are these spaces within that work as outdoor spaces and the entire building is encased and along this did you see is where the those outdoor those spaces have been created the walk out of your offices would be in that area. Then of course the idea of the terrace gardens is there in the Kanchenjunga building, but Charles Correa has used the idea, the idea of these sky gardens is also there in the Antilia that is Mukesh Ambani's house and you find that at a higher level I believe somewhere here.

So, forgive me here we have the Sky Garden. And so that is another example. This is putting the skygardens together this was or whatever we are talking about in this receipt building the outdoor hangout space within the overall glass volume of the building. This is the GYS vision Skygarden this is in Commerce Bank and this is the Kanchenjunga apartments.

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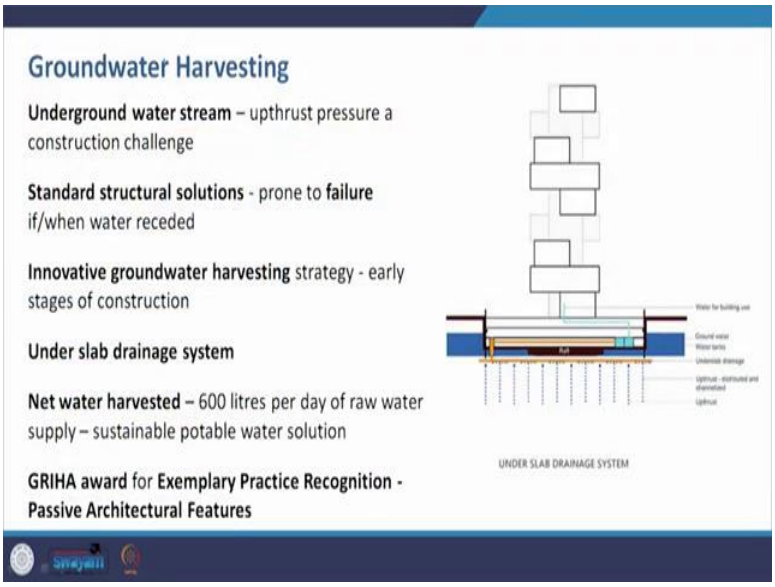

Now there is another idea with regard to what, ground water harvesting in GYS vision, the underground water stream turned out to be a construction challenge. The standard structural solution was prone to failure when the water receded.

So, therefore, they came up with the innovative groundwater harvesting system. They have used an under slab drainage system. The net water harvested through this ground water system is about 600 litres per day of raw water supply.

And they have been awarded the GRIHA award for exemplary practice recognition for passive architectural features for this building. Now, please understand that this building is yet to be completed. But already the practices used by the architects in the building have been adequately recognized and rewarded.

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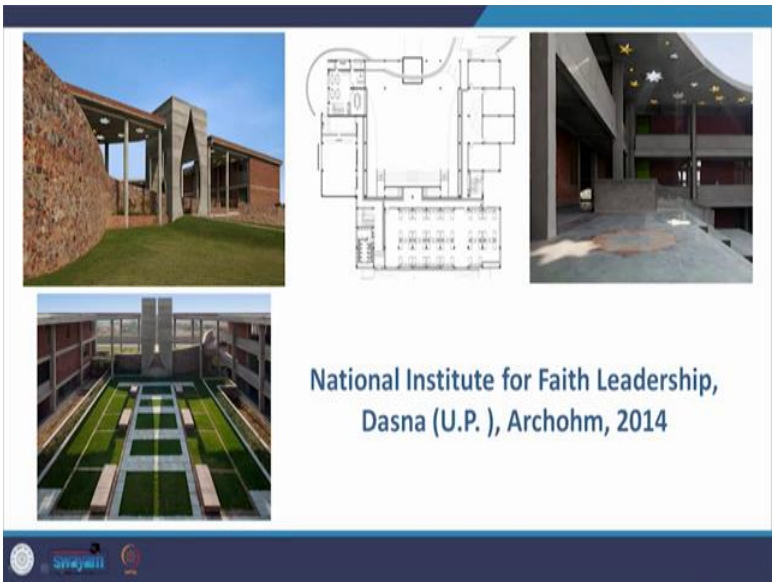
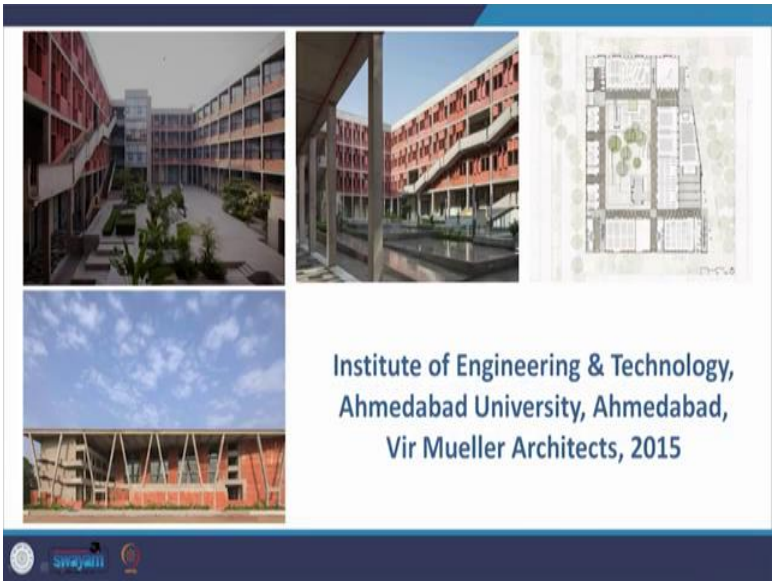
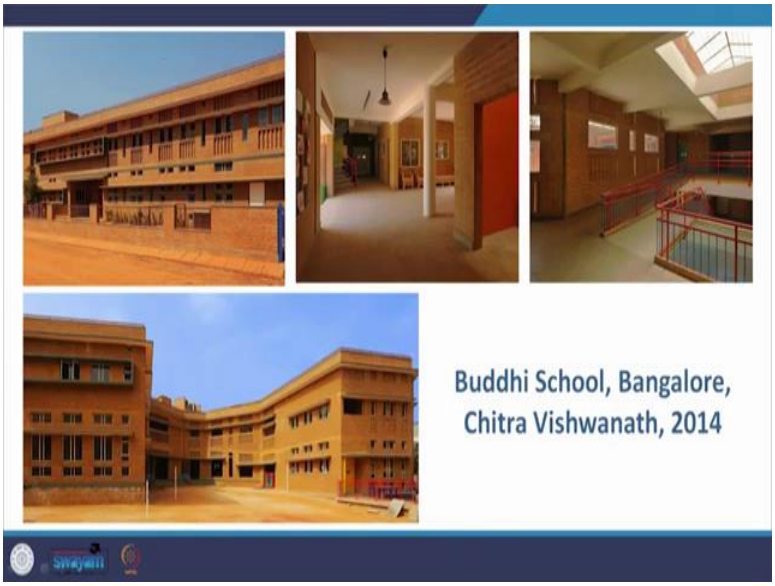
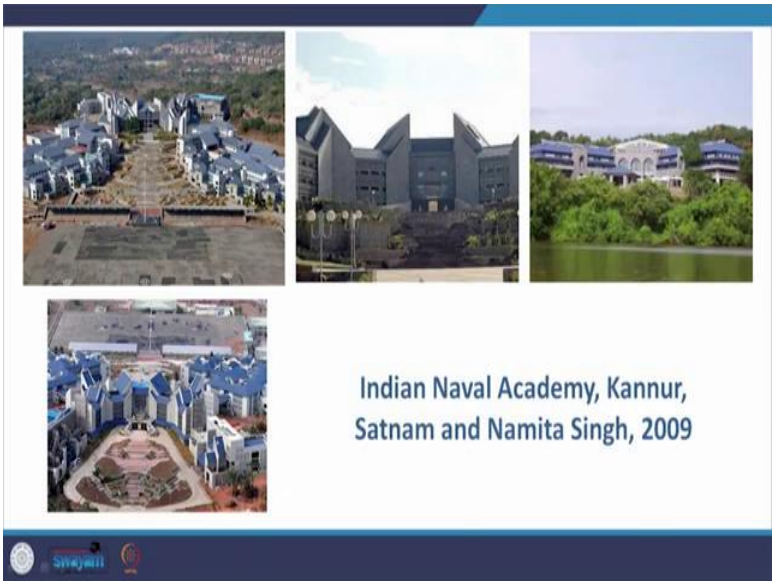


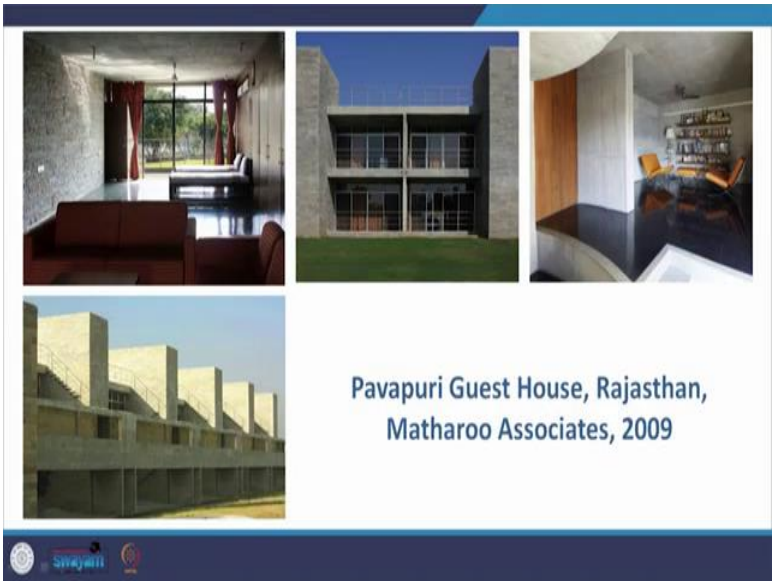




Buddhi School, Bangalore,
Chitra Vishwanath, 2014



Indian Naval Academy, Kannur,
Satnam and Namita Singh, 2009



Pavapuri Guest House, Rajasthan,
Matharoo Associates, 2009

There are other buildings also that fall within the category of critical regionalism where all these ideas of thermal comfort et cetera are explored. And I will just give you a list of few of them. National Institute for Faith Leadership, in Dasna, Archohm, in 2014.

The Institute of Engineering and Technology in Ahmedabad University, by Vir Mueller, architects in 2015. The Kumaon Resort, Almora, by Zowa architects in 2017. The Buddhi school in Bangalore by Chitra Vishwanath in 2014, the Indian Naval Academy in Kannur by Satnam and Namita Singh in 2009.

The Pavapuri Guest House, in Rajasthan, by Matharoo Associates in 2009. Now, if all these buildings if I take you back again, what I would like you to focus on for a minute is where these buildings are located. This is an UP composite climate, composite, hot climate and about cold climate Almora Hot or tropical climate Banglore it is more much more comfortable climate come over Kerala hot and humid. Rajasthan hot and dry.

So, what do you find here is that all these different projects are spread all over the country in different climatic zones, and each one has a different climatic response. Now, when I keep on repeating the idea of thermal comfort, energy efficiency, climatic response, please do not read into my statements, the idea that I am neglecting the point of design, I am not at all neglecting that, I am reinforcing that. And how not reinforcing that what I mentioned earlier to you, active control buildings are much easier to design.

All I need is because when building is actively controlled, I do not have to play much with the form, because I am not constrained by the form at all. My firm will not contribute to the conditioning of the building, the systems will do that the mechanical conditioning systems will do that I can raise a tall building, I can make it surrounded with sleek glass and fantastic looking materials, look very beautiful, very attractive, the even Posh, but these buildings require a huge amount of effort, because the built from plays a very important role in the climate control.

And not only that, remember the Vitruvian triad I talked about earlier from function structure nonbuilding. I repeat, no building can succeed without good aesthetics without a good and attractive form without a very functionally well working space. And of course, a safe and sound structural system, we will end here. Thank you so much for joining in this presentation. We have 2 more presentations left with regard to a search for new architecture. And I hope to see you next time. Thank you.