**Glass in buildings : Design and Application**
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**Lecture – 58**
**Energy Efficiency Facade System**

Welcome all to the session of Energy Efficient Facade System. I am Varghese I am heading the facade division of Sobha. Today we will discuss about the balanced facade where as you know facade is like the skin of the body. It is a very vital organ of the body it will give shape to the body, it will control the body like that facade is always very important element of the building. When we talk about any facade it should have 6 to 7 aspects.

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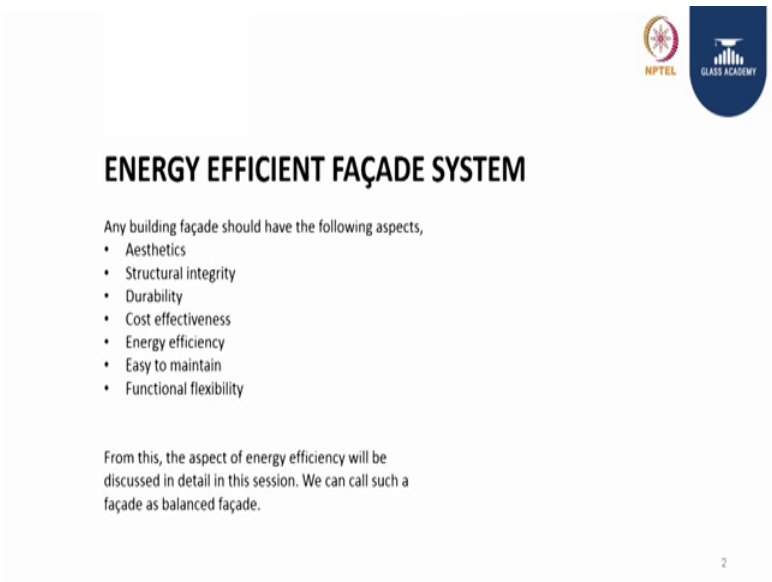


One is aesthetics, another one is structural integrity, it should be durable and the facade should be cost effective. And, it should have the energy efficiency also, it should be easy to maintain and functional flexibility is also important.

If you look at it many of the things are contradictory. When we work for something the other aspect will we have to compromise on this. Today we will discuss about a system where the energy efficiency is given the prime importance. We will try to achieve all other aspects in optimum benefit, but giving more and more importance to the energy

efficiency from this the aspect of energy efficiency will be discussed in detail in this session, we can call such a facade as balanced facade.

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If you see recent times in the facade industry a trend is there to save lot and lot, energy not spent is energy saved. So, usually we will be having we have to approach this in two aspect, one is to spend less energy on air conditioning or inside the building, second to cut down the energy what we are spending for artificial daylighting. So, these aspects will be discussed in detail. We if we discuss about balanced facade at least four things we have to consider.

One is the sufficient day light should be there in the building without much artificial lighting, second is energy efficiency of the building where all heat ingress of the building we have to reduce, third is to avoid glare and radiation. So, that the occupant will have maximum comfort level other challenge is to bring day light to deeper or inner core of the building.

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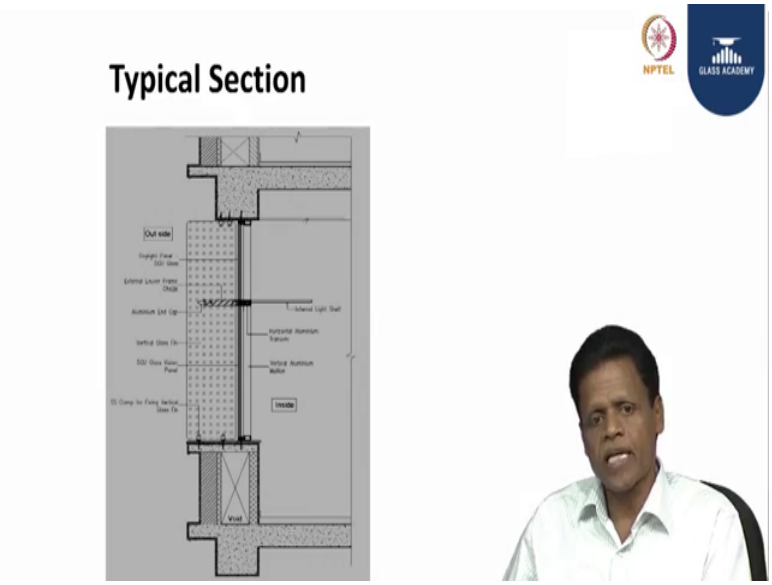


Here I am showing a typical section where this aspects of energy efficiency is kept in mind while designing the particular section. Suppose a building of 4 meter 4.2 meter floor to floor one method is to give the entire floor having facade glasses, but here in this particular section what we have what we are doing is to give around 50 to 60 percent of the glass other area we are leaving as it is for other architectural elements.

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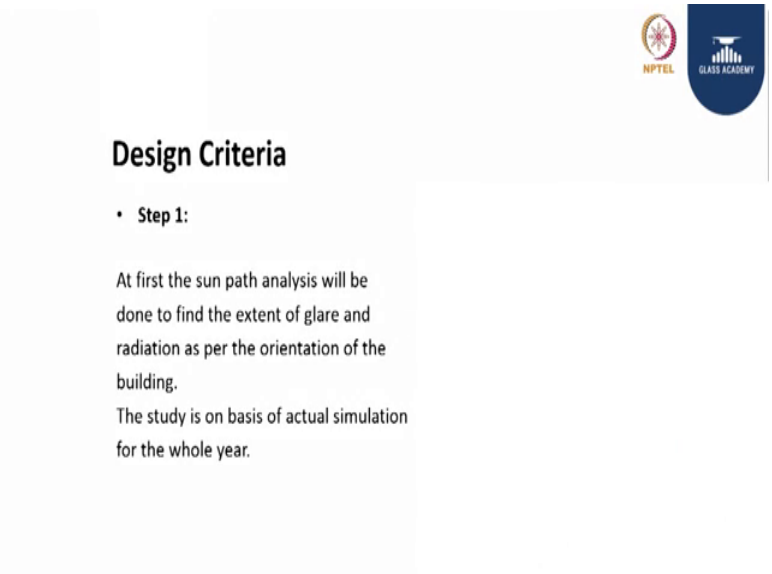

In this case we have a facade of around 2.4 meter having few elements designed for specific purposes, to arrive these design criteria we have to consider 7 steps or we have 7 different steps to arrive this particular section.

The first step is sun path analysis, nowadays if any major building facade design starts with study of the area and study of the sun path analysis as per the building orientation. Suppose the building orientation is fixed then according to that orientation a sun path analysis will be done considering the whole year.

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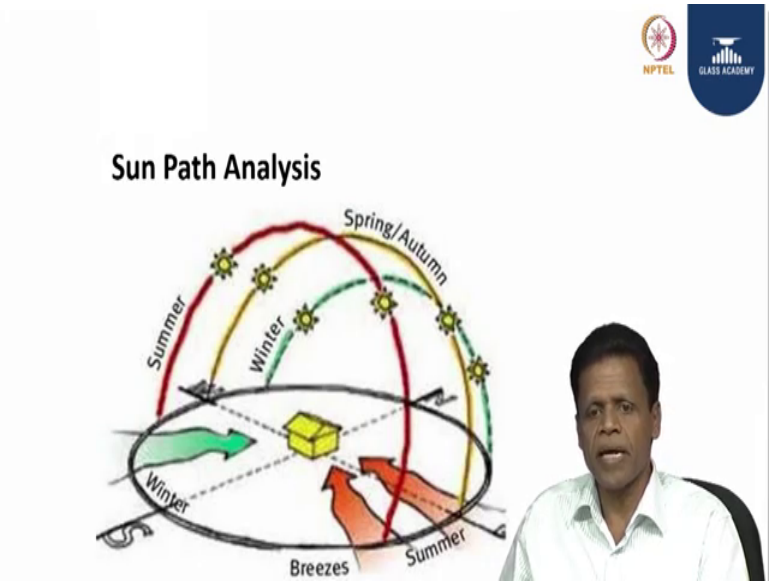


This is a simulation of sun path for the entire year for the all 4 seasons and even hour to hour. So, this will give a clarity where what are the sun penetration from the various parts of the building and elements can be designed accordingly. The ultimate aim is to have the energy efficiency in our mind and to have a complete comfort level to the occupant those who were sitting on the periphery of the building also.

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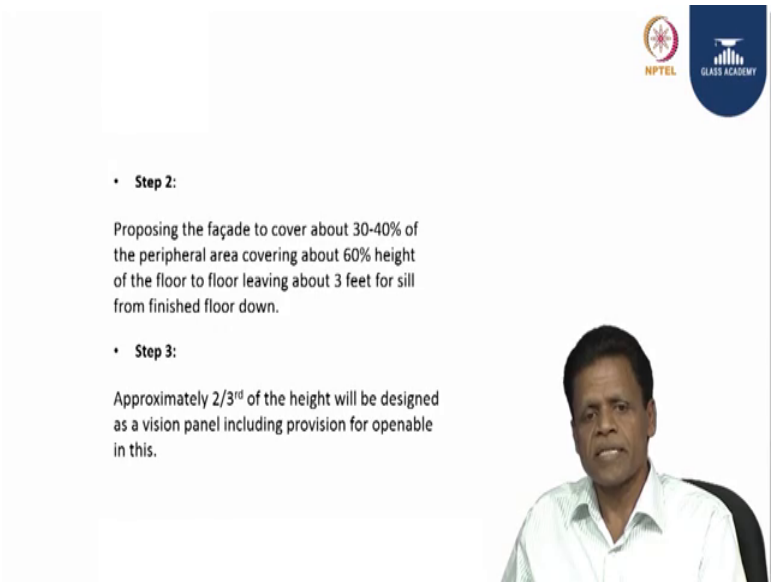


The next step is to propose the facade ideally around 50 to 60 percent of the floor height. We can cover the complete floor height also. So, the balanced portion that 40 or 35 percent of the portion will be treating as a spandrel panel where glass will be there from the outside, but there will be insulation inside. So, that particular area is designed for maximum insulation. So, the facading question will be around 60 percent of the floor to floor where this particular section of the facade will be splitted into 5 definite elements.

One is the total height of that 60 percent height suppose it is 2.4 meter around two third of that height will be designed as a vision panel. If you go back to the section this around 2.4 meter facade where the lower portion designed as a vision panel it is almost two third of the high and the upper portion.

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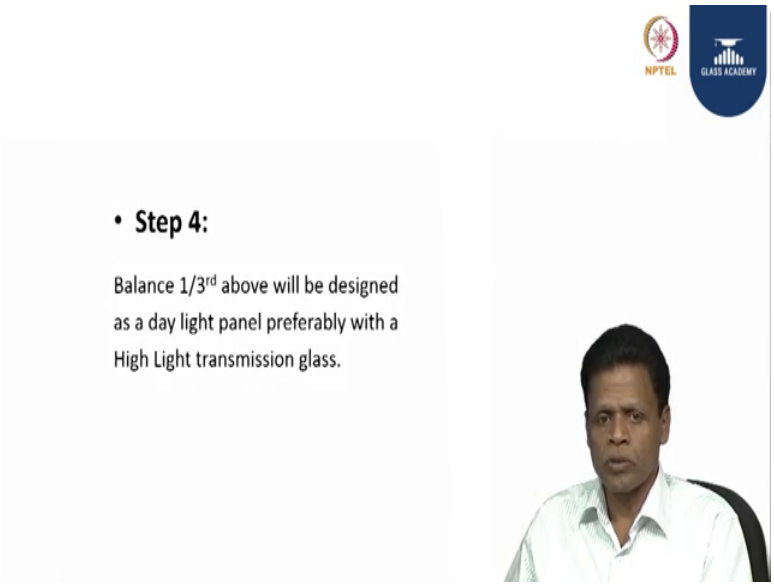


One third is designed as a day light panel where the function will be discussed little later and these are two major elements and there is an element called external chajjah, where as per the sun path analysis a certain width of this chajjah will be designed.

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The primary purpose of this to have to cut down the sun radiations and it will help up to certain extend in the heavy rainy season also. And another element you can see inside where we call it as a light shelf where it also having purpose of cutting down the sun

radiations and also to having the function of giving light to the internal portion of the building. So, after doing the sun path analysis a section is proposed.

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Total height two third is given for vision panel one third is given for the day light panel.

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A sufficient width chajjah is proposed and a sufficiently designed internal light shelf is also designed having the purpose of cutting down the radiation and giving the light to the inner portion of the building.

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Now, one more area is suppose during the lateral movement of the sun we will have radiation even after providing sufficient width external chajjah. Here we are addressing that issue by providing vertical fins in front of our mullions.

Here frosted glass or any other solid thin elements will be placed vertically in front of the mullion. So, that radiation due to the lateral movement of the sun also will be arrested. We will come back to this particular section where we have all the elements in place.

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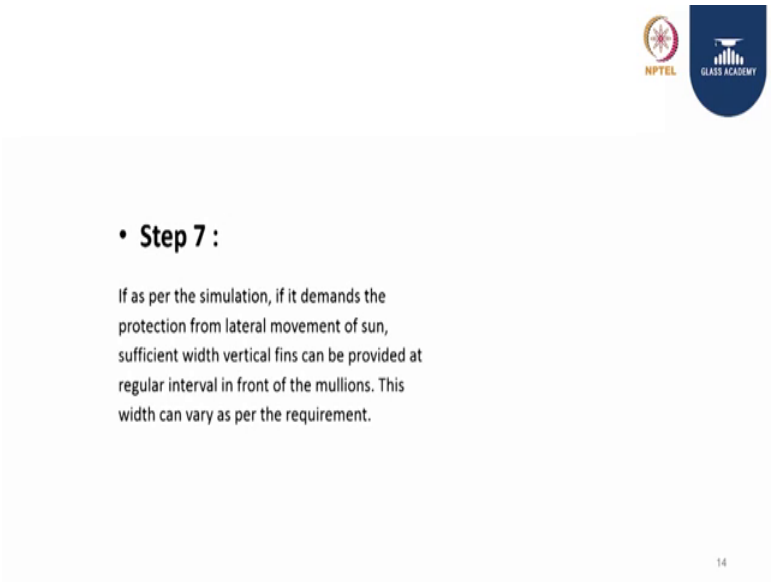

The design involves two as per the data's obtained by the sun path analysis we have to select the glass for the vision panel glass for the day light panel sufficient width design for the external shading element.

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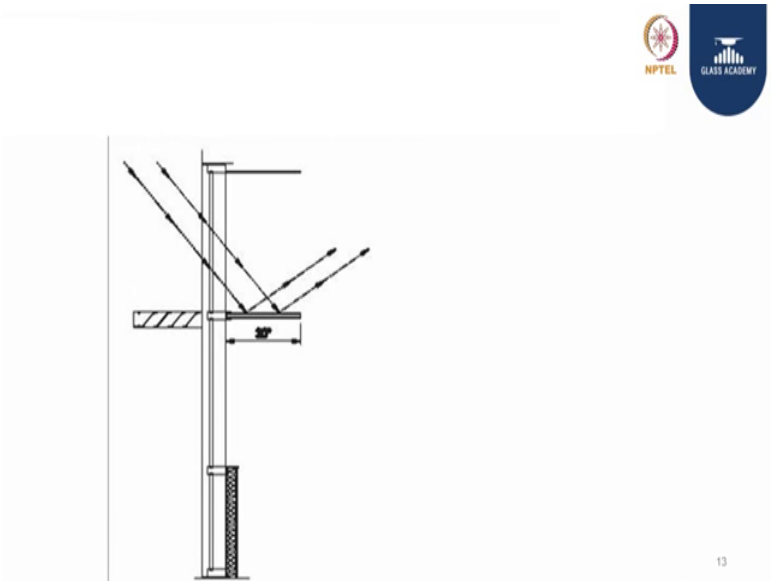


And there is an width criterion for internal light shelf and to provide the glass fin or the fin externally vertically to cut down the radiation due to lateral movement this particular section shows a typical section, where all these elements except glass fin is provided. If you go back to the go to the section we have various options for this is particular glass in what we have shown for all this elements we have various elements to select from. And most important as you know is the glass selection where have seen many sessions here to educate the students about the criteria of glass selection here.

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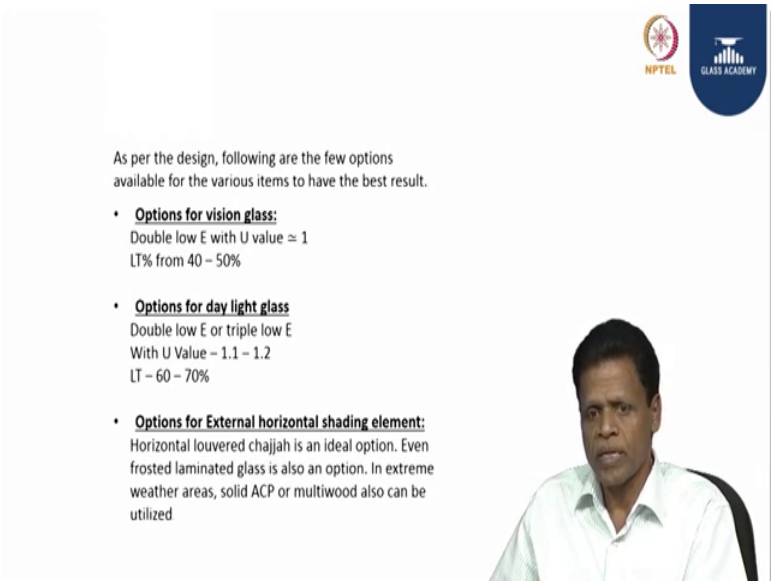


We have a very important role of selecting the vision glass where the purpose is to give sufficient light, but to make maximum insulation where I suggest a double low E glass of U value around 1 how we will achieve the U value 1. You are aware all aware that the glass single glass providing with this double low E coating may not fetch the required result.

What we to provide here is an insulating glass of sufficient thickness may be 27 32 mm thickness having inert gas filling in it and carefully selecting the light transmission percentage we can achieve a U value of 1. Here I suggest for this thing vision glass of U value 1 and having around light transmission of 40 to 50 percent. This 40 to 50 percent light transmission will be sufficient to give a optimum lux level for the building peripheries. We may have around 300 to 400 flux level which is more than sufficient to work with.

So, when you the most important of this selection of these elements the prime is selection of vision glass because it is covering the maximum area of the. So, go for a double low E having around light transmission 40 to 50 percent after treating with insulation techniques we will get a U value of 1. Here I am not taking any brand for the glass that selection is to the clients or to you to decide, but we have a range available in the market where LT is mentioned and U value is also mentioned after sufficient

treatment. When coming to the upper glass day light glass again we have to go by a low E double low E or tripe low E even here the purpose is little different.

We need to get sufficient light at the same time we have to cut down the radiation part of it here this one third of this glass this particular section selection will be little more open glasses where light transmission will be around 60 to 70 percent. We can have triple low E here sufficiently treating the glass with insulation techniques we can achieve a U value of around 1.2.

So, after doing this both glasses selecting both the glasses we can go back to the sun path analysis. And we can decide the width of the external chajjah it is very very important. The idea is to cut down the radiation to 0 up to 0 level where all the occupants of the building either those who are sitting in the periphery or inner part of the building will have a complete comfort level from the radiation.

Here start with a 2 feet or 3 feet may be in certain cases it may go to 4 feet also, but for this particular external light shelf for external shading element we have lot of options what we are discussing in the coming in the next pages.

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Coming back to the other elements other than this three we have internal light shelf where is a horizontal element providing with sufficient width this also width we have to simulate it from the sun path analysis. We have from 2 feet to 20 half feet horizontal

element lightweight and little thinner element. So, that it will look nice from the it has to go well with the internal portion of the building. What we need is a maybe an MDF with treated top and bottom differently.

Why I am telling top and bottom differently here the light shelf top should be totally glossy. We need to have a glossy laminate on top. So, that when we have radiations coming from outside it will be hitting on top of this and it should go back to the ceiling of the inner portion which will again reflect back to the inner core of the building. So, bringing the sufficient day light to the inner core of the building this particular selection of internal light shelf play a very big role usually we will go with very high laminate on top white colour. So, that whatever light coming on it will reflect totally to the ceiling of the building which in turn ceiling will reflect back to the inner core of the building. We will coming back to the selection of external light shelf.

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You can have many options are available we have to balance this functional aspect with the aesthetics also, we can have aluminium composite panel sufficient width. We can have even light laminated glass chajjahs where frosted chajjahs can be used for the purpose which will add aesthetics also.

We have even multiwood options are available, we have most of the time we will use louvered chajjahs where the advantage is it will bring down diffuse light to the bottom. So, the front facade of the building still will be lid with sufficient day lighting and at the

same time it will cut down all kind of radiation. We have to adjust the blades of the louvers where it will cut down the sun radiations, but at the same time it will bring diffuse light to the building.

So, this is a this by selecting the correct material for the chajjah adjusting the correct angle for this louvers we can have external chajjah having the function of cutting down entire radiations at the same time it will give diffuse light to the periphery of the building. So, this in this particular manner what we are planning what we are achieving is the keeping the artificial lighting at the daytime a minimum we have to try for the 0 day lighting and we will end up using very very minimum day lighting for the purpose. And all kind of heat ingress to the building we have to keep minimum.

Here I told you we have we have a statute restriction of using glasses after treating to have a u value of 2.5, but here by carefully selecting and treating repeated insulating process. What we try to achieve is to have a glass of treated glass of value U value 1 that is very good for the building facade where energy ingress will be very very less. And bringing the light inside the building cutting down the heat ingress up to the maximum the facade slowly become a balanced facade where, all the other aspects is dealt with optimum results.

Coming back to the sections where the few facades we will show here, where with this is a facade having all this kind of elements appeared here where coloured glass fins are used to have the optimum results for lateral movement. You can see here solid chajjahs used with aluminium composite panel where many areas for aesthetic purpose we have used aerofoil louver where angle and all adjusted to have the best results and.

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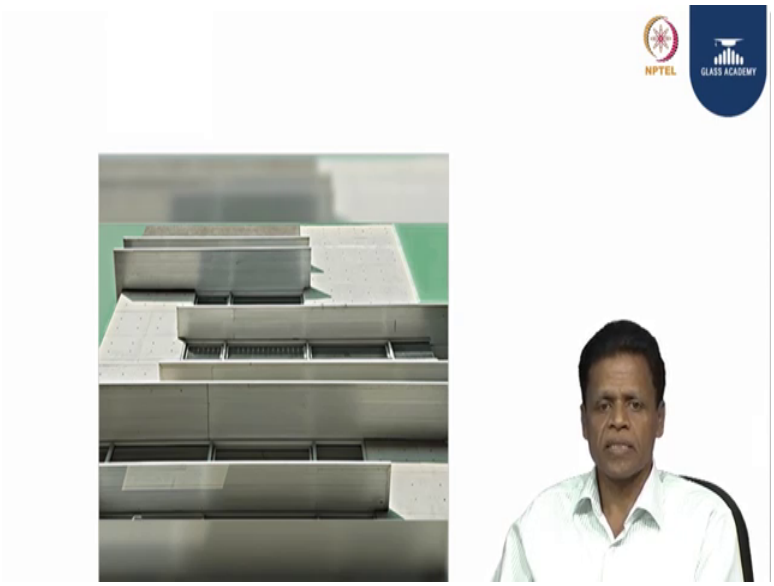

This here we can see lot of external shading elements are used chajjahs are used the here we used solid aluminium composite panel where the area having very bright sunny sun of the part of the countries, we can use the solid aluminium chajjahs here we used box sections in a loured manner to add aesthetic at the same time it will cut down the radiations up to certain extent. And through that vertical light will be given. So, that the facade externally facade will be properly lit.

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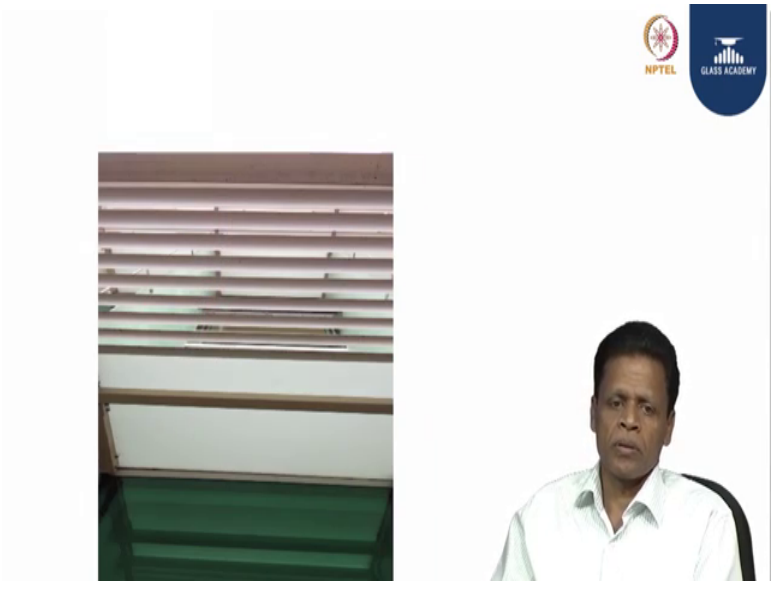

We have aerofoil louver again we have option of partly frosted glass and partly aerofoil louver.

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Internal light shelf of the all (Refer Time: 20:06) discussed usually will go with a MDF having top treated with highly gloss laminate bottom. We can have any laminate having of which will go with the internal interior of the building.

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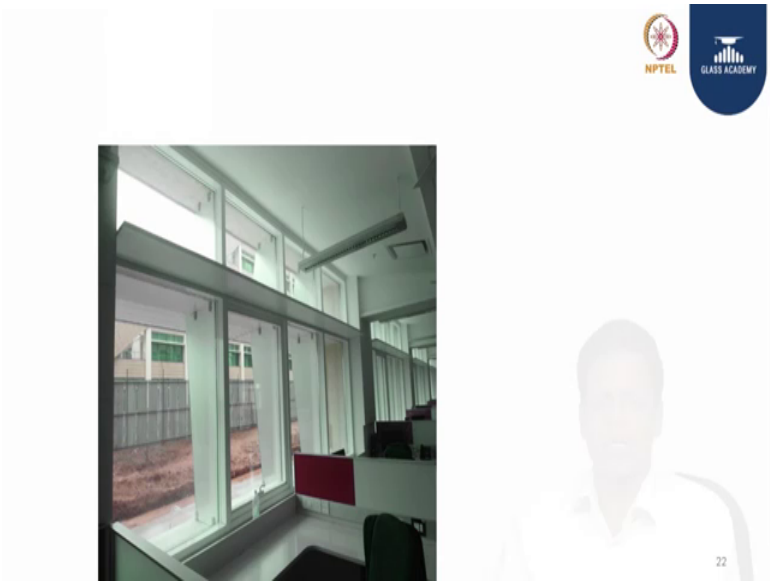


This is a typical balanced section where internal light shelf is given of around 2 feet, we have around 2.3 2.4 meter facade having day light pane. We have a vision glass, day light

glass we have openable panel; usually openable panel will be given in the vision areas where we kept a ratio of two third and one third.

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This particular fin elements we have to discuss usually we have all the options, we have frosted glass is the first option because, it will go very well with the aesthetics; easy to clean and when we frost it will cut down the sun radiation up to certain extent or up to the maximum and still it will give a little glow or diffuse light to the facade. We have solid fins we can give even ACP fins are possible, but it will look bulky glass fins always will be thinner and neat.

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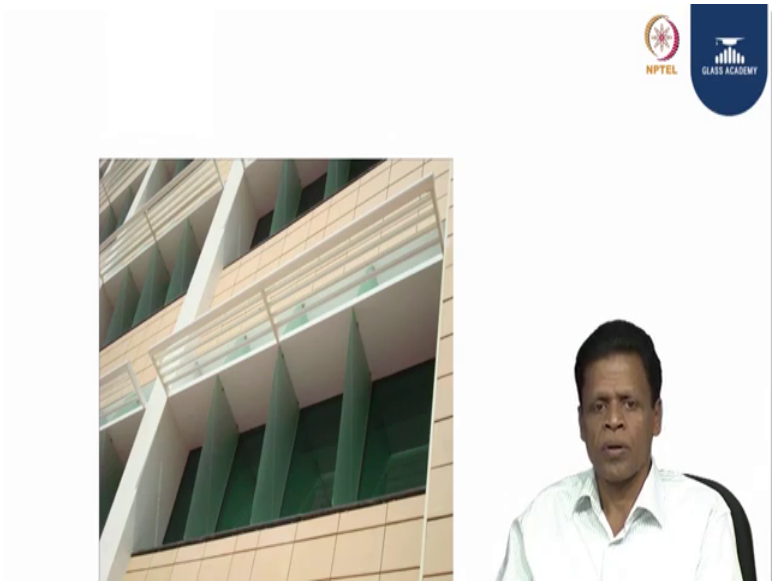

This again external view of a balanced facade having see the shape of the glass fin where it is a tapered. These are all data's simulating from sun path analysis. And the external shading element considered design as a combined unit where first 2 feet portion is designed as a solid, later we have aerofoil louver to this is to bring aesthetics to the building also.

If you see the total height of the floor it is around 4-4.2 metre out of that 2.4 meter is taken for the balance of the facade element other area is treated with sufficient insulation. So, that total heat ingress to the building kept minimum.

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These are all various options for glass fins again now a days lot of colours coming into play. We have safety treated glass fins can be used for this purpose usually ceramic fritted glass will be used. Here we have to add the safety or also always this such a glasses will be used with lamination of sufficient thickness.

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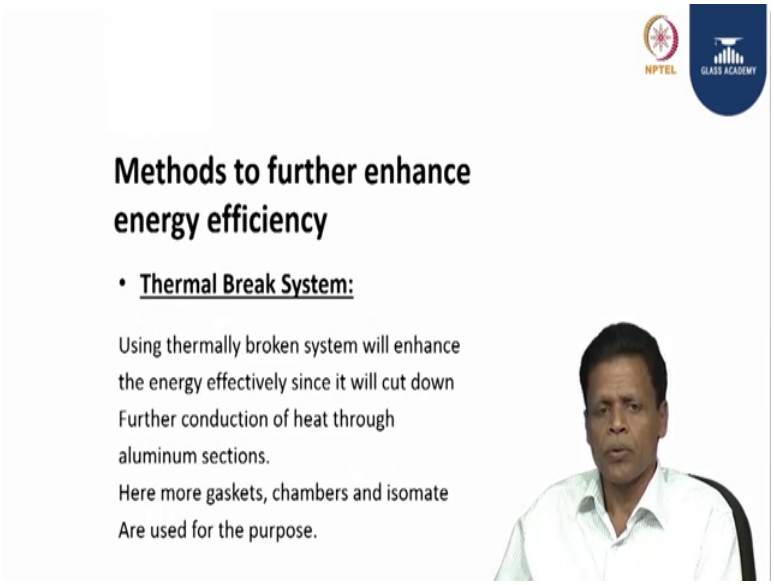


After discussing the balanced facade we have further methods to enhance the energy efficiency. We can bring down heat ingress to the building further by using this particular technique thermally broken system.

This thermal break usually will be used in to cut down the heat ingress through the aluminium you know any facade having metal light weight metal like aluminium and major area will be covered with the glass. We have all the techniques of treating the glass to bring down the heat ingress where we have double glazing techniques using this spaced with inert gas. We have lamination techniques all bring down the U value of the glass area where, the heat conduction through the metal aluminium is taken care by using a technique called thermally broken system.

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Here the aluminium sections structurally strong aluminium sections will be designed and which will be broken into two isolated from inside and outside.

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If you the a the section where we have the glass outside, where inside is the aluminium section were the structural part of it is split into two or split into many compartments, where the direct chance of direct heat ingress is reduced we you use an insulation material called isomat. By this we can cut down the heat ingress through the aluminium metal. Any facade will have 10 to 15 percent of the metal and balance 80 to 85 to 90 percent glass area where this 15 percent of the area is further strengthened by using this technique.

This is what we discussed about balanced facade today. I will summarize we have a facade having many functional aspect, out of that one particular aspect is considered for energy efficiency today, where 7 steps are there; starting with sun path analysis we have to carefully select the systems, sections, height of the facade a balanced facade. Then later all the elements of day light vision glass, external shading element, internal shading element, glass fins are designed all the width and selections are all depending on the requirement of your energy efficiency and sun path analysis of the area.

And we have to provide the sections with sufficient glass fins on front to cut down the radiations. Here energy ingress is also controlled and we are bringing sufficient day light to the building. So, when we achieve all this from a normal facade this particular facade is called a balanced facade.

Thank you.