

Glass In Buildings: Design and Application
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Lecture - 72
Case Study of a Different Concept of Facade

Welcome to the session of case study of a building, which is situated in the southern part of the country in Cochin. This particular building is a normal building and it becomes special because of an additional Facade; we call it as tree. I think this concept first time used in the country a building of size around 100 meter by 70 meter, a fully facade clad building having additional facade of 16 number of trees all around in the long side 5 plus 5 and the other shorter side we have 3 plus 3.

So, this design of the building and design of the tree make it unique were we have not used this concept till date in the country. If you see Europe and Japan, they are using double facade buildings creating a space in between to control the ambience temperature inside. But here, we have used in open concept, but shading of the building up to certain extent is achieved by providing an additional facade; that is go through the details of this particular facade.

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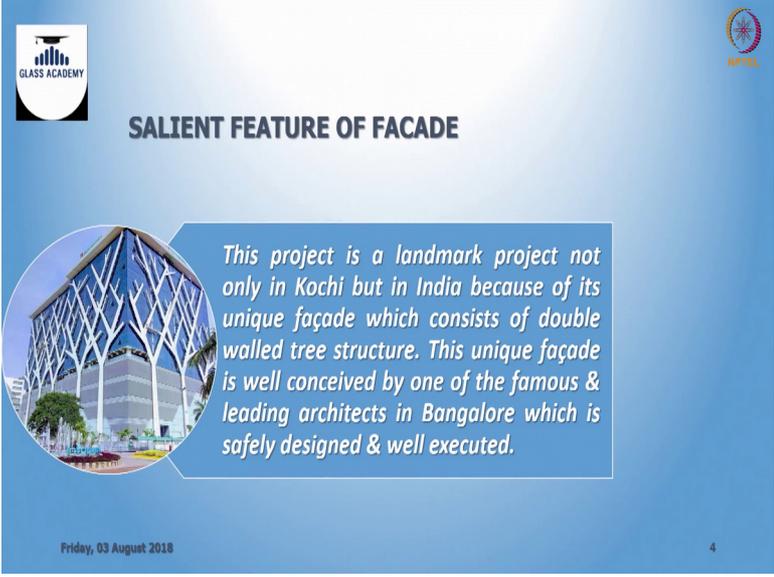
It is a ground plus 19 building having around 9 till 19th floor we have commercial space. It is a normally fully cladded building for high energy efficiency.

And you see the building up to the 8th floor it is used for multi level car park where we used a technique of ventilated façade, using louvers and rain screens. And addition to this every elevation, we have a concept of tree growing from ground till the top of the building. This particular aspect making it unique the building become unique in the space I think it may be the first in the country we tried something like that.

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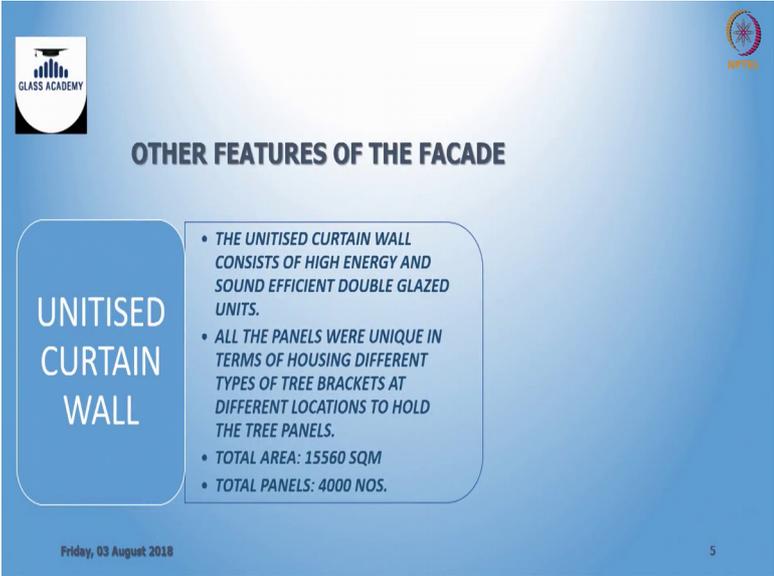
SALIENT FEATURE OF FACADE

This project is a landmark project not only in Kochi but in India because of its unique façade which consists of double walled tree structure. This unique façade is well conceived by one of the famous & leading architects in Bangalore which is safely designed & well executed.

Friday, 03 August 2018 4

Going for the project details, we have a big project having around 1.5 million square feet space. Out of which around 1 million is for commercial purpose and 1 floor is fully dedicated for common space food court and all and the lower areas dedicated for parking, it is good for around thousand car parking.

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OTHER FEATURES OF THE FACADE

UNITISED CURTAIN WALL

- THE UNITISED CURTAIN WALL CONSISTS OF HIGH ENERGY AND SOUND EFFICIENT DOUBLE GLAZED UNITS.
- ALL THE PANELS WERE UNIQUE IN TERMS OF HOUSING DIFFERENT TYPES OF TREE BRACKETS AT DIFFERENT LOCATIONS TO HOLD THE TREE PANELS.
- TOTAL AREA: 15560 SQM
- TOTAL PANELS: 4000 NOS.

Friday, 03 August 2018 5

So, coming to the features of the façade, we have a unitized curtain wall it is highly energy efficient facade and we have these are all panel designed in such a way that this can carry the load of the tree panels also.

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The slide features a blue background with a white box on the left containing the title 'SEMI-UNITISED GLAZING'. To the right, a white box contains technical details. A portrait of a man in a suit is positioned in the bottom right corner. Logos for 'GLASS ACADEMY' and 'NPTEL' are in the top left and right corners, respectively. The date 'Friday, 03 August 2018' is at the bottom left.

SEMI-UNITISED GLAZING

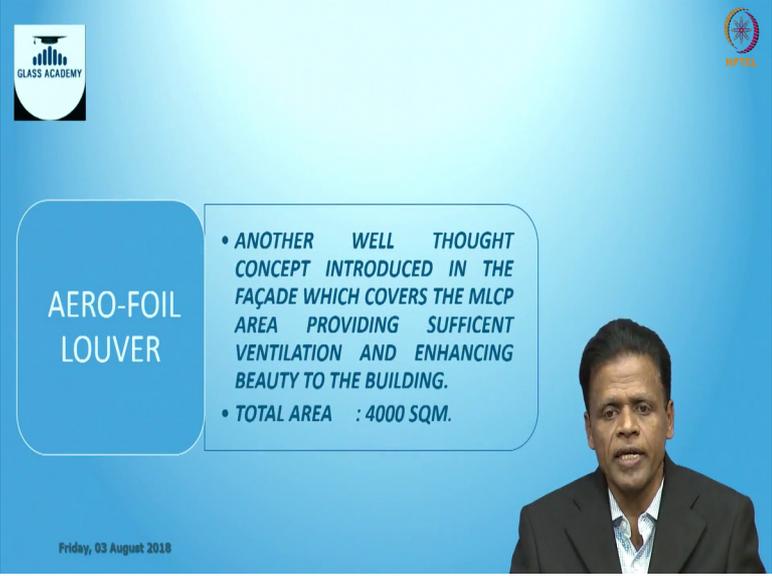
- THE SEMI-UNITISED GLAZING IS A PART OF FAÇADE FORMING A WELL DEFINED GEOMETRY AND COVERS THE MLCP (MULTI LEVEL CAR PARKING) AREA. 10 MM THICK CERAMIC FRITTED GLASS USED BLENDS WELL WITH THE OTHER FAÇADE ELEMENTS AND PROVIDES BOTH WELL LIT AREA AND PRIVACY TO THE BUILDING.
- TOTAL AREA : 3725 SQM.
- NO. OF PANELS : 1600 NOS.

Friday, 03 August 2018

If you see further slides we have trees which is designed growing from ground, but it actually it is not touching the ground. So, the panel from ground till the roof is attached to the facade and each panel around 3 metre high or floor to floor high is hanging from the facade. So, it is not the construction technique of building one above the other even though it is visually give an impression that it is built like that actually, but this 6 inch thickness tree panels are produced ant hank from the facade. So, facade design was also a challenge where it is to satisfy all the facade requirements and additional function of carrying these tree panels individually.

So, the challenge was very high because the unitized system itself we have to find the space to accommodate hidden brackets later which will be connected to the tree panels separately by brackets which will see in the time.

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GLASS ACADEMY

NPTEL

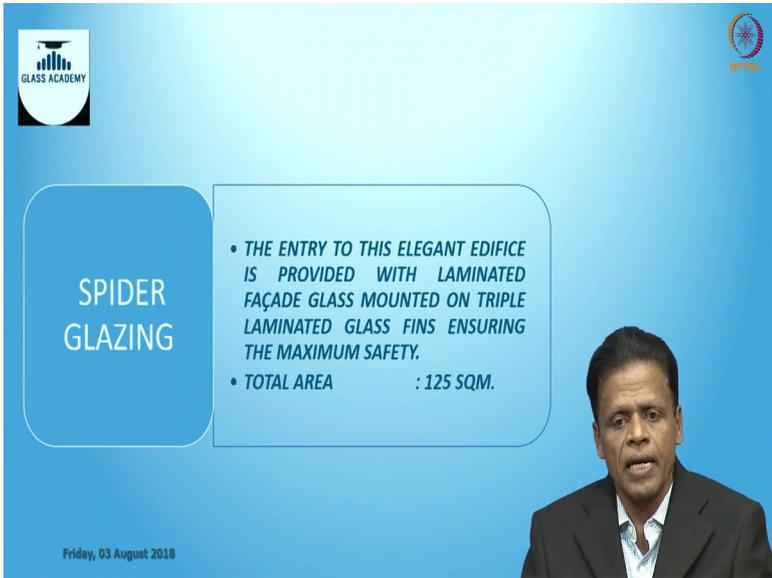
AERO-FOIL LOUVER

- ANOTHER WELL THOUGHT CONCEPT INTRODUCED IN THE FAÇADE WHICH COVERS THE MLCP AREA PROVIDING SUFFICIENT VENTILATION AND ENHANCING BEAUTY TO THE BUILDING.
- TOTAL AREA : 4000 SQM.

Friday, 03 August 2018

And in this MLCP area we split this building into 2 above 9th floor for commercial space with the façade, down 8th floor we have dedicated this for car parking and the requirements are also totally different where this area is not air conditioned area we need to have sufficient ventilation and light. For the bottom portion till 8th floor we design a normal curtain wall semi unitized where it is split into 3 different areas, one is rain screen having ceramic frit glasses, another one is Kalzip area where a special kind of cladding is provided to break the monotony of the building till 8th floor and we have aerofoil louvers which will ensure sufficient air circulation in the building.

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GLASS ACADEMY

NPTEL

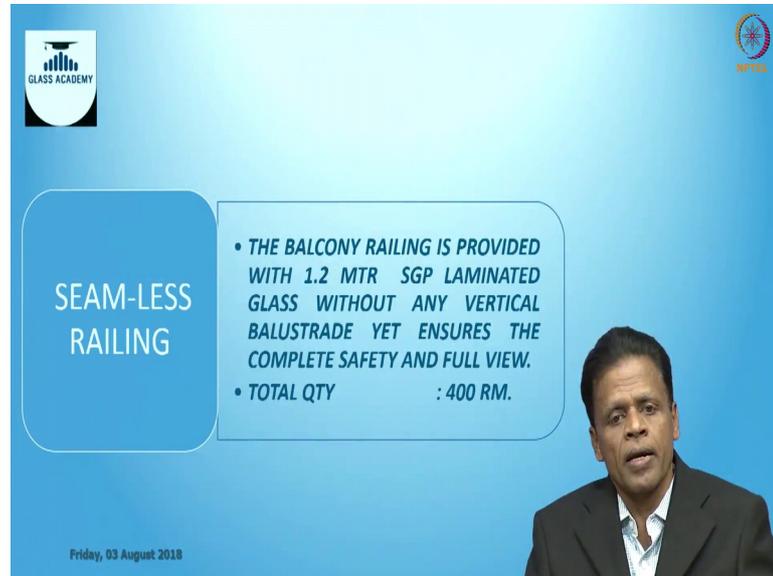
SPIDER GLAZING

- THE ENTRY TO THIS ELEGANT EDIFICE IS PROVIDED WITH LAMINATED FAÇADE GLASS MOUNTED ON TRIPLE LAMINATED GLASS FINNS ENSURING THE MAXIMUM SAFETY.
- TOTAL AREA : 125 SQM.

Friday, 03 August 2018

And there is a special entrance for the building which is lights is attached in the next slides it is giving a very grand look for the building.

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GLASS ACADEMY

NPTCL

SEAM-LESS RAILING

- THE BALCONY RAILING IS PROVIDED WITH 1.2 MTR SGP LAMINATED GLASS WITHOUT ANY VERTICAL BALUSTRADE YET ENSURES THE COMPLETE SAFETY AND FULL VIEW.
- TOTAL QTY : 400 RM.

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And if you see the 8th floor it is almost like an open concept where 2 to 3 metre of the periphery is open for free movement, where it is given a railing which is totally frameless there is no vertical supports we call it as seamless railing.

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GLASS ACADEMY

NPTCL

QUANTITY SUMMARY

UNITISED GLAZING	: QTY – 15650 SQM.
TREE PANEL	: QTY – 5900 SQM.
SEMI-UNITISED GLAZING (RAIN-SCREEN)	: QTY – 3725 SQM.
AERO-FOIL LOUVER	: QTY – 4000 SQM.
KALZIP CLADDING	: QTY – 1100 SQM.
SPIDER GLAZING	: QTY – 125 SQM.
SEAMLESS RAILING	: QTY – 400 RM.

Friday, 03 August 2018

The slide features a blue background with a white speaker overlay in the bottom right corner. The text is presented in a clean, sans-serif font.

If you see the quantity summary, the building is provided with around 16000 square metre of unitized glazing we have tree panel of around 6000 square metre. It comprises

of 16 trees growing from ground to terrace and we have semi unitized glazing which is for the lower area in that we have 3700 square metre of rain screen, we have around 4000 square metre of aero-foil louver and there is a additional Kalzip cladding of around 1100 square metre.

And you will see the entrance that grand look is given by providing around 125 square metre of spider glazing and we have almost 400 running metre of seamless railing around the building periphery at 8th floor.

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This is a unitized building from 9th to 19th floor is a normal unitized building the entire area is cladded with vision panel and spanel panel only the difference in design is every panel or wherever it is required a provision is given in the form of hidden brackets. So, the extrusion design itself taken care of that space and the special space is given the shape of an Z, which can carry the hidden brackets later this will be connected to the tree panels.

This tree panels are around 2 feet away and if you see the branches, this branches should not touch each other means it should not coincide each other. So, if you see the trees every alternate tree is researched by 150 mm. So, the inner tree is at a 600 mm distance from the building and the outer tree is 750 mm difference 150mm being the thickness of the panels.

So, we have 2 type of trees, were inner trees are 600 mm away and the outer trees are 750 mm away and few see the branches of this adjacent trees are going and touching each other it will overlap, it will not coincide each other. And each tree panels are 150 thick and here special kind of extrusions are made to provide this lightweight tree structure and surprisingly this particular tree panels are also all unitized construction.

There is a frame all around giving provisions for bonding with the outer skin and inner skin. And this skin construction is by solid aluminium sheet of 3 milli metre, which is percolated with 25 year warrantied powder.

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This is the tree panels if you see we call it up to 8th floor we call it as tree trunk, since it is starting from ground and from this slide you can see is around 3 metre wide bottom which is not touching on the ground we are leaving a space for the free movement, every tree panel can move a little bit, every panel is attached to the respective area either on the unitised panel or semi unitised panel, special care is taken for this particular purpose.

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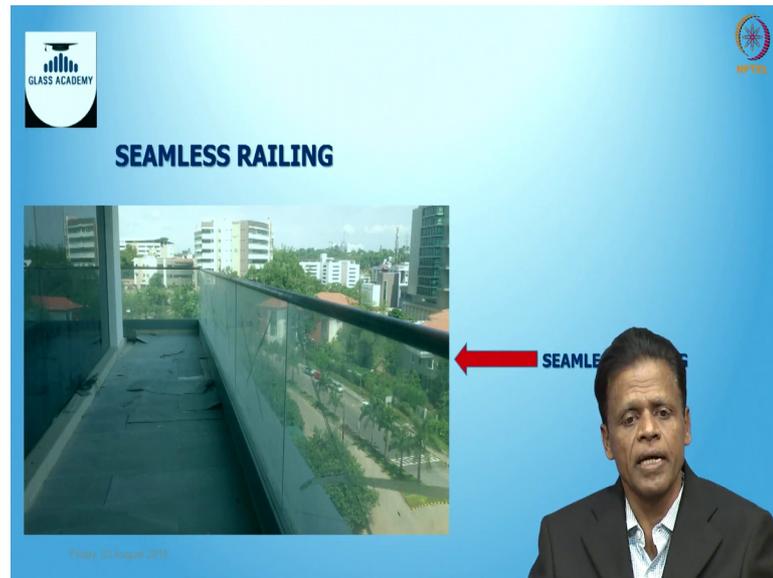
You see semi unitized area till 8th floor split into 3, we have rain screen with ceramic frit glasses, we have kalzip cladding all around to break the monotony and we have aerofoil louver to give sufficient ventilation.

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And you see the spider glazing earlier I told there is grand entry to the building providing with the help of glass pins and we have not used any metal members there it is with the glass pin and spiders.

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This is the one which is the given all around the building seamless railing were vertical balustrades is not used, that top member is just to hide the lamination these are all 17.52 centri pvb laminated glasses and each glass is structurally cantilevered from the bottom and bottom there is a hidden wedge which is around 150 mm deep which is hidden in the up stand, this 150 mm will carry the glass and it is free standing.

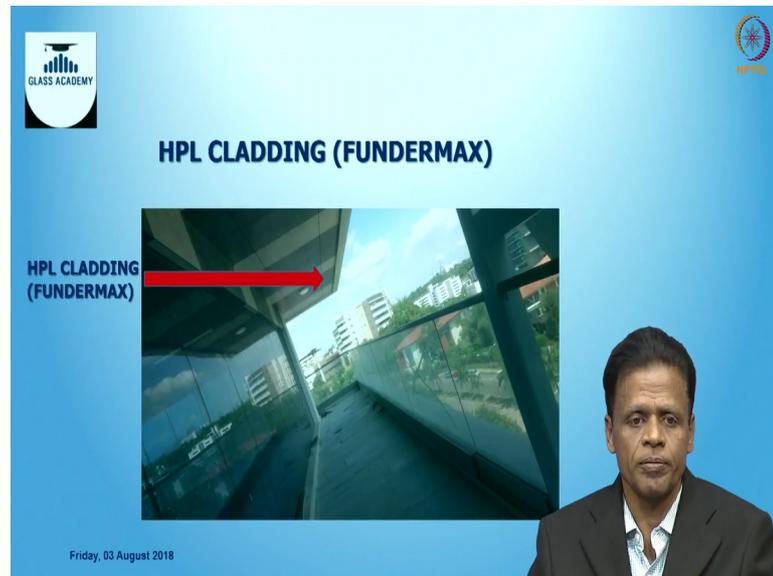
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This you channel is the provided for the resourced area since it is a resourced area there is no system used, it is not unitized or semi unitized here we have used simple you

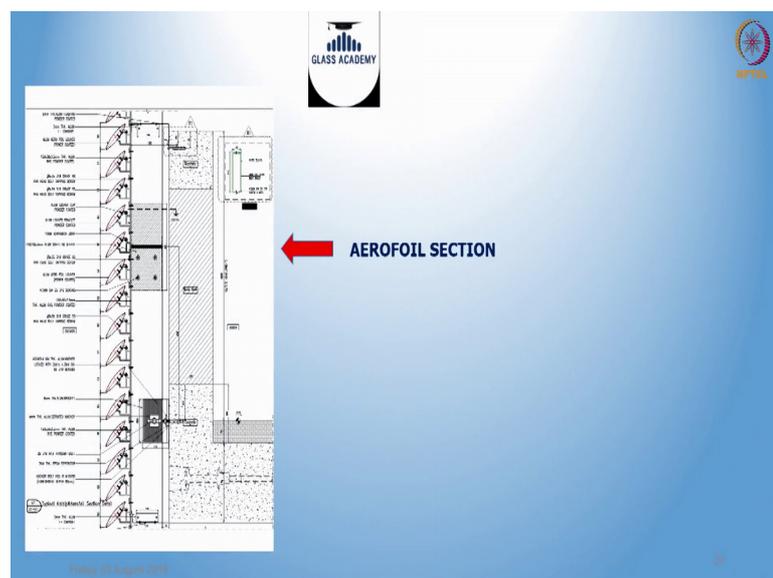
channel top and bottom which is almost a hidden from the elevation and this area is for the food court of the building.

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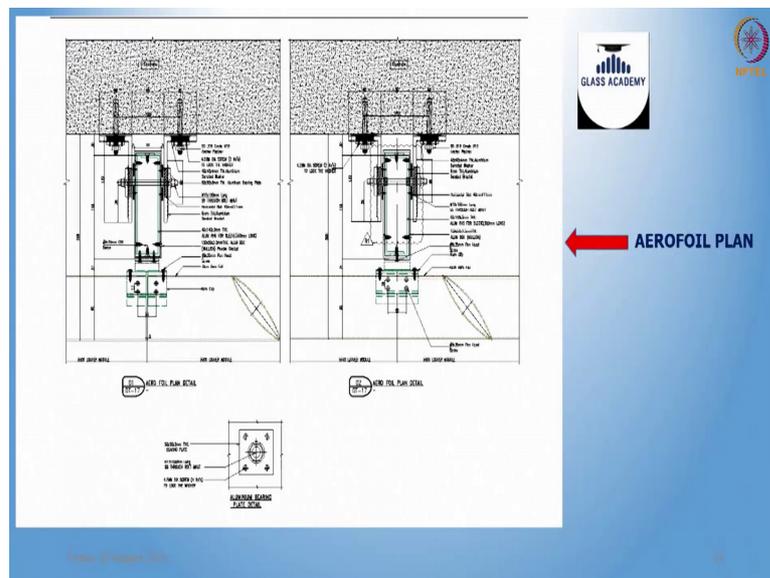
And if you see the difference that resourced area ceiling all around the building since it is stands for water entry or moisture we have used HPL this used social product of fundermax used here.

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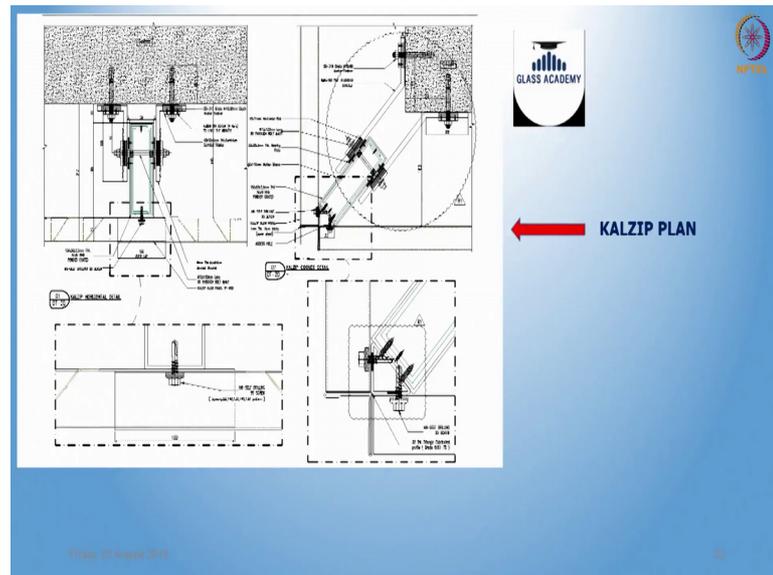
And you go to the details of every sections, this is the aerofoil louver were every floor it is given for a round 1 metre width all around for the parking space means in the MLCP area where sufficient light and air circulation is ensure. And this is a special kind of louvers design for this particular purpose, no fixing mechanism will be visible to the outside everything is hidden, lot of designs gone into this special kind of hidden brackets design extrusion design all fixing mechanism techniques are all such that when we look from the outside elevation it is a clean, nice look of the louvers of that particular shape and there is no even fixing screws or fixing mechanism visible outside. This is coming all around the building out of 3 metre floor height for the MLBP area around 1 metre is taking care to give sufficient air circulation.

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This is the fixing mechanism in plan if you see all the louvers are around 150 mm white with the help of hidden brackets and even fixing by the hidden cleats everything is special design we have not used anywhere this consultant I have given special care for this concealed designs.

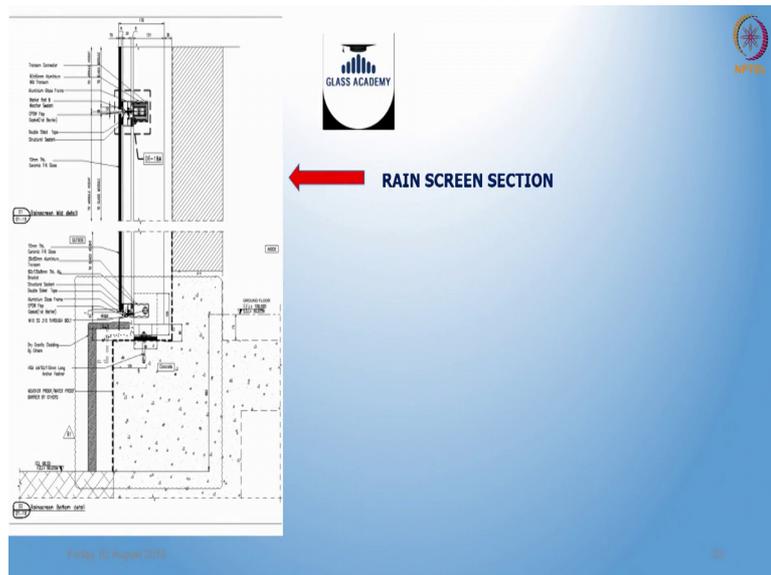
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Another aspect of this design is kalzip where rain screens are floor to floor were 1 metre louver is ensuring all the air circulation, the one metre area is taken care by a product kalzip which is like a little corrugated kind of facade which is adding aesthetic to the building.

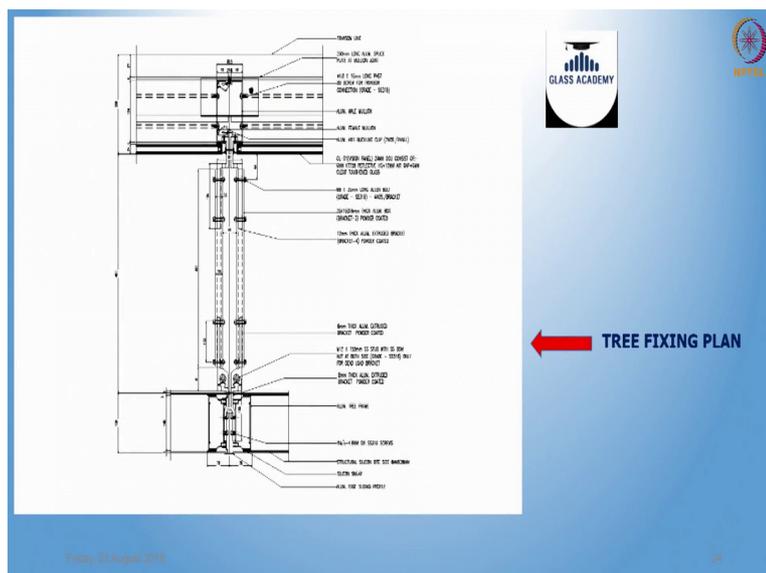
And it is breaking the monotony otherwise there have been a single level facade from top to bottom. If you see the details here also all similar fixing mechanisms are introduced where concealed type of brackets are fixed from the building and is a clip on system where no fixers or screws will be visible.

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Entire semi unitized area up to it for we want to call it is a rain screen where is giving protection from the rain, which measure is glass where we have used the here white ceramic frit glasses to give the white elegant look for the building for the bottom. So, every floor is split into 3 rain screen is there on top of that that 2 kalzip and aerofoil louver, the entire MLCP is lit inside sufficient light is given sufficient air circulation is given it is a aesthetically treated area.

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Coming back to tree we have a lot of things to discuss as I told earlier this particular tree panel lot of design aspects gone into this initially we thought of building one above the other later for the movement of the panels the facade consultant objected to have the concept of building one above the other. So, the concept of hanging from the unitized and semi unitized panels come into the picture, lot of design work is gone into this.

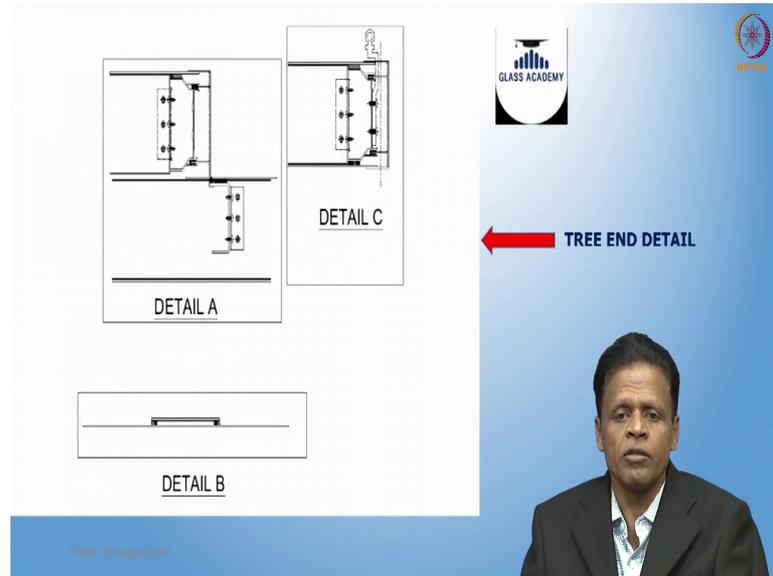
And the finally, we arrived a product where the each tree panel is also unitized almost like floor to floor in the shape of a diamond if you see the tree concept later I will come back every panel is a shape of a rhombus where floor to floor is taken care there is a specially designed extrusion all around the tree panel and the both side outer skin and inner skin both are 3 mm thick aluminium which is attached to the frame all around by the method of ligand bonding only.

So, it is also a structurally bonded structurally glazed tree panels. And the concept of modular concept is used here this also surprisingly this particular design even though showing very lightweight structure. Each square metre of this design consists of around 30 kilogram of aluminium where the all around perimeter sections also aluminium we have 3 mm thick aluminium skins structurally bonded to this.

And lot of stiffness are given inside which is hidden to avoid waviness. So, if you see the building elevation is around straight and there is no waviness at all this we achieved because of the hidden stiffener inside. This is the plan for this if you see unitized panels for the building facade having a provision of taking hidden brackets in the shape of Z, which is around 200 mm it is coming out first during the panel fixing stages later, 600 long hollow aluminium thick boxes which will be inserted to this hidden brackets.

And bolting there and coming back to the tree panel each tree panel also fixing with coming to this site from the factory with hidden brackets which will be also inserted inside this particular hollow boxes and bolting there and flexibility is kept there for alignment purposes. This is the each tree is produced if you see in a tree panels are around 600 mm away where the boxes same fixing mechanism is provided for the both inner and outer tree only the differences is in length of this particular connecting brackets it will be either 600 or 750. This sketch shows the particular horizontal sectional view or sectional plan of tree sectional plan of facade unitized panel above 90 above 8th floor and the clear cut connection details between them.

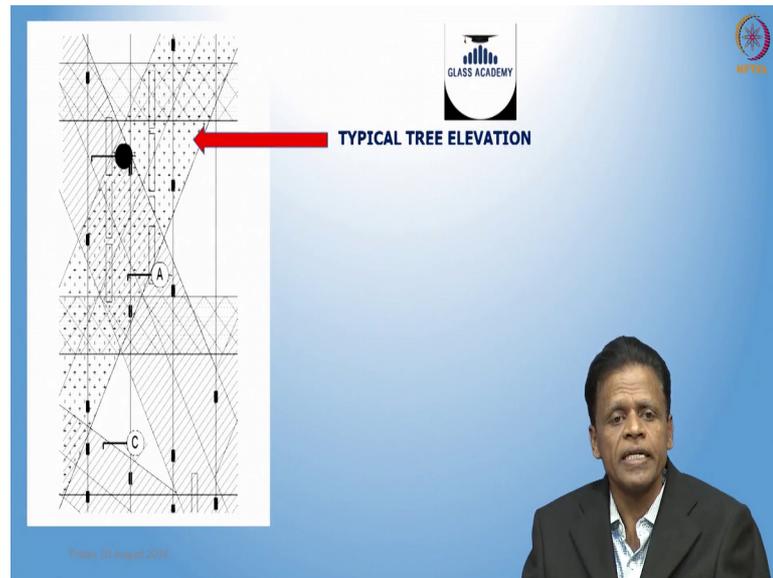
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This is the details of the tree where 150 you can see it is 6 inches trees, there is a hollow section little stepped running all around which is connected together with the help of corner plates and space is created for bonding the 3 mm thick aluminium sheets it is structurally bonded to the aluminium without any mechanical fixtures, after all bonding after erection at site the entire exposed edges of the tree is provided with the capping to make the look very neat and clean.

So, if you see the at site now entire exposed periphery of the tree, tree trunks and tree branches is completely it is closed with a special kind of special kind of cap which can see in the sketches.

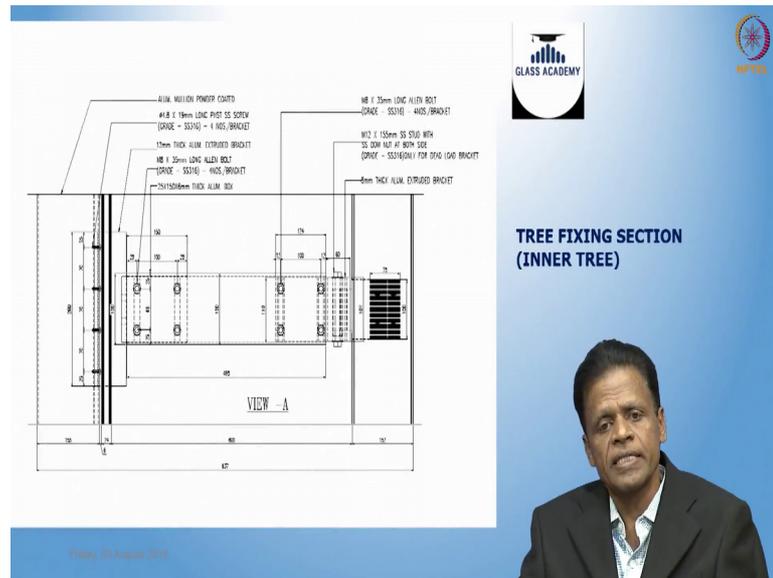
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This is the details elevation work 2 tree panels are going crisscross as I told you this 2 tree panels are touching each other, but not coinciding or not hitting each other the reason is the alternate tree panels are designed having a distance of 150 mm, 150 mm is the thickness of the tree panel. So, inner tree panel and outer tree panel is overlapping each other like this not hitting each other like this.

So, this design is same, construction is same, only thing is the connection distance between the building to this tree is varying by 150 mm is a particular elevation were tree shown separately that shaded portion is actually the common area, where one tree is overlapping through the front side of the other tree.

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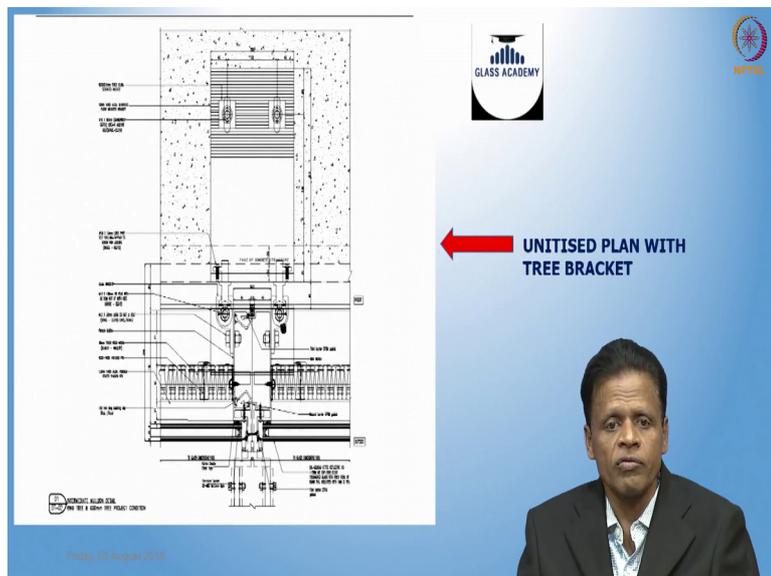
This is a sectional view of the tree panel where as I told you hidden is at brackets are given on the unitized panel from there a reasonably heavy aluminium specially extruded sections are taken and it is hollow which you can hide. This brackets the brackets will be slipped into it and with the help of ss bolt it is kept in position, you see the tree side here right side; this hidden brackets are given inside the tree during the construction itself. The provision of connection is already given that particular specially designed brackets are going inside this aluminium heavy box sections, again they are with the help of 4 bolts this is kept in position and here all connections we kept flexibility in the connection for alignment purposes.

This is actually if you really see to with this is the inner tree were exactly the inner edge of the tree is 600 milli away from the building, this 600 millimetre is also a thought out process after completion of the building for playing purposes people have to go inside this tree panels. So, a player space of 2 feet is provided for this there a technique of cleaning the tree panels.

And facade is by the spider man technique where hooks are given on top movable hooks are given on top people will be going through the space of 600 mm and will be a cleaning the building facade and the rear side of the tree panel. And to clean the front side of the tree panel top there is building cleaning mechanism is given where freely they can come and clean the front face of the tree.

Again this is outer tree where it is at clearly shows 750 construction is same, brackets are same, provision taken from the unitized facade is the same, connection at the tree level is the same, only the difference is the length of the connection bracket. This is a construction showing both tree panels are coming in one particular section where it is crossing each other or I will say overlapping each other, where we can see double tree brackets are given here hidden brackets are there the bracket from the building coming and holding each tree panel individually.

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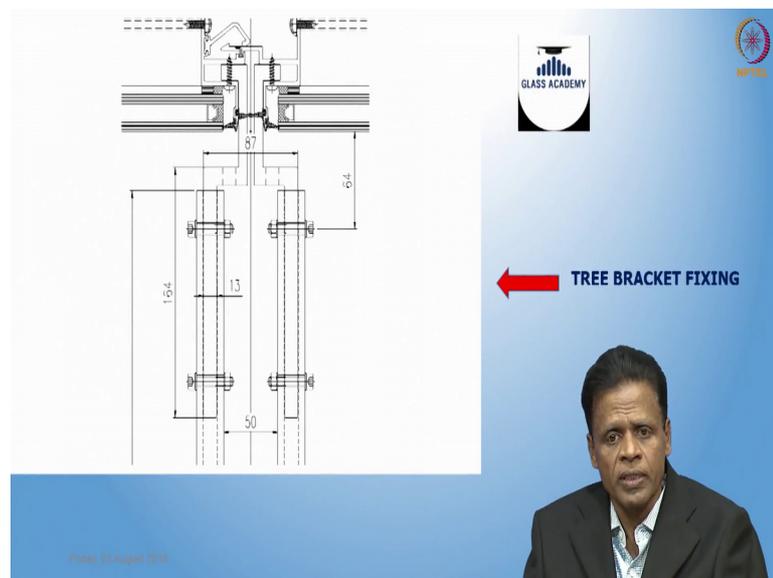
As I told you earlier this particular design and a challenge of finding a unitized panel or the design of the unitized panel also had the challenge of designing something which have the flexibility of carrying the tree panel. So, if you see the unitized construction the mullions, where male mullion and female mullion already a space is created in the front side which can take this Z bracket it is very clearly shown in the sectional plan. The Z bracket which is hidden and house within the mullion and with the help of I think around 8 screws, this particular brackets are secured to the unitized mullions were male mullion and female mullion.

And this particular building if you see we have around 4000 numbers of unitized panel above 8th floor, even though the building shows typical panels every panel become unique or different because of this bracket position, every unitized panel is 1.1 metre by 4.2 metre is counted separately because every panel have it is provision for this brackets

at different locations. So, every panel is numbered serial wise and in any unitized construction the advantage is standardization, one particular notation we will have 1000 panels or 500, 2000, 2500 panels here. That technique we could not adopting because of this tricky situation of tree bracket positions. Every tree bracket positions is mapped from the scaled drawing and numbering of the tree and panels is done accordingly.

The challenge was sending the panels without this bracket if you attach this bracket before in the factory itself then transportation is going to be a tricky affair. So, provision is created it is marked and this panels sent to the site with particular notation and this brackets are fixed at site after receiving at site otherwise we could not transport this panel safely.

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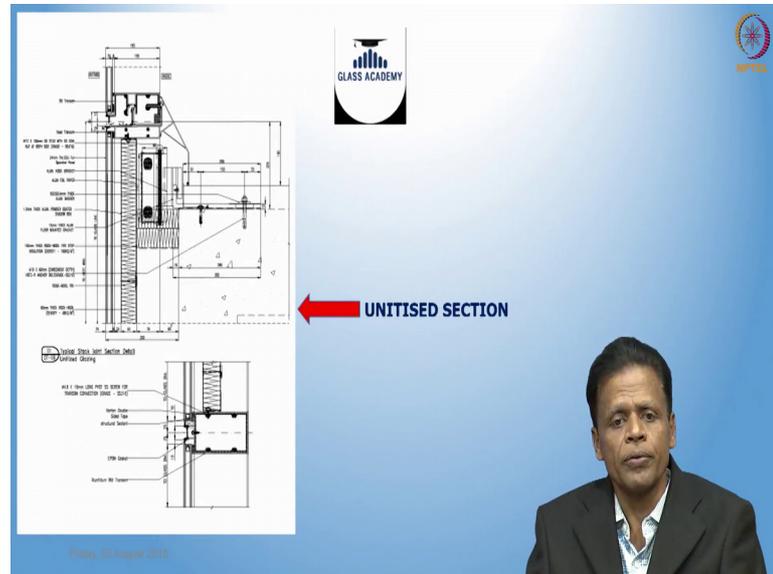


And coming back to this is a very clear cut blow up of tree bracket fixing, starting from the front side of the mullion unitized male and female mullions. We see that particular space created for Z bracket it is come from there.

And both side we have hidden brackets Z shaped, which is secured that space is created almost to house this bracket sufficiently it is a tight fit actually. Addition to that we have hidden screws before putting those gaskets we have hidden screws to make it more secure to the mullion and the brackets are coming out. And it is already giving the provision for receiving the heavy duty aluminium brackets you can see that very clearly. So, the Z bracket is coming up to 164 mm from the facade and it is giving a clear cut

provision to connect the hollow brackets in turn, which will be used to connect the brackets from the tree directly.

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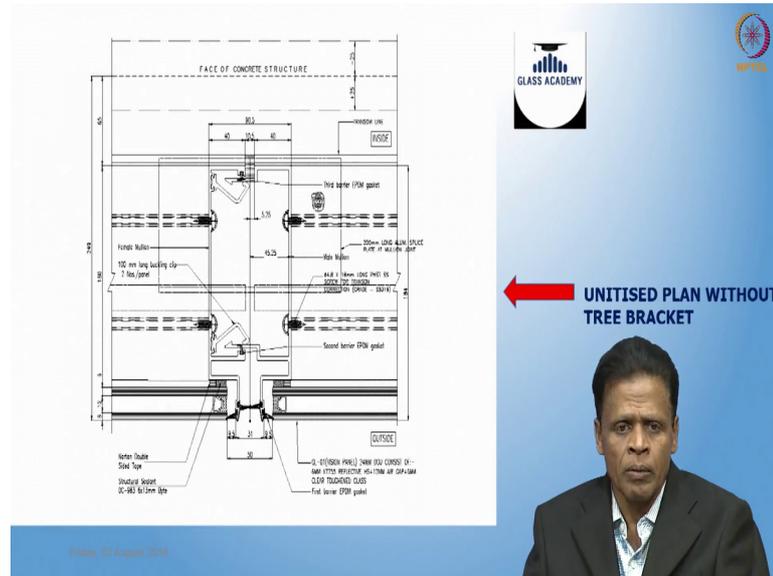


Is a particular unitized section were all the details are given here transom is a normal design, as I told you mullion is having special design because of this house in the bracket is a normal facade having around 200 and 20 deep mullions because of this additional load of the tree. If you see the building around 25 percent of the building is shaded. So, the purpose of giving this tree is not only to give a different look for the building not only to address the aesthetic issue it is a additional responsibility of giving a shading to the building.

Here there is no other shading elements there is no louvers provided, there is no chajjas provided. So, the shading function of the building is done by this tree panels only, around 25 percent of the entire facade all around is taken care by tree panel which give sufficient shading to the building at the same time since we used sufficiently open light transmission glasses I think the glass used is light transmission around 54 percent.

So, if you see any part of the building we have sufficient lighting in the building, we have around 300 to 400 lux level anywhere which is the requirement of the it space. This particular phase will be used for commercial purposes above 9th floor is fully for commercial purpose only we have one million square feet and below portion as I told you earlier it is for the parking purposes.

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This is a particular section showing normal construction of a unitized panel construction where mullions are shown with anti buckling clips on both side, where sufficiently heavy duty mullions are provided. This is a particular section where we cannot see any tree panels because many mullions are there is no provision of tree is required at all.

So, this is in area where there is no tree brackets still the space provided for this is there, suppose the tree panels is coming immediately we are to insert a Z bracket through that space you have to secure that with the screws and later connection has to be taken. Areas once again the most important was the unitized construction usually unitized construction will take around 8 kilogram of aluminium per square metre. Here it was a little heavy duty we have consumed around 10 kilogram per square metre of aluminium because of the tree panels every tree is sufficient provision given for moving and every trees not touching each other it is like a earthquake safe design also unitised panel is given tree panel is given in the bottom site semi unitized area.

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And later this client is coming with a wonderful lighting details which is not provided till date, they are options are explored every tree will be lit from inside. So, there will be different at night we will see different look for the building that was an added advantage of this building, at you will see different building for different days it is different light concept is used where edge is not incorporated now.

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The challenge was to have a building with a dummy facade which first time in the country we were also very sceptical about taking this challenge because we have seen

buildings in the Europe with total area enclosed double wall construction, but that purpose is not utilised here. It is an open concept and it is not touching the ground every the client have desired to have this panels not loading on the ground. So, every panel is attached to the unitised area without touching the ground the design was so challenging because of the shape every panel is different going upward inclination and size of the panel changing.

So, numbering also if you see every panel around 2003 panels are different only even every tree is different the standardization is not used at all here and the other specialities about rain screen we have kalzip and this building took around 8 months for the facade to construct. Initially the client decided to have this in 6 months time because of the design challenges initially we lost lot of time and finally, the building completed in 8 months time. The client was very happy about this completion because of this different concept a lot of people are thinking about double wall construction now having a full fledged double wall construction where the entire ambience is controlled because of this, but here the purpose is not that that technique is not utilised only what advantage we got is for shading around 25 percent of the building is shaded.

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Summary:

By the end of this video, you have learnt about:

- Case study of Lulu cyber tower 2, Kochi, India
- Salient features:
 - Unitized curtain wall
 - Semi-unitized glazing
 - Aero foil louver
 - Spider glazing
 - Seamless railing

