Glass in buildings : Design and Application
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Lecture – 59
Structural Design of Facades

Good day to all I am Sreelakshmi structural engineer and I would like to thank glass academy for giving me this opportunity to present the structural design of facades. So, basically today we will be covering the topics of types of facades codes of practice for the design of the facades loads for which the facade has to be designed.

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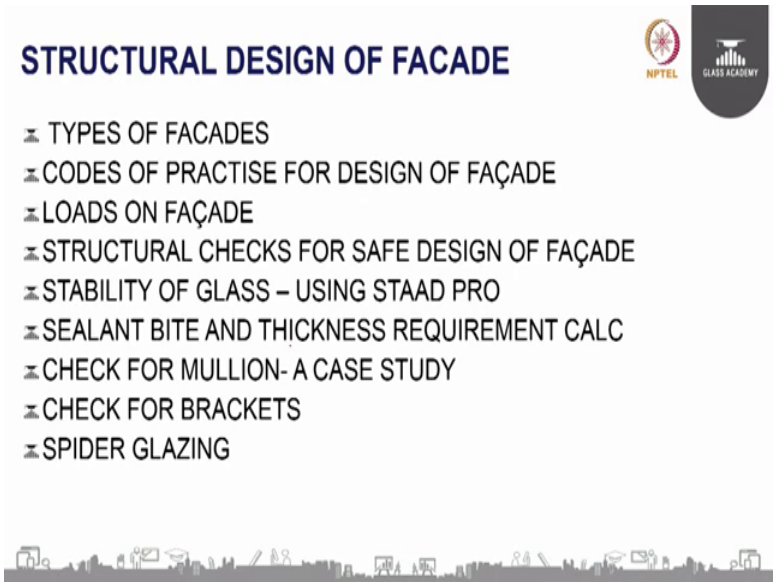

And the structural checks for the safe design of the facade, stability of the glass using the finite elements of software such as STAAD pro sealant bite and thickness requirement for in the facade the calculations. And the check for the mullion- a case study check for the brackets and spider glazing the types of facades.

So, let us begin with.

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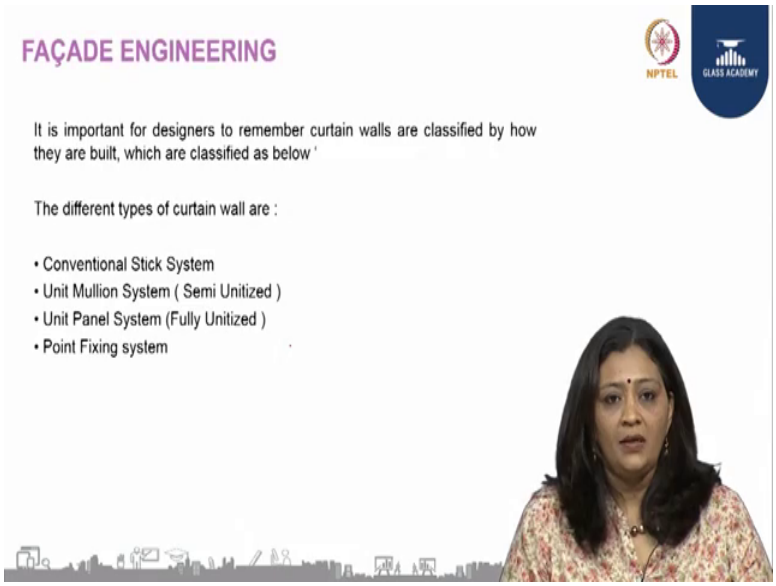

So, it is very important for the designers or the persons who is dealing with the curtain walls or to know the different types of the curtain walls used in the industry. So, there are mainly the curtain wall has been classified as the three types that is the conventional stick system. So, a semi unitized glazing, unitized glazing and point fixed systems tension rod cable systems etcetera.

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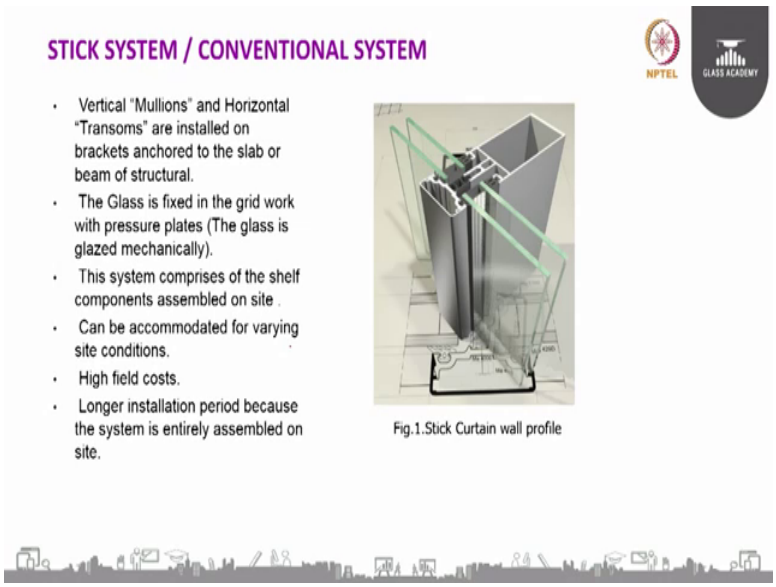

So, to brief with the stick system, in the stick system the vertical mullions and the horizontal transoms are installed and it is bind or installed and its anchored onto the slab.

So, the glass is fixed, the glass is fix with the pressure plates and all these assemblies are done at the site so this the stick system is specially is completely the site oriented work.

So, where in it is very hard to achieve the standards, which has to be maintained so, and it takes the longer installation period because the system is completely assembled in the site.

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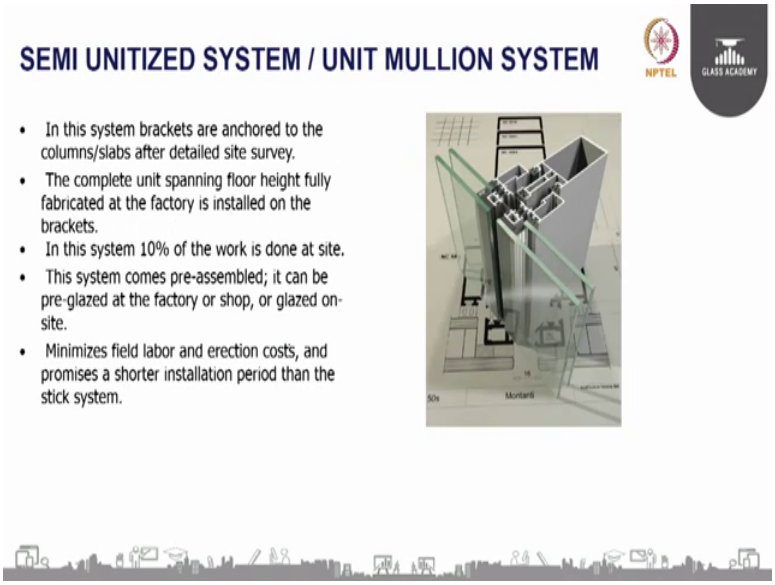

Second is the semi unitized system; in the semi unitized system so, the anchors are pre installed that is the anchors and the brackets are installed at site on the slabs or the supporting main structure.

And the whole panel is assembled that is the millions the transoms are assembled at the factory and installed at site. Whereas, the glass is installed at site on these panels that is when compared to the stick system so, only the 90 only the 10 percent of work is done at site. We have since all the panels are assembled at the factory it is the quality can be achieved, but still the glass panels has been installed at site where in it is very difficult to achieve the quality when it comes to the glass installation.

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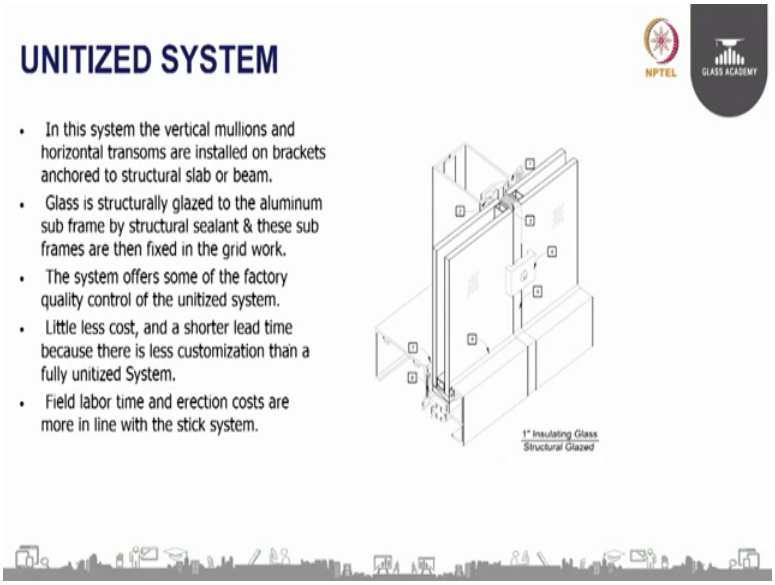

The unitized system is completely factory made that is it is also called as unit panel system. Where in the panels it is the panels are floor to floor height and these panels will be assembled at the factory along with the glass and brought to the site. And the anchors and the brackets are installed at are installed on to the supporting structure and the panels are installed on to the brackets.

So, in this the quality can be maintained and its very much less manual effort is required and also the labour time and erection cost are in line or more in line with the stick system.

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So, in the point fixed glazing the glasses the point fixed glazing or structure called laminated or tempered heat strength or heat strengthened any kind of as glasses is been fixed in the using the fixed point that is called the spiders. And these spiders are connected on to the glass films.

So, these systems are very long lead time and are proprietary in nature, manufacturer involvement early in the design process and is typical and defining ability components and structural capability so, we will be dealing with all these the structural calculation for all these types of glazings.

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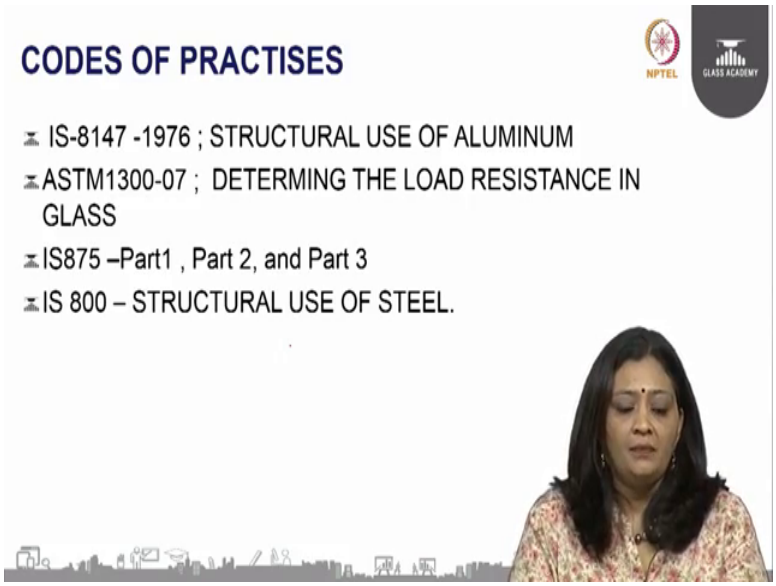

So, let us take up the codes of practices which are commonly used in the facade industry. To begin with it is the IS 8 Indian standard code of practice of a 875 part 1 part 2 part 3 which deals with the dead load live load and the wind load.

So, IS 8147, 1976 which is been especially designed for the structural use of aluminium and ASTM 130007 is determined the load resistance in the glass. And IS 800 is for the structural use of steel in the facades that is we will be making use of IS 800 in the design of the brackets and all the structural steel part which will be used in the facade.

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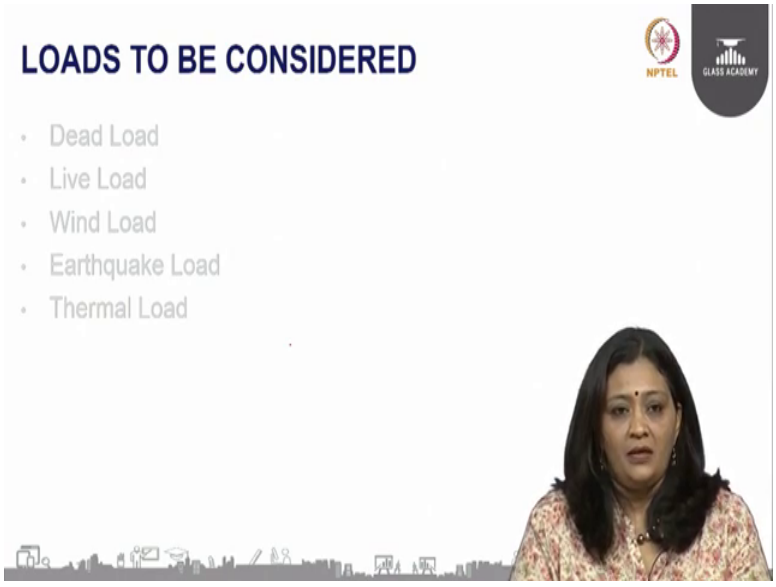

So, the loads to be considered while designing the facade; so, the first load will be the dead load which comprise of the self weight of the panels and the glass dead load these are the main dead loads which has to be considered in the design of the facade.

And live load; especially the live load normally in the vertical facades there will be no live load will be acting on the facade. So, it is only the BMU or the maintenance load which has to be considered as 75 kg per meter square or its 0.75 kilo Newton as a single point load which is already specified in the IS875 part 2.

So, the wind load, if the wind load has been specified for the project by the client or the architect or the structural consultants the same can be followed if thus the wind load has not been specified in the project. We can always determine the wind load acting on the facades using IS 875 part 3 that is Indian standard for to derive the wind load.

And apart from the above main dead load live load and the wind load the earthquake loads also has to be considered and also the thermal load depending on the location where the project is where the project is located. And apart from all these again these loads have to be considered along with the combined loadings that is the dead load, live load; dead load, live load, wind load, dead load, wind load and the dead load, earthquake load the thermal loads along with the dead load live load wind load. So, all these load combinations and the loads have to be followed as per the standard which has been set.

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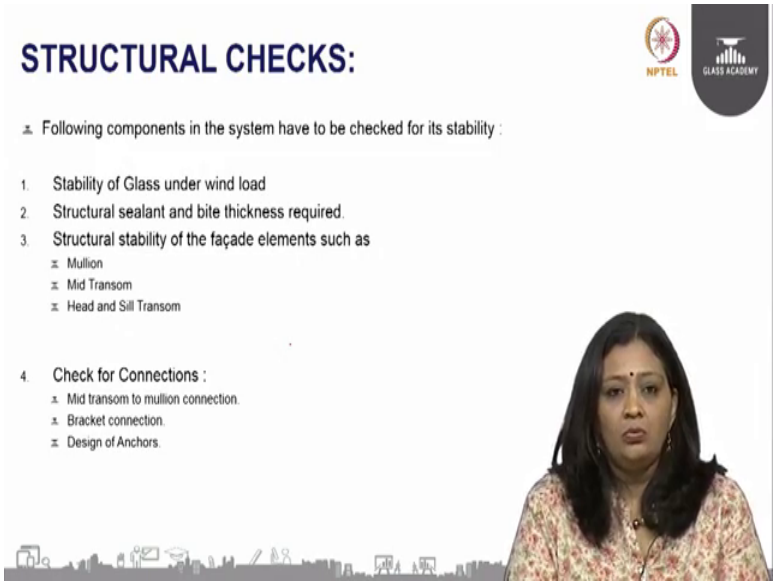

So, let us go to the structural checks mainly especially what we have to do to make sure that the facade is safe. The first check will be the stability of the glass under the wind load. The wind load is the main critical load which will be acting on the facades for which the glass is directly subjected to. So, we have to make sure that the glass panels are or the glass thickness which has been specified is structurally stable to carry the loads.

I think in the previous presentations you all might have explained how the glass thickness is very important and how the processing, the glass processing will help in the strength of will help in the increase in the strength of the glass. So, based on those factors the glass we have to design the glass for the wind load.

And then the next comes is the sealant and the sealant bite thickness requirement. So, after the glass and the sealant bite is designed we will go with the design of the facade elements those are the mullions, the transoms, the mid transoms, the head and sill transoms and the open able panels the size frame extra. All these has to be checked for all the loads that is especially the dead load and the wind load and if any live load is acting on the facade.

So, and after checking all the mullions the transoms and the mainly the structural elements of the facade panels. Then we will go with the checking of the connections that is how the transom is connected on to the mullion and how the loading is being transferred and how much, how many bolts or the screws are required to connect the transoms to the mullion.

And then the mullion is connected through the bracket on to the main structure where in the all the loads will be transferred onto the main supporting structure whether it is RCC or the steel or the slab or the beam whatever the main supporting structure the connection has to be designed which is very much critical. And if the facade, if the main with the mullion and is connected through the bracket and anchor onto the slab then the design of the anchors also has to be done based on the edge distance the loads being transferred the moment generated etcetera.

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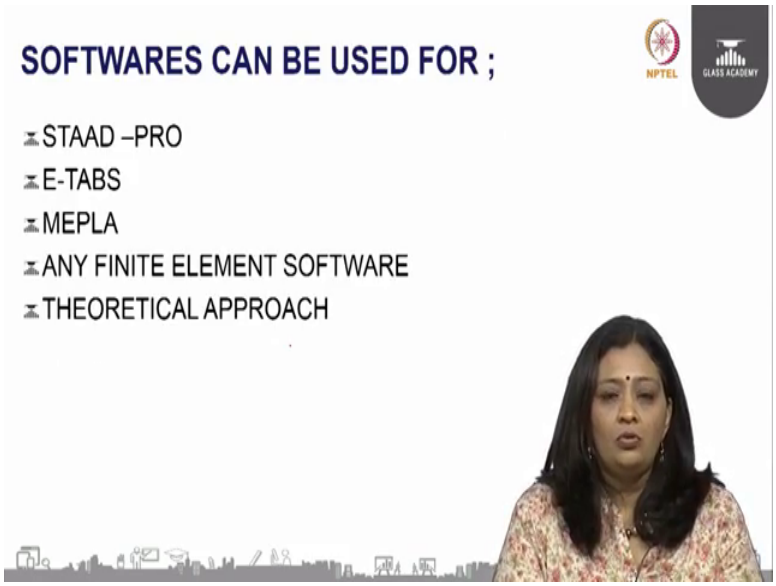

So, to design all these panels the structural glazing, unitized system so, the following software can be used such as STAAD pro E-TABS, MEPLA is completely onto the glass design software. Any kind of finite element softwares can be used to design the glass to design the unitized panels and if there is no approach for any softwares the above mentioned softwares you know always use the theoretical approach because the because the panels behave as a continuous a simply supported beam.

So, we can always go with the theoretical approach also which is not advisable if the panels are or if the geometry is quite complicated. So, but still we can always go with theoretical approach.

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