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DESIGN OF FACADE STRUCTURE.

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***Abstract*—This Facade is one of the most significant exterior elements for building functionality. Façades and building envelopes not only form the outer skin of buildings, but also project image and creative intent. The façade plays a critical role in the energy performance and interior function of a building. It protects the occupants from wind and rain and the extremes of temperature and humidity. The main objective undertaken in this project is the application of façade to the right side external part of selected site i.e Hostel A . The analysis and costing needed is discussed in detail as below. The another objective of project is to comparison between cladding and glazing , i.e ACP Sheets and glass and Tiles on the basis of cost.**

Keywords—Glass and steel Façade ,SIP and ACP ,Extream Loads, RFEM, VHB Tapes.

I. INTRODUCTION

The facade plays a critical role in the energy performance and interior function of a building. It protects the occupants from wind and rain and the extremes of temperature and humidity. It is also an essential part of the building's aesthetics, complementing the structural form and outlining its visual impact on the urban environment. As technology continues to improve, different options for improvement become available for incorporation into building facades. These elements are geared toward improvement of the performance of the building envelope.

Fig.1-Glass Facade

The term facade is generally defined as one exterior side of a building. The word facade is derived from French and literally means "frontage" or "face". From an engineering perspective, the facade of a building is also of great importance because of its impact on energy and environmental efficiency. Sustainable development calls for the creation of innovative facades that can harmonize the relationship between humans and the natural environment. The sun provides abundant energy to the earth; therefore, the impact of sunlight on facades and whether it should be reflected, absorbed or reutilized must be considered. Options for managing sunlight have become the focus of building environment research and building design and engineering. Facades that are ingeniously and properly designed can act as a link between the built environment and the natural environment. Hence, in addition to the functions of building facades.

I.1 Typs Of Facade System.

A wide variety of facade systems may be used in modern multi-storey buildings, which are:

- Brickwork and stonework (masonry)
- Curtain walling
- Precast concrete panels with various types of finishes
- Insulated render
- Metallic cladding
- Tiles and stone veneer panels Corrosive
- Glass and steel facade system.

I.2 Properties Of Facade Structure.

- Fire protection
- Lightning protection
- Sound insulation
- Rain Protection
- Protection against moisture and condensation
- Thermal Insulation

II. MATERIALS

Facade materials can be used by making the use of locally available material like glass and acp. In order to maximize the use of façade structure, a thorough study should be made accordingly. Some most commonly used materials are mentioned below.

A. Aluminium Composite Sheets (ACP)

Aluminium composite panels (ACP), made of aluminium composite material (ACM), are flat panels consisting of two thin coil-coated aluminium sheets bonded to a non-aluminium core. ACPs are frequently used for external cladding or facades of buildings, insulation, and signage. ACP is mainly used for external and internal architectural cladding or partitions, false ceilings, signage, machine coverings, container construction, etc. Applications of ACP are not limited to external building cladding, but can also be used in any form of cladding such as partitions, false ceilings, etc. ACP is also widely used within the signage industry as an alternative to heavier, more expensive substrates. ACP has been used as a light-weight but very sturdy material in construction, particularly for transient structures like trade show booths and similar temporary elements. It has recently also been adopted as a backing material for mounting fine art photography, often with an acrylic finish using processes like Diasec or other face-mounting techniques. ACP material has been used in famous structures as Spaceship Earth, VanDusen Botanical Garden, and the Leipzig branch of the German National Library.

Fig.2- ACP Sheets.

Types :-

- ACP (Aluminium composite panels)
- SIP (Structural insulated panels)

Characteristics of ACP :-

- Thermal resistance.
- Acoustic insulation.
- Mechanical properties.
- Fire behaviour.
- Impermiability.

B. Cladding Tiles-

Cladding is the covering of one material with another. It has different meanings depending on the context. In building construction, cladding may refer to the application of one material over another to provide a weather-proof layer intended to control the infiltration of weather elements.

Fig3- Wall Cladding

C. Glass Panals-

A hard, brittle substance, typically transparent or translucent, made by fusing sand with soda and lime and cooling rapidly. It is used to make windows, drinking containers, and other articles.

Types-

- Float glass.
- Safety laminated glass.
- Obscured glass.
- Annealed glass.
- Heat strengthened glass.
- Tempered glass.
- Insulated glass.
- Mirrored glass.
- Tinted glass

Properties of glass panels-

- Transparency
- Strength
- Workability
- Transmittance
- U value
- Recycle property

D. Aluminium Frames-

Aluminium frames are mainly made of aluminium metal as well as aluminium alloys. It functions as a supporting structure for different materials like ACP and glass panels.

E. VHB Tapes-

VHB tapes and silicon gel's main use is to act as a adhesion between the glass panels and aluminium frames.

Fig.4-VHB Tape

III. METHODOLOGY

Procedure for design of facade structure is given below. It consist of following stages.

- Site Selection.
- Analysis Of Selected Site.
- Load calculations.
- Software Analysis

A. Site Selection-

. We have selected 2 sites for implementation of façade.

- Hostel A Dr. Vithalrao Vikhe Patil College of Engineering. Ahmednagar , Maharashtra.
- Main building of Dr. Vithalrao Vikhe Patil College of Engineering Ahmednagar , Maharashtra

Fig.5-Hostel A (current status)

Analysis and load calculations for Hostel A of engineering college has been given below in details . All dimensions are taken from respective plan of building. Due to college security purpose we can not put plan in the paper.

B. Analysis Of Hostel A

- Type of building- Hostel 'A' Dr. Vithalrao Vikhe Patil College of Engineering.
- Total height of building – 10.15m.
- Location- Vilad ghat, Ahmednagar..
- Material used- ACP, Aluminium pipe.
- Size of Aluminium pipe- 1"X2"
- Thickness of Aluminium pipe- 5mm.
- Size of ACP sheet- 2'X2'.
  - Thickness of ACP sheet- 4mm.
  - Strata- Hard soil.
  - Unit weight of aluminium pipe-0.583Kg/M
  - Unit weight of aluminium panel-4.76Kg/M
  - Length of building- 29.29m
  - Height of building- 10.15m
  - No. of panel required-800

C. Load Calculations-

As facade is new invention the procedure of designing it. As per buero of Indian Standards IS875:1987 part 1,3 IS 456:2000, IS 1893:2002 is applicable. Load calculations for dead load , Wind load , and Seismic Load are required to made separately. Initially dead load of structure is calculated as per procedure given in IS 875:1987(part 1) ,Then as per procedure given in IS 875:1987 (part 3) total quantity Of Wind Load acting on structure is calculated. Finally calculations for Seismic load are done with the help of IS 1893:2002. These all loads are summed up and load acting on each floor is calculated . After this connections between aluminium frame and wall are designed by using procedure given in IS 800-2007.

D. Software Analysis-

In present study the design of façade structure is done by various software such as REVIT , RFEM is used. Here we used RFEM. RFEM is a 3D finite element analysis software working under Microsoft Windows computer operating systems. RFEM can be used for structural analysis and design of steel, concrete, timber, glass, membrane and tensile structures as well as for plant and mechanical engineering or dynamic analysis.

RFEM is Refine finite element analysis. In this software, use by using Commands we have to make a model then apply load as Per IS specification. Calculate loads analytically then apply gradually on software. Select the section as per analytical Calculation. take load multiplication factor as 1.5 .Choose the appropriate section in software and make model. After application 0f Load on model, section should be Safe in all Conditions. It should be satisfy all checks as per Is recommendations.

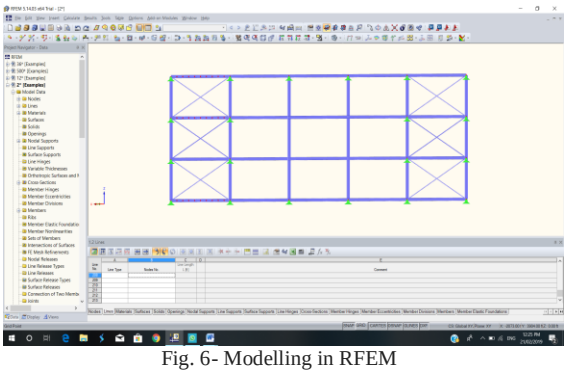

Fig. 6- Modelling in RFEM

IV. CONCLUSION

As we can see that the Facade structure are really developing in a rapid way. By taking into consideration the above, this research paper will provide basic data which will be required for the design of facade structure. After implementation of façade to the structure i.e. Hostel A, its aesthetic will improve as compare to today's look. The aesthetical view will modify into a better view as compared to today's appearance.

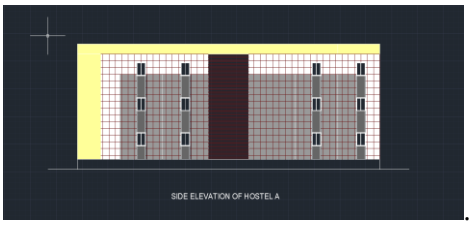

Fig7-Hostel-A (final output)

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