

Architectural Crafting Building Envelope Engineering

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Abstract — The building functions like a living organism, creating a controllable micro-ecosystem within an uncontrollable larger ecosystem to provide suitable living conditions. This metabolic process involves various components, including the façade. While façade design dates back to the earliest architectural creations, "Façade Engineering" is a relatively new scientific discipline, gaining importance due to concerns about building sustainability and climate change. This study uses a qualitative approach and content analysis to identify eight key groups of effective façade engineering components: Structure, Sociability, Material, Security, Physics, Management, Integrity, and Aesthetics, providing a basis for developing a conceptual framework. In this paper, we choose a case study of a building with a façade and conduct a cost analysis.

Keywords: Façade Engineering, Effective Components, Conceptual Framework, Building Envelope Design

I. INTRODUCTION

Facade engineering involves the design, construction, and maintenance of a building's outer envelope or skin. It is a multidisciplinary field that collaborates with architects, structural engineers, and others to create innovative building exteriors. The facade separates interior space from the external environment. Recent concepts have led to the emergence of "facade engineering" as an interdisciplinary discipline, envisioning building envelopes as spatial locations. Modern technologies make buildings dynamic and responsive to environmental changes. Facade engineering aims to treat buildings as live organisms, adapting to user needs. The concept is crucial for energy conservation, architectural education, reduction of visual pollution, promotion of sustainability, reduction of construction costs, and streamlining implementation processes. Despite these needs, an integrated approach to facade engineering is lacking in both theoretical and practical studies.

A. Objectives of Exterior Façade Engineering:

- 1) Cost-effectiveness for high-rise buildings: Exterior façade engineering aims to be budget-friendly for tall structures.
- 2) Simplified construction process: The goal is to make building exterior facades simple and easy.
- 3) Accessibility: Facade materials are easily available, making procurement and implementation straightforward.
- 4) Diverse options: Various exterior façade choices are offered to meet different design preferences.
- 5) Adaptability to structural design: Facades can be easily adjusted to match the specific structure's design.
- 6) Environmental sustainability: Focus is on eco-friendly practices in exterior façade engineering for sustainable construction.

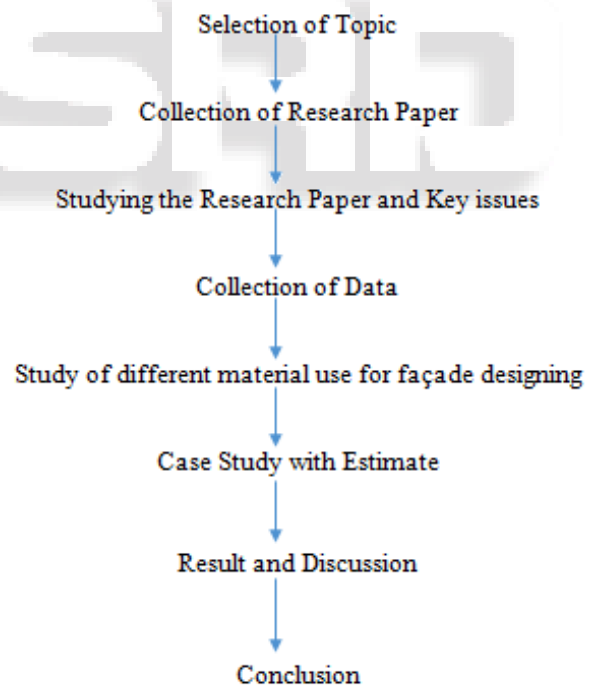
II. LITERATURE REVIEW

Most existing literature and experimental research focus on Structural Analysis, Effective Components of Façade Engineering, High-Performance Structural Elements, and Strategies for High-Performance façade design. The impact of Smart Materials on contemporary building facades has been a topic of discussion for many decades.

Incorporating modern technology, especially the potential of smart materials, has become essential for architecture and architectural design. This technology has led to significant changes in the design process, specifically in architectural facades, affecting entire buildings and their users. The theoretical framework is explored, and practical studies on a group of buildings have been conducted to validate these concepts.

III. MYTHOLOGY

A. Flow Chart



B. Material Used:

1) Concrete



Wood



Metal



Ceramic Cladding



Glass



IV. PROPOSED PROJECT (CASE STUDY)

In this building Single Glass Glazing was used for exterior façade designing. Below are the key features in designing

- 1) Structural Glazing- Single Glass Glazing
- 2) Saint Gobain 5mm Tranquil Blue Tempered Glass
- 3) Hunter Douglas Louvers
- 4) Aluminium Composite Panel
- 5) M. S. Fabrication

Roongta Business Centre was designed for Commercial use by Roongta Buildcon.

Address- Roongta Business Centre, Govind Nagar, Nashik
Construction Year- 2016-21

Exterior Designers- Alchemist Associate, Nashik



Technical Specification of Materials

1) ACP sheet- AL 45- 4mm THK Thickness and grades

Aludecor ACP sheet comes in 6mm, 4mm and 3mm with the aluminium coil thicknesses varying from 0.12mm to 0.5mm. Based on this, they are divided into different grades:

- AL-45 - 4mm panel with 0.5mm aluminium coil thickness, meant for exterior applications.
- AL-43 - 4mm panel with 0.25mm aluminium coil thickness, meant for exterior applications.
- AL-33 - 3mm panel with 0.25mm aluminium coil thickness, meant for both exterior and interior applications.
- AL-33D - 3mm panel with 0.3mm aluminium coil thickness, the aluminium alloy being AA3105, is meant for exterior applications, especially fascia and signage.
- AL-32 - 3mm panel with 0.20mm aluminium coil thickness, meant for interior applications.
- AL-312 - 3mm panel with 0.12mm aluminium coil thickness, meant for interior applications.
- AL-63 - 6mm panel with 0.25mm aluminium coil thickness, meant for both exterior and interior applications.

V. COST ANALYSIS

| Sr. No. | Description | Sq. Ft. | Rate | Total |
|---------|--------------------|----------|------|----------------|
| A | Structural glazing | 19343.94 | 290 | 56,09,742.60 |
| B | Acp sheet | 8284.12 | 210 | 17,39,665.20 |
| C | Louvers | 9931.28 | 280 | 27,80,758.40 |
| D | Ms fabrication | 41587 | 90 | 37,42,830.00 |
| E | Canopy | 7474.44 | 210 | 15,69,632.40 |
| TOTAL | | | | 1,54,42,628.60 |

VI. CONCLUSION

During the project, we examined various aspects such as exterior design, structural maintenance, and the overall aesthetic of the building. Exterior façade engineering is a comprehensive and intricate field that not only enhances the building's appearance but also influences its design. It proves to be an excellent solution for maintaining high-rise buildings, offering easy cleaning and sustained visual appeal over the years.

Additionally, exterior façades incorporate treatments to promote eco-friendliness and reduce reliance on non-renewable resources, contributing to a healthier environment for building occupants. The project involved a detailed exploration of different materials, considering factors like temperature regulation, natural light reflection, and minimizing light intensity to prevent issues in the future.

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