

### Faculty of Engineering

### Department of Architectural Engineering

# Managing Design and Implementation of Curtain Walls for High Rise Buildings

A Thesis submitted in partial fulfillment of the requirements of the degree of

Master of Science In Architectural Engineering

By

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# **Statement**

This thesis is submitted as a partial fulfillment of Master of ScienceinArchitectural Engineering Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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### **Thesis Summary**

Finishing the installation of the curtain walls through successive phases (design, manufacturing, implementation, maintenance) and each phase affected by the previous phases. Lack of communication between stakeholders (architect, consultant, structural engineer, client, faced engineer, manufacturing officials, contractor) leads to conflicting information leading to failure of curtain walls.

Problems in many curtain walls in the design, manufacture and implementation phases resulting from the absence of a framework that helps the project manager to make the appropriate decision when designing and implementing curtain walls.

The thesis deals with the study of the design phase and the implementation phase of the curtain walls and the factors affecting the performance of the curtain walls to try to reach a frame that helps the architect in making the design decisions and assisting the project manager in the implementation of the curtain walls to improve the performance of curtain walls by reviewing literature and analyzing case studies and interviewing engineers with experience in designing and implementing facades.

During the design phase, the curtain wall system is chosen according to the cost, quality, performance and appearance. The environmental conditions, the location of the project and the built-in orientation should be studied. The use of the checklist helps the designer achieve the performance requirements of the curtain walls, Wind resistance, air leakage resistance, water leak resistance, fire resistance, curtain wall maintenance and access). Checking and documenting the materials used for the curtain walls not only facilitates the work during the design phase, but also helps to improve the performance at all phases.

Organizing the site and setting a timetable for the implementation of the tasks of installation, documentation and control of the work from the delivery of parts of curtain walls to the site until the completion of installation leads to the success of the implementation phase. For each system has the special installation method recommended by the manufacturer to ensure the quality and safety of installation.

Any defect during the installation may lead to the failure of the system such as a complete leakage of water, air leakage and glass breaking resulting from the expansion of aluminum. The use of checklist during the implementation phase of the curtain walls helps to follow the progress of the work during the implementation phase, as well as the confirmation of receipt of all the necessary drawings to install and confirm the implementation as the required form in order to provide a suitable faced for building and capable of the following performance requirements:

- Water penetration resistance
- Air Infiltration Resistance
- Structurally adequate enough to transfer imposed loads back to the main structure.
- Energy Efficiency
- Aesthetics
- Durability and Ease of Maintenance
- Special Performance criteria including sound attenuation, fire resistance and blast resistance.

Documenting data and continuous communication among stakeholders during the life cycle of curtain walls helps to make decisions. Checklist is a workbook designed to ensure that design data is documented and the design quality is guaranteed according to project requirements, customer specifications. If the designer and project manager has a properly organized checklist, it will facilitate the design and implementation of all curtain walls and create a workflow that helps achieve the desired goals. A framework from the beginning of the selection and the start of the design work helps to reduce the failure of the curtain wall system resulting from the design phase and there is a framework that requires the designer to meet the performance requirements of the glass facade and ensure that the wall system is suitable for environmental factors and able to withstand the wind loads.

The thesis is divided into three chapters dealing with the first chapter of the study the types of curtain walls and the advantages of each system and its disadvantages and the details of the curtain walls (glass types, frame and sealant) that affect the performance of curtain walls and ways of classification of curtain walls according to (type of glass, installation inside the building or using scaffolding, frame type, assembly place at factory or site).

The second chapter deals with the life cycle of the curtain walls from the design phase, the manufacturing phase, the implementation phase to the maintenance phase and the tests necessary to verify the performance of the curtain walls during the manufacturing and implementation phase. The third chapter deals with the analysis of some cases of study (Neil Ritz Hotel, Saudi Embassy , Dar Al-Handasah and Capital Gate tower) and an interview with engineers with experience in the design and implementation of the facades to reach a checklist for the design and implementation.

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