

**An Approach for the Design of Building Envelope  
and Its Effect on Heat Transfer  
& Human Comfort in Buildings**

By

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# Abstract

The main idea of taking shelter for the human being across time was his protection, and under this concept came all the kinds of dangers surrounding him. For example, way back in the old time, this idea was basically taking shelter from wild animals and cruel weather conditions which man can't deal with. This idea developed across time till nowadays where buildings arise not only as shelters but also as public functional buildings.

After being a cave in a mountain in the old age, the shelter became buildings consisting of construction and finishing material, which were discovered and developed across time until it became possible for the owner and the designer of the building to finish it as he imagined it. This development passed through many stages, in which many designers and architects participated. Some of them participated in creating new styles; others participated in discovering and developing modern materials whether they were architectural or structural material. Also, some of them contributed with his architectural works until it became the heritage and civilization of their nations, as there are many buildings, which became civilized symbol of nations.

Despite passing through a great development till nowadays, this development had its advantages and disadvantages, as the development of architecture was correlated very much with the technological and constructional theories, in addition to the economical concepts development.

As technology and construction advanced, architectural construction, span development, liberty from traditional shapes and traditional finishing aroused. As an example, external facades treatment and finishing advanced; passing through different stages until it became possible to cover them totally with glazed surfaces, especially in administration buildings, without using any other material.

With this development, the increase in the materialized needs and the caring about financial profit, human needs of the spaces users were neglected, especially the weather conditions. Modern buildings with their modern treatments cause a great thermal load on the user to the extent that it became a must to use technological and mechanical ways to achieve the thermal comfort needed. This increased the post-occupation cost, the same time money dominated nations.

This affected on the buildings' designers. The designer neglected the environmental needs of the building to achieve the goal of the owners, which is the decrease of the building cost.

Determining the tools that enable architect to design external envelope of the building to achieve the required thermal comfort for the habitats, after being aesthetics became the only criterion in the design of the external envelope.

The research handles the concept of **An Approach for the Design of Building Envelope and Its Effect on Heat Transfer & Human Comfort in Buildings** to deduce optimum solutions in designing the external envelope for a building to achieve the thermal comfort of the users

In order to reach its final conclusion the research is divided into two parts:

**Theoretical Study:** (Four sections)

The 1<sup>st</sup> studies the development of architecture and the surrounding effects influencing it.

The 2<sup>nd</sup> studies the weather conditions and its factors and its effects on the external envelope of the building.

The 3<sup>rd</sup> studies the external envelope itself of the building and its elements.

The 4<sup>th</sup> studies the effect of the solar radiation on the external envelope of the building and calculating its thermal gain.

**Applied Field Study:** (Two sections)

The 1<sup>st</sup> studies the external openings according to its position, orientation, dimensions, areas and the usage of different shading ways.

The 2<sup>nd</sup> moves to an applied study to design an external envelope of a building in the city of Cairo.

The research concludes that the external envelope of buildings must be designed by architecture to achieve Human Comfort in buildings, and that envelope varies from site to another site according to the climatic conditions of each region.