

Constructive systems for glass domes with wide areas

"Application on Egypt Mosque"

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Summary

The last period has witnessed a major leap in technology and building materials, in addition to the rapid development in simulation techniques and modeling computer programs. Such sequential achievements have opened the door to a whole new world full of potentials in the field of building and constructions, so architects and designers get to have the ability to fulfil their imagination with creativity and innovation with little worries about the structural constraints.

Due to the high significance of building a new managerial capital for Egypt and what this capital must have of technological development in the means, methods and materials of construction, many of the modern religious buildings including “Egypt Cultural Complex” and “Egypt Mosque” have been submitted to a very distinctive artistic and architectural visions, also innovative methods in construction, the most important ones are the design of glass domes with wide areas for this mosque. We have noticed the presence of many distinctive ideas that require specialized constructional designs.

That is how **the research problem** has appeared:

Which is the need to create untraditional constructional methods and systems to process the suggested design thoughts for the domes of “Egypt Mosque”.

The research goal:

Reach scientific solutions for the constructive systems for glass domes with open areas.

Keywords: Wide areas- glass domes- constructive systems.

Types of metal constructional systems:

1- Iron frames system

It resembles steel frames but the used material in construction is iron.

2- Curved frames

There was a problem in this system at the point of connection between the frame and the dome, but it was solved due to technological development in constructions.

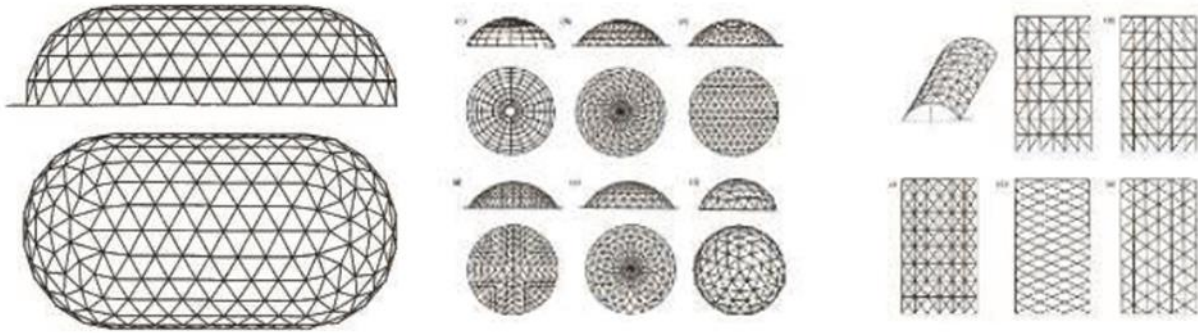
3- Shells system

- This system is designed using a concrete ceiling with small thickness and it takes up curved or rectangular shapes to reduce the weight on the ceiling, it could be used to cover up large areas.
- A concrete that is molded together and connected.
- It could be a previously made one that is assembled together using nails.

4- One direction metal frames constructions:

They are constructions relying on steel frames in forming the founding constructional structure. Such frames have many forms, pyramidal or triangular, they work as connecting elements that handle the axial pressure and strain as well as applied forces, but exterior forces are carried on connection points not on the frames themselves.

There is diversity in space frames according to the degree of curvature such as domes that are formed by bending frames in one direction which is cylinder or domes that are formed by frames bent around a center, also the merge between the dome and the cylindrical shape.



Shape (3) shows the merge between cylindrical shape and dome in the metal frames.

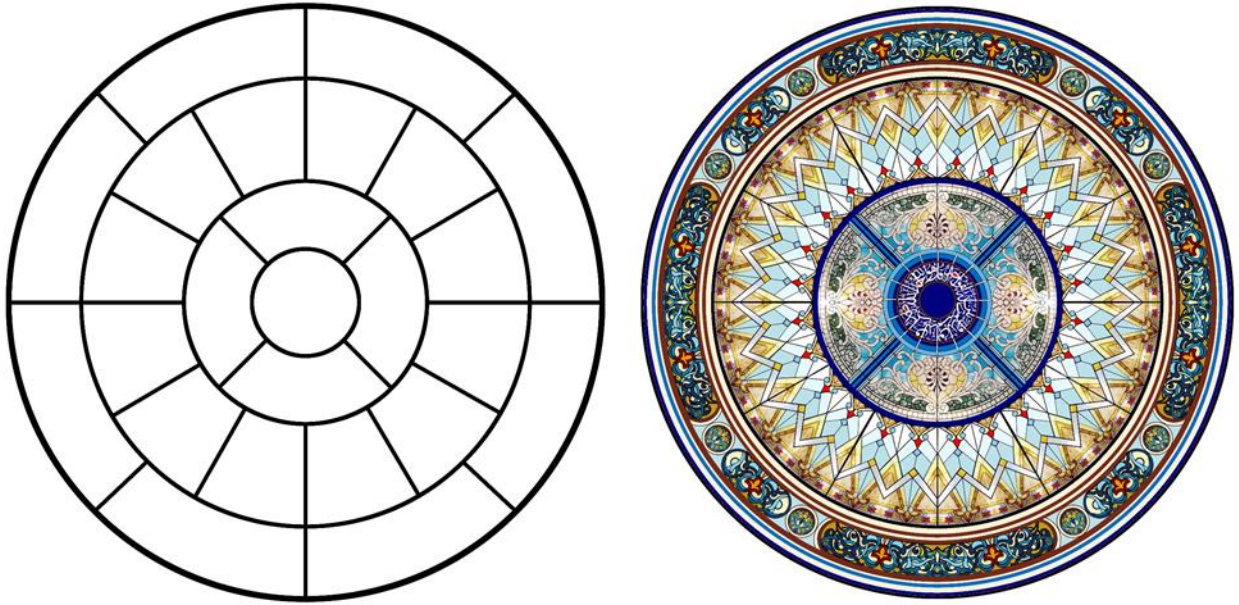
shape (2) shows metal frames in the shape of domes.

shape (1) shows cylindrical shape of the metal frame.

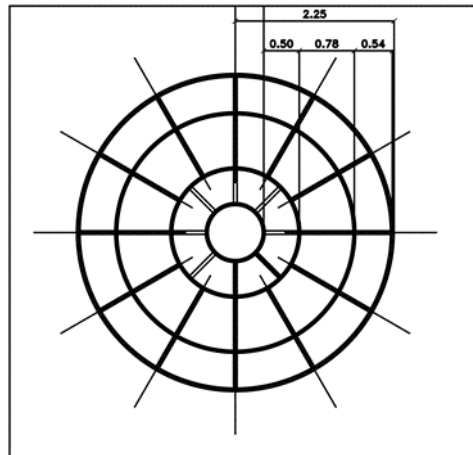
Applied study

Egypt Mosque

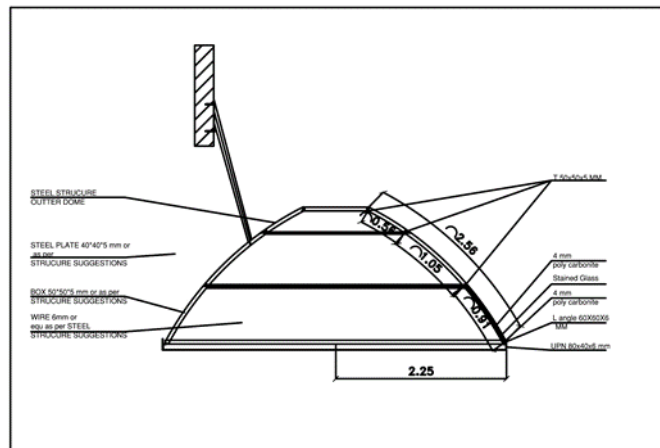
Floral motifs of Islamic art were benefited from using abstract in the design and modification of elements and motifs to fit with modernity in the artistic intellect. Distribution of these works to harmonize with dovetailed glass with colors used in Islamic art to be the design thought of the project in Egypt Mosque, and confirming the abstract floral Islamic elements in cohesiveness and entanglement around the outer frame of the dome, the previous shapes are clarifying some design ideas for the domes, the subject of the research.



Shape 21 clarifies the first design thought that was executed in Egypt Mosque



Shape 22 clarifies the horizontal projection of the dome



Shape 23 clarifies the lateral sector of the iron dome

Applied study:



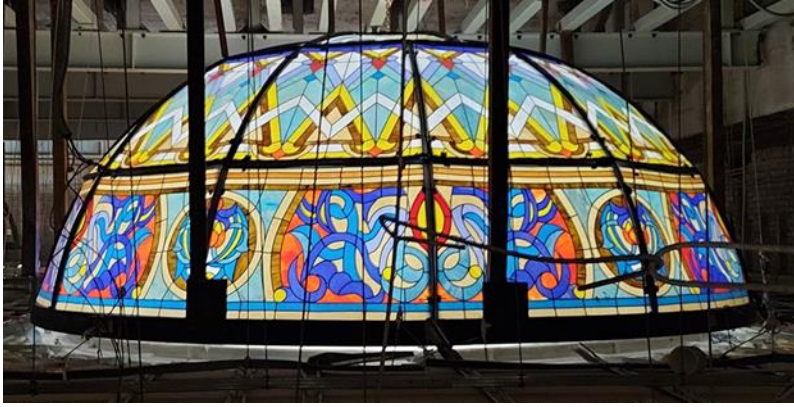
Shape 26 clarifies constructional sectors of the iron segments for the first dome



Shape 27 clarifies the process of cutting and mesh the dome glass according to the design
Glass was collected and interlocked with colored opal opaque glass according to the suggested design and executive drawing that was done previously is being applied on the required measures, then the dovetailing process and mantling of glass through lead sticks then welding with tin then cementation or pasting and oxidation, in order to get the colored, dovetailed required piece of glass.



Shape 28 clarifies the experiment of first lobe of dovetailed glass on metal constructional sectors related to the dome



Shape 29 clarifies the final look of the dome from inside the mosque

Results of the research:

- 1- 12 domes were executed with wide areas in Egypt Mosque.
- 2- Benefit from technology of various compositions to facilitate and ease the process of mantling domes with different constructional methods.

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