

Designing a Modern Tower in a Mathematically–Based World

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Abstract

Teheran, the capital city of Persia, Iran, is an interesting place, not only because of its long history, which goes back to the second century BC, but also because of its socio-cultural power in today's world. The cities around the world have been changed dramatically by the effects of socio-economical forces of modernizations and globalizations. Their needs and requirements also have been changed. In this context, the architecture has now a new meaning. *Ceylan Intercontinental Hotel and Shopping Complex*, which is planned to be constructed in Teheran, is an example of today's architecture that has a geometrically unique structure.

Concept and Phases

Teheran Ceylan Intercontinental Tower was designed by the *Project Architectural Group* during 2001-2005, in four phases: (1) Analysis and synthesis of the project in 1/200 scale; (2) Study of the 1/100 scale design, (3) Infrastructure and material details of the tower; and (4) Three-dimensional computer aided drawings and animations of the project. Among different types of tall buildings, only towers have the potential to create an iconic presence to symbolize a city. During the early part of the 20th century, it was predicted that an international style of architecture would emerge bringing the world's cities towards greater homogeneity. However, it is hard to deny that the early towers were monolithic in shape and far from being high-tech in style. Also, it is known that they were not ecological at all. It can be said that today's towers are the new generation of the 20th century's skyscrapers. *Teheran Ceylan Intercontinental Tower* is not only aesthetically pleasing, but is also a high-tech structure with an ecological recycling system.

Idea to become Form

The concept of the project is based on the Islamic lattice patterns. One of the characteristic features of Islamic art is the use of the *giri*, beautifully intricate lattice work or interlaced designs based on polygons and star polygons. There are different theories for the prevalence of such designs. These lattice patterns are adaptable to the most common building materials, glass, natural stones, tiles etc. Different forms of towers can be made digitally from these patterns, which can be constructed using well-defined grids and geometric transformations, which are classified as "wall paper" patterns. The process of creating the layout of the plan started with a lattice pattern with grids of squares, triangles, and hexagons. There are two main squares in the plan. Each main square is the base of a building. In the design of each of these buildings, there are two concentric circles that have been laid out symmetrically. To design the tower, a right square pyramid has been considered, which has been stand upside down on its apex. This gives the perspective of a diamond standing on a base. Thus, the base of the tower, the vertex (or apex), is just below the center of the square on the top. The monumental looking body of the complex is designed based on the three-main-parts rule, "base-body-head" rule, established by the Chicago School of Architecture, for tower designing since the 19th century. Nevertheless, the design has a modern and unique look. Moreover, the design has been performed based on modern technologies and new materials. The shape of the complex is an equilibrium point within two axes on four directions, suitable to Feng-Shui. The "base" part of the building has four stories, which are designed for a shopping mall on the upper part of the ground level. The 'body-head' part of the complex has 52 stories and 4 towers at edges and 3 rings on different levels (13th floor, 33rd floor and 53rd floor) to have a connection in between. The body-head part of the complex has a radial design; 4 towers starting from the same base point and finishing on points having 180 meters in between.

Conclusion

Mathematically based architecture has been created since pre-modern times, especially as secret geometry. Examples of interesting architectural designs include gothic cathedrals of the 11th and 12th centuries, Islamic patterns on the walls of mosques, classical Ottoman palaces and so on. Nevertheless, all these interesting structures have been created based on their spiritual background. The interesting phenomenon in today's architectural designs is that most of them are created based on a mathematical perspective. The digitally created architectural designs are constructed purely on mathematical rules and geometrical patterns. Digitally created 'Architectural Reality' is based on the mathematical background of 21st century. The search for finding elements and symbols of a culture to be added to a design is not forgotten. Nevertheless, it seems that the common language of the universe is still mathematics in the way that Galileo remarked in his famous quotation: "The big book of nature can only be read by the one, who knows its' language: the language of mathematics."

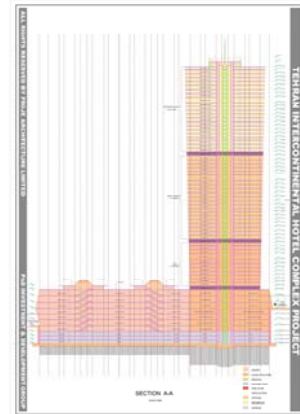
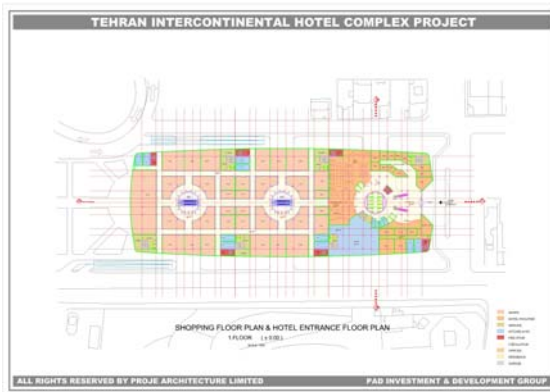


Figure 1: Plan of Ceylan Intercontinental Tower **Figure 2:** Section of Ceylan Intercontinental Tower

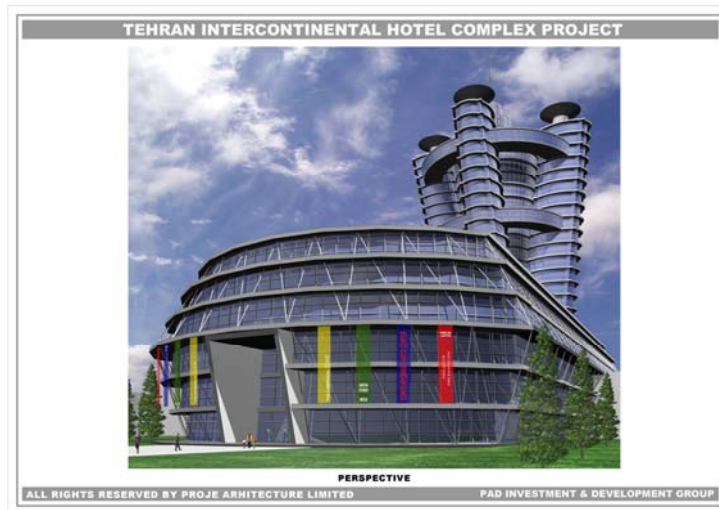


Figure 3: Perspective of Ceylan Intercontinental Tower, Teheran

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