

The significant of Iranian Domes: Analysis of Morphology and Typologies

Maryam Ashkan, maryamashkan@gmail.com
Yahaya Ahmad, yahaya@um.edu.my

Department of Architecture, Faculty of Built
Environment, University of Malaya, Kuala Lumpur

Abstract

Persian master builders had been innovated an architectural form which had an imperishable effect on the world architecture: surmounting a dome on *squinches*. This paper analyzes the distinct types of Persian domes that widely appeared since the beginning through into the late Islamic in Iran. It starts with a historical study of the Persian dome origin, types, and evolutions. By analytic reviewing examples of such domes, then the paper suggests their formal constitutions and stylistic attributes. Finally, and based on the above, the morphological and typological forms of Persian domes have been presented and decoded. Analytical analysis of Persian domical buildings is a preference implement to discern deep knowledge of traditional Persian architect-artisans in their work and to develop the modern theories of Islamic dome constitutions for setting new design criteria.

Key words: Middle East and Central Asia, morphological features, Persian domes typological arrangements, dome constitutions

1. Introduction

Persian domes have played a significant role in Islamic architecture. Overall speaking, the fundamental contributions of the Persian architecture in the dome development in the Middle East and Central Asia are, firstly the establishment of the foundations for using masonry domes covered the chamber halls, and secondly the innovation of an approach for transferring from the square to the circle, namely, *squinches*. On the other hand, domes are seen as a common feature in the Persian ecclesiastical architecture that strongly affiliated with their symbolic meanings. In fact, it can be considered as a fundamental cause for their rapid developing all over historic eras. Despite several existing studies, about Islamic domes and their relative configurations, Persian domes still do not have completely known architectural morphological constitutions and typologies. An analytical approach presents a novel method to derive common features of their conceptual configurations and typological arrangements.

The study of characteristics and styles of Persian domes can be manipulated to give contemporary meanings to the essences of traditional dome designs, especially, in the Islamic architecture. It also helps to understand the styles and aesthetic principles of these domes in Islamic architecture. The presented dome analysis method has the potential to be used for understanding the properties of other sorts of Islamic domes in the Middle East and Central Asia.

This paper contains three parts: 1) a brief outline of the origin and developments of Persian domes since the pre-Islamic era through in the Saffavid period; 2) elaborations of various morphological features of such domes; 3) definitions of their derived common typologies.

2. Outline of Origin and Development of Persian Domes

Persian domes are one of the vast groups of Islamic domes, in retrospect, resulted in the fairly continued developments of the dome practice. What we can be learned from the domical historic literature is that to be provided a useful relevant overviews of evolutions of their morphological features. Historically, apart from their ancient origin, the earliest types of dome in the Persian architecture associated with the Parthian and Sassanid dynasties. They commonly were whether semi-circular or semi-elliptical domes placed on magnificent monuments of Zoroastrian temples such as, palace of *Ardeshir* in *Firuzabad* and the great Temple of *Anahita* in *Sarvistan* [8,10] (fig. 1).



Figure 1. a) Domes of Sarvistan palace with primary samples of *squinches*; b) The Zoroastrian temple and palace of Ardeshir, Sassanid period. (Source: Authors)

During Islamic periods, a wide variety of domes types which reflected dynastic and religious thoughts were appeared in Persia and nearby areas [1]. In fact, the early Muslim architects (or master builders) used in symbolism meanings for giving rise dome designs, depending on the Holy Quran, and their great believe in “*Allah*” [2]. Some of the achievements in the architectonic designs of domes in the early Islamic era (1000- 1200 A.D.) can be addressed as follows:

- The great diversity of tomb towers, cube mausoleums topped with various types of shell formations

including pointed and conical shapes [9]. The best samples are Qunbad-e Qabus (1000 years old) and Gunbad-i Surkh (1147/1148 A.D.) (fig. 2).



Figure 2. The early Islamic types of mausoleums; a) The celebrated conical Gunbad-e Qabus tomb tower, (Source: Authors); b) Gunbad-i Surkh (Red tomb), Maragha, Iran. (Photo from <http://www.panoramio.com/photo/10767975>).

- The introduction to the pointed discontinuous double-shell domes which their shells are completely disconnected such as: a couple of Persian tomb towers in Kharqan which are considered as the earliest known of discontinuous double-shell domes [4].



Figure 3. Tomb towers topped with the discontinuous double-shell domes, Kharraqan. (Source: Authors).

- In terms of designing conflicts between the external and internal appearances of domes, the external shells were technically divorced from the internal shells at the angle of 22.5° ; their internal shells, some times, have eight ribs [5]. The ample samples are the Bersian mosque (11th-12th) and the Friday mosque of Ardestan (10th-11th) (fig. 4).

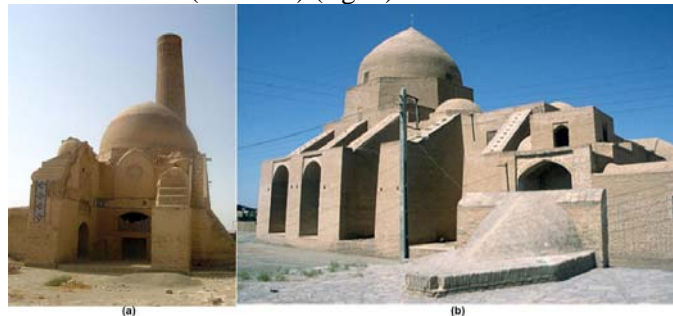


Figure 4. Two main samples of the continuous double-shell domes in the early Islamic era: a) The Bersian

mosque in Isfahan (Source: www.kousha.fotopages.com); b) The Friday mosque in Ardestan. (Source: www.archnet.com).

After architecture severe degeneration caused by several Mongol's invasions, the material culture of Persia flourished again by appearing Ilkhanids and Timurids and characteristics of their architectural features i.e. enormous scale of edifices [6]. The constructions of the tomb towers considerably decreased in comparison to the Seljuk era as results of developing several types of the discontinuous double-shell domes [6]. Commonality of features of Persian domes in the medieval Islamic era can be addressed as follows:

- To develop the various types of the discontinuous double-shell domes with the pointed profiles. In this regard there are two examples: the dome over the Sultan Bakht Aqa mausoleum (1351/52 A.D.) in Isfahan and the Friday mosque of Yazd (1364/1470 A.D.) (fig. 5).



Figure 5. a) The discontinuous double-shell dome topped the Sultan Bakht Aqa mausoleum in Esfahan; b) The continuous double-shell dome of the Friday mosque in Yazd. (Source: Authors)

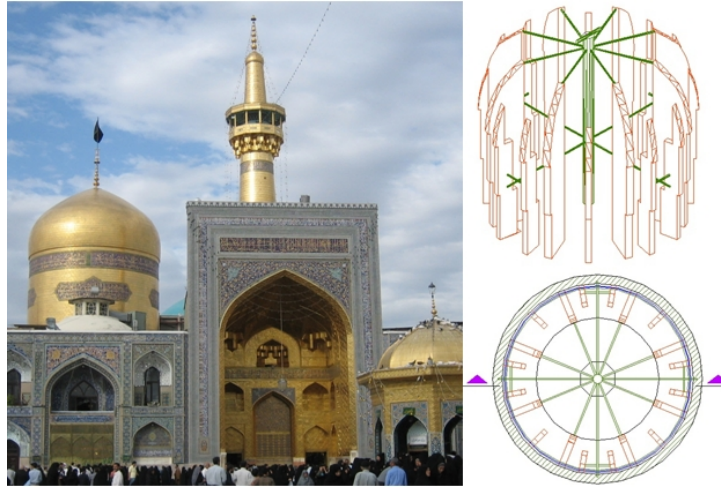
- To introduce triple-shell domes in such a way that the discontinuous double-shell domes from the pervious eras, were developed by adding a shell in their

configuration [5] such as, Shaykh abd al-Samad shrine complex in Natanz (1000/ 1325 A.D.) and the Bayazid Bistami shrine complex in Bistam (1120/1300 A.D.) (fig. 6).



Figure 6. a) Shaykh abd al-Samad shrine complex in Natanz; b) The conical dome of tomb of the Bayazid Bistami complex in Bistam. (Source: Authors).

- To develop the systematic morphological components of dome by developing various compositions of radial stiffeners and wooden struts [3] such as: The Holy shrine of Ali al-Reda (14th-20th) in Mashad (fig. 7).



**Figure 7. The Holy shrine of Ali al-Rida (Reza) in Mashad.
(Source: Authors).**

The emphasis on the greatness of buildings, which was started during the Timurids era, continued to be a principle in the Saffavid empire included Persia and nearby areas throughout the 16th and 17th centuries [7]. The bulbous domes are the significant achievement of this era and effectively influenced on architectural styles of other countries, especially, in the late Mughals in India [11]. The best samples of Saffavid bulbous domes can be named as Shah mosque (Masjid-e Imam, 1611ca. 1638 A.D.), and *Chahar Bagh madrasa* (school) (1706-1714 A.D.) (fig. 8).



Figure 8. Two samples of the bulbous domes of the Saffavid era in Esfahan; a) The Imam Mosque (Friday mosque of Shah). (Source: www.flickr.com/photos/cjb22222222/3177601447/); b) Chahar Bagh madrasa (Madar-e Shah school). (Source: Authors).

On the other hand, two components of Persian domes had been evolved, firstly, console mini-arches in the transition zone and the creation of external shell with bulbous formation. There are some specific factors which gave rise Persian domes their specific distinctive characteristics in the Saffavid era [12];

- To use of the high cylinder drums
- the innovation of various shapes of bulbous domes
- To use the complex compositions of arches and vaults forms in their supporting systems
- To use plenty of the coloring mosaic works such as, yellow, green, blue, gold, and a denseness network of vegetarian.

3. Morphological Features of Persian Domes

Structurally, dome can be considered as a structural consonance and a hierarchy of ordered parts i.e. the relationship between the internal space and structural mass and/or positive-negative space. Morphologically, the eastern domes consist of the four generic features, called “*vocabularies*” including load bearing system, transition tier, drum, and shell (s) (fig. 9).

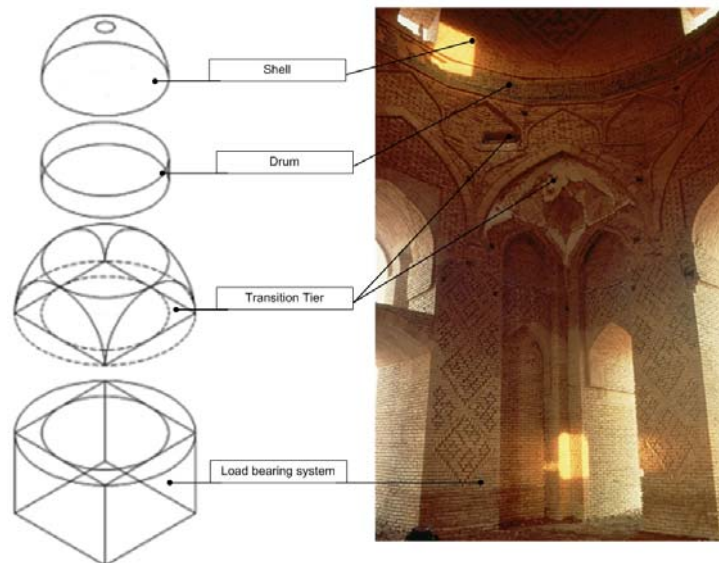


Figure 9. Illustration on the four generic components of the Persian domes. (Source: Authors).

- **Load bearing system:** there is a defined concern for the load bearing items i.e. the essential structural system which must fulfill the requirements of the building's statics by transferring the load to the ground;
- **Transition tier:** the architectural component designed to transfer from the square shapes of load bearing system into the circular form of dome base, namely, *squinches*;
- **Drum:** is a cylinder form which the shell is rested on; and finally
- **Shell(s):** the special sacred space was provided by the shell(s). In fact, the architectural item which was often used in synonymous at several climes. In fact, it is a total reflection of the dome dynamism, in particular, at various periods.

4. Typological Arrangements of Persian Domes

In the construction of Persian domes, the shell(s) can be put together in three different ways (fig.10). These include one shell (the earliest type of the Persian domes: (OS-Type 1 and OS-Type 2), two shells and three shells. However, the few samples of these triple shells that emerged in comparison to the large numbers of the other sorts can thus verify its origin from the double-shell domes.

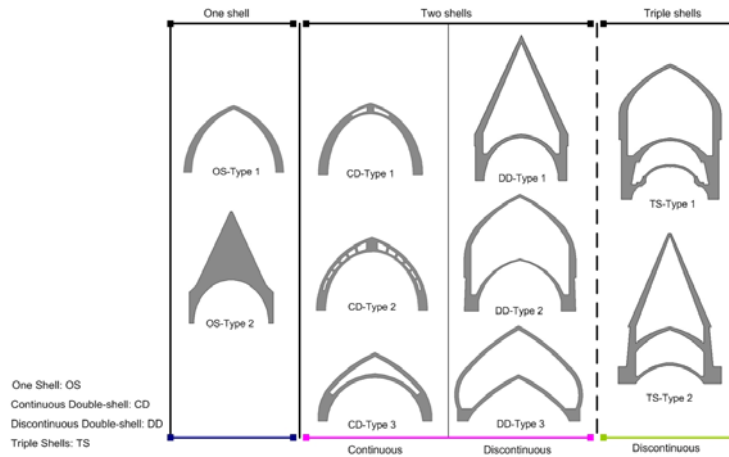


Figure 10. Illustration on the domical typologies according to their shell(s) compositions.

Regarding the double-shell types, two subdivision groups have been defined based on how these two shells are composed together. They are the continuous and the discontinuous groups.

In the continuous double-shell domes, sometimes, there exists no considerable distance between the shells (CD-Type 1), or they are connected by brick connectors (CD-Type 2), but very often the distance between these shells are small (CD-Type 3). It could thus be said that the continuous two shells domes are called 'evolving' from the one shell dome to the two shells domes in the Islamic domical architecture

development. The constructions of the one shell dome were continued up to the late Islamic era.

In the discontinuous double-shell domes, there are considerable distances between the two shells. The discontinuity may start either from the base (DD-Type 3) or from the top of the drum (DD-Type 1 and 2). This is considered higher than the other types of the Islamic domical typologies (DD-Type 2; TS-Type 1).

5. Conclusion

The dome, which had special symbolic meanings, undertakes many forms in the Persian architecture. Regarding dome design, Persian builders had solved many questions such as, transferring from the square to the circular by innovation of *sqinches*, and developing various kinds of domes in Islamic architecture. Historically, the Persian domes are resulted in systematic evolutions and continuous works over historic eras, especially, after the coming of Islam.

Morphologically, four main components recognized such as, load bearing system, transition tier, drum, and shells. The composition of internal stiffeners and wooden struts mainly appeared in the Ilkhanid period through developing the various types of the discontinuous double-shell domes. Typologically, according to the ways of setting of shells, Persian domes are categorized into one shell, two shells, and three shells. The presented analytical approach has the potential to be employed for understanding the essences of other sorts of Islamic domes. The study of conceptual characteristics of Persian domes can be manipulated to give contemporary meanings to the essences of Eastern traditional dome designs, developments and styles, especially, in Islamic architecture educations.

6. References

- [1] H., Ayatollahi, *The Book of Iran: The History of Iranian Art*, Alhoda Press, United Kingdom, 2003.
- [2] K.A.C Creswell, and J.W., Allan, *A short Account of Early Muslim Architecture*. In Hillenbrand, R.(eds), *Bulletin, British Society for Middle Eastern Studies*, vol. 17, No. 1, 1990, pp. 86-87.
- [3] M. M., Hejazi, *Historical Buildings of Iran: their Architecture and Structure*, Computational Mechanics Publications, Southampton, 1997.
- [4] R. J., Mainstone, *Vaults, domes, and curved membranes, Developments on Structural Form*, Architectural Press, London, 2001, pp. 124.
- [5] G. H., Memarian, *Statics of Arched Structures (Niyâresh-e Sâzehâye Tâghî)*, Vol. 1, University of Science and Technology Press Tehran, Tehran, 1988. (In Persian)
- [6] G., Michell (ed.), *Architecture of the Islamic world: Its History and Social Meaning*, Thames and Hudson, New York, 1978.
- [7] A., Petersen, *Dictionary of Islamic Architecture*, Reprint edition, Routledge Press, London, 1999, pp.124.
- [8] A. U., Pope, *Introducing Persian Architecture. In A Survey of Persian Art*, Gluck. J., Arthur Upham Pope and Phyllis Ackerman(eds.), Soroush Press, Tehran, 1976, pp. 52-68.
- [9] R., Saud, "Muslim Architecture under Seljuk Patronage (1038-1327)", Foundation for Science, Technology, and Civilization (FSTC), 2003, [online], Available:
<http://www.muslimheritage.com/features/default.cfm?ArticleID=347>.
 Viewed 8/3/2009.
- [10] E.B., Smith, *The dome: A study in the History of Ideas*, Princeton Press, New Jersey, 1971.
- [11] H., Stierlin, *Islamic art and Architecture: From Isfahan to the Taj Mahal*, Thames and Hudson, London, 2002.
- [12] D. N., Wilber, *The Architecture of Islamic Iran: The Il-Khanid Period*, Greenwood Press, New York, 1969.