



The Architectural Proportions on Kedah Indian Mosques: Before and After Mosque Renovations

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Paper ID: 14A2J

Volume 14 Issue 2

Received 10 December 2022

Received in revised form 01 August 2023

Accepted 06 September 2023

Available online 25 September 2023

Keywords:

Masjid Zahir; British Malaya architecture; Measured drawings; Mughal architecture; Mosque renovation; Proportional analysis; Islamic architecture; Indian Mosque; Golden ratio.

Abstract

The Kedah Indian Mosque's architectural style was begun in 1912 by James Gorman, a British-Malaya Government architect, to replace the old Masjid Zahir, an aging wooden mosque building built in 1735. Masjid Zahir, as it stands today, is a proud symbol of Kedah architecture. It was actually inspired by the great heritage of Mughal architecture in northern India. Many people are unaware of Masjid Zahir's theory and architecture. This study reveals the identity of Indian-Mughal architecture in the Masjid Zahir as well as five other Indian mosques in Kedah with similar characteristics. Validation tests on the measured drawings of these mosques were carried out using the evaluation of the geometrical golden rectangle. The proportional analysis of the golden ratio shows that the original design of these mosques has a higher percentage of golden ratio than these mosques today, which have undergone extensive renovations. Conclusion: The influence of Indian-Mughal architecture on the Masjid Zahir, as well as the architectural relationship with other mosques in Kedah is a new branch of knowledge in the history and theory of architecture. These buildings' location has the potential to be developed as domestic tourism nodes appreciating the architecture of Indian Mosques in Kedah.

Discipline: Architecture Science, Architecture & History, Islamic Studies, Islamic Architecture.

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Cite This Article:

Saaid, A., Hassan, A.S., Arab, Y., and Witchayangkoon, B. (2023). The Architectural Proportions on Kedah Indian Mosques: Before and After Mosque Renovations. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies*, 13(2), 13A2J, 1-10. <http://TUENGR.COM/V13/13A2J.pdf> DOI: 10.14456/ITJEMAST.2023.31

1 Introduction

This study was conducted to determine which Kedah Indian Mosques have good architectural proportions. Scholars and the general public agree that Masjid Zahir is one of Malaysia's most prominent mosques. This mosque has served as a model and new standard for the construction of other mosques throughout Kedah (Saaid & Hassan, 2019). According to our recent case study, five rural mosques in Kedah were found to exhibit a significant Indian-Mughal architectural style. These mosques' original designs had a high proportional percentage value. However, the golden ratio percentage has decreased because these mosques have undergone extensive renovations. This paper will also discuss the suitability of the renovated mosques and the community's benefit from research findings.

1.1 Early History of Masjid Zahir

Masjid Zahir was once recognized as one of the ten most beautiful mosques in the world (India TV News, 2014). The mosque was built in cement and bricks in 1912 by a British-Malaya Government architect from Scotland named James Gorman, with approval from the 26th Sultan of Kedah, Sultan Abdul Hamid Halim Shah (*Dictionary of Scottish Architects*, 2016). In 1735, Kota Setar was established as the Sultanate of Kedah's eighth administrative centre, with a palace, a great hall, dwelling quarters, and a mosque (Mapjabil et al., 2010). Masjid Zahir's architectural history can be traced back to the original construction of the wooden mosque, which was around 300 years ago.

According to historical evidence cited by the Malaysian Historical Society (Kedah branch, PSMCK) during the Kedah-Bugis War of 1770 and the Kedah-Siam/ Ligor war series that took place from 1821 to 1842; the Kedah Sultanate army suffered several defeats and Kota Setar had been burned repeatedly by the Bugis and Siamese troops. This war also destroyed the mosque in Kota Setar at that time (Yusof, 2014). However, the wooden mosque was redeveloped several times before being demolished in 1912 to make way for a solid masonry building. Architect J.Gorman and HRH Tunku Mahmud Ibni Sultan Ahmad Tajuddin Mukarram Shah, (then the Crown Prince of Kedah) planned to build Masjid Zahir as stunning as Masjid Azizi in Tanjung Pura, Langkat, Sumatera, Indonesia (Saaid & Hassan, 2019).

2 Literature Review

In Malaysia, mosque architecture is divided into two types: traditional mosques and colonial mosques. Mosques in the traditional category are those built with a regional or local identity. In contrast to the colonial category, the identities of these mosques were influenced by the Middle East, Morocco, and India (Ahmad, 1999; Basri, 2002). Khazae et al. (2015) have classified Masjid Zahir as a mosque with a colonial identity. The difference between Moorish and Mughal architecture adorning early Malaysian mosques was also observed in this study.

The Islamic architecture found in mosques evolved over time from various forms and terms (Rasdi, 2007). Multiple factors such as climate, technology, and socio-political would decide the architectural characters of the mosques. Although there are plenty of studies on the mosque as an

Islamic institution, however, most of them lack architectural aspects. Rasdi and Utaberta (2007) singled out the Masjid Negara as an example of Malay Islamic Architecture that has not been extensively studied from a design standpoint. Ali and Hassan (2018) studied Mughal architectural elements in Malaysia through case studies in three mosques: Masjid Kapitan Keling in Georgetown, Penang, Masjid Alwi in Perlis, and Masjid Jamek in Kuala Lumpur. The original Mughal monuments in India, such as the Jama Masjid in Delhi and the Taj Mahal in Agra, were also compared in this study. The study was deemed incomplete since the Masjid Zahir was not included in the Mughal architectural elements listed in the local context. Ibrahim and Abdullah (2016) and Khan et al. (2021) conducted a study of elements of the Masjid Zahir, however, their study did not look at its affinity with other common mosques, particularly in Kedah.

For a long time, the proportion theory has been used in the architecture of notable buildings as well as mosques. Researchers such as Aytug & Akbulut (2001), Boussora & Mazouz (2004), and Handayani & Soewardikoen (2017) have used the theory of golden section to study the architecture of prominent mosques in their respective countries. God's organic elements and artificial man-made objects have the same rhythm of scale and proportion (Meisner & Araujo, 2018). Meisner also explained that the golden ratio arrangement can be well sketched on the Mughal monument complex, the Taj Mahal in Agra, India (Meisner, 2013, Mac 5).

3 Methodology

This study uses the qualitative case study method. The researchers, with the help of a group of Polimas Architecture students, visited the mosque sites, observed, photographed, and measured every detail found in the mosques. The case study began with the preparation of drawings for Masjid Zahir, a building with a significant Indian-Mughal character in Kedah. When the measured drawings for this mosque were finished, it was used as a reference mosque. Next, a case study was conducted on five other mosques with designs similar to the reference mosque. These mosques are

- Masjid Al-A'la (1958)
- Masjid Nurul Ehsan (1962)
- Masjid Sultan Abd Halim (1963)
- Masjid Ar-Rahmah (1965)
- Masjid Rayatulislam (1969)

Based on a site investigation and building measurements; Two types of measured drawings were prepared, namely the original mosque drawing and the current mosque drawing (after renovation). In this article, the researchers only discuss proportion analysis on 12 elevations. Therefore, the golden ratio analysis method was used to compare the proportions of the original and current buildings. The golden ratio analysis of proportion has produced the value of Phi (Φ). A high Phi value percentage indicates that the mosque has a good proportion.

4 Data Analysis

Proportion is also mentioned in the Noble Quran in the following verse:-

قَدِرٌ (Qadira) means measurement and in this verse, it means “We measure perfectly”. It also means Allah has the best proportion in each of His creations. All the best things have a specific ratio.

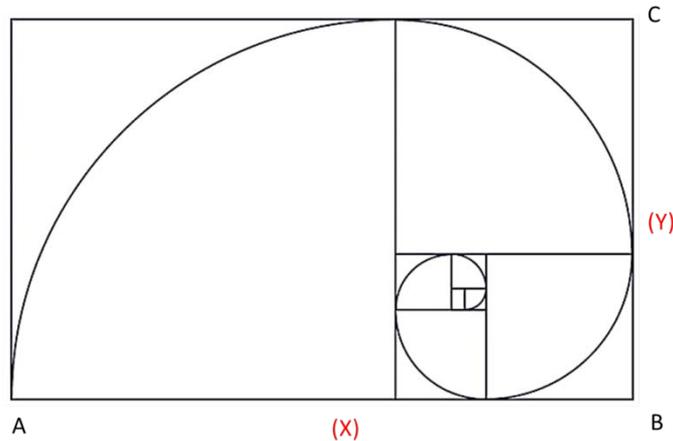


Figure 1: the golden ratio method

In the golden ratio; two sets of measurement values are used for Y and X; there are either 1 and 1.618 or 0.618 and 1 (refer to Figure 1). If X is 1, then the value of Y is 0.618. If the value of x is 1.618, the value of Y is one. When compared to the elevation drawings of the case study mosques, the golden ratio measurement yields values around 1.618 and 0.618. When the values for the X and Y drawings of these mosques are divided by the numbers 1.618 and 0.618, the result is multiplied by 100. Finally, the value is a percentage of the mosque's elevation proportion.

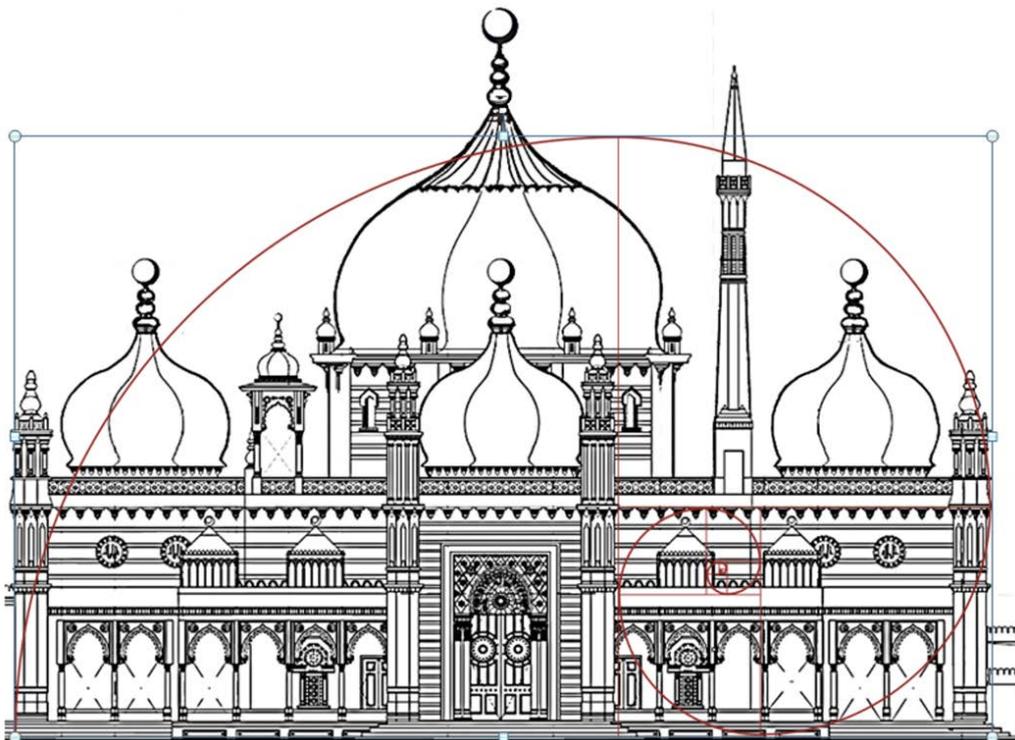


Figure 2: Front Elevation of Masjid Zahir (1915)

Based on data analysis, Masjid Zahir which was completed in 1915 has a good proportion value of 82%. As can be seen, the golden rectangle encompasses almost the entire front elevation of this mosque (Figure 2). Masjid Zahir has since been renovated several times, and it now extends up to 26 metres to the mosque's left side. Because of this, the Masjid Zahir building now appears asymmetrical, with only one open prayer hall on one side (Figure 3).

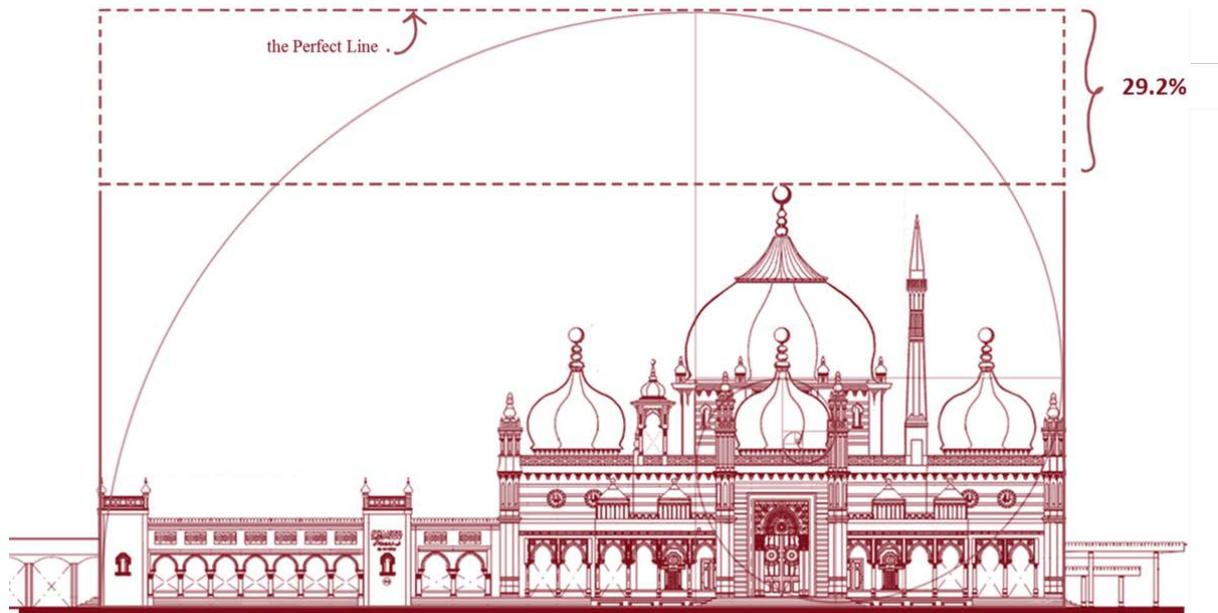


Figure 3: Front Elevation Masjid Zahir (present-day)

The proportion value of this mosque has been reduced to 70.8 percent. The current Masjid Zahir has lost its harmony due to the unbalanced enlargement of the main building, which results in a negative proportion of 29.2 percent. According to this study, a good golden ratio proportion is greater than the value of 80% obtained by the original Masjid Zahir. In a separate study, researchers discovered that the proportional value for Jama Masjid in Delhi was nearly 95%. Although there is a 15% difference in Phi value, it has little effect because almost all of the Masjid Zahir is still within the volute area of the golden rectangle. Only the finial and minaret of this mosque do not conform to the golden ratio. When elements like the dome, finial balls, or crescent are placed too high above the top line (*the perfect line*) of the golden rectangle, the proportional percentage for the mosque is reduced. This situation occurred in two mosques, namely Masjid Ar-Rahmah and Rayatulislam, where the Φ value was less than 75% (Table 1).

Table 1: Proportion analysis of original and present mosques

	Case study Mosques	Percentage/Phi (Φ)	
		Original	Present study
1	Masjid Zahir	82.0	70.8
2	Masjid Al-A'la	88.3	91.0
3	Masjid Sultan Abdul Halim	96.4	81.6
4	Masjid Ar-rahmah	70.0	77.8
5	Masjid Nurul Ehsan	91.6	54.0
6	Masjid Rayatulislam	74.5	74.7

5 Discussion

According to this case study, the original buildings of Masjid Sultan Abdul Halim and Masjid Nurul Ehsan were the two best Indian mosques in Kedah. These mosques' golden ratios exceeded 90%, indicating that they were nearly perfect examples of Indian mosques. (Figure 4A-4B).

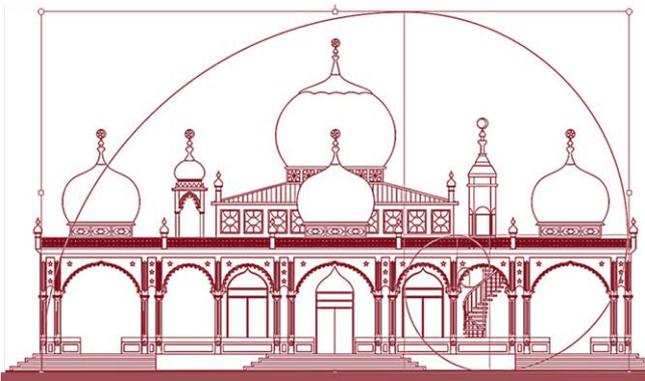


Figure 4A: Masjid Nurul Ehsan (1962).



Figure 4B: Masjid Sultan Abdul Halim (1963).

Indian-Mughal architectural features found in these mosques are a *gunbadh* dome, onion domes, dome-kiosk (*chhatri*), stone-newel posts (*guldastas*), crenellation and cusped arches (multifoliate arches). Only about 300 people could pray in these mosques. They have been inevitably enlarged to accommodate the needs of the growing congregation. However, after being renovated and modernised with modern amenities, the architecture of the mosques did not stand out as much as it had previously.

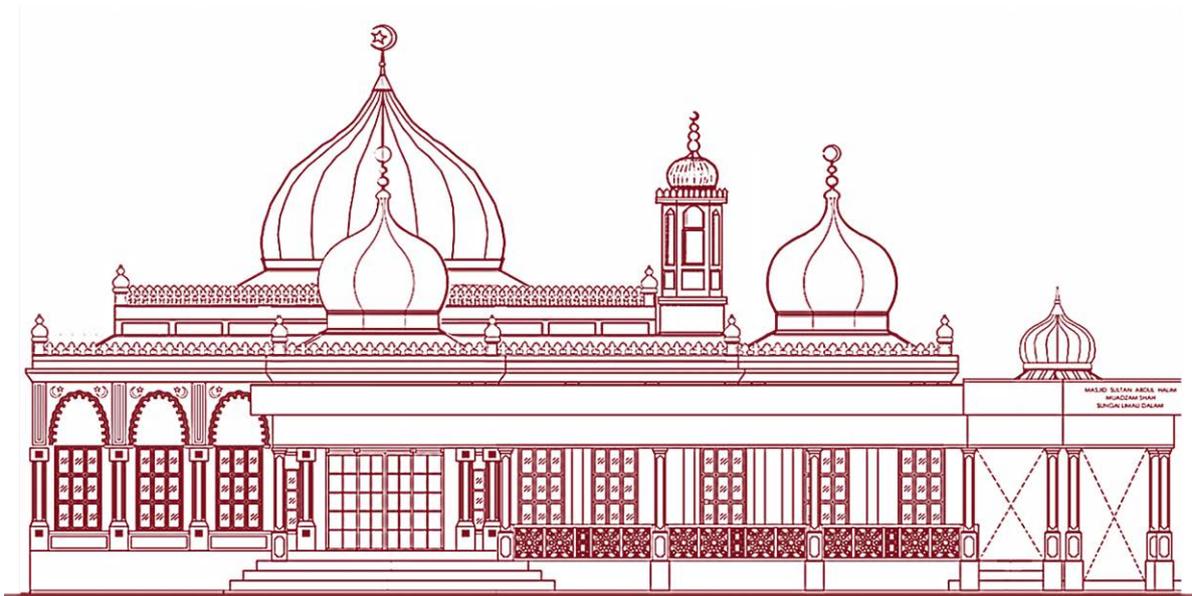


Figure 5: Masjid Sultan Abdul Halim (present-day)

Masjid Sultan Abdul Halim has undergone many significant changes, but it still has a good golden ratio of 81.6 percent. The original mosque's prayer area has been covered by walls and glass, preventing the mosque from emphasising the cusped arches visible from the exterior elevation (Figure 5). The mosque's main roof, the *gunbadh* dome, leaked and was replaced with a new dome, but it does not match the other onion domes on the mosque.



Figure 6: Masjid Nurul Ehsan (present-day)

The current Masjid Nurul Ehsan retains the architectural features of the original building, but like the Masjid Zahir, it appears unbalanced due to the enlargement occurring only on the left side of the mosque. (Figure 6). Although the additional part has a dome shape like a gunbadh dome or the mosque's main dome, it has arches and crenellation that are different from the original elements used by this mosque. This should not happen; any renovations must be exactly matched to the mosque's original architectural features.

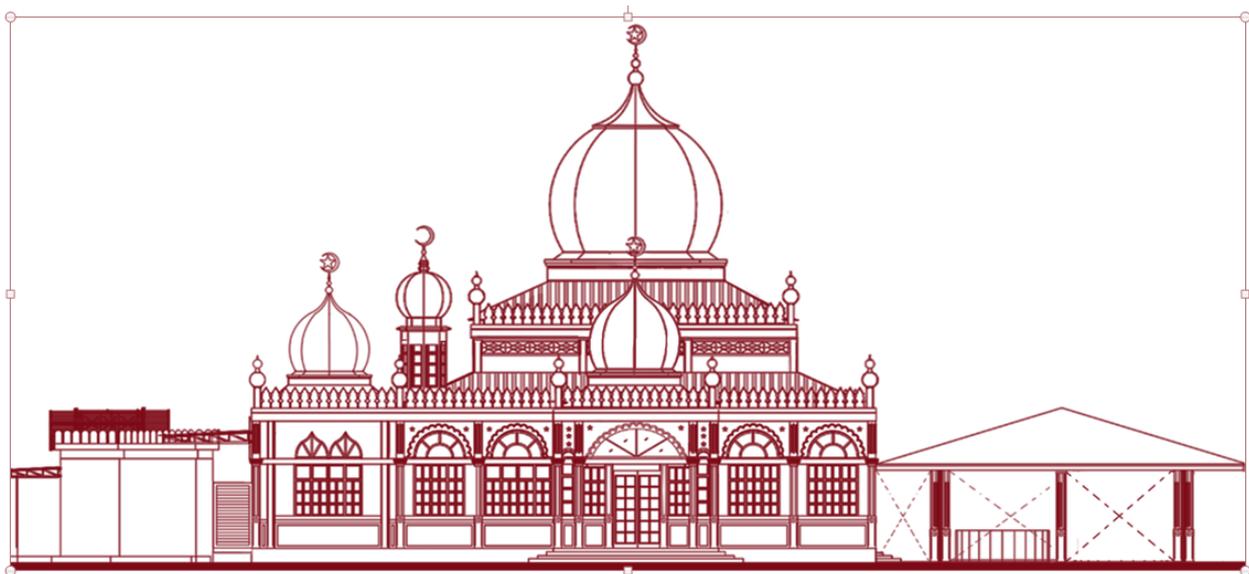


Figure 7: Masjid Rayatulislam (present-day).

As shown in Table 1, two mosques, Raiyatulislam and Ar-Rahmah, have original proportion values that are less than 75%. Following the most recent renovations, the Phi value of these mosques has increased slightly and is now approaching 80%. Despite having a relatively good golden ratio, the architectural composition of these mosques is mixed and discordant. Unplanned additions to the mosque appear to have occurred (Figures 7 and 8). In terms of architecture, these buildings have created an eyesore, not a way to decorate an Indian-Mughal mosque in Kedah.

The original architecture of Masjid Al-Rahmah is not well received by the mosque's administrators. The renovation of this mosque resulted in a very disappointing architectural composition. In previous studies, the researchers had discussed the renovation issues at Masjid Ar-Rahmah. (Saaid & Hassan, 2019). According to this current study (Figure 8 depicts this mosque),

the design of this mosque will undoubtedly be more outstanding and admirable if the hipped roof structure on the left is removed and the cupola is returned to the *chhatri* minaret.

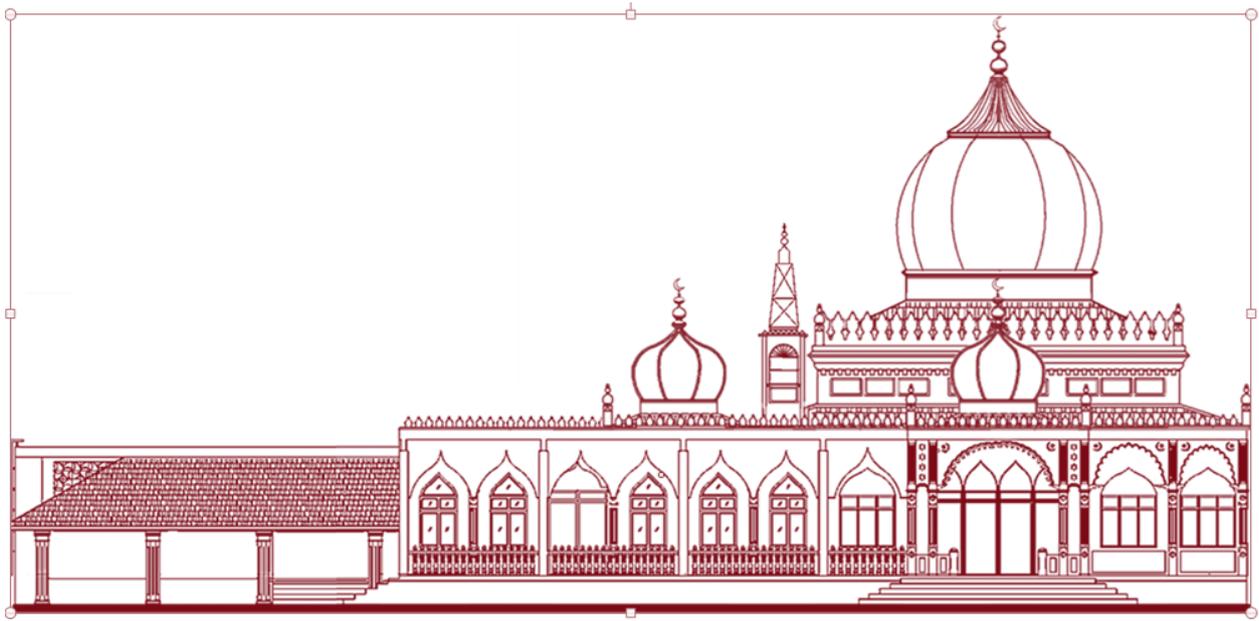


Figure 8: Masjid Ar-Rahmah (present-day)

Apart from the Masjid Zahir which is located in the historical site of Kota Setar, Kedah has five special mosques designed in the style of the Indian Mosque. It is not the original Mughal architecture of India. However, these mosques are the Kedah Indian Mosque, which was built in accordance with the architectural standards established by the Masjid Zahir. These mosques, which are located throughout the state of Kedah, have the potential to be developed as tourism nodes, contributing to the state's economic development.

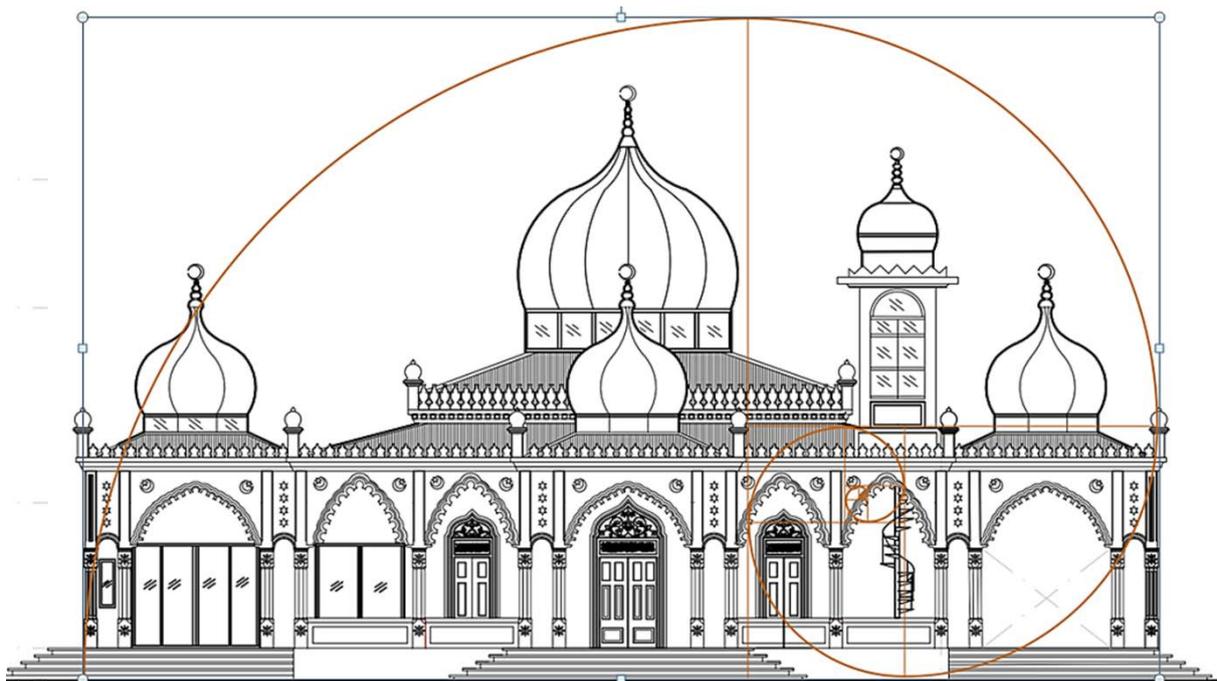


Figure 8: Masjid Al- A'la (present-day)

6 Conclusion

The architectural proportions of Indian mosques in Kedah can be measured using golden rectangular analysis or the golden ratio. Six case study mosques had an average Phi of 83.8 percent. After these mosques were renovated, the mean for this percentage fell to 75%. In the current context, it is inevitable that these mosques, which were originally built as small mosques, will need to be enlarged due to an increase in the number of congregants. Renovations are required in order to provide the mosque with modern equipment and facilities. According to the findings of the study, almost all renovated mosques have proportion issues; the current mosques appear deformed when compared to the proportions of the mosques (once they first came into use).

Completing the case study, not all mosque buildings experienced a decline in proportion. Carefully planned renovations will provide better Phi values. The original building of Masjid Al-A'la consists of only three domes and one *chhatri* minaret. The onion dome on the left side is part of the mosque's extension (Figure 8). After the renovation, the Phi value of this mosque has increased to 91%. This is a good example. The outlook and architectural proportions of the mosque should be considered during the renovation, not just the comfort of the interior space.

7 Availability of Data and Material

Data can be made available by contacting the corresponding author.

8 References

- Ahmad, A. G. (1999). The Architectural Styles of Mosques in Malaysia: From Vernacular to Modern Structures. In *Proceedings of the Symposium on Mosque Architecture: The Historic and Urban Developments of Mosque Architecture*, King Saud University, Riyadh, Saudi Arabia, 2, 147-163.
- Ali, A., & Hassan, A.S. (2018). Influence of the Mughal Architectural Style on Malaysian Mosques. *The Arab World Geographer*, 21(4), 318-330.
- Aytuğ, A. & Akbulut, M.T. (2001). The Geometrical Analysis Of Mosques Of Architect Sinan. *Journal of Mathematics and Design*, 1(1), 51-65.
- Basri, F. (2002). Seni Bina Masjid di Malaysia. *Jurnal Tasawwur Islam*, 5, 61-74.
- Boussora, K., & Mazouz, S. (2004). The use of the Golden Section in the Great Mosque at Kairouan. *Nexus Network Journal*, 6(1), 7-16.
- Dictionary of Scottish Architects (DSA). (2016). *James Gorman: Basic Biographical Details*. Retrieved March 2021, from http://www.scottisharchitects.org.uk/architect_full.php?id=201346
- Handayani, T.W., & Soewardikoen, D.W. (2018). Exploration of Golden Section Proportion Potency in Mosque. *Advances in Economics, Business and Management Research*, 41, 360-364.
- Ibrahim, M., & Abdullah, F. (2016). *Masjid Zahir: A Heritage Masjid as a Traditional Landmark in a City*, Chapter 10: 163-182. Retrieved June 2018, from <http://irep.iium.edu.my/53193/3/Chapter%2010.pdf>
- Independent News Service Private Ltd (India TV). (2014, 14 July). Top 10 most beautiful mosques in the world. <http://www.indiatvnews.com/news/india/top-10-most-beautiful-mosques-in-the-world-29415.html>
- Khan, S., Ali, A., Khozaei, F., & Hussain, A. (2021). The Stylistic Similarity of Mughal Architecture with Malaysian Mosques: An Alternative Approach. *The Monthly Scientific Journal of Bagh-e Nazar*, 18(97), 93-104.
- Khazae, M. (2015). *Influence of Timurid architecture on Safavid and Mughal mosques in India / Maryam Khazae*. PhD thesis, University of Malaya.

- Mapjabil, J., Yusof, N., & Jusoh, A.T.M. (2010). Transformasi pembangunan ekonomi di negeri Kedah: perspektif historikal. *Prosiding PERKEMV*, 2, 171-181.
- Meisner, G.B. & Araujo, R. (2018). *The Golden Ratio. The Divine Beauty of Mathematics*. New York: Race Point Publishing.
- Meisner, G.B. (2013). *Phi and the Golden Section in Architecture. Phi: The Golden Number*. Retrieved Dec 2020, from <https://www.goldennumber.net/architecture/>
- Rasdi, M.T.M. (2007). Mosque Architecture in Malaysia: Classification of styles and possible influence. *Jurnal Alam Bina*, 9(3), 1–37.
- Rasdi, M.T.M., & Utaberta, N. (2007). *Pemikiran dan Ide Seni Bina Islam di Malaysia Pada Era Moden (1950-2000)*. Research No 78137; Universiti Teknologi Malaysia, 3-180.
- Saaid, A.S.H.M., & Hassan A.S. (2019a) The Influence of Mughal Architecture on Masjid Zahir: Case Study on Five Rural Mosques in Kedah, Malaysia. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies*, 10(12), 1-14, Paper ID: 10A12I. <http://tuengr.com/V10A/10A12IM.pdf>
- Saaid, A.S.H.M., & Hassan A.S. (2019b). Case Study on the Renovations of Minarets and Chhatris in Four Types of Mughal-Influenced Mosques in Kedah, Malaysia. *The Arab World Geographer*, 22(4), 321-333. DOI: 10.5555/1480-6800.22.4.320
- Yusof, A., & Ismail, S. (2014). Sumbangan Pertukangan Cina Terhadap Reka Bentuk Masjid: Kajian Terhadap Komponen Luar Masjid di Melaka Pada Abad Ke-18 (Contribution of Chinese Design Towards Mosque: A Study of Outside Components at Malacca Mosque in 18 Century). *Journal of Al-Tamaddun*, 9(1), 57-66.
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