

Exploration of Golden Section Proportion

Potency in Mosque

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Abstract Various mosque designs appear in Indonesia, with various shapes, with or without domes. Until now the visualization of mosque formation that mosque has domes still accepted in general. Architectural forms are part of the visual language that is bound by the rules of geometry and proportion. Historically, the proportion of the Golden Section is a mathematical comparison applied to the design process. While in design, architects often involve a sense, whether the building design has been proportional or not. The research question, whether the sense of a proportional form can be measured mathematically? The results show that Golden Section elements exist in some parts of the mosque.

The research explores the design of 3 mosques, At Tin Mosque in Taman Mini Indonesia Indah, Dian Al Mahri Mosque in Depok, and Trans Studio's Grand Mosque in Bandung, private built mosques, with geometric analysis methods and visual observations. The research benefits to explore the golden section are to control the building composition.

Keywords: visual language, golden section, proportion, mosque

1. Introduction

The mosque is a building that has a strategic role in Muslims life. At the beginning of the development of Islam in Indonesia, the construction of the mosque is usually carried out in mutual assistance by pilgrims. In addition to performing mandatory rituals, the mosque also represents the symbol of the local community.

Initially the shape of the mosque is not a building that was originally intended as a mosque. The old sites show that the mosque is a long cultural heritage of its journey. The origin of the mosque was a Pagan temple in pre-Roman times, converted into a church at the beginning of the Christian era around 378 AD. It was later converted into a mosque in 636 AD (Fanani, 2009).

Ibnu Khaldun mentions three basic models of mosques: the Sacred Mosque in Makkah, the Prophet's Mosque in Medina, and the Dome of Al-Sakhra, known as the Dome of the Rock in Jerusalem. Masjidil Haram, with its center is the Ka'ba, which is the point of orientation. Nabawi Mosque, originally was Prophet's house, and al-Sakhra Dome is a memorial monument of Prophet mi'raj.

In the present time, architects are also involved in the design of mosques, so that the various designs of mosques appear, domed and not domed. The background of architects in designing works is often based on architectural theories derived from various sources. The theoretical approach of original proportions was only referred to geometric

boundaries, even in the Middle Ages and the Renaissance began to be approached mathematically (Fanani, 2009).

The geometry analysis of the mosque was first performed at the Great Mosque of Kairouan, in Tunisia. Research that the Golden Section applied to a mosque found around 670 M may be used as a guide for reconstruction (Boussora, 2004). The other findings of the Golden Section study are found in vernacular mosques (Java) in Indonesia, potentially indicating the proportion of Golden Section (Phi) (Malik, 2010).

At Tin Mosque, Dian Al Mahri, and Trans Studio's Grand Mosque are designed by three different architects, and the processed coincidence of the form is a domed mosque. Exploration research on the three mosques using visual analysis method on the building's facade photo is to verify the composition follows the Golden Section formulation rules.

2. Theoretical Background

The theoretical approach used is to make visual observations on objects. When we observe at the architectural form it is a composition of architectural elements, such as windows, doors, staircases, horizontal gutter lines, and other ornaments. Comparison of the proportion of head or roof, body parts, and base parts, usually the result of the taste of the architect.

Open spaces are areas where we can observe research objects. Instructions for repeating and frequently-watched

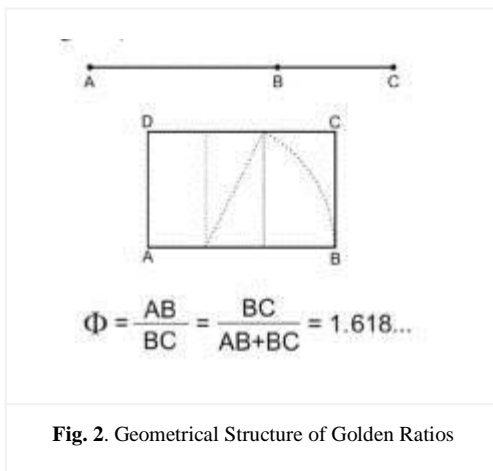
visual features, such as vertical rhythms, horizontal rhythms, skylines, wall detail, windows, doors, floor detail, or stairs (Bentley, 1987). The Responsive Environments approach emphasizes the importance of visual richness in designing buildings.

The principle of proportion in architectural design is known as one of the components to aid in the establishment of aesthetic dimensions visually. The principle that applies is the arrangement of the comparison between the sides of the line that form the field and space in the entire building cluster. Comparative arrangement through the Golden Section is a measure to measure mathematically proportional or not the final result of architectural work (Ching, 1996). The Golden Section describes a set of geometric figures that include: lines, circles, and rectangles. The ratio of Golden Section proportion can be defined as **phi** number:

$$\varphi = \frac{1 + \sqrt{5}}{2} = 1.618$$

Fig. 1. Golden Ratio

Golden ratios are achieved geometrically as follows (Figure 2)



Former research on the mosque obtained of framework that the mosque is recognized from the elements of dome, usually large, tall tower, inner courtyard, mihrab, makmun or prayer room, ceiling, signage, and ornament (Handayani, 2016).

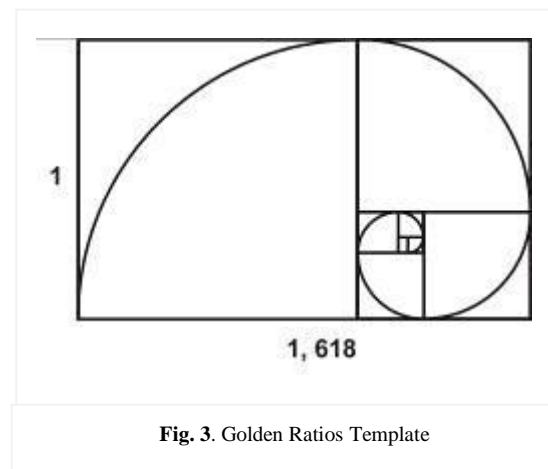
3. The Research Methods

This research uses qualitative descriptive method and visual exploration on selected objects. The reason for the selection of objects, because it is a mosque that has a similar shape and private built. The phenomenon that happens that a person who is financially able to establish a mosque has the

authority to determine the style of the mosque in accordance with his imagination and not the entire design submitted to the architect. The grandeur of the mosque visually as if it indirectly represents the strength of its founder economically, and incidentally the three mosques were founded by entrepreneurs.

At-Tin Mosque is located in Taman Mini Indonesia Indah, founded by Ibu Tien Soeharto Foundation, a foundation belonging to the descendant of Ibu Tien Soeharto, the wife of former president Soeharto. Opened publicly on 26 November 1999. Masjid Dian Al Mahri in Depok, founded by Hj. Dian Djuriah Maimun Al Rasyid, entrepreneur from Banten. The mosque was opened to the public on December 31, 2006. Then the Great Mosque of Trans Studio Bandung, was founded by entrepreneur Chairul Tanjung, chairman of CT Corp, in the integrated recreational and shopping area of Trans Studio Bandung. The mosque was inaugurated on July 10, 2015.

The three mosques above are paired and analyzed visually using the Golden Section proportion ratio. Observations are applied to the building façade of the roof or dome and the whole body of the building. Then the elements of the buildings observed are the shape of the roof, doors, windows, stairs, and ornament. The Golden Section exploration is applied by creating a quadrilateral template with a proportion ratio of 1: 1,618 first. Rectangular shape, when divided into rectilinear shape and rotated with the same ratio, will form a spiral known as the Golden Spiral. Spiral center is visually an important part of a composition.



4. Result and Discussion

At Tin Mosque, designed by Fauzan Noe'man and Ahmad Noe'man. The mosque is vaulted, in contrast of Ahmad Noe'man's earlier mosques design without a dome. The mosque occupies a land area of 70,000 m2, a capacity of about 9,000 worshipers in the mosque and 1,850 pilgrims in the hall and plaza. At Tin Mosque is designed with a main dome in the center of the building and ornament "Allah" on top of the dome. Small dome in each corner is the roof of the tower. The façade portion features three vertical-upward-pointed upward shapes and is the main entrance.

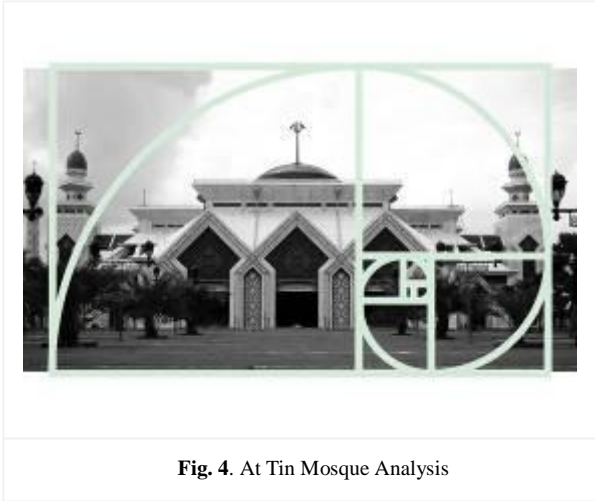


Fig. 4. At Tin Mosque Analysis

In Fig. 4 analysis, the proportion of the mosque corresponds to the Golden Section ratio when observed a certain distance including the two towers on left and right side. Most of the mosque plaza becomes part of the quadrilateral proportion. Perspective from a certain distance like this is embodied in the analysis of Responsive Environments. In order to support the visual richness, the elements to be seen must be clear. The spiral center is on one of the doors.

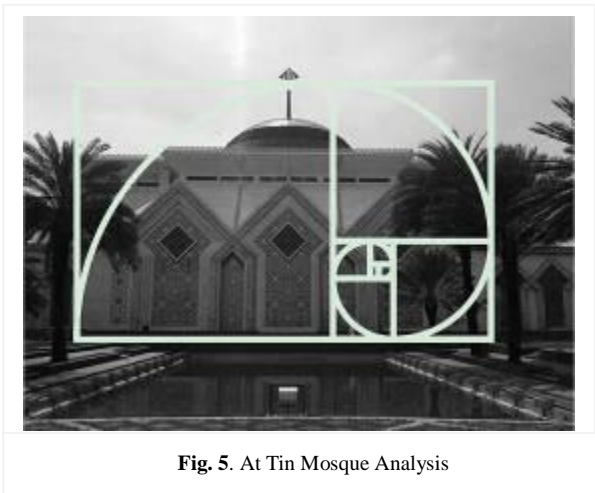


Fig. 5. At Tin Mosque Analysis

In figure 5 analysis, the minimized template only measures the center of the mosque. The observed portion is the western side, or the outer wall portion of the Mihrab. The entire body of the mosque to the pole ornament included in the template. But the center of the spiral shift is no longer right in one of the arrow shapes. But if the viewing angle retreats from a certain distance as well as the analysis of figure 6, below, then the spiral center is in one of the arrows.

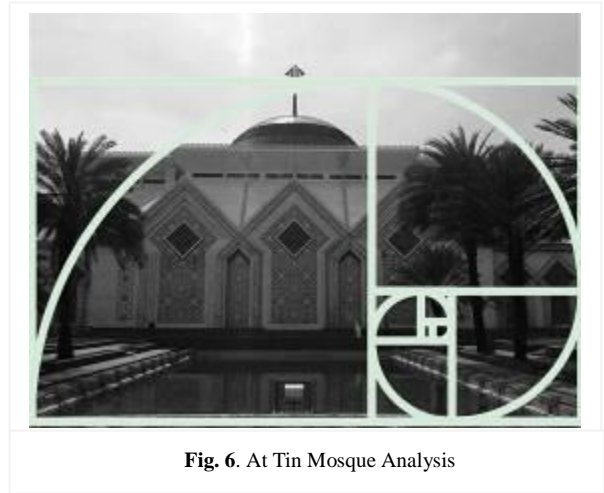


Fig. 6. At Tin Mosque Analysis

The Dian Al Mahri mosque design is also a domed mosque resembling the dome of the Taj Mahal. The diameter of the main dome is 16 meters lower, while the middle is 20 meters, and 25 meters in height. The main dome is surrounded by 4 smaller domes, a bottom diameter of 6 meters, a center of 7 meters, and a height of 8 meters. The inner pages are 45X57 meters deep and can accommodate 8000 worshipers. The mosque is also equipped with 6 towers (minarets) in the form of hexagons.

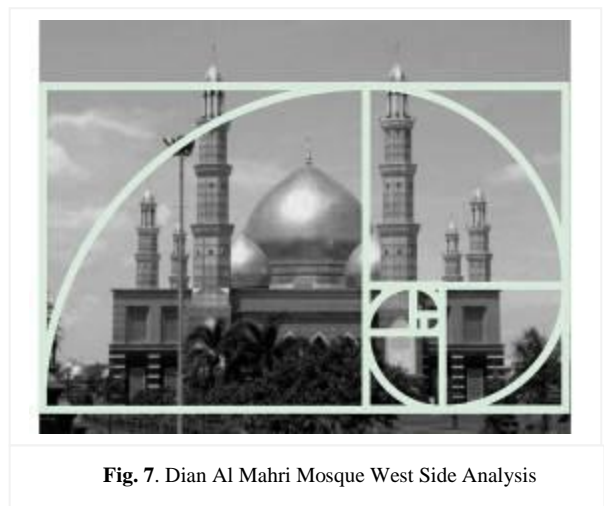


Fig. 7. Dian Al Mahri Mosque West Side Analysis

In figure 7 analysis, it is performed on the outside wall of the mihrab. This is done because the main entrance of the

mosque through the plaza which is surrounded by corridor. Two towers on the west wall seemed to be a marker of the boundary of the mihrab area. The results of the analysis through the Golden Spiral indicate the spiral center leading to one of the towers.



Fig. 8. Dian Al Mahri Mosque Entrance Analysis

Analysis on the main entrance (figure 8), indicating the main door is located exactly symmetry in the middle. To get the Golden Section proportions, the template is adjusted between the height and width of the field. Apparently gained the position of the main door right in the field of Golden. As explanation in figure 9 below:

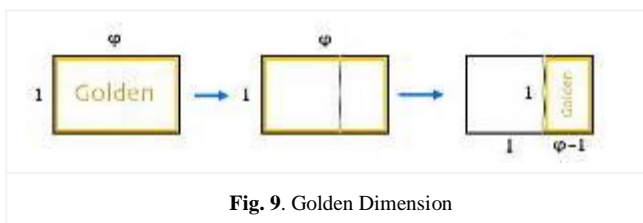


Fig. 9. Golden Dimension

The Trans Studio Grand Mosque Bandung has a building area of approximately 1800 m², consists of two floors, namely the ground floor and mezzanine for women's prayers. Part of the integrated recreation area of Trans Studio Mall, the mosque's façade is inspired by the design of the Nabawi mosque in Madinah and can accommodate 1500-2000 worshippers. Semi-basement section functioned as a reception room. It has 5 domes, comprising 1 main dome in the middle colored gold, and 4 smaller domes in the corner of a silver building.

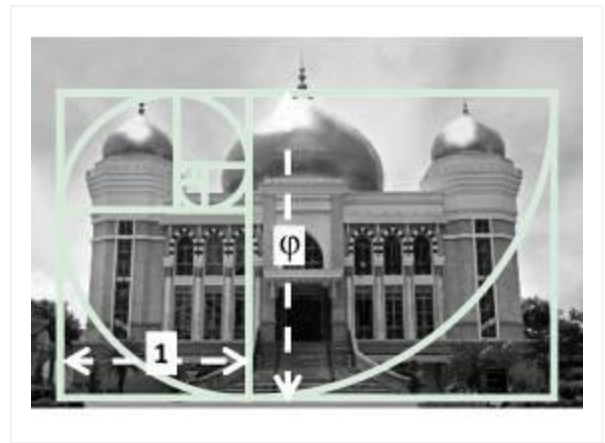


Fig. 10. Trans Studio Great Mosque Analysis

In contrast to the analysis of the previous two mosques, the Trans Studio Grand Mosque does not have a plaza that is part of the mosque. Analysis figure 10 still uses the Golden Section template and rotates to find the proper golden proportions. The results of the analysis show that the side of the front looks, from the base of the building to the dome still enter the proportion of golden.

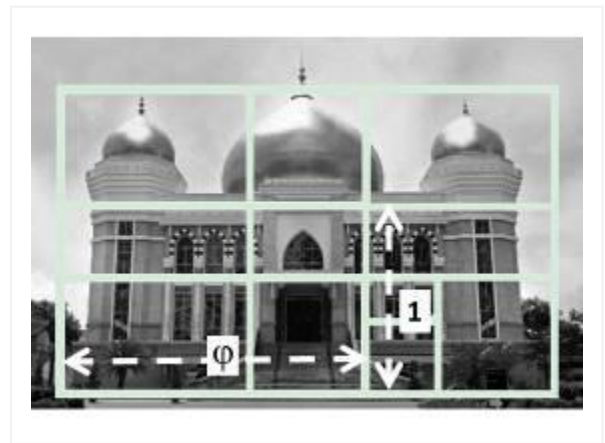


Fig. 11. Trans Studio Great Mosque Analysis

In contrast to the previous analysis, on the analysis figure 11 applied grid templates. The grid template is a simplify of the previous Golden Section template. Each rectangular box, between the short side and the long side has a proportion of Golden composition, which is 1 : 1.618. The head of the building looks dominant in the top grid. Compared to the two other mosques analyzed, At Tin Mosque and Dian Al Mahri Mosque, the comparison of dome composition and building body of Trans Studio Grand Mosque, looks dominant.

5. Conclusion

Building analysis methods with Golden Section templates are for evaluation, whether the composition and proportion of the building is in harmony or in good composition. Processing the shape and looks of the building is a taste of the architect, and is very personal. Similarly, public who use the building often does not realize, what underlies a building already looks good or weird.

The phi number as the Golden number of the processed form composition in history is allegedly applied to the Parthenon temple in Greece. Various studies show that the proportion of gold 1: 1,618 is accepted as a fitting proportion. The conclusion of research on 3 mosques shows that using the proportion of gold on the façade is one step to get harmony and unity.

Although visibility and focus on the field to be observed also affect the results of the analysis. So that it could happen, from the visibility is too close, the composition of the building is not harmony. But when viewed from a certain distance, and observers can see the whole building, just obtained the right proportion.

Research can still be more refined, because the possibility of distortion from the angle of photo shoots. The application of the Golden Section can still proceed to measure façade elements, such as the proportion of windows, doors, and other details.

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