

Concept of Prostration in Traditional Malay Mosque Design to the Surrounding Environment with Case Study of Tranquerah Mosque in Malacca, Malaysia

Ahmad Sanusi Hassan
sanusi@usm.my or sanusi.usm@gmail.com

Universiti Sains Malaysia

Abstract

This study discusses symbol of prostration concept in the traditional Malay mosque design in Malacca. The literature review covers definition of the keywords, which are sustainable elements, traditional mosque design in Malacca and prostration. The purpose is to identify factors that have significant roles in defining symbol of obedience concept based on Islamic perspectives in the traditional Malay mosque design. In this study, concept of obedience is defined as the acts of prostration to the surrounding environment. The level of prostration is measured based on five Islamic laws as follows; obligation (wajib), desirability (sunnat), permissibility (harus), undesirability (makruh) and prohibition (haram). These laws are used as measurable scale in the research analysis to measure the level of prostration in the mosque design. Tranquerah Mosque located in Tranquerah district, Malacca is selected as the case study. This mosque is the oldest mosque in Malacca and second oldest mosque in Malaysia. The analysis shows that the mosque's symbol of prostration concept is influenced by the local climatic context with reference to comfort and health as the primary indicators. The design elements comprise pyramid roof form, tiered roof system, roof overhangs, roof ridge form, building orientation, open veranda and wall openings.

Keywords: sustainable elements, mosque, the traditional Malay, prostration.

INTRODUCTION

The objective of this study is to analyse concept of prostration to the traditional Malay mosque design in Malacca. The concept refers to the acts of prostration to the surrounding environment. The argument is that modern mosque design in Malaysia hardly has the concept of obedience to the local context because it is derived from Arab, Turkish, Indian or colonial mosque style; for example, there is an emphasis on iconic 'dome' roof form, which is hardly considered as sustainable design approach to the tropical context. This issue indicates the design superseded by iconic symbol from other regions, which has nothing to do with concept of prostration to the contextual environment. The end-result creates clashes of the architectural identity due to lack of narration to the root of local architecture with an emphasis on harmony to the existing environment. There are four key words in this study which are 'sustainable elements', 'mosque', 'the traditional Malay' and 'prostration'. The study comprises literature review to understand definition of the key words and to identify factors that influence sustainable design approaches in the traditional Malay mosque in Malacca, which images the architectural style with concept of prostration. The other part of this study is to measure the level of prostration in the traditional mosque design.

DEFINITION OF SUSTAINABILITY AND TRADITIONAL MOSQUE DESIGN

The first key word in this study is 'sustainable elements'. In this study, sustainable elements mean integration of design elements, which reflect to the regional climatic context influenced by religious, social and technological factors as noted in the Brundtland report, "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (MacDonald, 1998). This research study is to test an argument from the research assumption that warm temperature, relatively high humidity, heavy rainfall, prevailing winds (Atmaca, Kaynakli & Yigit 2007) and tropical day lighting become the indicators, which influence to the obedience symbol of sustainable elements constructed in the traditional Malay mosque design. These values have indirectly formed concept of prostration in the mosque design, which portrays the Islamic and regional identity.

Mosque is one type of buildings, which symbolises Islamic architecture (Zaki 1995, 15). The word 'mosque' is derived from French language, which means 'mosque'e'. The origin of this word is from Spanish, *mezquita*. In Arabic language, this word is known as 'masjid' coming from the word 'sajd' (Gazalba 1975, 108), which means '*sujud*' (prostration) and '*sejadah*' (prayer mat) (Nasir, 1984). The combination of these two words means an act of prostration by a person on a prayer mat. This act of prostration is necessary when a Muslim is performing prayers. In architecture terminology, the word 'mosque' refers to a building used for prayer activities. The existence of mosque is very important for the Muslims' devotion to Allah as argued by Selamat (2002, 187) because without the mosque existence, the Muslims are leading to neglect the congregational prayer (*solah*). The mosque design therefore should portray symbol of prostration, which reflects to the meaning of 'masjid'.

The other key words are 'traditional' and 'Malay'. The words 'traditional' is an adjective which refers to the meaning of customary, long-established or habitual, and 'Malay' is a specific ethnic background who live in Peninsular Malaysia and Malay archipelagos in South East Asia where the majority is Muslims. The traditional mosque design in Malacca has historical values of Islam and its development in Malacca. In 14th century, Malacca reached its glory as a great kingdom in this region. The kingdom had played an important role as the centre of Islamic study (Che Mat, 2010) as well as trades, politics and architecture. Its empire covers Peninsular Malaysia, and parts of Java and Sumatra. The kingdom became the trading centre and controlled the trading routes at the Straits of Malacca, South China Sea and Straits of Sunda.

The surviving traditional Malay mosques in Malacca today as argued by Mohamad Rasdi (2000, 106) illustrates the architecture of the Malay world with its uniqueness in its construction

age of technology and climatic approach to integrate with the space function and elements of the mosque architecture. The space function and elements are very important in the mosque design. Their main reference is originated from the Prophet Mosque (Omer 2004; Syed Ariffin 2005) known today as Nabawi Mosque in Madinah, which has the space function and elements as follows:

- Building orientation to qiblat direction
- Entrance gate
- Ablution (*wuduk*) area
- Veranda area (*serambi*)
- Prayer hall
- Niche area (*mihrab*)
- Sermon podium (*mimbar*)
- Main roof design
- Minaret

CONCEPT OF PROSTRATION BASED ON ISLAMIC PERSPECTIVES

Concept of prostration (key word) in relation to the surrounding environment becomes fundamental considerations in Islamic architecture. In Islam, there are many verses in Al-Quran and Hadith mentioned about Allah (God), His created universe and environment. Concept of prostration is an expression to an act of devotion to Allah, the creator of the nature and universe. Stated in Surah Al-Nahl (a translation of verse 23)¹, saying that Allah dislikes whoever filled with pride. Therefore, an act of devotion to Allah becomes a primary subject in Islamic architecture. An act of devotion means an act of obedience to Allah. In architecture, the measurable factors of the building design therefore should be symbolised by concept of prostration to His creations, which reflect to 'how the mosque is designed' in relation to the existing surrounding environment.

Islamic architecture co-relates to an expression with an act of devotion in the mosque design. An expression of its physical form and space should reflect to the surrounding environment as its prostration values. Utaberta (2003) argued that without this expression, the building design does not fully able to deliver its sustainable devoted linkage, and it instead shows either an act of arrogance and pride, or ignorance to the God's creation. The focus in this study is a physical and spiritual approach of sustainability related to an act of devotion to Allah, the creator of the nature and universe (Hassan 2004). The basis of architecture in Islamic point of views should comprise its concept of prostration, a design integrated with the natural surrounding environment as a symbol of devotion to the God's existence (Mohamad Rasdi 2005, 19). Mohamad Rasdi (1998) in his journal has questioned the style of mosque architecture, which is important to describe Muslim architecture rather than Islamic architecture because the former can be the latter but not necessarily vice versa.

The issue in modern mosque design nowadays is that it connotes misleading appreciation of architectural beauty. The design portrays self-pride and arrogance over the contextual environment. It ignores the importance to the concept of prostration. The translation from Surah Al-A'raaf (verse 31)² is that "Allah dislikes people who cross the limits". Integration of beauty and aesthetics in the building design from the surrounding context is therefore essential which can enhance the act of prostration and generate the growth of faith (*Iman*)³ to the believers.

¹ Surah Al-Nahl (verse 23), Al-Quran Al-Karim

² Surah Al-A'raaf (verse 31) from Al-Quran Al-Karim

³ Based on Chapter 8 - Art In Islam in Subject Tassawur Islam (UDI3052) of IKIP College and Open University Malaysia by lecturer Khazali Idris from source [http://khazalii.googlepages.com/8udi3052keseniandalamislam\(bab8\)](http://khazalii.googlepages.com/8udi3052keseniandalamislam(bab8)).

*Fitrah means the basic human creation in terms of needs and capabilities.

Architecture is a combination of art and science, and art in Islam as noted by Idris (2009) is scientific connection of man-made design to the existing nature and living things.⁴ Art in Islam refers to an expression, which shows a connection between human and God with reference to the natural surroundings and living things. A translation from Al-Hadith by Abdullaah Ibn Mas'ood⁵ quoted that Allah is beautiful and likes beauty.

CONCEPT OF PROSTRATION TO THE SURROUNDING ENVIRONMENT

Understanding geographical condition is important to identify a design, which is able to portray the concept of prostration. It provides an indicator to the designer to design a mosque with an expression related to the concept of prostration. The study on climatic approach in architecture currently becomes popular topics (Lin, Tan, Wang, Song, Zhu & Zhai 2004) among the researchers, academicians and architects to enhance comfort and healthy level to the building occupants. In addition to comfort and health factors, this study is also an important reference in Islamic perspective to design mosques and buildings, which are able to portray an act of prostration to Allah. The design should be conducive, harmonious and habitable which remind to the Muslims about the Greatness of Allah, and the goals in their livelihood. In Islam, the message of modesty in architecture is the first goal to be achieved as argued by Mohamad Rasdi (2001, Utusan Malaysia 02 April) which illustrates the building design adaptation to the existing place and its natural surroundings. The geographical condition therefore provides important indicators to the building design to relate its prostration concept influenced by the surrounding environment such as temperature, humidity, rainfall, natural air flow and sunlight.

The geographical condition in this region becomes a reference for the traditional Malay mosque design. It provides information how to portray an expression to the concept of prostration to the mosque design. One of the indicators is that the design should be adaptive to the regional warm temperature. The temperature ranges from 25°C at night to 38°C in the evening. Due to the warm temperature, sun shading and day lighting become important factors in the building design. In addition, the building design needs to comply with the constraint of humidity factor. This region has high humidity level because it has high annual rainfall (an average of 2500mm) and is surrounded by sea (with an average distance of less than 200 kilometres from the sea and a quarter of the region is land while the rest is ocean) (Robequain 1954). The wind direction is southwards (southwest monsoon) in January but gradually changes its direction to northwards (northeast monsoon) in July (Robequain 1954). Excessively high annual rainfall accelerates evaporation, which causes humidity. The vapour content has only a slight difference between day and night as well as throughout the year. The water vapour is normally from 19 to 24 grams per cubic metre which is twice that of England during the summer (Fisher 1964). The average humidity level is above 60%. All areas experience about the same duration of day and night, and have similar annual climatic patterns and seasonal weather (Fisher 1964). The sun path is at about an angle of 90° degree during the daytime from east to west direction. As a result, sun shading, air ventilation and rainwater discharge system become important design factors for an expression of prostration concept integrated to the mosque design.

⁴ Based on Chapter 8 - Art In Islam in Subject Tassawur Islam (UDI3052) of IKIP College and Open University Malaysia by lecturer Khazali Idris from source [http://khazalii.googlepages.com/8udi3052keseniandalamislam\(bab8\)](http://khazalii.googlepages.com/8udi3052keseniandalamislam(bab8)).

⁵ Al-Hadith narrated by Abdullaah Ibn Mas'ood.

METHODOLOGY OF THE RESEARCH

Tranquerah Mosque is selected as the case study because it is the oldest mosque in Malacca and the second oldest mosque in Malaysia. The unique about the traditional Malay mosque in Malacca is that there are 56 traditional mosques survived and still used for Friday prayer. All these mosques have the same design with dominant pyramid and attached roof form concept. According to Mohd. Akib (2003), the pyramid roof name in Malay language is '*bumbung son pecah empat*' which means a 'mount shape' roof form with four different roof ridge slopes. Tranquerah Mosque is gazetted under conservation programme by the State of Malacca Museum Foundation (*Perbadanan Muzium Negeri Melaka* known as PERZIM). This programme is a part of the state government incentives to conserve heritage buildings when the inner city of Malacca is recognised as a heritage site under the UNESCO World Heritage Lists.

The roof has three-tiered roof form (three levels of pyramid roof form) which is like 'a roof constructed above the roof' system. The roof tiers are meant for multiple volume expression of the building interior. There are two segments (roof walls) erected between the upper and middle roof layer, and between the middle and lower roof layer. The roof design is the same as those in the other three oldest mosques in South East Asia, which are Kudus Mosque at Demak in Java; Kuno Mosque in South Vietnam, Indo China; and Kampung Laut Old Mosque in Kelantan, Peninsular Malaysia. It has an influence from Chinese building construction style rather than dome roof form from building construction style in India, Persia, Arab and Turkey. It is therefore the objective of this study to show that the traditional Malay mosque typifies the most ideal mosque design in this region which symbolises concept of prostration to the existing surrounding environment. This study uses qualitative analysis. The resources are taken from written reports and books, measured drawings, site observations, interviews with the local residents and curator of the Architecture Museum in Malacca.

The scale of measurement for the analysis are referred to five Islamic divine laws which are obligation (*wajib*), desirability (*sunat*), permissibility (*harus*), undesirability (*makruh*) and prohibition (*haram*). These five laws are termed as *Ahkam Khamsah*⁶. In this analysis, this scale is used to measure the level of prostration in the traditional mosque design. The definition of these five divine laws is as follows:

- a). *Wajib* means compulsory to obey basic requirements in the building design in symbolising the concept of prostration to Allah who is the creator of nature and universe. The design expresses an ideal sacred place for worship. There will be a reward by Allah for this obedience.
- b). *Sunat* means an obedience which is not compulsory. It generates additional goodness and beneficial in conveying the concept of prostration to the building design. There will be a reward for this obedience.
- c). *Harus* means that there is neither restriction nor encouragement in Syariah laws. In this case, the act of either obedience or disobedience has no impact in expressing the concept of prostration.
- d). *Makruh* means the building design which promotes something that is useless, no goodness and unbeneficial (*Lagha*^{7*}) to the concept of prostration.
- e). *Haram* means disobedience in fulfilling basic requirements in the building design to reach the level of prostration. This disobedience consists of wrongdoings and neglecting

⁶ The Word Jurisprudence (*Fiqh*) in the Holy Qur'an and the Traditions by Martyr Ayatullah Murtada Mutahhari from <http://www.imamreza.net/eng/imamreza.php?id=832> sourced by Dr Nizam bin Sahad, lecturer of Islamic Studies Department of School of Humanities, Universiti Sains Malaysia.

* *Pahala* means good and rewarding points which will be accumulated by Allah S.W.T for every good deed done by us.

* *Dosa* means bad and punishing points which will be accumulated by Allah S.W.T for every forbidden and bad deed done by us.

* *Lagha* means worldly things, useless, unbeneficial, time-wasting and does not bring any good to someone.

responsibilities, disassociating the concept of prostration to Allah who is the creator of nature and universe. This disobedient design is instead shows pride and superiority over the God's creation. It is considered as sinful.

THE CASE STUDY: TRANQUERAH MOSQUE

The location of Tranquerah Mosque (Figure 1) is at Tranquerah (*Tangkera* in Malay language) in Central District of Malacca. The building was built in 1141 Hijrah (Islamic calendar) or in 1728 AD. On 8th September 1977, this mosque was gazzeted by PERZIM as heritage building under Section 15: Act 168/1976 Antiquity. The existence of Tranquerah Mosque becomes evidence that Islam was a primary religion in the Kingdom of Malacca 600 years ago. When the Portuguese conquered Malacca in 1511, all mosques in this city were destroyed by the Portuguese, and all activities related to Islam were prohibited. These occurrences were due to a great sentiment by Portuguese over the Muslims who had once ruled their country (Andalusia currently known as Portugal and Spain) in Europe during the era of Omayyad Caliph.



Figure 1. Tranquerah Mosque

After the defeat of Portuguese at Malacca by the Dutch in 1641, the Dutch gave permission to the local Muslims to build the mosque and had their Islamic practices. As a result, many mosques were built in Malacca in that time. In case of Tranquerah Mosque, this building was originally built during the Kingdom of Malacca's time, using timber materials and its roof cover was enveloped with *nypa* or *bertam* (palm like tree) leaves. It was destroyed by the Portuguese, but later was rebuilt with the same architectural style during the Dutch time with new materials like timber and brick as what can be seen today. It has four central pillars made from 'belian' timber (*eusideroxylon zwagerias* as its scientific name, also known as Borneo ironwood) located in its prayer hall. Two renovations had been done in 1890 and 1910. Part of this mosque is a cemetery. There is a tomb of [Sultan Hussein Muhamad Shah](#) beside this mosque who involved in the agreement of Singapore's execution to the British represented by Sir Stamford Raffles on [6th February 1819](#) (Risalah PERZIM*** 1969). After the execution, the majesty left Singapore and move to Malacca. He died on 5th September 1835.

The scope of this qualitative analysis is limited to the original part of the mosque design. It consists of three areas, which are prayer hall, *mihrab* and *serambi*. It does not comply with the additional parts of the mosque constructed after that, which were built to create additional areas for congregational Friday prayer. Prayer hall is the main area for congregational prayers. It covers the largest area of the mosque. Its dimension is 12.20m (width) x 15.55m (length). *Serambi* is a

*** State of Malacca Museum Corporation

perimeter corridor or veranda area at the southwest, northeast, and southeast parts of the prayer hall. Its width is 3.35m. *Mihrab* is a niche area, a small prayer area for one person, the *Imam* who leads the congregational prayers. Its size is 1.5m (width) x 1.5m (length).

ANALYSIS

Measurable factors in this analysis are pyramid roof form, tiered roof system, attached roof overhangs, roof crown, roof ridges, roof tails, post and beam construction, building foundation, building orientation, open veranda and wall openings. Each factor is measured using the scale of measurement [obligation (*wajib*), desirability (*sunat*), permissibility (*harus*), undesirability (*makruh*) and prohibition (*haram*)] as mentioned earlier in order to know its level of importance in the mosque design which symbolises the concept of prostration in relation to the surrounding environment. The analysis is as follows:

A. Pyramid Roof Form



Figure 2. Pyramid roof form.

Tranquerah Mosque has pyramid roof form design (Figure 2). This roof form has excellent performance to tackle the problem of harsh tropical sunlight and large amount of rainwater. The pyramid roof functions like a large ‘umbrella’ to protect the building interior from direct sunlight and rainwater. This pyramid roof works best with the surrounding contexts to provide healthy and comfortable condition to the building occupants. Selection of this type of the roof form is therefore obligatory in Islamic perspective, which expresses concept of prostration to Allah, the creator of the natural surrounding and universe. Table 1 shows results of the analysis as follows:

1. The pyramid roof provides excellent shades to the prayer area from high angle sunlight, which occurs when the sun position is at an angle more than 30° degree from the ground level in the morning and evening. This roof design is obligatory (*wajib*).
2. The roof has overhangs about one metre wide from the building wall. With these roof overhangs, the roof provides additional shades to the roof windows and veranda areas from direct exposure to the sunlight. Only diffused sunlight penetrates into the building. The design of roof overhangs is obligatory (*wajib*).
3. The roof overhangs do not able to give efficient shades to the roof windows and prayer area from low angle sunlight (when the sun angle below 30° degree from the

ground). The other problem is that the low angle sunlight creates glare. The weakness is that the design does not apply screen louvers (only limited to fascia boards) as a part of the important roof elements. However, the impact from direct exposure to this low angle sunlight is minimal, which penetrates limited to the walls and ceilings. The evening's low angle sunlight has similar position (northwest) to the qiblat orientation. The qiblat wall has limited window openings. As a result, the temperature created by the low angle sunlight is low (29° C) compared to high angle sunlight (34° C) (Hassan, 2010). The analysis concludes that without the use of screen louver, this design approach is undesirable (*makruh*).

4. There is no need to have louvered elements at the pyramid roof to hinder direct exposure from the morning's low angle sunlight. Skin exposure from low angle sunlight in the morning is necessary for health reason. This design approach is desirable (*sunat*).
5. Pyramid roof with its slope angle at 45° degree is the best roof form, which induces smooth rainwater flow from the roof to the ground level. It hinders the problem of rainwater leakages. This roof design is obligatory (*wajib*).
6. The roof overhangs hinder rainwater deflections into the prayer area. The design of roof overhangs is obligatory (*wajib*).

Table 1. Analysis of pyramid roof form.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Pyramid Roof Form		Comfort & health	x				
Simple roof with overhangs but has no screen louver in the design, only with fascia board	1	High angle sun shading	x				
	2	Diffused day lighting	x				
	3	Low angle sunlight (evening)				x	
	4	Low angle sunlight (morning)		x			
	5	Smooth rainwater flow	x				
	6	Rainwater deflections	x				

B. Tiered Roof System

Tranquerah Mosque has three tiered pyramid roof design (Figure 3). The design gives excellent level of thermal comfort and health. Nasir noted that this design is typical to the traditional Malay mosque construction in South East Asia in Sumatra, Jawa, Kelantan, Pattani, Perak dan Kemboja. (Nasir 1984, 33; Nasir 2004, 59; Ambary 2002, 164), known by the locals as 'three roof segments' (*bumbung tiga tangkup*). This design has three roof and wall segments at the ground floor, lower roof and upper roof level. The purpose is to create a series of lower and upper roof windows at the roof wall segments for air ventilation and stack effect.

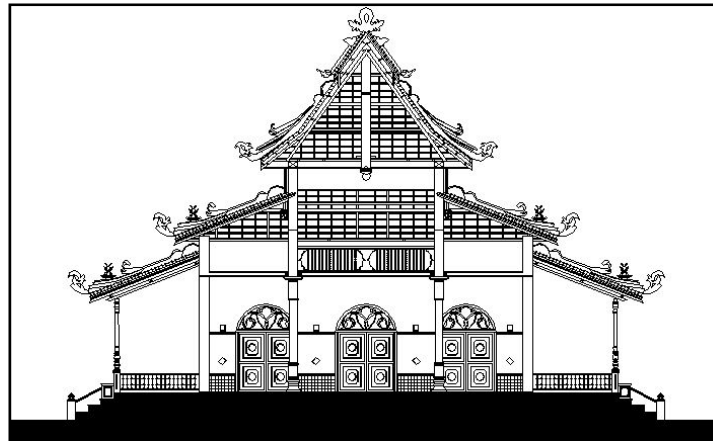


Figure 3. Tiered roof form construction.

Table 2 shows that there are four advantages (Table 2) of this tiered roof system, which are as follows:

1. Tiered roof system is a design meant for multiple volume expression to the building interior. The purpose is to provide excellent air ventilation for passive cooling. Application of this roof system shows an understanding by the local master builders to the law of natural environment that warm air is lighter than cool air. With this understanding, they had applied tiered roof system as an important part of the design elements. The multiple volume design creates large interior space for warm air to ventilate upward to the upper level and induces fresh and cool air ventilation from outside into the building. Application of this tiered roof system is therefore obligatory (*wajib*).
2. Tiered roof system provides window design at the lower and upper roof level. The design creates a series of roof window openings for the indoor warm air to flow outside the building. The window design induces stack effect where the warm air is pressured upward to flow outside the building through roof windows while outside cool air is pressured to flow into the building through window and door openings and the ground level. This design approach is obligatory (*wajib*).
3. The design provides diffused day lighting into the building through lower and upper roof window openings. This day lighting creates lighting ambience into the interior space. The design for diffused day lighting is obligatory (*wajib*).

Table 2. Analysis of three tiered roof form.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Three Tiered Roof		Comfort & health	x				
Simple three level roof system with multiple volume space for passive cooling system	1	Air ventilation (passive cooling)	x				
	2	Stack effect	x				
	3	Day lighting roof windows	x				

C. Attached Roof Overhangs



Figure 4. Lower and upper attached roof overhangs.

Construction of attached roof (Figure 4) is important in the traditional Malay mosque design. The attached roof is attached to the pyramid roof structures. In case of Tranquerah Mosque, there are two types of attached roof, which are lower and upper attached roof overhangs. Lower attached roof are erected between the recessed wall’s beam and outer veranda beam whereas upper attached roof are erected between the primary roof beam and the recessed wall beam. These attached roofs work like an attached large ‘umbrella’ to protect the building interior from direct sunlight and rain. Results of the analysis (Table 3) are as follows:

Table 3. Analysis of attached roof overhangs.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Attached Roof Overhang		Comfort & health	x				
Simple two attached roof overhangs but has no screen louver in the design, only with fascia board	1	High angle sun shading	x				
	2	Low angle sun shading				x	
	3	Smooth rainwater flow	x				
	4	Prevent rainwater deflection	x				

1. These attached roofs have overhangs, which block high angle sunlight and allow penetration of subtle sunlight. Lower and upper attached roofs provide shade to the open veranda area (3.35 meter width) and roof window openings respectively. These attached roofs have projected eaves about one meter width. The purpose is to have overhangs to obstruct direct sunlight exposed to the prayer hall and veranda (*serambi*) area. Application of attached roof overhangs in the mosque design is obligatory (*wajib*).
2. The attached roof overhangs block high angle sunlight from penetrating to the building interior. They however do not able to block low angle sunlight. To tackle this problem, the traditional mosque design applies recessed wall concept with open veranda (*serambi*). This design does not work at the northwest wall which has no recessed wall and open veranda. The wall’s exposure to the low angle sunlight is

minimal because it has limited openings. The analysis finds that no screen louver is integrated in the traditional mosque design. The advantage of the screen louver is to block low angle sunlight. With no screen louver, this design approach is undesirable (*makruh*).

3. The attached roofs function like a lower and upper parts of the roof's umbrella. With the slope angle at 22.5° degree, which generates smooth rainwater flow cascading from the pyramid roof.
4. The attached roofs have overhangs to prevent rainwater deflection. The design approach is obligatory (*wajib*).

D. Roof Crown



Figure 5. Roof crown.

Roof crown (Figure 5) is one of the important symbolic elements in the traditional Malay mosque design. It is built on the pyramid roof top and images like a trophy, an ultimate decorative symbol of the mosque recognised by the local community (Nasir 1984, 34). The roof crown is supported by a kingpost. Ambary (2002, 164) described the roof crown as to comply with its priceless and special symbol of Islam. Application of Islamic dome design is crucial to illustrate its difference from temple and other buildings. Unlike the mosque design in Arab region, traditional mosque design in South East Asia does not have large dome construction but it has a very small dome. The roof crown is made from plaster cement. A small dome is designed inside a square flower vase (a lower and upper layer) like a petal projection of a flower. Results of the analysis (Table 4) are as follows:

1. The roof has relatively a very small dome. In contrast to the size of the building (15.55m length x 15.55m width x 13m height), the crown size is only 600mm in diameter and 900mm in height. In contrast to pyramid roof form, having a large dome for the mosque design is not suitable to the climatic context and the surrounding environment. This design approach is obligatory (*wajib*).
2. Only a small dome is integrated in the design. The purpose is to limit the importance of dome symbol and to have the significance of pyramid roof form appropriate to the surrounding contexts related to the mosque design (identity). Design with large dome is forbidden because it does not suit to the tropical context, and it rather portrays iconic symbol which supersedes the importance of the mosque design based on the surrounding contexts. Design with a small dome is obligatory (*wajib*).

Table 4. Analysis of the roof crown.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Roof Crown		Identity	x				
A small dome at the roof top like a petal flower	1	Small in size	x				
	2	Islamic with prostration symbol	x				

D. Roof ridges



Figure 6. Roof ridges.

Roof ridges are one of the important roof elements in the traditional mosque design (Figure 6). Roof ridges are constructed at a diagonal roof slope line, which joints a corner of two roof slopes. The design has an influence from Chinese roof construction (Boyd 1962). In case of Tranquerah Mosque, there are four roof ridges constructed at its pyramid roof and attached roof overhangs. The roof ridges are made of lime mortar, which consists of lime, sand and water. The lime powders are made from either limestone or seashells⁸. The analysis shows the results in Table 5 as follows:

1. Construction of the roof ridges is necessary for the climatic reason, which has heavy rainfall. The roof ridges inhibit the possibility of roof leakages at the roof joints. The roof ridge's design is obligatory (*wajib*).
2. The roof ridges are designed to look like a 'spine' of the roof surface. The ridges creates a division of the roof joints to allow smooth flow of rainwater. The design is obligatory (*wajib*).

Table 5. Analysis of the roof ridges.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Roof Ridges		Health	x				
A ridge constructed at the joint of two roof corners	1	Avoid roof leakages	x				
	2	Smooth rainwater flow	x				

⁸ Based on information from Iesnordin Haji Malan, the curator of Architecture Museum in Malacca.

E. Roof tails

Roof tails become a part of the roof elements (Figure 7) in the traditional Malay mosque design in Malacca. Table 6 shows results of the analysis as follows:

1. Roof tails are simply an aesthetic element, a subtle decorative figure creating more emphasis on the regional identity with Chinese influence (Nasir 1984, 33; Boyd 1962). The local master builders call these elements as ‘dragon tail’ (*ekor naga*), an influence from Chinese roof design. The design of the dragon tails has an emphasis on orientation to vertical projection in contrast to roof tails at Kg. Laut Old Mosque in Kelantan. The design approach is permissible (*harus*).
2. These elements mark as a gentle roof ridge’s end projection. These roof tails are carved objects projected out from the roof ridges. In case with Tranquerah Mosque, there are two roof tail projections at each roof ridge. The study finds that the design does not have any linkages to environmental adaptation. The design approach is permissible (*harus*).



Figure 7. Roof tails.

Table 6. Analysis of the roof tails.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Roof tails		Identity			x		
Abstract form of dragon tail figure influenced by Chinese architecture	1	Dragon tail figure			x		
marking the end point of the roof ridges	2	Marking the end point			x		

G. Post and Beam Construction



Figure 8. Post and beam construction of the lower attached roof at veranda area.

The design of Tranquerah Mosque applies simple post (column) and beam construction technique (Figure 8). Belian timbers, a local material which is abundance at that time from the surrounding forest are used to construct the building and roof structures. They are one of the hardest and most durable timber types in Malaysia. Table 7 shows results of the analysis as follows:

1. The reason for the selection using post and beam construction technique is because of its suitability for pyramid roof's construction using timber as the primary structural material. Today, due to lack of timber supply and availability, concrete material is used in the post and beam construction. To construct a mosque with pyramid roof form, four central columns are erected as the core structure. These columns support the floor and roof structures. These columns are known as the 'central pillars' (Dawson and Gillow 1994, 28) and the local people call these columns as '*tiang seri*'. The dimension of each central pillar is 500mm (length) by 500mm (width), and its height is 17.5m. Design with post and beam concept is therefore obligatory (*wajib*).
2. Cantilevered, transfer beams and columns are important in the construction of the mosque to construct multiple volume pyramid roof form and roof overhangs. All beams are erected to the columns at 90° degree's angle while the rafters are erected at angles varied from 30° to 60° degree depending to their locations. The upper roof construction applies transferred cross and tie beam system, and one transferred column (kingpost), which functions as a thrust to the rafters erected to support the pyramid roof. The columns, beams and rafters are erected using mortise joints with wooden pegs. The other columns are secondary and tertiary which are columns erected at the recessed walls and tertiary columns at *serambi* area known as '*tiang serambi*' respectively (Figure 8). The dimension of secondary columns is 180mm width by 180mm length and 4.7metre high while the tertiary columns has a dimension of 180mm diameter with 3m height. This post and beam construction has cantilevered rafters, making possible for construction of the roof overhangs as sun shading device. The design approach is obligatory (*wajib*).

Table 7. Analysis of post and beam construction technique.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Post and Beam		Construction Technique	x				
Simple structural building construction, prefabricated system applying based on building materials from the surrounding environment	1	Post & beam structures	x				
	2	Cantilevered and transferred structures (shades)	x				

H. Building Foundation



Figure 9. Building foundation.

Tranquerah Mosque has a podium foundation (Figure 9). The original design of traditional mosques in Malacca has ‘on stilt’s structure’. All the mosques were destroyed by the Portuguese during colonisation. All the mosques today were built during the Dutch period. No wonder that their building foundation has a design influence from China with European construction materials and decorative elements. The results of the analysis (Table 8) are as follows:

1. This podium with its height of 0.9 metre is not appropriate building foundation design to this region compared to the traditional ‘on stilt foundation’ system. The podium construction requires site clearing in order to build the foundation perimetered by retaining walls. This design approach is undesirable (*makruh*).
2. Lime cements (mixed with gravels, sands and water), bricks and stones are the materials for retaining wall construction. This building foundation is then compacted with soils and gravels during the landfill operation. The construction damages the construction site, which causes problems of soils erosion and sedimentation to the river system. It causes river pollution and an increase of flood prone areas. This design approach is undesirable (*makruh*).

Table 8. Analysis of the building foundation.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Building Foundation		Construction Technique				x	
Podium based foundation, influenced by Chinese architecture	1	Podium base Retaining wall				x	
	2	Landfill (compacted) levelling				x	

I. Building Orientation to Qiblat

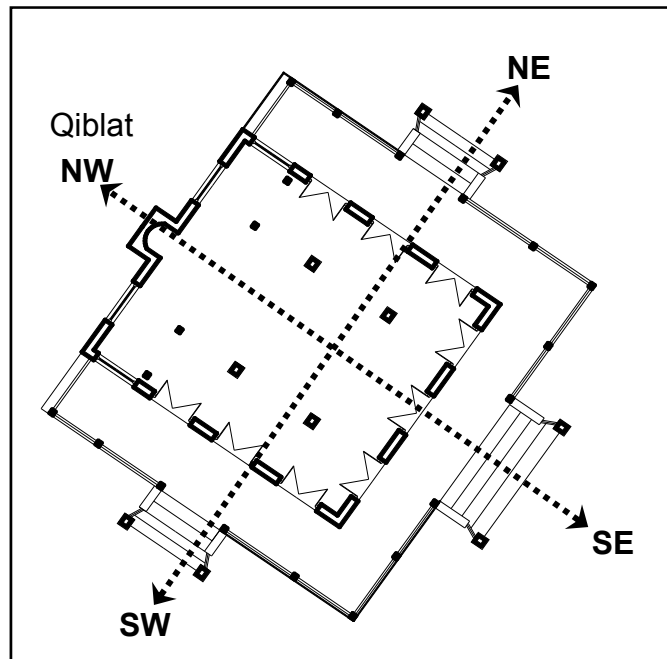


Figure 10. Mosque designed orientation to qiblat.

Direction to qiblat is compulsory in mosque design. Qiblat direction is an orientation to Kaabah. Kaabah is a monument, almost a square-formed building. Its dimension is 12.30m length, 10.18m width and 15.40m height (Risalah, 1969). Its location is in Mecca, the birthplace of Prophet Muhamad (peace be upon him) in Saudi Arabia. It marks a direction or compass, and the symbol of unity. Table 9 shows results of the analysis as follows:

1. Mosque orientation to qiblat (Figure 10) is the most important consideration in the mosque design, as mentioned by Petherbridge (1995, 202). This orientation is compulsory in Islam because all prayers must be at the qiblat direction. The design orientated to qiblat direction is obligatory (*wajib*).
2. In South East Asia, the qiblat is about northwest direction at 292° degree and the mosque orientation is at this direction facing the qiblat. This orientation is similar to the sun path orientation. At two times in a year, the evening sun path has exact orientation to the qiblat direction. With this orientation, the mosque design has minimum exposure to high angle natural sunlight, which reduces the indoor temperature. This condition offers excellent facade design with maximum door and window openings at southeast, southwest and northeast walls for air ventilation and diffused sunlight. The design approach is obligatory (*wajib*).

Table 9. Analysis of the building orientation

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Building Orientation		Comfort & Health	x				
Building orientation to Qiblat direction similar to the sunpath	1	Islamic requirement	x				
	2	Sunpath orientation	x				

J. Open Veranda



Figure 11. Open veranda

Veranda is a long and narrow area. The local people call this place as *serambi* area. It is an open area (Figure 11) located outside the prayer hall. The width of this area is 3.35m. Its floor level is about 75mm slightly lower than a floor level of the prayer hall (Gibbs 1987). No veranda area is built at the qiblat direction (northwest) of the mosque. This area becomes a part of the prayer hall with *mihrab* area. Table 10 shows results of the analysis as follows:

1. The design of Tranquerah Mosque has an open veranda concept, which is an open indoor mosque area under the roof overhang, functioned as an open area for performing prayers. Its facade has no perimeter walls, only bordered with railings and stair entrances. It is an open area where one shall enter after stepping the entrance stairways. The design is important because it creates wide roof overhang area to block direct sunlight and to get excellent air ventilation. The design of open veranda concept is obligatory (*wajib*).
2. Veranda design enhances the level of thermal comfort because it makes possible for the construction of recessed walls to block the sunlight and rainwater deflection into the prayer hall. The design approach is obligatory (*wajib*).

Table 10. Analysis of the open veranda concept.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Open Veranda Concept		Comfort & Health	x				
Open veranda concept to increase the area of overhang and application of recessed wall concept	1	Open veranda	x				
	2	Recessed wall	x				

K. Wall Openings

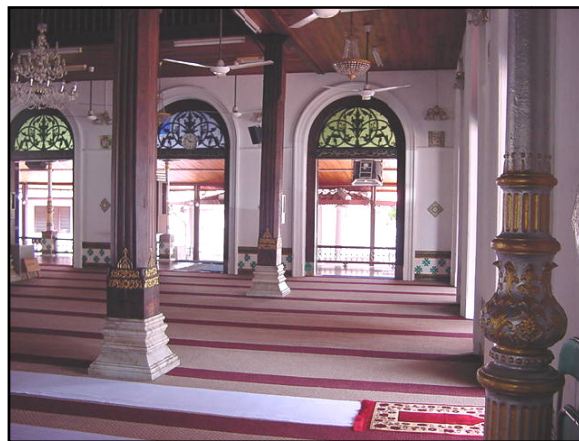


Figure 12. Prayer hall with large door openings.

Prayer hall is the most important area in the mosque design. It is where all prayers are conducted. Prayer hall is an enclosed space enveloped by walls. In case of Tranquerah Mosque, this area has large wall openings (Figure 12) for air ventilation (Stavrakakis, Koukou, Vrachopoulos and Markatos 2008). Tranquerah Mosque has a square building plan design with rectangular plan of its prayer hall. The prayer hall has 12.20m width, 15.55m length and 13m height. Table 11 shows results of the analysis as follows:

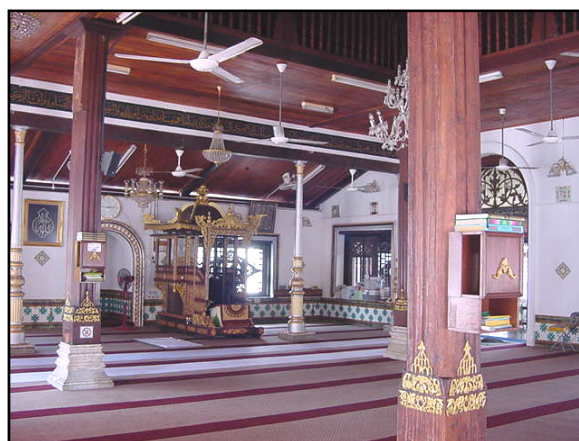


Figure 13. Prayer hall.

1. Mosque orientation to qiblat direction is the best position to gain from prevailing winds (Brown & Deekay 2001, 182; Hamdi, Lachiver & Michaud 1999; Chiras 2002)

of northeast and southwest monsoons to the northeast and southwest wall openings respectively. These door and window openings induce excellent cross air movement. The design approach is obligatory (*wajib*).

2. Excellent air flow is necessary because it ventilates cool air into the building and induces warm air upward and outward. This type of air flow is known as stack effect. This condition occurs because the warm air is lighter than the cool air. The air pressure induces the warm and humid air to ventilate outside the building through the roof window openings. The purpose of this design is to attain excellent indoor air quality. This condition can be achieved by inducing the outside fresh air into the prayer hall which dilutes the existing polluted indoor air. It is an efficient design for comfortable and healthy indoor air environment. Allard, Santamouris and Alvarez (1998) noted that the level of cross air ventilation is depending on the quantity of the air ventilation into the indoor area. Stavarakakis, Koukou, Vrachopoulos and Markatos (2008) noted that with this passive cooling design, it reduces the energy cost 40% compared to building using air-conditioning system. The design approach is obligatory (*wajib*).
3. Design with wall openings for day lighting is crucial for comfortable and healthy environment. Edwards and Torcellini (2002) argued that with large window and door openings on the recessed wall, they provide openings for day lighting. Permitting direct sunlight into the building in a tropical region is considered as poor design because it penetrates sun heat with it. It increases the indoor temperature. The recessed walls and open veranda area offer excellent overhang design to shade the prayer hall from direct sunlight. They furnish daylight to the interior spaces from indirect sunlight. The design approach is obligatory (*wajib*).

Table 11. Analysis of the large wall openings.

Architectural Elements	No.	Sustainability	Level of Obedience				
			Wajib	Sunat	Harus	Makruh	Haram
Large Wall Openings		Comfort & Health	x				
Large wall openings (doors, windows and upper windows) at ground floor and roof wall.	1	Air ventilations	x				
	2	Stack effects	x				
	3	Day lighting	x				

CONCLUSION

The result shows that the traditional mosque design has integrated concept of prostration to the surrounding environment. The connection is illustrated through its design related to the climatic contexts in the tropics. Comfort and health plays important roles in the mosque design, which applies design elements such as pyramid roof form, three tiered roof system, attached roof overhangs, roof ridges, building orientation, open veranda and wall openings. The results show that all the design approaches are under obligatory (*wajib*) and desirable (*sunat*) category except the followings:

- No consideration to tackle the problem of evening low angle sunlight in the design of pyramid roof form and roof overhangs. This design approach is undesirable (*makruh*). Direct exposure to evening sunlight generates heat, solar radiation and glare. Screen louvers should be an important design element to block the evening low angle sunlight.
- Podium construction for the building foundation is not suitable in this region. This design approach is undesirable (*makruh*). It gives negative impact to the environment leading to

the problem of soil erosion and river sedimentation. The design using elevated floor with on stilts structures is recommended.

The traditional mosque design should be the best example to other buildings which is able to portray the design integration of surrounding environment with concept of prostration. With this improvement, the traditional mosques are able to serve as a sustainable model based on Islamic perspectives, which symbolises an act of prostration and obedience to Allah the creator of nature and universe, towards positive development of mosque architecture in this region.

Acknowledgement

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