Argument Islam Came from East to South east asia: Influences of Traditional Chinese Construction Elements at Kampung Laut's Old Mosque, Malaysia

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Abstract

The aim of this paper is to support an argument that Islam came to South East Asia from East in contrast to most arguments that Islam came from West, and Kingdom of Champa plays a crucial role in spreading this religion and Chinese architecture in this Malay Archipelago. This argument uses evidence from a construction study of Kampung Laut's Old Mosque (KLOM) in Kelantan, which is the oldest mosque in Malaysia. There are several historical studies already shows evidences to support this argument. In this study, this argument will be supported through analysis of the construction elements, comparisons to the influences of Chinese construction elements to the design of KLOM. There are two categories of the construction elements, which are roof constructions and building structures. These categories are defined from a literature study. The analysis finds that KLOM has construction elements influenced by Chinese architecture, but if compared to its construction details, there are differences between KLOM and the traditional Chinese buildings. KLOM has its own specific regional construction elements which apply simple post and beam construction technique, on stilts' structures, triple volume roof form and the design based on Islamic influence.

1. Introduction

The purpose of this research is to measure the level of influence of the Chinese construction elements to Kampung Laut Old Mosque (KLOM) in the state of Kelantan, Malaysia. In addition, the Kingdom of Champa in Indo China plays a significant role in spreading this religion and Chinese architecture to the southern parts of South East Asia (known as the Malay Archipelago consisting Indonesia and Malaysia). The importance of this study is to reveal through construction analysis to support an argument that the spread of Islam to Malaysia as well as South East Asia comes first from China (East), not from India and Arabian region (West). The study is very crucial because its findings can be used as a guideline to the design development of Islamic architecture in Malaysia, especially to building construction in the state of Kelantan. KLOM is chosen as the case study because it is the oldest mosque not only in Kelantan, but also in Malaysia. There are several architectural research studies done before, related to this area but these studies do not focus like the title of this study. The studies instead are for the building conservation and inventory research.

2. Theoretical Background

The existence of Kampung Laut's Old Mosque as the oldest mosque in Malaysia becomes the evidence that Islam comes to the Malay Archipelago from the east in contrast to most written history text books in Malaysia which note Islam comes to this region from the west. The spread of Islam in this region occurred during sea route's trading activities. The primary trades were along port cities in Sumatra, Java, Malacca, Kelantan, and Pattani. Location of Champa port cities (Indo China) was at the middle route, before reaching port cities in China. The Arab merchants while doing trading activities had introduced and spread Islam in South East Asia. As a result, there were many Islamic Empires established in Indo China, Peninsular Malaysia, Java, and Sumatra.

This study attempts to prove by analysis of the building construction elements of KLOM that the spread of Islam comes much earlier to this region, not from the west but from the east. According to Ishak (1992, 65-70) in his book titled *Islam in the Malay World*, one of the theory is Islam comes to the Malay Archipelago from China and Champa. There are arguments from the Chinese Muslims in the Republic of China that trades between Arab and Chinese people had established before the birth of Islam. The Arab Muslims had come to China during Pang Dynasty under the rule of Emperor Tai Tsuing (627-650 AD). Lui Tshich, one of the Chinese writers at that time reported that Caliph Othman ibnu Affan had sent Saad ibnu Abi Waqqas as a messenger to China and he lived in Canton.

In addition, Ishak (1992, 70) noted that there is a written report during Dynasty Tang (618-907) that many messengers of the Abbasid Caliph were sent to China for political and economic relationship. Many Arab Muslims were awarded Chinese citizenship, and there were intermarriage between Arab Muslim and the local women. The Arab merchants also had participated in trade with South East Asian cities which were among important trading routes with China. The religion of Islam spread during the trading activities. In 878 AD, a rebellion however occurred in China by the Chinese people due to their jealousy to the Arab immigrants who were regarded as a noble and respective group (traders) in China because of their success in economy. About 100,000 immigrants were killed who were mostly Arab ethnic background. The tragedy had led the Arab immigrants to migrate to South East Asia and settle in this region.

Azmi (1980, 144) besides in his study argued that in case of Kelantan, the discovery of 'dinar' gold schilling in Kelantan in 1914 AD. There are several Arabic texts inscribed with Arabic number 'OVV' which means the date of the schilling, 577 Hijrah equivalents to 1181 AD, much earlier than the existence of Islam in Malacca. This archaeological discovery becomes the evidence that the population in Kelantan at that time were Muslims. It also proved that Kelantan was one of the earliest Islamic regions located at the east coast of Peninsular Malaysia in South East Asia. This argument is supported by Emanuel Codinho de Eridia, the Portuguese who wrote in a report in 1613 that Islam was spread to Malacca from the east coast, Pattani and 'Pang'. Many historians argue to the place referred to the word 'Pang' to two different places in this region which are 'Pahang' in Peninsular Malaysia and 'Phan Rang' in Champa (Al-Ahmadi 1990, 6).

3. History of KLOM

Kampung Laut's Old Mosque (Figure 1) is recorded as the oldest mosque in Malaysia. It is the oldest mosque and timber building in this country. Based on the folk story by the local villagers (Al-Ahmadi 1990, 11), KLOM was believed built by Muslim missionaries (who were at the same generation to Wali Songo, known in Indonesia as popular nine local pious missionaries who had spread Islam in this region) from Islamic Kingdom of Demak, Java while sailing to Islamic Kingdom of Champa in Indo China. At that time, Champa and Demak Dynasty had a closed tie to each other. There was recorded that the King of Champa had married princess from Demak as a part of the efforts by these two nations to strengthen their brotherhood. Trading activities between these two nations, and other port cities along its routes were grown rapidly. Muslim missionaries from Kingdoms of Champa and Demak also played their important role in

spreading knowledge of Islam and teaching Islamic education at these port cities.

Figure 1: Perspective view of KLOM and its minaret.
Source: Drawn by Mohd. Hafiz Muhamad Jubri Students Year 2, 2009 Architecture.

The location of Kingdom of Champa is at the present day known as Indo China. Champa architecture is grouped under Indo China building styles. The architecture is from Kingdom of Champa. In present time, Indo China consists of several countries which are Vietnam, Cambodia, Laos and Thailand. This region is located at the northern part of Peninsular Malaysia. The specific location of Champa Kingdom is at the present day South Vietnam and southern part of Cambodia. At that time parts of Indo China (North Vietnam and Laos) were under Kingdom of China ruled by Han Dynasty.

Mohd. Akib (2003, 7-8) and Al-Ahmadi (1984, 67) argued Champa Kingdom had played a significant role in spreading Islam and having economic activities in Kelantan and Pattani in the 16th century. Construction elements from Indo China were also transferred to many regions in the Malay Archipelago along its trading routes to the Kingdom of Champa. The influence of Champa architecture can be traced at the traditional mosque architecture in the Malay Kingdoms such as Majapahit, Demak and Malacca. According to Wikipedia (2008), role of Champa people in spreading Islam to the Malay Kingdoms of Srivijaya, Majapahit, Demak, Malacca and Johore-Riau were significant through sea route's trade and cultural relations.

The record from Indonesia describes the role of Champa Princess, Princess Darawati who influenced her husband, King Kertawijaya of Majapahit converted to Islam, and the same role from Champa Kingdom was to Malacca when its king, Parameswara converted to Islam. The evidence is the discovery of tombstone belongs to Champa Princess in Trowulan, the archeological site used

to be a capital city of Majapahit Kingdom, Java. Its date of construction is about slightly later than the date of construction of the other two oldest mosques in South East Asia which are Kudus Mosque at Demak in Java and Kuno Mosque in Champa, Indo China. This means that these three mosques can be grouped as among the earliest surviving mosques built at the same period in South East Asia. They have similarities in construction styles from Kingdom of Champa in the 16th century (Ambary 2002, 166). The style also has Nusantara(1) influence. It has a mixture of Chinese and Malay architecture.

KLOM today still functions as a mosque (a living gallery) for Friday *khutbah* (sermon) and congregational prayers. Like other mosques, KLOM is a place for worships by the Muslims. Kuban (1974) noted that mosques are defined as a place for prayers. The word 'mosque' in Arabic language is 'masjid' 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. It is due to an obligatory to all Muslims (Antoniou, 1981) to perform five times congregation prayers a day as stated in the holy book of Al-Quran. According to Nasir (1984), the mosques were also used as a discussion and conference centre in governing the nation during the time of Prophet Muhammad (peace be upon him).

The location of this mosque is at Nilam Puri about 15 km from Kota Bharu, the state capital of Kelantan. The original location of KLOM is at Kampung Laut. It is where the name of the mosque was derived from. The relocation of KLOM was restored after the 1966-67's great flood occurred in Kelantan as well as other parts of Malaysia. During the opening ceremony of this restoration, Hamdan Sheikh Tahir, the chairman of Malaysian Historical Association had noted that the flood had risen to the level of the KLOM. When the flood shrunk, the riverbank closed to the mosque had collapsed and damaged the pedestrian walkways. The floor and building structure had slanted, and it was dangerous for the local villagers to continue using KLOM for religious activities. This timber mosque was then disassembled by the State government, and restored to a new site, Nilam Puri a distance away from Kelantan river to avoid from flood. The restoration was completed in 1970. Near at its original site Kampung Laut), the state government had built a new brick mosque for the local uses. The distance between Nilam Puri and Kampung Laut is about 18 km.

4. Construction Elements of KLOM

The focus of this study is to analyse construction elements which influence the architecture of KLOM. Before the analysis is made, a synthesis to the design

(1) Architecture in South East Asian Region or Malay architecture.

constructions is crucial. The aim is to understand the definition of this building construction by identifying factors by categories which influence the construction elements of KLOM. This synthesis comprises two categories as follows:

a. Roof Constructions

b. Building Structures

4.1 Roof Constructions

Roof construction plays an important role in defining the roof form of KLOM. The study finds that there are 10 elements of the roof construction. These elements become measurable factors for this analysis. They are as follows:

(a). Pyramid Roof Form

Roof construction of KLOM has pyramid roof type (Figure 1 & 2). This roof type is commonly used for traditional mosque and surau(2) (madrasah) in Southeast Asia. It has a square base. According to Mohd Akib (2003, 40), the roof is called in Malay language as *bumbung son pecah empat*. It means a mount shape roof form with four different ridge slopes.

Figure 2: KLOM with its triple roof form.

(b). Tiered Roof Form

The roof design of KLOM has three-tiered pyramid roof form (Figure 2). The roof tiers are meant for multiple volume design in segmented form, which provides air-ventilation and indirect natural sunlight in the hot humid climate. There are two segments erected between the most top and middle roof layer, and between the middle and lower roof layer creating upper and lower windows

(2) A small building used for congregational prayers except Friday prayer

known as *sisir angin* (clerestory window). The roof is covered with roof tiles. The size of tiered roof form is related to the size of the prayer hall. Mosques with three-tiered pyramid roof form are also found in Malacca. According to Abdul Halim Nasir (1995, 59), three-tiered roof form is also used for construction of traditional mosques in Java and Sumatra (Ambary 2002, 164), Pattani (Southern Thailand), Perak (Peninsular Malaysia) and Cambodia. It creates an expression of triple volume architectural space. This triple volume character does not mean that KLOM has three floors' design. It is instead a single storey building. There is no construction for the upper floor.

(c). Attached Roof Form

Construction of three tiered pyramid roof form of KLOM applies attached roof eave concept (Figure 2). The projected roof eaves give shades to the window openings and verandah (*serambi*) area from direct sunlight. This roof overhang is about 1 metre from the building wall (or for verandah is the floor edge). There are four primary columns erected on the ground to give support to the roof structures. The same columns besides support the attached roof structures. The roof structures consist of roof beams which have two types of spans, primary beam for middle spans and secondary beams for the side spans. The side span is about 2/3 of the middle span.

(d). Roof Crown

KLOM has a roof crown (Figure 2), a structural element at its pyramid roof top on the kingpost. It is like a 'crown' for this building to express its ultimate role as a religious centre, and priceless and special symbol (Ambary 2002, 164) by the local community. Local master builders call this element as *buah butung*. The crown has a 'dome like form' similar to the dome construction at mosques in Middle East, North Africa, Iran, Turkey and India. Compared to the dome size constructed in these parts of the Islamic World, the dome size of KLOM is relatively very small. In contrast to the size of the building (15.86 x 15.86 metre), its size is only about 2.4 metre in diameter and 3.15 metre in height. The roof crown was made from ceramic material. The crown has three tiers. The bottom layer has a domical shape, and the middle layer has spherical form with about 0.7 metre, which is 1/3 of the diameter of the dome at its bottom or 1/4 of the overall height. The top layer has conical shape to mark the end point of the dome.

(e). Roof ridged boards

KLOM has dominant roof ridges (Figure 1 & 2). These ridges mark the horizontal line jointing corners of two roof slopes. The use of dominant roof ridges expresses the cultural identity of the traditional mosque design. The roof

ridges are made from lime mortar. This material may be the same as the material used in the construction of roof ridges at traditional mosques in Malacca which is lime, sand and water as a mortar, available at that time. The lime is made from either limestone powder or seashells(3).

(f). Roof Tails

One of the most attractive decorative figures at KLOM is roof tails (Figure 1 & 2). These roof tails are carved objects projected out from the roof ridges. These objects are known by the local master builders as 'duck tail' (*ekor itik*) because of their shape like a tail of a duck. This decorative figure is placed at the edge of the roof ridge. KLOM has 4 roof ridges at the pyramid roof, another 4 roof ridges at the middle attached roof, and the other 4 roof ridges at the lower attached roof. Therefore, there are a total of 12 duck tails placed to these roof ridges. Duck tails have a design emphasized on orientation to horizontal projection with curved surfaces. The duck tail has a design with 3 projected angles. Its middle angle is about twice larger than the size of its other two sides.

(g). Roof tiles

Senggora roof tiles (Figure 3) are commonly used as roof covers for traditional buildings in Kelantan and Terengganu at the East Coast of Peninsular Malaysia, and Sourthern Thailand. The word *Senggora* is derived from the name of a place in Southern Thailand, Senggora (Mohd. Akid 2003, 87). These materials are made from clay, also known by the local people as *atap bata tanah* (clay brick roof tiles). The same type of clay is used to make bricks. The clay is compressed into specific moulds, and after that these moulds are placed into oven room for drying process (**Hanafi** ????). This process will make these materials become water resistance and long lasting. The local people call the factory as *Gak Bata* (brick house/workshop).

(h). Upper roof window openings

Three tiered roof construction are meant for the design of upper window openings (Figure 1) creating natural air ventilation and indirect natural lights. These openings provide passive design solution which is important for tropical buildings especially public places like the mosques (public building) used by a large number of people at one time. The local people call these windows as *'sisir angin'* which means 'louvered openings' to permits wind ventilation. In KLOM's roof design, the construction of three roof layers creates two types of upper roof window openings (clerestory openings). These upper windows do not function like windows built on the mosque's floor level, which is constructed

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

using anthropomorphic scale (human proportion) with an emphasis of views and cross ventilation as important factors in the design. The upper windows however, are fitted to enhance for stack impact sucking warm air flow out from the upper roof windows and replaced by cool air from the ground. The design shows that the traditional master builder of KLOM understood the warm air is lighter than the cool air. As a result, upper windows are important elements for passive design approach.

Figure 3: A roof covered with Senggora roof tiles.

(i). Roof overhangs

KLOM has a design of roof overhangs (Figure 1). Roof overhangs are important for tropical buildings. It is projected roof eaves at the lower edge of a roof. The construction is possible by using cantilevered roof rafter to support the roof eaves. The overhang is cantilevered about 1 metre from the building wall. The purposes are to avoid rainwater sprinkle from deflected to interior buildings and to provide shades against direct sunlight. The roof edge is fitted with fascia boards to protect the cantilevered roof structures. The fittings are about few inches under the layer of *Senggora* roof tiles. Fascia boards are decorative elements commonly carved with floral and leaf motives.

(j). Roof structures

Roof structures (Figure 4) at KLOM are a combination of four layers of transferred columns and beams layers. The lowest structures support the building floor area, which is the main prayer hall. This floor has square in shape, elevated

about 1 metre from the ground surface. Its dimension is 16.2 m by 16.2 m (54 ft by 54 ft). The prayer hall has 26 regular and 4 large columns. The middle structures have two layers of roof beams. Both the upper and lower beams of these middle structures support the lower and upper attached roof. A series of rafters are placed on the upper and lower beams at 45 degree angle. The upper roof beams support entire loads of the pyramid roof. There is no ceiling construction in the traditional mosque. All structures are intentionally exposed and emphasised as parts of the beauty in architecture.

4.2 Building Structures

Building structures are important factors in defining the construction elements of KLOM. Measurable factors of the building structures are as follows:

(a). Post and Beam Construction

Construction of KLOM applies simple post (column) and beam (lintel) system (Figure 4). All beams are placed to the columns at 90 degree's angle, and the rafters at angle from 30 to 60 degree. This construction technique besides is used to build several layers of transferred column and beam system. Building structures like columns, beams and rafters are erected using mortise joints with wooden pegs. The design shows that the past master builders had understood to apply post and beam construction technique building a complex construction of three tiered pyramid roof structures of KLOM.

(b). Building Foundation

KLOM has a building foundation erected using 'on stilts' construction technique (Figure 4). 'On stilts' construction means erection of building floor system elevated at several feet above the ground earth's surface. Mohd. Akib (2003, 24) noted the actual height of the elevated ground floor is about 2.3 meter from the ground when this building was at its original site in Kampung Laut. Today at Nilam Puri, the ground floor of KLOM has a level about one meter from the ground. 'On stilts' construction begins with digging holes at certain depth for location of the column system. A series of stones (or a hardwood timber at the past before stones are introduced) are placed at these holes to function as the column bases. Timber columns are then erected on these bases and after that, with beams. The levelling process of the ground floor level at 0^{o} degree angle is made during the erection of lower beams that supports the floor area.

(c). Four Central Pillars

The construction of KLOM is primarily relying on its four inner columns (Figure 5). Dawson and Gillow (1994, 28) called these columns as the 'central

pillars'. These central pillars are at prayer hall area. These columns are called *tiang seri* by the local people. These columns functions as the core structure supporting the floor and roof structures. The dimension of each column is 500mm (length) by 500mm (width) (Al-Ahmadi 1990, 9), and the height is 10.5m. The columns' span is about 6m width to the Qiblat orientation and 7m length at the other side. These central columns become the landmark at the interior mosque's praying hall. Their existence is due to become the primary columns supporting the three tiered roof structures. These columns are erected to the height of the pyramid roof structures where a series of transferred cross and tie beams are placed.

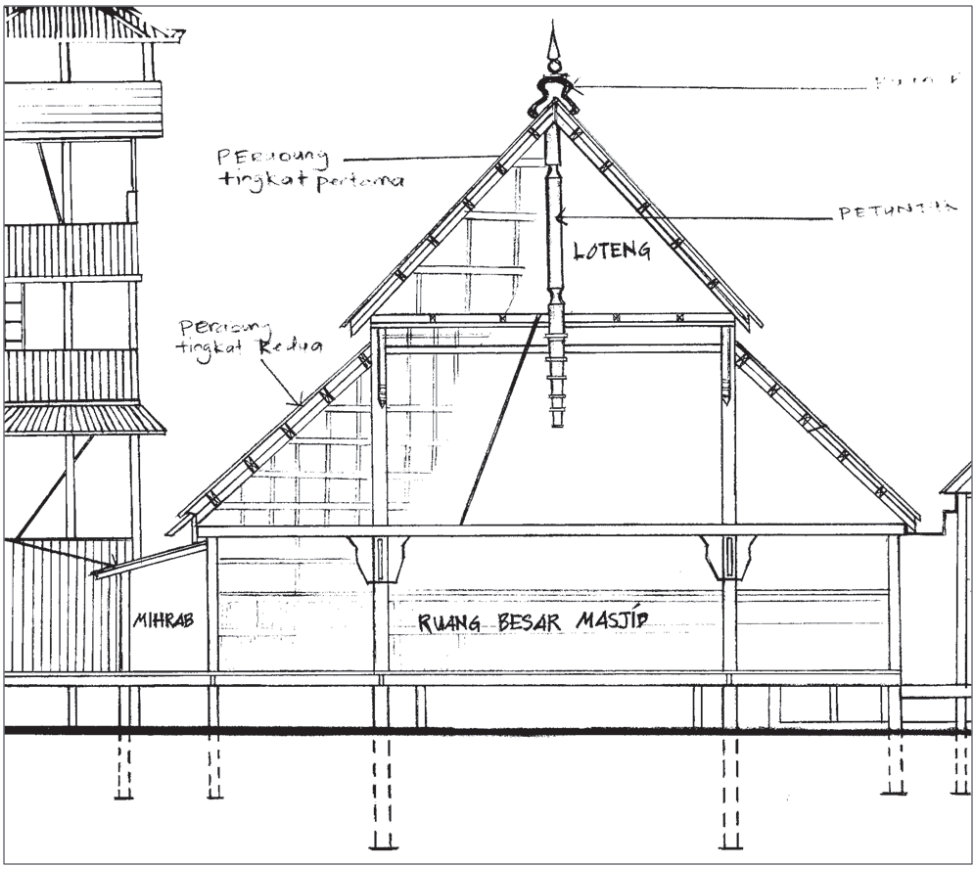

Figure 4: Section of KLOM.

Source: Drawn by Dubashan Subramaniam Students Year 2, 2009 Architecture.

(d). Transferred Structures

The roof structures (Figure 4) have only one transferred column which is a kingpost. The roof structures also have only one joist where the kingpost is placed. This kingpost is erected to give a thrust and support to the rafters of the pyramid roof. It also supports the load of the roof crown (*buah butung*). This kingpost is known by the local master builder as *tunjuk langit*. The load from the kingpost is transferred to the joist and upper beams under a support from the central pillars (*tiang seri*).

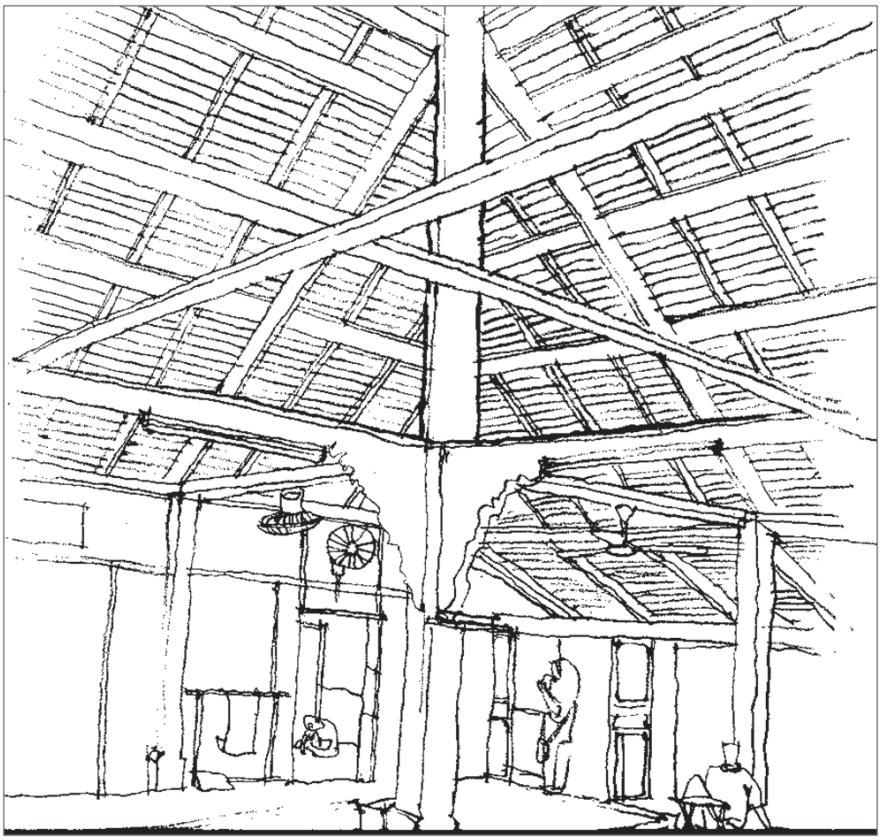

Figure 5: Interior view of the prayer hall with one of its central pillar.

Source: Drawn by Mohd. Hafiz Muhamad Jubri Students Year 2, 2009 Architecture.

(e). Structural orientation

Orientation to Qiblat becomes a fundamental axis in the mosque design. Qiblat is an orientation to Kaabah. All Muslims are aware of the orientation to Kaabah as an important point of direction when performing prayers and pilgrimage (Hussin 1998, 1). Kaabah is a square form building or monument located in Makkah (Mecca) (Abdul Ghani 2003, 35). In Peninsular Malaysia, the direction is about 30 degree at North East direction. Like other mosques, KLOM has an orientation to Qiblat. The orientation gives influences to its structural layout, which becomes a fundamental orientation in defining a space for the prayer area. There is a *mihrab* design at the front mosque's façade. *Mihrab* is a narrow niche indicating the direction to Kaabah. It functions as a point of reference for the Muslims (especially to those who are strangers) to place their direction when performing a prayer. This area also becomes a place for the Imam when performing congregational prayers. The back façade is about at Southeast direction, where the primary entrance is placed.

(f). Hierarchical Order of Structural Layout

There are four central pillars (50mm x 500mm) supporting the upper roof

(Figure 4) and middle roof structures while another 15 secondary columns (150 mm x 150 mm) (the other one only support the ground floor level) supporting the middle roof and ground floor level and the other 24 tertiary columns give a support to the lower roof and *serambi* (corridor's floor) area. The side facades have interior *serambi* (corridor area) except open *serambi* at the back façade. Only three of the tertiary columns are placed to support the *mihrab* area creating a small portion of *serambi* area at the front façade. The area is about 5.7 metre in length and 1.5 metre in width. Erection of beam construction is also important to build this three tiered pyramid roof form. There are four layers of beam structures to give a support to the elevated floor and roof of KLOM.

(g). Construction Materials

The construction materials of KLOM are timber, lime mortar and clay roof tiles. The material used to construct roof ridges and duck tails is lime mortar. All roof tiles (*Attap Senggora*) and a roof crown are moulded from clays. The primary material is timber. All structural components are from this material. The primary structural components like columns and beams are made from cengal. Cengal (dipterocarpaceae wood) is the finest and strongest hardwood in this region commonly used in making structural components like columns, beams, joists and rafters in the traditional Malay house, building and mosque construction. The other timber type material construction is merbau especially used for floor and wall panels (Mohd. Akib 2003, 38).

(h). Prefabricated Construction Technique

The use of timber as the primary construction of KLOM is because of its harmony to the prefabricated construction technique (Figure 4). In this region, the past traditional master builders did not interest to use clay bricks, stones and mortars as the primary construction material. There are several parts of the KLOM applying the construction with mortar and clay tiles that shows the past traditional master builders understood using these materials in the building construction. Ancient Hindu temples in this region such as Brobudur, Bali and Bujang Valley, Peninsular Malaysia are constructed using stones and clay bricks by the past master builders. Selection of timber as the primary material has to do with tropical architecture, an expression of prefabricated construction concept primarily with post and beam system with mortise joints and pegs (Dawson & Gillow 1994, 28). All prefabricated components are made in the workshop before they are transported to the construction site for the next process which is the building erection.

(i). Modular Wall partition

KLOM is one of the best examples that illustrate a modular system in curtain wooden wall construction (Figure 6). Each module is overlapped with wood panel as the perimeters. The layout of these wooden boards applies interlocking system. The local master builders call this wall as *janda berhias*. The function of wood panels is to conceal the line joints of the wooden boards. The dimension of the wooden board is a rectangular shape with 2:1 ratio, a size about 0.6 metre by 0.3 metre. The thickness of the wooden board is 15mm. The width of the panel is 75 mm. Similar interlocking modular boards are used in window's and door's construction.

(j). Verandah concept

Serambi or verandah at KLOM is an area where one shall enter after the entrance stairways or aisle at the perimeter of the prayer hall (Figure 7). It is the place where most guests are entertained. According to Gibbs (1987), the place of this space elevated about 300 mm lower than the primary floor level which separates it from the main prayer hall. The area always used by the users as a favourite when they perform individual prayer or iktiqaf (stay in the mosque) while doing *ibadah;* for example, reciting Al-Quran and read the books related to Islam. The low window design at the *serambi* area allows cross ventilation and views to the exterior. *Serambi* area is a long and narrow verandah. KLOM has *serambi* area at its both sides (13.2m x 1.5m), and at its back façade (16.2m x 1.5m). There is no *serambi* area at its front façade but a portion of projected area for *mihrab* is erected at this area. The dimension is 6 metre by 1.5 metre. Unlike *serambi* floor, the floor for mihrab has the same height as the main prayer hall.

5. Definition of the Chinese Construction Elements

Chinese architecture covers the regions at the present day's Republic of China, Indo China, Japan, Taiwan and Korea. Most people who live in these regions are Taoists and Buddhists. Besides, there are a small number of the population who are Muslims and in Japan, the primary belief is Shinto. Regardless to the regional diversity of the religions and geographies, Chinese construction style is adopted as a primary design of the religious buildings. In China, the local master builders had adopted Chinese construction technique in building the traditional mosques. The examples of Chinese mosques are Xian and Nunjie Mosque. The construction style also has an influence to mosque design in South East Asia. Tran (2008) in his research argued that Champa Kingdom with its Hoi An port-city at once time marked as a transition area in disseminating

Chinese cultures and influences to the Malay Kingdoms at the Malay Peninsular and Archipelago. This kingdom was established in 192 AD. Due to its lost in many wars against the Viet Kingdom (currently known as Vietnam) from 15th to 19th century, this kingdom fell under Vietnam, and assimilated with Vietnam cultures. Many Champa people migrated to Cambodia, Peninsular Malaysia, Java, Sumatra, Kalimantan and Sulawesi (Mohamed 1989, 8-9). The basic elements of Chinese building construction are as follows:

Figure 6: Modular wall's partition with interlocking style.

5.1 Roof Constructions

Roof construction plays an important role in defining the traditional Chinese roof form. The study finds that there are 10 elements of the roof construction. These elements become measurable factors for this analysis. They are as follows:

(a). Pyramid roof form

Roof form is emphasised as a dominant element in Chinese building construction. There are basically four types of Chinese roof forms, which are pitched roof, gable roof, half pitched and half gable roof, and pyramid roof. According to Kohl (1984, 26), the adoption of these traditional roof forms had been used in China since two thousand years ago during Ching Dynasty. Pyramid roof form is one of the roof types constructed in these regions. Sketch

illustrations by Boyds (1962, 35) shows that this pyramid roof form is known as '*Cuan Jian*' in China. It is commonly used in roof construction for the temples, mosques and palaces. Chinese roof has a curved form at its edges. The construction is possible because it uses bracket system for its roof structures. No ceiling construction is made. All roof structures are intentionally exposed and clearly visible, an emphasis of the beauty in architecture.

Figure 7: Serambi (aisle) area at a perimeter of the prayer hall.

(b). Tiered roof form

Chinese architecture commonly emphasises on two tiered pyramid roof form except the construction of pavilion with single pyramid roof form. The design is meant for double volume space to create air inlet and outlet for stack impact and to permit indirect sunlight. The top roof is elevated at certain height to separate from its attached roof. This separation allows the construction of upper windows. The building does not have an upper floor construction. By applying bracket system in the roof construction, it is possible to design cantilevered lower bracket roof structures.

(c). Attached roof form

Attached roof form is an important element in traditional Chinese roof design. The pyramid roof has four primary columns (central pillars) which are fundamental structures, supporting a series of transferred roof structures. There are several layers of upper (primary) beam structures with bracket joints which carry the

load of the pyramid roof form. Besides, these beams support the attached roof of the building. There is no roof beam at a middle span erected in the traditional Chinese roof structures. The attached roof beam constructed between primary column and secondary column, which support the attached roof structures. The central and side beams have about the same span. Application of Chinese bracket

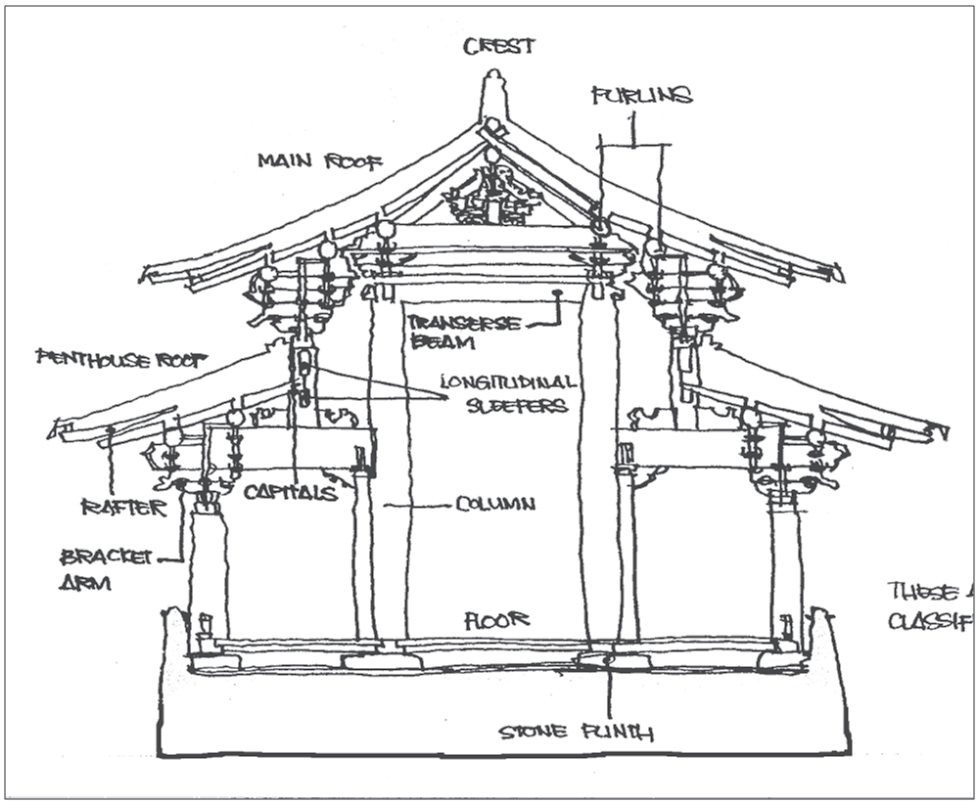

Figure 8: Section of the traditional Chinese building.
Source: Drawn by Goh Chee Haw Students Year 3, 2003 Architecture

system makes possible to construction of the attached roof with curved roof form.

(d). Roof crown

Chinese pyramid roof commonly has a roof crown at its top. This roof crown is a roof's 'crest or pinnacle', like a sacred jewel, a priceless decorative figure. The form of the roof crest in China has an influence from the Buddhist architecture originated from the architectural elements in the stupa construction. It is a pot-shaped cupola built at its modest size (Bussagli 1989, 32) fitted at the top of dome and pyramid roof.

e). Roof ridged boards

Chinese roof style has an emphasis of dominant roof ridged boards (Figure 8) to the junction of two sloping surfaces at the pyramid and its attached roof. The roof ridges are overly constructed elevated above the roof slope (Knapp 1989, 101) to a certain height as if the ridged boards were parts of the building

walls. The ridged boards have lavish decorative motives. According to Kohl (1984, 27-30), the construction material is lime mortar, a mixture of lime, sand and hemp straws. The ridge boards normally have decorated with floral and leaf ornaments on the walls. In addition the ridge boards are integrated with decorative objects ranging from figurative fishes and dragons as primary objects to phoenixes, lions, chickens, goats, peacocks, crane, deer and unicorns.

(f). Roof tail

One of the important elements in Chinese architecture is roof tail (Figure 8 & 9). It is a decorative object which marks an expression of the roof edge at the ridged board as argued by Knapp (1989, 100-1) as creating etched or sweeping profiles. This is known as dragon tail (the Chinese sacred animal figure) in Malaysia. The design emphasises on the erection of dragon tails at the end of the roof ridges at the pyramid and its attached roof. The dragon tail's design has an emphasis on vertical orientation with curling tail's style marking as the end treatment to the roof ridge.

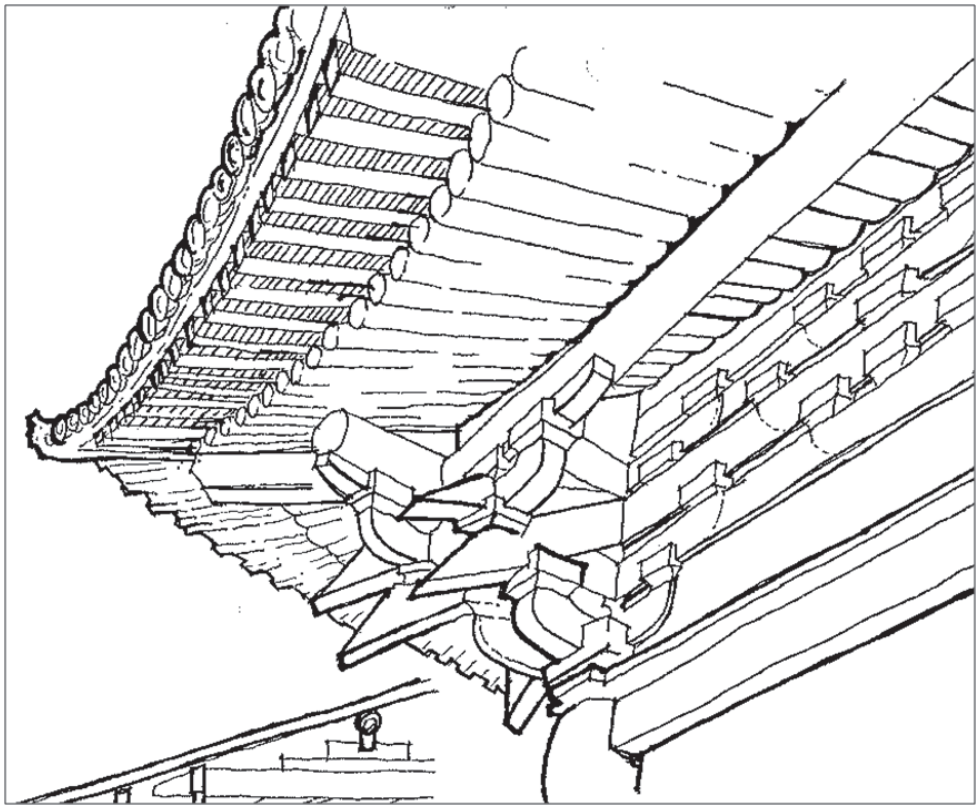

Figure 9: Bracket roof overhang.

Source: Drawn by Student Year 3, 2003 Architecture

((g). Roof tiles

Chinese roof tiles (Figure 9) have bamboo design styles. The bamboo tiles are

laid interlocking with half round tiles in vertical rows. The roof layout creates wavy pattern with a series of bamboo ridged tiles and furrows. Kohl (1984, 208) noted this roof tiles' pattern has 'ridge and pan' system, alternating the bamboo rows with alternated valleys for the rainwater's run off. It functioned as an alternated gutter system. The interlocking pattern between bamboo ridge tiles and curved half round tiles creates the roof gutters. The advantage of the roof gutters is to allow instance rainwater flow. The type used for the roof tiles are glazed roof tiles made from lime powder, sand and water cast in moulds, then burnt and glaze before ready for use.

(h). Upper roof window opening

There is a construction of roof window openings (Figure 8) in the traditional Chinese buildings. The window openings are placed between the pyramid and attached roof of the building. Double roof construction creates one layer of segmented wall openings from the lower roof. These openings become a wall perimeter of the four central pillars. These windows are designed for air stack effect to permit warm air ventilated out from the prayer hall through the roof window openings while creating low pressure to allow cool air suction into this space. The other reason is to permit indirect sunlight into the prayer hall from the roof openings, functioned as a skylight.

(i). Roof overhangs

Large projected eave (Figure 9) is one of the important characters in Chinese architecture. The projection creates a roof overhang, to provide shades from the summer sunlight (Ashihara 1989, 36-7). Application of cantilevered bracket system on beams and rafters makes possible to a large span construction of the roof overhang. No fascia board is placed as one of the roof elements in Chinese building. The large roof overhang is able to give shades and protection to the timber roof structures from rainwater sprinkles.

(j). Roof structures

Bracket system (Figure 8 & 9) is a key factor for Chinese roof construction technique. The system plays a crucial role in the roof design. Bracket system has a roof structural truss supporting transfer beams (cross beams, tie beams and purlins), columns (queen and king posts) and rafters in a series of layer system.

5.2 Building Structures

Building structures are important factors in defining the construction elements of traditional Chinese building. There are 10 factors of the building structures as follows:

(a). Post and Beam Construction

Traditional Chinese master builders apply bracket post and beam system (Figure 10) in the construction. Bracket is a joint system made from timber to support the building and roof structures. It comprises two main components which are bases (*dou*) and cantilevers (*gong*). The fabrication of these objects constructs a cluster of cantilevered brackets known as *dou-gong*. Kohl (1984, 34-6) noted that the construction technique is adopted as principle structures in Chinese building design since Sung Dynasty. It is considered the formal technique (Imperial style) in Chinese construction which influences the architectural style in building palaces, temples, mosques, pagodas, etc. By using cantilevered brackets, it is possible to project a large roof overhang's construction, to construct double roof form, and to build curved roof structures. In contrast to typical post and beam system, Chinese bracket post and beam system is a complex construction technique much relying on cantilevered brackets. It is a corbel bracket system used as a joint system to support column and beam framing structures.

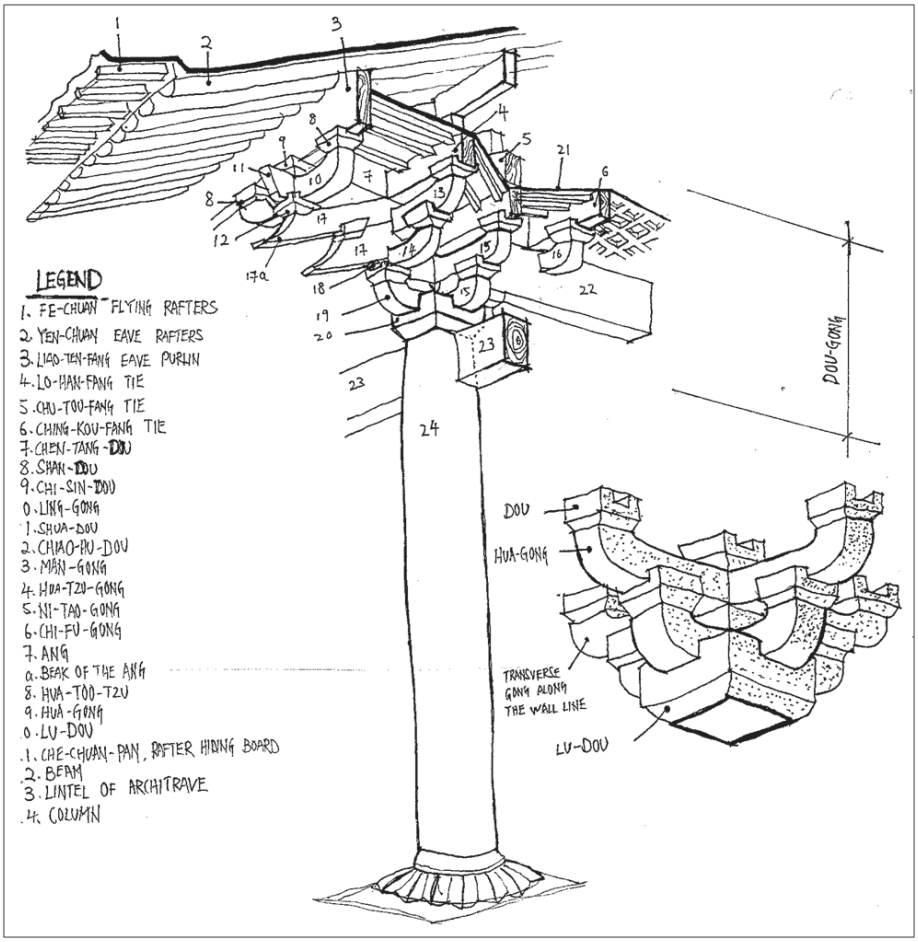

Figure 10: Bracket post and beam construction technique.
Source: Drawn by Student Year 3, 2003 Architecture.

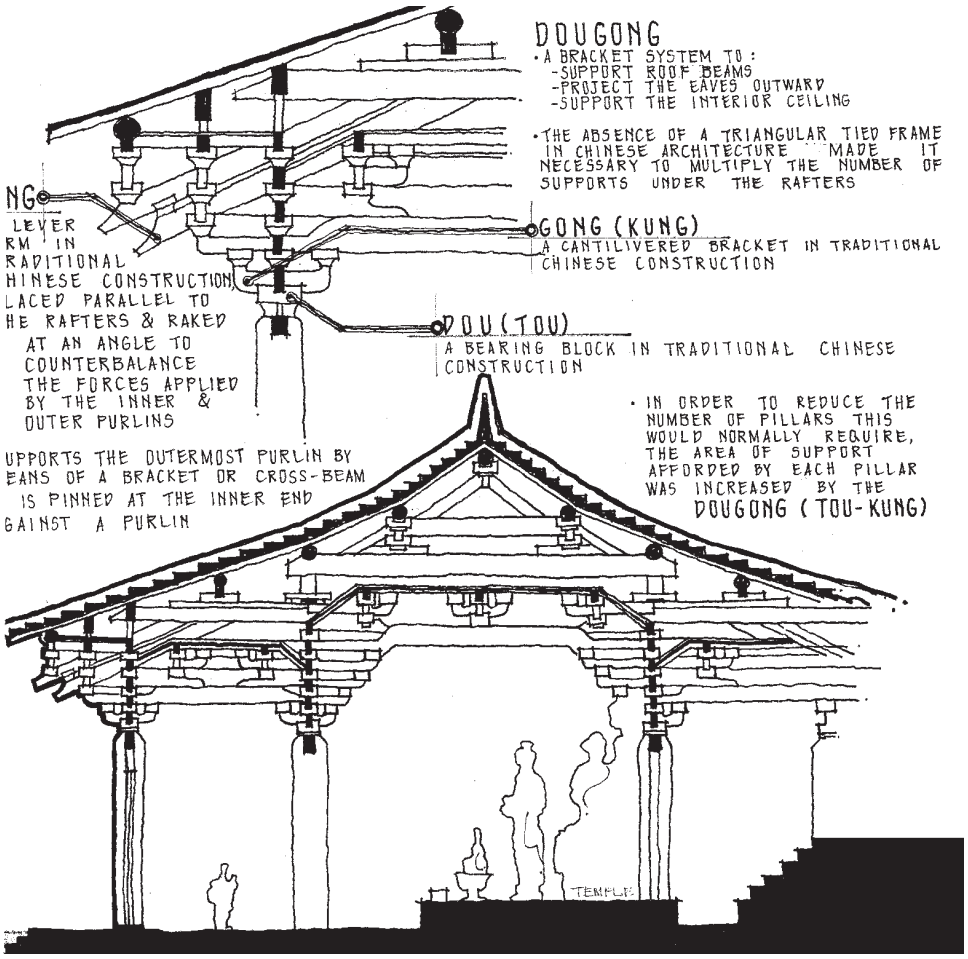

Figure 11: Section of the traditional Chinese building.

Source: Drawn by Nurzuliyana Zulkhaflee Student Year 3, 2003 Architecture.

(b). Building Foundation

The traditional Chinese buildings are erected on podium structure (Figure 8 & 11). Podium is a foundation platform base construction (Caffarelli 1989, 65). Building erection takes place after the base for the building foundation is constructed. The podium's height varies from several feet above the ground, and possibly built to the height of two floor building levels. The examples are the Great Walls of China and Winter Palace in Beijing. Both have a high plinth foundation. The platform symbolises the earth whereas the roof is as the heaven (Blaser, 1979, 8). The podium commonly has either rectangular or square base. To build this platform, retaining walls are constructed along the perimeter of the area. The materials for the wall construction are stones or clay bricks or both. After the construction of the retaining walls, landfill of rammed earth is made. The rammed earth is densely compressed (tamped) using traditional compacted tool (rammers) by the construction workers. The works increase bearing strength of the building foundation (Knapp 1989, 69-70).

(c). Inner Column System

Traditional Chinese architecture commonly has inner and outer column system (Figure 11). For pyramid roof construction, there are four central pillars erected at the interior of the building, usually functioned as a main hall. These pillars give a primary support to the roof structures. These pillars are the most dominant structures, and as written in Shinto manuscripts, they are regarded as 'sacred centre columns' (Inoue 1985, 10-11). The uniqueness of the traditional Chinese construction technique is that it applies bracket post (column) and beam system. The central columns therefore play a crucial role as a main building support to the roof bracket structures with a series of transferred columns and beams. These central columns are erected to the height of the building wall. A primary bracket system is then placed to give a support to the cross-beams and tie-beams which cover the length and the width of the building. These beams support all transferred roof structures. These entire loads are under the support of the primary columns. Besides, the traditional Chinese buildings have an attached roof system. This attached roof structures are jointed by the bracket system which is supported by the central pillars and the secondary columns (aisle columns) at the other end.

(d). Transferred Structures

Traditional Chinese bracket construction technique is heavily relying on transferred structures (Figure 11) in the building construction. Kohl (1984, 35) argued that the presence of transferred beam and column system gives design flexibility that determine the dimension of the roof form. This emphasis is on the horizontal axis which makes an important role of transferred beam frame system. Fletcher (1999, 693) defined this construction as 'beam-in-tiers' technique. This bracket construction makes erection of the curved roof form possible. The system applies cantilevered bracket beam system that able to give the erection of cantilevered purlins to control the angle of the curved roof construction.

(e). Structural orientation

The emphasis of traditional Chinese architecture is north to south axis. As a result, the structural layout has a design to this orientation. Kohl (1984, 22) noted that this shows the 'Chinese affinity' for north-south building orientation with symmetrical plan layout. This orientation is influenced by the geographical factor of the region. Kohl (1984, 20) argued that it is the 'symbolism of the directions' to the seasons and winds. The south orientation avoids from direct exposure of sand's storm from Gobi desert (especially to regions at the Northern China). The south façade opening besides gives the building frontage orientated to intense

sunlight which is necessary during the winter season. Furthermore, the design emphasis on central axis in defining the structural layout in lined to its south building entrance. The orientation becomes a fundamental element in defining layout of the building space and form. The front façade is at south orientation while the rear façade is at north orientation. The south façade therefore has a primary entrance and window openings. The south building wall is recessed inward for an open verandah exposed with a series of aisle columns.

(f). Hierarchical order of structural layout

Application of double layer roof form influences the order of the building structural layout. Four central pillars give a main support to the pyramid roof form. A series of secondary (aisle) columns are erected to give additional support to the attached roof form. With application of Chinese bracket system, number of the aisle columns in building layout is limited. The bracket system emphasises on transferred structures for roof construction. There are several layers of transferred structures which comprise beams, columns, purlins, rafters, queenposts and kingposts jointed by bracket system. The design gives flexibility order of the bracket structures, flexible number of upper beams and columns, used in the bracket roof construction. The number of layers used for the roof structures determines the size of the transferred structures.

(g). Construction Materials

Timbers, stones, bricks and rammed earths are the important material in the traditional Chinese construction (Knapp 1989, 68). Timber is the most important construction building material in Chinese architecture. Timbers are used in the construction of structural components such as brackets and joints, beams, columns, rafter and purlins. Timber is in many cases selected for the wall construction Brick and stone blocks are used more frequently than timbers for wall construction in China. Lime cements mixed with gravel, sand and water, compressed earths, bricks and stones are the materials for retaining wall's, podium's and building floor's construction. This cement is the construction material for roof ridge boards and crown. The other building material is clay for the construction of clay roof tiles.

(h). Prefabricated construction technique

Traditional Chinese construction applies prefabricated construction technique (Figure 11). The use of timber material is important for this timber framework construction (Knapp 1989, 69 & 76-82). All prefabricated components are produced before erection process takes place on the site. The most unique factor of the Chinese architecture is that it is heavily relying on bracket system. As a

result, it reduces the number of the column structures designed in plan layout compared to ordinary post and lintel (beam) construction. The structural design has an emphasis on layers of roof structures with transferred column and beam system. The bracket system uses limited timber mortise joints for the structural components. The brackets function as a structural joint.

(i). Modular Wall partition

Curtain wall is commonly used in Chinese building construction. Brick, stone and timber are popular materials in Chinese wall construction. Box bond and cross bond patterns are commonly used for the brick or stone work's construction (Kohl 1984, 39). The wooden walls have lattice patterns carved and cut into various sizes and shapes of geometric frameworks (Knapp 1989, 128-32). The lattice pattern construction integrates modular, interlocking and repetitive system. The pattern is a combination of the wooden panel creating the building wall (Knapp 1989, 128). The wall construction is not in line with the column and beam perimeter. It is instead slanted back to the column and beam perimeter exposing the cantilevered bracket construction (Kohl 1984, 38).

(j). *Verandah* **(Aisle) concept**

The building axial orientation with an entrance to the south creates the importance of open aisle or *verandah* to the building front facade. Construction of south building wall is recessed at several metres from the aisle columns to create a *verandah* area. The double pyramid roof form projects additional aisle. The length of this single aisle system is determined by the number of bays used in the construction. The number is always odd in number, for example; three, five and seven bays (Inoue 1985, 86-7). The use of cantilevered bracket system for the roof construction creates a large roof overhang providing shades to this area. It is the tradition in China to have an open lattice wooden frameworks at south *verandah* entrance toward positive warm sunlight (Yang concept) and a solid building wall at the northern side to avoid from negative cold direction (Yin concept) (Kohl 1984, 22).

6. Methodology of Analysis

It is the aim of this study to analyse the level of design influences by Chinese architecture in building construction at KLOM. The methodology of this survey applies qualitative survey, a comparative analysis thorough observations to the level of similarity. In other words, the analysis will measure the level of influences by the Chinese construction elements using comparative method to the construction elements used in the construction of KLOM. There are three

types of measurable scale used to analyse the levels of similarity, represented by three levels of influences of Chinese construction elements to those in KLOM. The levels of influence are based on the comparative analysis of each construction elements as discussed earlier in the literature study. These three levels of similarity are as follows:

1. none (no similarity at all in the analysis)
2. moderate (has some similarity in the analysis)
3. exactly (has almost exact similarity or the same in the analysis)

By doing this qualitative analysis, it will help to identify the level of influences by Chinese construction elements to the construction of KLOM. There are two categories in this analysis which are construction elements in (a). Roof construction; and (b). Building construction. Roof construction consists of 10 categories which are pyramid roof form, tiered roof form, attached roof form, roof crown, roof ridge boards, roof tails, roof tiles, roof window openings, roof overhangs and roof structures. On the other hand, building construction comprises 10 categories which are post and beam construction, building foundation, inner column system, transferred structures, structural orientation, order of structural layout, timber construction materials, prefabricated construction technique, wall construction and *verandah* construction.

There are two types of the analysis in this survey. The first type is a comparative analysis by categories. It is a general observation study. The other type is a comparative analysis by factors. The comparative analysis by factor is a specific observation study. The results of the analysis are as follows (table 1 & 2):

Table 1: Roof Constructions

	Roof Constructions	KLOM	Chinese Architecture	Level of Similarities		
				none	moderate	exactly
A	Pyramid roof form					x
	1	Linear roof slope	Curved roof slope	x		
	2	Upper beam	Upper beam			x
	3	No ceiling	No ceiling			x
B	Tiered roof form					x
	1	Three layers' system	Two layers' system		x	
	2	Triple multivolume	Double multivolume		x	
	3	Single storey	Single storey			x
C	Attached roof form					x

	Roof Constructions	KLOM	Chinese Architecture	Level of Similarities		
				none	moderate	exactly
	1	One attached roof	Two attach roof		x	
	2	Linear roof slope	Curved roof slope	x		
		Lower & upper beams at middle span	Bracket lower & upper beam at middle span		x	
	3	Attached (secondary) beams	Attached (secondary) bracket beams		x	
	4	Secondary beam 2/3 span of the primary beam	Secondary bracket beam the same span as the primary beam		x	
D	Roof crown					x
	1	Small dome	Pot shape copula		x	
	2	Islamic character	Buddhist character	x		
	3	Fitting at the roof top	Fitting at the roof top			x
E	Roof ridged boards					x
	1	Dominant	Extremely dominant		x	
	2	No decorated floral & leaf motives	Decorated with floral & leaf motives	x		
	3	Not fitting with object sculptures	Fitting with object sculptures	x		
F	Roof tail					x
	1	Fitting with duck tail figure	Fitting with dragon tail figure		x	
	2	Horizontal form emphasis	Vertical form emphasis		x	
G	Roof tiles					x
	1	Senggora tiles flat shape	Bamboo roof tiles Curling wave shape	x		
	2	Clay tiles (no glaze)	Clay glazed tiles		x	
	3	Roof tile not with gutter concept	Roof tiles with gutter concept	x		
H	Roof windows					x
	1	Upper roof windows	Upper roof windows			x
	2	Lower roof windows	No lower roof windows	x		
	3	For air ventilation (stack impact)	For air ventilation (stack impact)			x
	4	For indirect sunlight	For indirect sunlight			x
I	Roof overhangs					x
	1	Projected roof eaves	Projected roof eaves			x
	2	Cantilevered roof	Cantilevered bracket roof		x	
	3	With fascia boards	No fascia boards	x		
J	Roof structures					x
	1	One kingpost	Many bracket queen posts & one kingpost		x	
	2	One transfer cross beam	Layers of bracket cross beams, tie beams & purlins		x	
	3	Cantilevered beams & rafters	Bracket cantilevered beams & rafters		x	

Table 2: Building Structures

	Building Structures	KLOM	Chinese Architecture	Level of Similarities		
				none	moderate	exactly
A	Post and Beam Construction					x
	1	Post and beam	Post and beam bracket system		x	
	2	Cantilevered post and beam	Layers of cantilevered bracket framing system		x	
B	Building Foundation			x		
	1	On stilt concept	Podium base	x		
	2	Elevated columns	Retaining Wall	x		
	3	Elevated floor levelling	Landfill (compacted) levelling	x		
C	Inner Column System					x
	1	4 main inner columns (Tiang seri)	4 main inner columns			x
	2	Inner serambi (aisle) columns	Inner aisle column			x
	3	Outer serambi columns	No outer serambi columns	x		
D	Transferred structures					x
	1	Fixed one transfer columns	Flexible transfer bracket columns		x	
	2	Fixed transfer beam	Flexible bracket transfer beam		x	
	3	Not able to construct curved roof	Creating curved roof	x		
	4	Multi layer beams	Multi layer bracket beams		x	
	5	Horizontal emphasis	Horizontal emphasis			x
	6	Purlin on rafters	Purlin on beams	x		
E	Structural orientation				x	
	1	Qiblat orientation	North-South orientation	x		
	2	Entrance Façade orientation to qiblat with open serambi structures	Entrance Façade orientation to south with open aisle structures		x	
	3	Portion serambi space for mihrab façade while other serambi recessed	No recessed aisle at North facade	x		
F	Order of structural layout				x	
	1	Limited column number	Limited column number			x
	2	Primary, secondary & tertiary columns	Primary & secondary columns		x	
	3	Hierarchy order of upper column structures	Hierarchy order of bracket upper column structures		x	
	4	Hierarchy order of upper beam structures	Hierarchy order of bracket upper beam structures		x	

	Building Structures	KLOM	Chinese Architecture	Level of Similarities		
				none	moderate	exactly
	5	Fixed order of structures	Flexible order of bracket structures	x		
G	Main Timber Construction materials					x
	1	Main timber structures	Main timber structures			x
	2	Timber walls	Timber & brick/stone walls		x	
	3	Timber planks floor	Lime Cement Floor	x		
	4	Timber mortise/wooden peg joint	Timber bracket & joints		x	
	5	Lime cement roof ridge boards	Lime cement roof ridge boards			x
	6	Lime cement ridge tails	clay ceramic ridge tails		x	
	7	Clay roof tile	Clay roof tile (glaze)		x	
	8	Clay ceramic roof crown	Lime cement/ceramic roof crown		x	
H	Prefabricated construction technique					x
	1	Simple post and beam system	Bracket post and beam system		x	
	2	Mortise joints with pegs	Bracket joints	x		
I	Timber wall partition				x	
	1	Modular wall grid partition with Malay decorative style	Modular lattice wall grid partition with Chinese decorative styles		x	
	2	Interlocking patterns	Interlocking patterns			x
	3	Repetitive pattern	Repetitive pattern			x
J	Verandah construction					x
	1	Double aisle/serambi	Single aisle/serambi		x	
	2	Open serambi entrance	Open aisle entrance			x

7. Analysis and Findings

This section discusses the result of the analysis and findings on the survey. The first part of the discussion is the result of the analysis by categories and factors. The results are as follows:

(a). Analysis by categories

1. Roof constructions

i. The analysis finds that all roof categories have the same (100% mark) construction elements between KLOM and the traditional Chinese buildings.

2. Building structures

i. There are 6 categories in building structures which apply the same (60% mark) construction elements which are post and beam construction, inner column system, transferred structures, timber construction materials, prefabricated construction technique and *verandah* construction.

ii. Another 3 categories have moderate level of similarity (30% mark) which are structural orientation, order of structural layout and wall construction.

iii. The other one category is building foundation which has no similarity (10% mark) in construction element between KLOM and the traditional Chinese buildings.

(b). Analysis by factors

1. Roof constructions

There are differences and similarities by factors in roof construction elements between KLOM and the traditional Chinese buildings. These factors are:

i. KLOM has linear roof form whereas the traditional Chinese building has curved roof form (no level of similarity).

ii. KLOM has triple volume roof construction while the traditional Chinese building has double volume roof construction (moderate level of similarity).

iii. The traditional Chinese building has attached curved roof construction using bracket construction system in contrast to ordinary post and beam attached roof construction at KLOM (moderate level of similarity).

iv. KLOM has a small dome construction with Islamic influence as a roof crown compared to pot shaped copula with Buddhist influence in traditional Chinese construction (no level of similarity).

v. Traditional Chinese roof construction has extremely dominant ridge boards ornamented with floral and leaf motives and fitted with sculptures (animal figures) in contrast to those of KLOM(moderate level of similarity).

vi. KLOM has roof tails with duck tail's figure (horizontal form) in contrast to dragon tail's figure (vertical form) fitted as roof tails in the traditional Chinese buildings (moderate level of similarity).

vii. In contrast to KLOM, the traditional Chinese building has gutter concept design for the glazed roof tiles with curling wave shape (no level of similarity).

viii. KLOM has upper and lower roof windows while traditional Chinese building has only upper roof windows (moderate level of similarity).

ix. Unlike KLOM, the traditional Chinese building has projected roof

overhangs constructed from cantilevered bracket roof structures. No fascia board is fitted to the projected eaves (moderate level of similarity).

x. Unlike KLOM, the traditional Chinese building has more elaborated roof structures with bracket construction of cross and tie beams, cantilevered beams and rafters, queen posts and one king post (moderate level of similarity).

2. Building Structures

There are differences and similarities by factors in building structural elements between KLOM and traditional Chinese building. The factors are:

i. KLOM has post and beam structural construction whereas the traditional Chinese building has bracket post and beam construction (moderate level of similarity).

ii. KLOM has on stilts structural concepts with elevated floor a few metres from the ground level while the traditional Chinese building has a podium based foundation using landfill technique into squared and rectangular based retaining walls (no level of similarity).

iii. Both KLOM and the traditional Chinese building have 4 inner columns and aisle (*serambi*) columns supporting the pyramid tiered roof form. However unlike single aisle used in the the traditional Chinese buildings, KLOM has double *serambi* (aisle) column system giving a support to its first and second attached roof (moderate level of similarity).

iv. The traditional Chinese building has flexible transferred bracket column and beam structures whereas KLOM has fixed structures. In contrast to bracket structural system, fixed structural system does not able to construct curved roof and erect purlins on transferred beam structures. However both building constructions have horizontal emphasis in building form's design and multilayer of transferred beam structures (moderate level of similarity).

v. Traditional Chinese roof construction has north to south structural orientation with an emphasis of recessed south wall for the entrance while KLOM has a qiblat orientation with an emphasis of recessed entrance wall (*serambi*) and a quarter portion of projected *serambi* wall for *mihrab* area (no level of similarity).

vi. Both buildings are able to be built with limited number of column system because their construction emphasis is on transferred column and beam structures. As a result, the construction has hierarchical order of upper column and beam system (application of primary, secondary, tertiary and minor column and beam structures) (the same level of similarity).

vii. Both buildings use timber as a primary construction material with clay and lime cement for the roof construction. The difference is that the traditional Chinese building has brick and stone wall construction for retaining wall's podium and some buildings have stone or brick construction (moderate level of similarity).

viii. Both buildings apply prefabricated post (column) and beam construction technique in the building construction. The difference is that KLOM was built using simple post and beam system, and mortised structural joints with pegs whereas the traditional Chinese building was erected using bracket post and beam system with bracket structural joints (moderate level of similarity).

ix. Both buildings have modular concept of the timber wall partitions with interlocking and repetitive pattern (moderate level of similarity.

x. Both buildings have open aisle (*serambi/verandah*) entrance with recessed wall design. The difference is that KLOM has double aisle design while the the traditional Chinese buildings have single aisle design (moderate level of similarity).

(c). Findings

The study finds that KLOM has construction elements influenced by Chinese architecture but if we compare to its construction details, there are differences between KLOM and the traditional Chinese buildings. This has made architecture of KLOM is unique and able to express its own regional identity. The research findings are as follows:

1. There are influences of traditional Chinese construction in the construction of KLOM. The results by categories show that roof construction of KLOM applies the same design concept and the building structure applies 60% of the total categories with the same design, and 30% with moderate level of similarity.

2. The only difference design by category is the building foundation. KLOM has 'on stilts design' in contrast to podium structure used in traditional Chinese construction.

3. Although analysis by categories shows that many basic concepts of Chinese building construction are used in the construction of KLOM, analysis by factors show that there are differences in design details to the construction elements between KLOM and the traditional Chinese buildings.

4. The differences in number of layers in roof construction between the traditional Chinese buildings (two tiered pyramid roof form) and KLOM (three tiered pyramid roof form) gives differences in design details of the construction elements.

5. Impact on the religious and cultural influence has made building orientation with *mihrab* and entrances different to each other.

6. Difference in structural construction technique used in building construction has influenced the design details of the roof construction and building structures between traditional Chinese building and KLOM. Compared to KLOM, the traditional Chinese buildings are not erected using regular post and beam construction but it is built based on bracket post and beam construction with bracket joints; as a result, this application creates difference in structural layout and hierarchical order of transferred column and beam structures which make possible for curved roof construction.

8. Conclusion

The study concludes that construction of KLOM has an influence from traditional Chinese building construction. This influence can be traced to the integration of roof construction elements (pyramid tiered and attached roof form; roof crown, ridge boards and tails; roof tiles and windows; and roof overhangs and structures) and building structures (post and beam construction, inner column system, transferred structures, timber construction, prefabricated construction technique and *verandah* construction). However, there are differences in design details of the construction elements of KLOM that have identified unique characters of architecture in Kelantan. These differences are:

1. KLOM has three tiered roof form concept compared to two tiered roof construction in the traditional Chinese buildings.

2. Religious influence has made the design of building elements such as dome roof crown, duck tails, building/structural orientation and projected *mihrab* at KLOM different to those in traditional Chinese construction, which emphasises on Chinese culture and Buddhist religion.

3. Construction of KLOM does not apply bracket post and beam construction technique with bracket joints but it uses regular post and beam construction technique with mortise joints. As a result, building construction elements using bracket system such as curved roof form, flexible bracket upper transferred column and beam structures, and cantilevered bracket roof overhangs are not be able erected in KLOM.

4. Construction of building foundation at KLOM applies on stilts concept with elevated floor system in contrast to traditional Chinese building foundation based on podium concept of construction with retaining wall and landfill technique.

The findings of the differences and similarities of the building construction elements between KLOM and the traditional Chinese buildings can be used as a guideline to understand architecture in the state of Kelantan. The findings

give evidence to support the argument that Islam came to South East Asia from East (China), and the role of Kingdom of Champa in disseminating Chinese cultures and influences to the Malay Kingdoms. Construction influences from the East have shaped the design of KLOM as well as other traditional mosques in South East Asia. The construction elements can be used a guideline, which is important because it can be used as a reference to the development of the local architecture which concerns to the local culture, spiritual perspectives in Islam and climatic approach as argued by Mohamad Rasdi (2005, 34) posturing an act and intention of the man's humility to the God's built natural environment. Future research study on mosque design in other parts in South East Asia is crucial because it can enrich more definitions to the regional construction elements of the mosque architecture. Construction of *wakaf* (kiosk/pavillion) structures (Figure 12) with triple roof form is widely designed in pre-colonial period across the region in Kelantan and other parts of South East Asia, imaged as a symbol of the traditional architecture.

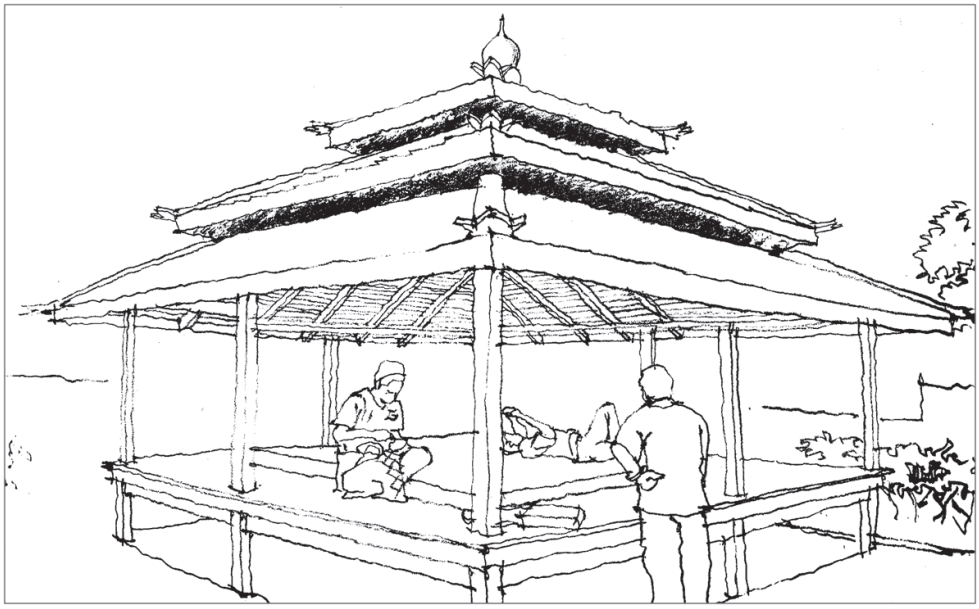

Figure 12: Traditional wakaf (pavilion) structures are widely constructed during precolonial period for public/community uses.
Source: Drawn by Mohd. Hafiz Muhamad Jubri Students Year 2, 2009 Architecture.

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نظريه دخول الاسلام لجنوب شرق اسيا من الشرق
تأثيرات عناصر التشييد الصينية التقليدية على المسجد العتيق
بكامبونك لاوت بماليزيا

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ملخص:

هدف هذا البحث لتأييد نظرية الأسلام دخل جنوب شرق اسيا من الشرق في مقابل النظريات السائدة ان الاسلام دخلها من الغرب وان مملكة شامبا (champa) لعبت دورا كبيرا في نشر هذة الديانة والعمارة الصينية في اقليم ماليزيا (malay archipelag).

ويرتكز هذا الطرح على الشواهد الواردة في دراسة لانشاء المسجد العتيق بكامبونك لاوت في كلانتان (kampong lauts old mosque kelantan) وهو اول مسجد في ماليزيا .

وهنالك العديد من الدراسات التاريخية التي تتضمن شواهد تؤيد هذه النظرية . وسيتم تأييد هذه النظرية من خلال تحليل عناصر الانشاء ومقارنتها بتأثيرات عناصر الانشاء الصينيه على تقييم المسجد العتيق بكامبونك . وهنالك صنفين من عناصر الانشاء : انشاء السطح وانشاء المبنى وذلك حسب دراسة الادبيات .

وتخلص الدراسة الى وجود عناصر انشاء بالمسجد العتيق تأثرت بالعمارة الصينية ولكن عند مقارنه تفاصيل التشييد يظهر وجود فروقات بين المسجد العتيق بكامبونك والمباني الصينية التقليدية . وذلك ان المسجد العتيق له عناصر تشييد اقليميه محدده خاصه به تستخدم تقنية انشاء العمود والكمرة المبسطة والبناء المرفوع على ركائز وهيئه السقف المرتفع لمستوى ثلاثة طوابق ( ) والتصميم المستند على التأثيرات الاسلامية .