

Malay Architectural Heritage on Timber Construction Technique of the Traditional Kampung Laut Old Mosque, Malaysia

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Abstract

This study discusses timber construction on the historic Malay traditional Kampung Laut Old Mosque (KLOM) in relation to cultural factors. The discussion starts with a brief history of the KLOM, building construction technique, design elements and building materials. This mosque is believed the oldest surviving timber mosque construction in Malaysia as well as one of the oldest in South East Asia. The methodology applies research inventory of the building construction elements. The construction elements resemble the richness timber building design which concerns to the local culture, spiritual perspectives and climatic approach portraying the regional identity of the built environment.

Keywords: architecture, Malay, heritage, form, space, elements, culture

1. Introduction

The KLOM (Figure 1) is selected as the case of the study because it is the oldest mosque in Malaysia which is still standing, usable and intact in the original condition. According to Yin (2008), the case study term refers to an entity, an event, an individual, or even a unit of analysis. The vernacular architecture design of the KLOM strongly resembles the traditional Malay architecture which implemented sustainable and passive design approach as argued by traditional architecture historian (Ahmad, 1999; Rasdi, 2003; Hassan, 2011). Furthermore, it is the only mosque which was fully built using local materials which are the “*chengal*” (*Neobalanocarpus heimii*) and “*Merbau*” (*Intsia bijuga*) hardwood, and “*Singhorra*” roof tiles, in the Malay world (Akib, 2003; Hassan, 2010b; Surat & Utaberta, 2010).



Figure 1. The Kampung Laut Old Mosque (KLOM)

2. Kampung Laut Old Mosque (KLOM)

The current location of the KLOM is in the district of Nilam Puri, the Islamic academic district of Kelantan (Figure 2). Kelantan is located at 6°07'N and 102°15'E in a tropical zone (Saat et al., 2005). The climate

condition is commonly stable with the dry bulb air temperature ranges from minimum 21°C to 25°C and maximum 30°C to 36°C, with the mean relative humidity of 70-90%. Based on Malaysian Meteorological (2011), the Malaysia's climate is uniform throughout the year because it is situated near the equator, thus it has the same and equal period of days and nights. Daily average of day lighting in Malaysia range between 4 to 8 hours and the solar radiation is ranging from 4000-5000 Whr/m² (Sopian & Othman, 1992; Ismail, Sibley, & Wahab, 2011). Annually, two monsoon winds will occur namely the Northeast monsoon which starts from November to March and Southwest monsoon during the months of June to September. While in the months of April and October, inter-monsoon season will occur (Nugroho, 2011).

The KLOM is recognized as one of the earliest signs of Islamic arrival in Malaysia. The arrival of Islamic religion in Malaysia was around the 7th to 10th century (Yatim & Nasir, 1990; Sharif & Hazumi, 2004). According to Nor, Ibrahim, Yusof, Zakaria, and Ramli (2012), Kelantan is one of the states that have an earliest history of Islam in Malaysia. The Kelantanese had already known about Islam for more than 300 years before based on the KLOM, which is the oldest mosque in Malaysia built in the century (Zaitun, 1985). Furthermore, there are other evidences which support the statement. According to Awang (1986) the earliest records about Islam in Kelantan showed that there was engraved Arabic words on the front face of the gold coins which means that Islam had already arrived in Kelantan during 12th century and it proved that the existence of Muslim population therein (Salleh, 1986; Hassan, 2010b; Surat & Utaberta, 2010).

The KLOM is a very famous mosque not only to the local, but also among the foreigners. The terminology of the mosque was described in detail by M. F. Ismail (2003) and Sulaiman (2007) which stated that the word "*masjid*" was originated from the Arab's words "*Sajada*" which means prostrate. The mosque not only functioned as a place for prayer, but it also serves as the administration centre for the mosque officials and caters for Muslim religious celebrations (Rasdi, 1998; Sharif & Hazumi, 2004). The mosque represents the Islamic religion by portraying the concept of the Muslim's prayer house through its design which adapt to the environment and the surroundings. The design also suits with the local culture, climate and surrounding and simultaneously represent the beauty of Islamic architecture (Sulaiman, 2007; Omer, 2010). The statement above was supported by Rasdi (2007) which stated that there are varieties of mosque designs and forms in the world. According to Ariffin (2005); Hassan (2010a), the important spaces of the mosque are the main prayer hall, niche ("*mihrab*"), verandah and ablution area while the mosque orientation must face the Kiblah direction.



Figure 2. Location of KLOM at Nilam Puri, Kelantan

3. History

Nowadays, even though the KLOM aged over than a century, it still serves the local people as a place for worship. The KLOM is regarded as a living museum, which continues to attract the researchers, architecture students, Muslim faithful, and historian to visit this legendary mosque to explore its vast history and knowledge which lies within (Abdullah, 2000). It is arguable regarding the exact date when the KLOM was built. But many researchers agreed that this mosque is the oldest mosque not only in the state of Kelantan, but also in Malaysia (Al-Ahmadi, 1984; Nasir, 2004; Hassan, 2010b). The well-known story behind this old mosque is that the Islamic missionaries faced danger when their ship sprang a leak in the middle of the sea in their journey from Java and Champa. In the desperate condition to seek for help, they have made a vow that if they manage to reach the shore safely, they will build a mosque. With the god permission, the missionaries managed to escape from the

danger after they safely anchored ashore at Kampung Laut and then, they immediately built the mosque with the help of the locals (Al-Ahmadi, 1984; Akib, 2003).

According to Al-Ahmadi (1984); Hassan (2010b), the KLOM was built on the original site located at the river bank of Kampung Laut, Tumpat which is a district adjacent to Kota Bharu, Kelantan. Along of its age, it has survived two big floods which the first flood namely “*Bah Air Merah*”, occurred in 1926 and another flood which occurred in 1966. During The second flood, the building was severely damaged when portions of the mosque nearby the river was swept away by the strong current of flood water. Some of the building's foundations were left dangling on the air while the ground underneath have been washed away by the flood.

The endangered and damaged mosque which consists only the main building was moved in 1968 to the current site. According to Mahmud (2002), the mosque had been reconstructed according to the original condition while the “*mihrab*”, was placed in front of the mosque and the tower had been rebuilt according to the original form. The mosque had undergone a renovation which started in 1988 to rebuild the complete KLOM as could be seen today which consists of all the main spaces namely the Main Prayer Hall, “*Wakaf Orang Kaya*”, “*Balai Lintang*”, verandah. The building was also installed the electrical system for the electrical appliances such as fans and lamps during the renovation (Akib, 2003).

4. Methodology

It is the aim of this study to analyze timber building construction technique of KLOM. The methodology applies inventory of the building construction elements which comprise the building form, spatial and functional elements, cultural and construction elements. The objectives of this paper are:

- a) To identify the building form in relation to its spatial function of activities;
- b) To identify the building structures and elements which influence the building form, spatial functions and activities.

5. Building Form

The architecture of the KLOM (Figure 3) is very significant and it was said to have similar architecture with Demak mosque in Jawa, Kuno mosque in Champa and Wadi Hussein mosque in Thailand. The KLOM design contains all the classical elements of the traditional Malay architecture; with elevated raised floor, three-layered roof and carved supporting columns which all were fully built using “*Chengal*” hardwood timber and “*Singhorra*” clay roof tiles (Petersen, 2002; Nasir, 2004; Surat & Utaberta, 2010). According to Akib (2003), the KLOM was developed in several stages which can be categorized into the early stage, developing stage and the final stage of development. During the final stage of its development, several spaces were added namely “*Balai Lintang*”, “*Wakaf Orang Kaya*” and the attic floor. This condition is the final form of the mosque before it was moved to Nilam Puri in 1968. This period was known as the splendor era of the KLOM where it was visited by many people not only from the local visitors, but also the visitors from other regions.

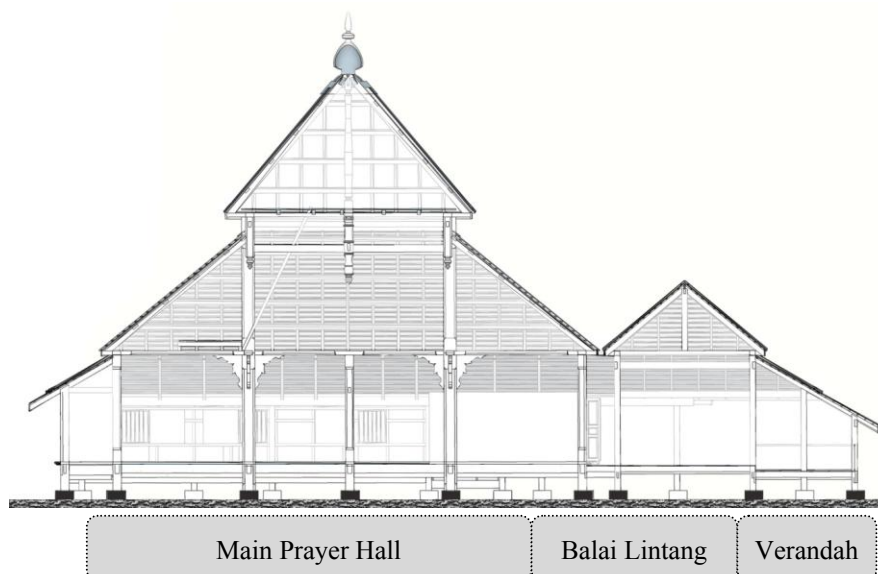


Figure 3. The section drawing of the KLOM

According to Said (2001), the traditional master builders had optimally considered and make use of the natural air flow in this tropical climate. Due to the demands of plenty ventilation for building in this hot-humid climate, the traditional master builder installed many perforated building elements such as perforated floors, perforated walls and ventilated panels at the tiered roofs. The building elements of this traditional building were carved in various decorative patterns such as geometrical patterns, floral patterns and calligraphy patterns which featured the aesthetic and the high value of traditional Malay culture.

6. Building Spaces

The KLOM consists of several combined spaces (Figure 4). The spaces are different in terms of the design due to the different purposes of the spaces. There are six important main spaces in the KLOM as described as follows:

6.1 Main Prayer Hall

The prayer hall's dimension is 13.2m * 16.2m. At the centre is four main columns namely "*tiang seri*" which is 30.5cm * 30.5cm. This hall is supported by a total of twenty columns.

6.2 "Wakaf Orang Kaya"

The space is located at the right side of the mosque and near the tower. Originally, this space was used by rich and noble people to rest after performing prayer.

6.3 "Balai Lintang"

The dimension is 4.5m * 16.2m. It is located between the wall of the main prayer hall and the big verandah.

6.4 Verandah

There are three verandahs at the KLOM which located on both sides of the main prayer hall and at the rear area. The biggest one is at the rear of the mosque which measuring 3m * 16.2m. The function of the verandah is as an extension to accommodate the increased number of the people especially during most visited period.

6.5 Tower

The tower is located at the front right area of the mosque. Its height is 10.5m and the area dimension is 2.4m * 2.4m. The tower was used as the place for the muezzin to call for the prayer before the era of electricity. Nowadays, the mosque used electrical speakers which were installed at this tower to call for the prayer.

6.6 Mihrab

The mihrab is a place for an Imam to lead the prayer. It is located in the front of the Main Praying Hall. It also indicates the Kiblah direction of a mosque. The dimension is 5.7m * 1.5m.

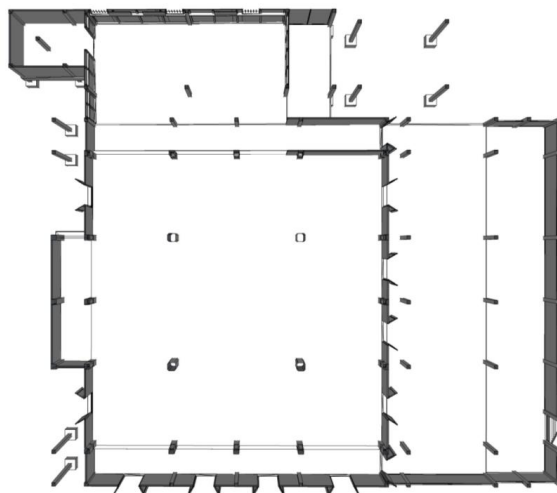


Figure 4. The spatial arrangement in the KLOM layout plan

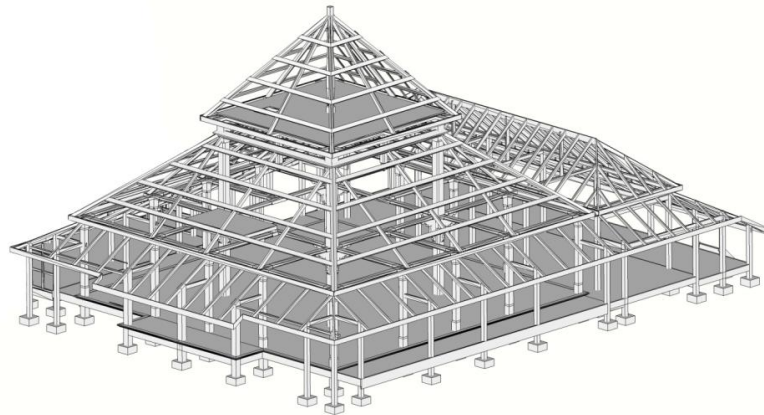


Figure 5. The structure design of the KLOM

The KLOM is oriented to the Mecca (Kiblah direction), which is the fundamental orientation of all the mosques in the world. As in Figure 5 and 6, the KLOM construction implemented post and beam system. All the beams are placed on the columns at 90° angle, and the rafters at angle from 30° at the lowest roof tier to 50° at the top roof tier. The main prayer hall has forty four columns to support the roof and the building structure. Two main spaces which attached to the main building structure which are the “*Balai Lintang*” and rear verandah has seventeen columns, and the “*Wakaf Orang Kaya*” space has eight columns. While the tower which has its own structure, has four columns. The construction of KLOM is primarily supported by four big inner columns which functioned as the core structure to support the roof and building structures. These timber columns are called “*tiang seri*” by the local people.

There are four layers of the beam structure at the KLOM (Figure 7). The top, second and the third layer of the beam structures supported the three-tiered roof. While the lowest layer of the cross beams supported the building floor area. The lowest beam elevated at approximately 910 mm from the ground surface. In general, the primary structural components which are the beams and columns are made of “*Chengal*” hardwood. While on the other construction parts of the KLOM, the “*Merbau*” hardwood were used especially at the wall panels construction (Akib, 2003; Hassan, 2011).

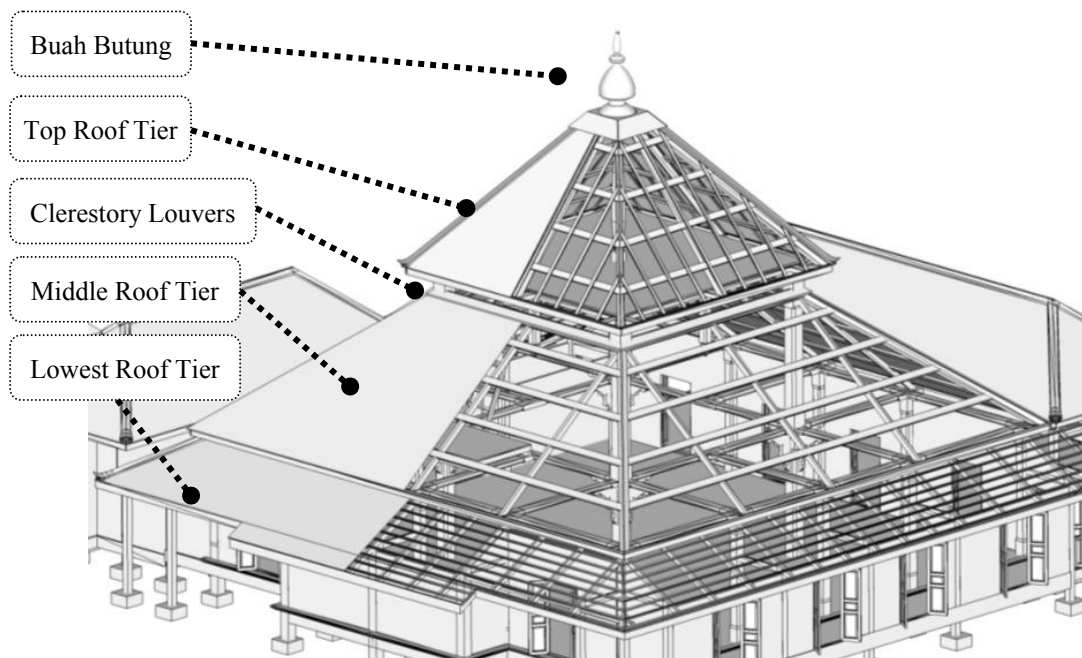


Figure 6. The roof elements of the KLOM

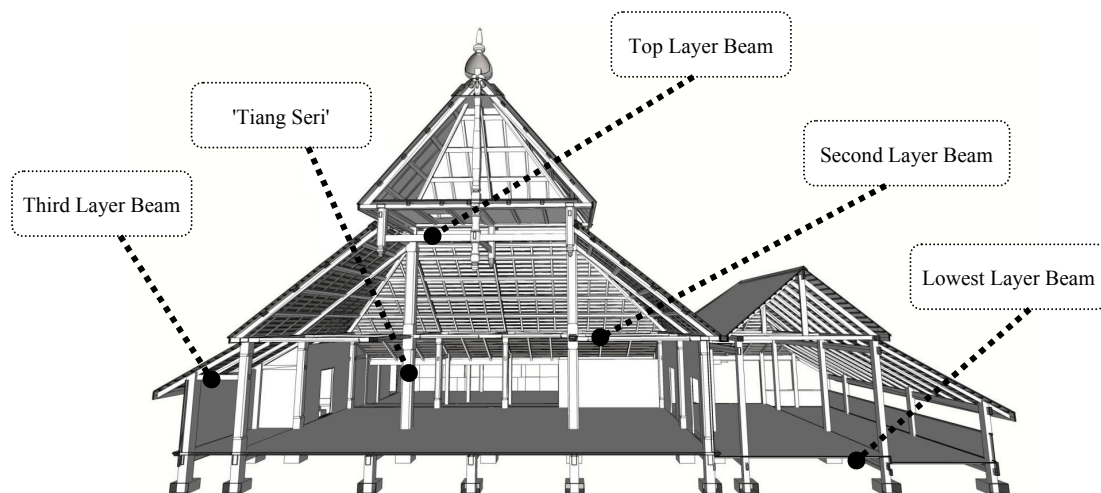


Figure 7. Sectional perspective of the KLOM

7. KLOM's Building Construction Elements

The building envelope elements of the KLOM can be divided by four elements which are the roof elements, external wall elements, openings elements and floor elements.

7.1 Roof Elements

The roof of the KLOM was constructed in three tiers (Figure 7 and 8). Each of the roof tiers is separated by a gap to allow air circulation. The roofs are supported at the four corners by big wooden pillars, sixteen interior pillars and twenty four verandah pillars thus making forty four pillars in all. There is overhang roof around the lowest roof tier which dimension is approximately 50 cm. This design element is important in tropical country to act as a shield which protects the building from the rainwater and sun rays from admittance through the openings. Between the top and the middle roof tiers, there are clerestory louvers which functioned to allow air flow of stack effect and penetration of indirect natural lights.



Figure 8. The structure which support the middle roof Tier and the lowest roof Tier

The roof is covered with the local material roof tile which is the clay. The roof tile, namely the “Singhorra” tile (Figure 9) is commonly used on the traditional building in the East coast of Malaysia. On the topmost of the roof, there is a sculpture element which acts as the roof crown for this traditional mosque. It was called as “*buah butung*” by the local master builder. The KLOM has no ceiling construction thus the roof structures are exposed and emphasized the aesthetic of the Malay architecture (Nasir, 2004; Hassan, 2010b). In term of the roof construction, no insulation installed, only clay tile and roof structure. The surface area of the roof at the Main Prayer Hall is approximately 417.2m² while the roof for “*Balai Lintang*” and Verandah is 187m². Whereas the “*Wakaf Orang Kaya*” has the least roof area which is only 72m². The thickness of the “Singhorra” tile is 7mm while for the roof structure is 25mm. The height of the roof is 9.55m measured from the lowest roof tier to the top of the roof (not including “*buah butung*”).



Figure 9. The “Singhorra” clay tile

7.2 External Wall Elements

Figure 9 illustrates the wall elements which consist of two types of wall which are the full-height wall panel at the Main Prayer Hall and 750mm height of decorated railings at the “Balai Lintang” and Verandah. The external wall at the KLOM is made from opaque “Janda Berhias” wall panel (Figure 10 and 11) and the material of the wall elements is made of the “Merbau” (*Intsia Palembanica*) which is highly durable hardwood with density 830kg/m^3 (Ahmad, 2004; WADIC, 2012).

There is no insulation material installed to the external wall construction. The surface area of the wall at the Main Prayer Hall is the largest which is approximately 126.4m^2 , followed by the external wall of “Wakaf Orang Kaya” which is 53.6m^2 . The least external wall area is at the “Balai Lintang” and Verandah which is 20.4m^2 because this area has hardwood railings (“Pagar Musang” Decorated Railings-Figure 10 and 11) at the perimeter. At the Main Prayer Hall, the height of the wall is 1.9m for the lowest and 2.8m at the highest wall. Whereas at the “Wakaf Orang Kaya”, the lowest wall is 2.2m and the highest wall height is 2.82m. The thickness of the wall at the Main Prayer Hall and “Wakaf Orang Kaya” is 25mm with 40mm structure while the hardwood railing is 15mm thickness.

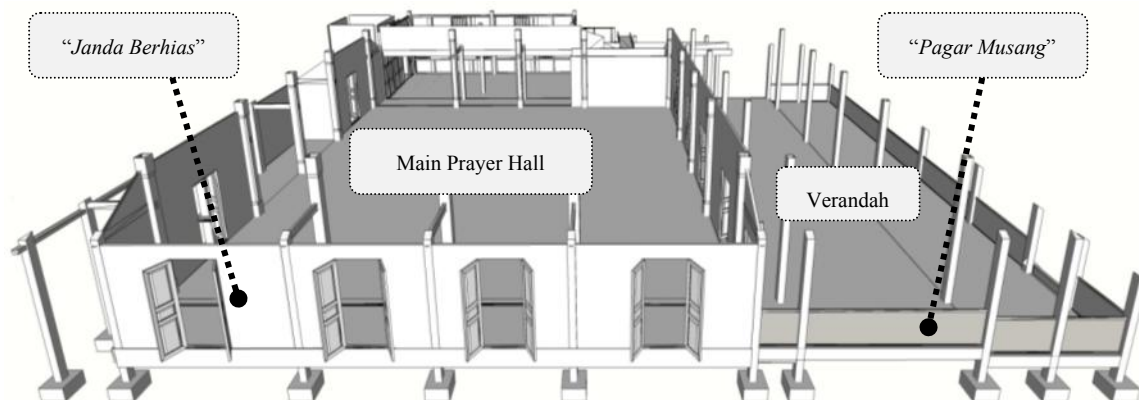


Figure 10. The external wall elements of the KLOM



Figure 11. “Janda Berhias” wall panel (left), “Pagar Musang” decorated railings (middle) and double swing windows (right)

7.3 Openings Elements

There are two types of openings at the KLOM. Both of the openings are different in terms of their design. The openings at the Main Prayer Hall is full height double swing windows (Figure 11) while at the “Wakaf Orang Kaya” is sliding windows (Figure 12) with hardwood grill and can only be operable from the inside. There are 12 full height windows at the Main Prayer Hall with the surface area is 1.71m^2 for each window with the dimension $1780\text{mm} \times 960\text{mm}$. Thus the total surface area for the opening at Main Prayer Hall is approximately 20.5m^2 . Whereas at the “Wakaf Orang Kaya”, there are 5 windows with the surface area is 0.8m^2 for each window with the dimension $960\text{mm} \times 790\text{mm}$ and there is also a double swing door with the surface area is 1.71m^2 . The total surface area at the “Wakaf Orang Kaya” is approximately 5.71m^2 . The thickness and the material of the double swing windows and the sliding window at “Wakaf Orang Kaya” is equal which is 25mm and both were made of “Merbau” hardwood.



Figure 12. Sliding windows with hardwood grill



Figure 13. The on stilt floor construction of the KLOM

7.4 Floor Elements

The KLOM was constructed using on stilt floor construction. The material of the floor is “*Chengal*” (*Neobalanocarpus Heimii*) hardwood (Figure 13) and it is a heavy and durable hardwood with the density 915kg/m^3 to 980kg/m^3 (Ahmad, 2004; Forestry Malaysia, 2012). At the Main Prayer Hall, the height of the floor is 910mm from the ground while at the Verandah, the height of the floor is 760mm from the ground. The height was made shorter during the KLOM relocation. According to Akib (2003), the original height of the on stilt post is much higher which is 2.3m. For the construction of floor elements, there are no insulation material was used similar to the other building envelope elements of this KLOM. The surface area for the floor at the Main Prayer Hall is the largest among other spaces which is approximately 222.4m^2 with the dimension of the floor strip is $30.5\text{cm} \times 7.6\text{cm}$ depth. Whereas the floor surface area at the “*Balai Lintang*” and Verandah is 121.5m^2 . The least floor surface area is at the “*Wakaf Orang Kaya*” which is only 49.7m^2 . The floor thickness at the “*Wakaf Orang Kaya*”, “*Balai Lintang*” and Verandah is the same which is 50.8mm. According to (WADIC, 2012), the hardwood with higher density is higher in thermal conductivity and lower the insulation value. Therefore, the “*Chengal*” hardwood is higher in thermal conductivity and lower insulation value than the “*Merbau*” hardwood.

8. Conclusion

This study presents the case of this study which is the Kampung Laut Old Mosque (KLOM). It explained the history, the building form and the design of the KLOM. The last section of this paper discussed the building envelope elements of the KLOM which to be drawn into 3-Dimensional model. The building envelope configuration of the KLOM can be summarized as in Table 1. The surface area of the roof elements is the largest between the building envelopes of the KLOM. It is followed by the floor elements and the external wall elements. The openings element is the least floor surface area. The KLOM was built to work and blend with the nature since there is no electricity during its construction era. The mosque can be acknowledged as a successful passive designed building in Malaysia because of its durability to stay standing and still functional until today. It can be an example and reference for the designers who intend to design a sustainable building. Apart from the great history, the KLOM is also very intellectual in terms of the building design. The technology applied to the building structure is very advance especially at the three-tiered roof structure. It is becoming another wonder when considering the limitations during the past time which has no machine, computers and even the electricity. Moreover, this old mosque had already implemented the passive design approach to its design. The openings design allows the penetration of natural air through the cross air ventilation at the horizontal openings. Accordingly, the openings at the KLOM allow day lighting into the building. It can be summarized that the design of the KLOM showed that the traditional master builder had very high understanding regarding how the building works with the climate and also the ability of the local material usage. The KLOM is no doubt a masterpiece of the Malay architecture. The vernacular design implemented on this mosque resembles strongly the aesthetic of Malay architecture and the richness of Malay culture. This traditional building must be preserved for the benefit of the new and the future generation.

Table 1. The KLOM's building envelope configuration

ELEMENTS	MATERIAL	SURFACE AREA	HEIGHT	THICKNESS
1 ROOF	“ <i>Singhorra</i> ” Clay Tile	676.2m^2	9.55m	7mm
2 EXTERNAL WALL	“ <i>Merbau</i> ” Hardwood	200.4m^2	1.9m-2.82m	25mm
3 OPENINGS	“ <i>Merbau</i> ” Hardwood	26.2m^2	0.96m-1.78m	25mm
4 FLOOR	“ <i>Chengal</i> ” Hardwood	393.6m^2	-	76mm

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