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The Facade Proportion of Three-*Bengkilas Limas* House in Palembang, South Sumatra, Indonesia

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Abstract **- The vernacular housing was built in certain proportions for various reasons ranging from practicality to aesthetics. This study aims to explore the proportion of the facade in a *limas* house with three *bengkilas* in Palembang City so that it can bring up certain ratios in determining the proportion of buildings. A total of eight types of *limas* houses were studied representing 30 *limas* houses in Palembang City. Measurements were made on the physical dimensions of the house such as length, width, and height in various variations. The results found that there was a 3:1 ratio for the width of the house compared to the height of the roof, a 1:1 ratio for the width of the house to the height of the house, a 5:1 ratio for the length of the house to the height of the back room, a 0.35 ratio for the height of the peak roof with the total buildings height, and a number of other ratios. These results contribute to the formulation of ratios in the proportion of *limas* houses in particular and other vernacular houses in general.**

Keywords: facade, proportion, ratio, limas house, vernacular

I. INTRODUCTION

The house is a place for people to protect themselves from the natural forces that surround them, while at the same time maintaining their benefits from the positive aspects of the environment. This applies to all houses of all ages, including vernacular architecture. According Mishra [1], vernacular architecture has a rational basis based on geography, climate, material availability, and cultural responses to these physical factors in creating buildings that are comfortable, inspiring, and in harmony with their environment. One of the communities that is unique in terms of the shape and proportion of vernacular buildings is the Palembang community in South Sumatra, Indonesia. Their house, called the *limas* house, has a rare characteristic found in vernacular architecture in Southeast Asia. *Limas* house has multilevel terraces (*bengkilas*) which makes this building has long distance to the back. In line with the shape of a long building, the *limas* house has a very extensive roof that it dominates the overall shape of the building. If it only refers to the physical aspect, houses with multilevel terraces should only be found in sloping mountainous areas, but Palembang is a lowland area on the river bank. Likewise, extensive roofs should only be found in mountainous or coastal areas to protect residents from strong winds, but *limas* houses have been set up in the inland region of Sumatra. This emphasizes the unique status of the *limas* house as a vernacular house and the increasing importance to conserve the *limas* house.

The study of the proportion of *limas* houses is important to do considering the decreasing number of *limas* houses in Palembang, if this is not done, in the next one or two decades, Palembang will lose a local wisdom that has long been held up as a regional identity. Even if there is a construction of a new *limas* house to save identity, without sufficient research, the new buildings are only a 'haphazard' work and do not respect ancestors, which are likely to immediately get criticism from indigenous peoples, as has happened in efforts to build new *limas* houses for tourism destinations in Palembang at the moment [2].

One form of conservation efforts is to understand the proportions in *limas* house. An understanding of proportions allows buildings to be made in accordance with cultural characteristics which produce proportions along with socio-philosophical meanings contained therein.

II. RESEARCH METHODOLOGY

2.1. Study Area and Dataset

The research was conducted in the city of Palembang, South Sumatra, Indonesia, in 30 three-*bengkilas limas* houses. Previous studies identified that these 30 houses can be grouped into eight types [3]. The characteristics of these eight types of *limas* are presented in the Table 1 below. The average age of the *limas* house studied is older than 150 years and is in 3-4 Ulu Village with a front width of 9-11 meters.

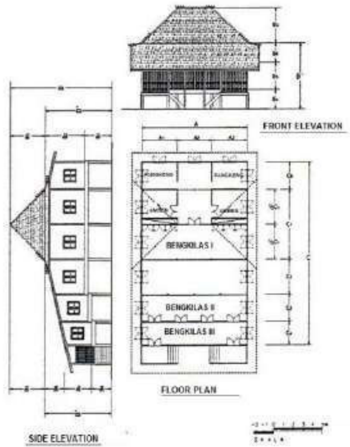

Figure 1. ***Limas*** **House Plan under Study**

Table 1.
Basic Parameter of the *Limas* House under Study [3]

Type	Total	Group
L08	1	L-8
L05	5	L-5, L-33, L-27, L-22, L-24
L03	16	L-3, L-35, L-38, L-40, L-39, L-41, L-42, L-34, L-19, L-20, L-28, L-12, L-24, L-26, L-29, L-30
L18	3	L-18, L-21, L-13
L09	2	L-9, L-25
L11	1	L-11
L04	1	L-4
L14	1	L-14

Measurements were made by identifying elements of height, length, and width of the house. Figure 1 shows the house plans while Table 2 shows the definitions of each measurement element. Table 3 presents the measurement values in meters.

Table 2. Element Definition of the *Limas* House under Study

Element	Parameter	Description
Width (front)	A	Front width of *limas* house
Length	C	Length from the front to the back of *limas* house
	C1	The length of *limas* house main building under the peak roof
Height	B1	Height of the back underneath area from the ground
	B2	Height of the back room from the back underneath area
	B3	Height of peak roof from the back room/lower roof
	B4	Height of the front underneath area from the ground
	B5	Height of the front room from the front underneath area
	B6	Height of lower roof from the front room
	B	Height from the ground to the peak roof
	B'	Height of lower roof from the ground

Table 3. Data of Element Measurement of *Limas* House under Study

	A	C	C1	B1	B2	B3	B4	B5	B6	B	B'
L08	2.4	4.8	1.4	0.5	1	0.8	0.3	0.5	0.7	2.3	1.5
L05	2.7	4.9	0.9	0.7	1	0.9	0.5	0.6	0.6	2.6	1.7
L03	2.7	4.7	0.9	0.7	1	0.9	0.5	0.7	0.5	2.6	1.7
L18	2.7	4.8	0.8	0.6	1	0.9	0.4	0.7	0.5	2.5	1.6
L09	2.7	4.8	0.8	0.6	1	0.9	0.4	0.6	0.6	2.5	1.6
L11	2.4	4.5	0.9	0.5	1	0.8	0.3	0.6	0.6	2.3	1.5
L04	2.1	4.9	1.2	0.7	1	0.7	0.5	0.6	0.6	2.4	1.7
L14	2.4	4.7	0.8	0.5	1	0.8	0.3	0.5	0.7	2.3	1.5

The definition of the ratio is based on a number of ranges to accommodate measurement errors. Ranges are made so that they do not overlap one another. Each range has an inverse so a ratio does not directly illustrate that the first element has the same value as the numerator element of the ratio. For example, a ratio of 1:4 in the comparison between B1 and B4 does not mean that B1 is 1 and B4 is 4 because it can also mean B4 is 1 and B1 is 4. This can be seen from the exact ratio reported along with the type of ratio. The following table shows the definition of the ratio group and the measurement error tolerance range.

Table 4. Definition of the Ratio and Measurement Tolerance Range

Ratio	Exact Value	Inverse	Range (<1)	Inverse Range (>1)
1:5	0.20	5	0.19-0.21	4.91-5.09
1:4	0.25	4	0.24-0.26	3.91-4.09
1:3	0.33	3	0.32-0.34	2.91-3.09
2:5	0.4	2.5	0.39-0.41	2.44-2.56
1:2	0.5	2	0.48-0.52	1.91-2.09
3:5	0.6	1.67	0.59-0.61	1.64-1.69
Greek Ratio	0.62	1.62	0.62-0.64	1.55-1.63
2:3	0.67	1.5	0.65-0.67	1.49-1.54
Chinese Ratio	0.71	1.41	0.68-0.73	1.36-1.48
3:4	0.75	1.33	0.74-0.76	1.32-1.35
4:5	0.8	1.25	0.79-0.81	1.23-1.27
1:1	1	1	0.91-1.09	0.91-1.09

2.1. Analysis

Data analysis was performed by calculating a number of ratios related to the exterior and interior parameters of the *limas* house. The ratio is calculated in two groups. First, compare the length and width elements with each height element. This means that the ratio is calculated by comparing A, C, and C1 with B1, B2, B3, B4, B5, B6, B, and B'. The total ratio is 3 x 8 = 24 comparisons. Because there are eight types of *limas* houses, the total ratio calculation is 24 x 8 = 192. Second, compare between combinations of high elements. This means that height element is compared to every other height element. The ratio between the height element is made up of a ratio between the eight height elements, so a 7 x 8 ratio or 56 ratio is obtained for each *limas* house. Because there are 8 pyramid houses, the total calculation is 8 x 56 = 448 calculations.

Each ratio obtained is identified based on the ratio range (Table 3). Ratios that are not included in the ratio range are expressed as special ratios. A ratio is said to be dominant if at least five of the eight types of *limas* houses contain that ratio.

Based on the results obtained, the ratios are then matched in such a way that they can be used to construct a housing model that contains ratios that are consistent with taking the most dominant starting ratios. If there are two conflicting ratios due to the existence of two different measurement ratios as a consequence of the establishment of previous ratio, then the more dominant ratio takes precedence. This might have happened because the ratio taken was partly not complied with 100% *limas* houses

III. RESULTS AND DISCUSSION

3.1. Relation of Length and Width with Height

The width of the front of the *limas* house has a very uniform ratio with B2, B3, B and B'. In comparison with B2 (height of back room), it was found that half of the types of pyramid houses follow the 2.70 ratio. This ratio is not included in the simple ratio category or the golden ratio. Even so, other *limas* houses do not show any ratio close to the 2.70 ratio.

Table 5, Result of Calculation of House Width Ratio (A)

	B1	B2	B3	B4	B5	B6	B	B'	B1	B2	B3	B4	B5	B6	B	B'
L08	4.80	2.40	3.00	8.00	4.80	3.43	1.04	1.60	1 : 5		1 : 3		1 : 5		1 : 1	GR
L05	3.86	2.70	3.00	5.40	4.50	4.50	1.04	1.59	1 : 4		1 : 3				1 : 1	GR
L03	3.86	2.70	3.00	5.40	3.86	5.40	1.04	1.59	1 : 4		1 : 3		1 : 4		1 : 1	GR
L18	4.50	2.70	3.00	6.75	3.86	5.40	1.08	1.69			1 : 3		1 : 4		1 : 1	3 : 5
L09	4.50	2.70	3.00	6.75	4.50	4.50	1.08	1.69			1 : 3				1 : 1	3 : 5
L11	4.80	2.40	3.00	8.00	4.00	4.00	1.04	1.60	1 : 5		1 : 3		1 : 4	1 : 4	1 : 1	GR
L04	3.00	2.10	3.00	4.20	3.50	3.50	0.88	1.24	1 : 3		1 : 3					4 : 5
L14	4.80	2.40	3.00	8.00	4.80	3.43	1.04	1.60	1 : 5		1 : 3		1 : 5		1 : 1	GR

Note: CH = chinese ratio, GR = greek ratio

The comparison of A with B3 (peak roof height) shows an overall ratio of 1:3. This is surprising because it means that the pyramid house architect consciously determined that the width of the house must be three times the height of the roof. Moreover, five of the six *limas* houses follow a simple 1:1 ratio rule in the ratio of the width of the house to the overall height of the pyramid house (B). Because B = B3 + B', it can be assumed that there is a special ratio between the width of the house and B' (height under the roof). Even so, the comparison with B' is not too strict. Five of the eight *limas* houses followed the Greek ratio (1.62 or 0.62) while two followed the 3:5 ratio and one followed the 4:5 ratio. This is more due to the narrow range definition in the 1.5-1.7 region. However, this shows that there is a fairly firm ratio between the width of the house and the height of the lower roof, the height of the peak roof, and the height of the house as a whole.

Table 6. Calculation Result of House Length Ratio (C)

	B1	B2	B3	B4	B5	B6	B	B'	B1	B2	B3	B4	B5	B6	B	B'
L08	9.60	4.80	6.00	16.00	9.60	6.86	2.09	3.20		1 : 5						
L05	7.00	4.90	5.44	9.80	8.17	8.17	1.88	2.88		1 : 5						
L03	6.71	4.70	5.22	9.40	6.71	9.40	1.81	2.76			1 : 5					
L18	8.00	4.80	5.33	12.00	6.86	9.60	1.92	3.00		1 : 5						1 : 3
L09	8.00	4.80	5.33	12.00	8.00	8.00	1.92	3.00		1 : 5						1 : 3
L11	9.00	4.50	5.63	15.00	7.50	7.50	1.96	3.00							1 : 2	1 : 3
L04	7.00	4.90	7.00	9.80	8.17	8.17	2.04	2.88		1 : 5					1 : 2	
L14	9.40	4.70	5.88	5.67	9.40	6.71	2.04	3.13							1 : 2	

Note: CH = chinese ratio, GR = greek ratio

In the ratio component of the house length with height, found the dominance of the ratio of 1: 5 in the ratio of the house length with the height of the back room (B2). Five of the eight *limas* houses tend to follow the ratio of 1:5 with a house length between 4.8-4.9 times the height of the back room.

Table 7.
Calculation of the Length Ratio of *Limas* House Main Building (C1)

	B1	B2	B3	B4	B5	B6	B	B'	B1	B2	B3	B4	B5	B6	B	B'
L08	2.80	1.40	1.75	4.67	2.80	2.00	0.61	0.93		CH				1 : 2	3 : 5	1 : 1
L05	1.29	0.90	1.00	1.80	1.50	1.50	0.35	0.53			1 : 1		2 : 3	2 : 3		
L03	1.29	0.90	1.00	1.80	1.29	1.80	0.35	0.53			1 : 1					
L18	1.33	0.80	0.89	2.00	1.14	1.60	0.32	0.50	3 : 4	4 : 5		1 : 2		GR	1 : 3	1 : 2
L09	1.33	0.80	0.89	2.00	1.33	1.33	0.32	0.50	3 : 4	4 : 5		1 : 2	3 : 4	3 : 4	1 : 3	1 : 2
L11	1.80	0.90	1.13	3.00	1.50	1.50	0.39	0.60				1 : 3	2 : 3	2 : 3	2 : 5	3 : 5
L04	1.71	1.20	1.71	2.40	2.00	2.00	0.50	0.71					1 : 2	1 : 2	1 : 2	CH
L14	1.60	0.80	1.00	2.67	1.60	1.14	0.35	0.53	GR	4 : 5	1 : 1		GR			

Note: CH = chinese ratio, GR = greek ratio

The results of the calculation of the length ratio of the main building with the height elements do not show any consistent pattern. No special ratios were found to be adhered to in relation to the construction of the length of the main building with the height elements.

3.2. Ratio Between Height Elements

The following table shows the calculation results for element B1 with respect to the other height elements. That is, this calculation compares the height of the back underneath area of *limas* house with other height elements. From 56 calculations, 18 did not find any suitable ratio, so the ratio obtained was 38/56 = 68%. Even so, there is no certain ratio that is consistently shown in each *limas* house (row) or every comparison (column). There is also no specific ratio that is dominant (more than 50%) for each comparison. Indeed, the comparison between B1 and B5 shows that half the types of *limas* houses follow the 1:1 ratio. B5 is the height of the front area of *limas* house calculated from the front *bengkilas* floor with the top of the door. That is, half of the three-*bengkilas limas* house type has the same measurement of the height of back underneath area with the height of front *bengkilas*.

Table 8. Calculation Results of the Height Ratio of the Back Underneath Area in *Limas* House (B1)

	B2	B3	B4	B5	B6	B	B'	B2	B3	B4	B5	B6	B	B'
L08	0.50	0.63	1.67	1.00	0.71	0.22	0.33	1 : 2	GR	3 : 5	**1 : 1**	CH		1 : 3
L05	0.70	0.78	1.40	1.17	1.17	0.27	0.41	CH		CH				2 : 5
L03	0.70	0.78	1.40	1.00	1.40	0.27	0.41	CH		CH	**1 : 1**	CH		2 : 5
L18	0.60	0.67	1.50	0.86	1.20	0.24	0.38	3 : 5	2 : 3	2 : 3			1 : 4	
L09	0.60	0.67	1.50	1.00	1.00	0.24	0.38	3 : 5	2 : 3	2 : 3	**1 : 1**	1 : 1	1 : 4	
L11	0.50	0.63	1.67	0.83	0.83	0.22	0.33	1 : 2	GR	3 : 5				1 : 3
L04	0.70	1.00	1.40	1.17	1.17	0.29	0.41	CH	1 : 1	CH				2 : 5
L14	0.50	0.63	1.67	1.00	0.71	0.22	0.33	1 : 2	GR	3 : 5	**1 : 1**	CH		1 : 3

Note: CH = chinese ratio, GR = greek ratio

The height ratio calculation of the back of *Limas* House shows a pattern of dominance of the 3:5 ratio. This dominance was particularly found in the results of comparisons with B5 and B6 where the 3:5 ratio reached 50% of the *limas* house type. B5 is the height of the front room of *limas* house while B6 is the height from the bottom part of the roof to the slope starting point of the lower roof. In all cases, the height of the back room of *limas* house is 1.67 times the height of front room and 1.67 times the height of the lower roof. Another ratio found was 1.11 which appeared in 50% of the type of *limas* house for the comparison of the back room of *limas* house with peak roof height (B3). Furthermore, this ratio was found in the same *limas* house in pairs, namely L05, L09, L11, and L04.

Table 9. Calculation Results of the Height Ratio of the Back Room in *Limas* House (B2)

	B1	B3	B4	B5	B6	B	B'	B1	B3	B4	B5	B6	B	B'
L08	2.00	1.25	3.33	2.00	1.43	0.43	0.67	1 : 2	4 : 5		1 : 2	CH		2 : 3
L05	1.43	**1.11**	2.00	1.67	1.67	0.38	0.59	CH		1 : 2	**3 : 5**	**3 : 5**		
L03	1.43	**1.11**	2.00	1.43	2.00	0.38	0.59	CH		1 : 2	CH	1 : 2		
L18	1.67	**1.11**	2.50	1.43	2.00	0.40	0.63	3 : 5		2 : 5	CH	1 : 2	2 : 5	GR
L09	1.67	**1.11**	2.50	1.67	1.67	0.40	0.63	3 : 5		2 : 5	**3 : 5**	**3 : 5**	2 : 5	GR
L11	2.00	1.25	3.33	1.67	1.67	0.43	0.67	1 : 2	4 : 5		**3 : 5**	**3 : 5**		2 : 3
L04	1.43	1.43	2.00	1.67	1.67	0.42	0.59	CH	CH	1 : 2	**3 : 5**	**3 : 5**		
L14	2.00	1.25	3.33	2.00	1.43	0.43	0.67	1 : 2	4 : 5		1 : 2	CH		2 : 3

Note: CH = chinese ratio, GR = greek ratio

The top of the pyramid house is shown to have no dominant ratio when compared to the height of the other facades. There are few ratios obtained can be included in the golden ratio category (China or Greece) or simple ratios. Although they do not have a golden ratio or a simple ratio, there are certain dominant ratios. The 0.90 ratio is the congruent ratio of B2 described above (the inverse of 0.90 is 1.11). Another ratio that appears is 0.35 which is in five of the eight *limas* houses in the comparison with the total height of *limas* house from the ground to the top (B). In fact, two of the three remaining *limas* houses were only at 0.01 disputes, amounting to 0.36. The same phenomenon also occurs in the ratio with the height of the underneath area + facade (B'), which is 0.53 in as many as 5 of the 8 types of *limas* houses. Moreover, this ratio is found in the same *limas* house. Five of the eight *limas* houses follow a consistent ratio for B and B'.

Tabel 10. Calculation Results of the Height Ratio of the Peak Roof in *Limas* House (B3)

	B1	B2	B4	B5	B6	B	B'	B1	B2	B4	B5	B6	B	B'
L08	1.60	0.80	2.67	1.60	1.14	**0.35**	**0.53**	GR	4 : 5		GR			
L05	1.29	0.90	1.80	1.50	1.50	**0.35**	**0.53**				2 : 3	2 : 3		
L03	1.29	0.90	1.80	1.29	1.80	**0.35**	**0.53**							
L18	1.50	0.90	2.25	1.29	1.80	**0.36**	0.56	2 : 3						
L09	1.50	0.90	2.25	1.50	1.50	**0.36**	0.56	2 : 3			2 : 3	2 : 3		
L11	1.60	0.80	2.67	1.33	1.33	**0.35**	**0.53**	GR	4 : 5		3 : 4	3 : 4		
L04	1.00	0.70	1.40	1.17	1.17	0.29	0.41	1 : 1	CH	CH				
L14	1.60	0.80	2.67	1.60	1.14	**0.35**	**0.53**	GR	4 : 5		GR			

Note: CH = chinese ratio, GR = greek rati

The front underneath area of *limas* house does not seem to get special attention from the architect of *limas* house in relation to the height of the facade or the roof. There is no particular ratio that is dominant, be it a golden ratio, a simple ratio, or a typical ratio based on a comparison with certain height, or based on the type of *limas* house.

Table 11. Calculation Results of the Height Ratio of the Front Underneath Area in *Limas* House (B4)

	B1	B2	B3	B5	B6	B	B'	B1	B2	B3	B5	B6	B	B'
L08	0.60	0.30	0.38	0.60	0.43	0.13	0.20	3 : 5			3 : 5			1 : 5
L05	0.71	0.50	0.56	0.83	0.83	0.19	0.29	CH	1 : 2				1 :	
L03	0.71	0.50	0.56	0.71	1.00	0.19	0.29	CH	1 : 2		CH	1 : 1	1 :	
L18	0.67	0.40	0.44	0.57	0.80	0.16	0.25	2 : 3	2 : 5			4 : 5		1 : 4
L09	0.67	0.40	0.44	0.67	0.67	0.16	0.25	2 : 3	2 : 5		2 : 3	2 : 3		1 : 4
L11	0.60	0.30	0.38	0.50	0.50	0.13	0.20	3 : 5			1 : 2	1 : 2		1 : 5
L04	0.71	0.50	0.71	0.83	0.83	0.21	0.29	CH	1 : 2	CH			1 :	
L14	0.60	0.30	0.38	0.60	0.43	0.13	0.20	3 : 5			3 : 5			1 : 5

Note: CH = chinese ratio, GR = greek ratio

The height ratio of the front room of *limas* house shows another special ratio at 50% of the *limas* house in addition to the 3:5 ratio previously discussed. This ratio appears in two types for comparison with B6 (lower roof height), namely the China ratio and the 1:1 ratio. It should also be noted that the 1:1 ratio can also be considered the ratio of China although it can also be interpreted as an Islamic ratio. This shows that half of the three-*bengkilas limas* house have the front room height equal to the lower roof height, while the other half has a ratio of 1.4 or 0.7 so that two of the *limas* house have a front room 1.4 times higher than the lower roof and two have a lower roof with height 1.4 times the front room. However, because of these two Chinese ratios, it can be said that this ratio is less consistent than the 1:1 ratio.

Table 12. Calculation Results of the Height Ratio of the Front Room in *Limas* House (B5)

	B1	B2	B3	B4	B6	B	B'	B1	B2	B3	B4	B6	B	B'
L08	1.0	0.5	0.6	1.6	0.7	0.2	0.3	1 :	1 :	GR	3 :	CH		1 : 3
L05	0.8	0.6	0.6	1.2	1.0	0.2	0.3		3 :	2 :		1 :		
L03	1.0	0.7	0.7	1.4	1.4	0.2	0.4	1 :	CH		CH	CH		
L18	1.1	0.7	0.7	1.7	1.4	0.2	0.4		CH			CH		
L09	1.0	0.6	0.6	1.5	1.0	0.2	0.3	1 :	3 :	2 :	2 :	1 :	1 :	
L11	1.2	0.6	0.7	2.0	1.0	0.2	0.4		3 :	3 :	1 :	1 :		2 : 5
L04	0.8	0.6	0.8	1.2	1.0	0.2	0.3		3 :			1 :	1 :	
L14	1.0	0.5	0.6	1.6	0.7	0.2	0.3	1 :	1 :	GR	3 :	CH		1 : 3

Note: CH = chinese ratio, GR = greek ratio

Apart from the dominance of the 3:5 ratio in the comparison with B2 and the 1:1 ratio in the comparison with B5, both of which have been discussed above, there is no longer a prominent ratio between the lower roof of *limas* house with total height (B) or height without roof (B'). This can be observed in the table below.

Table 13. Calculation Results of the Height Ratio of the Lower Roof in *Limas* House (B6)

	B1	B2	B3	B4	B5	B	B'	B1	B2	B3	B4	B5	B	B'
L08	1.40	0.70	0.88	2.33	1.40	0.30	0.47	CH	CH			CH		
L05	0.86	0.60	0.67	1.20	1.00	0.23	0.35		3 : 5	2 : 3		1 : 1		
L03	0.71	0.50	0.56	1.00	0.71	0.19	0.29	CH	1 : 2		1 : 1	CH	1 : 5	
L18	0.83	0.50	0.56	1.25	0.71	0.20	0.31		1 : 2		4 : 5	CH	1 : 5	
L09	1.00	0.60	0.67	1.50	1.00	0.24	0.38	1 : 1	3 : 5	2 : 3	2 : 3	1 : 1	1 : 4	
L11	1.20	0.60	0.75	2.00	1.00	0.26	0.40		3 : 5	3 : 4	1 : 2	1 : 1		2 : 5
L04	0.86	0.60	0.86	1.20	1.00	0.25	0.35		3 : 5			1 : 1	1 : 4	
L14	1.40	0.70	0.88	2.33	1.40	0.30	0.47	CH	CH			CH		

Note: CH = chinese ratio, GR = greek ratio

The total height of the *limas* house appears to have a special ratio that is quite consistent with the height of the house without a roof. Five of the eight types of *limas* house have a ratio of 2:3 with a combined height of the facade and underneath area. The total height of a *limas* house tends to be 1.53 times the combined height of the facade and underneath area. Moreover, two to three remaining *limas* houses tend to show a ratio of 1.56 which is only 0.03 adrift from the ratio of 1.53.

Table 14. Calculation Results of the Height Ratio of the Total Height in *Limas* House (B)

	B1	B2	B3	B4	B5	B6	B'	B1	B2	B3	B4	B5	B6	B'
L0	4.60	2.30	2.88	7.67	4.60	3.29	1.53							2 : 3
L0	3.71	2.60	2.89	5.20	4.33	4.33	1.53				1 : 5			2 : 3
L0	3.71	2.60	2.89	5.20	3.71	5.20	1.53				1 : 5		1 : 5	2 : 3
L1	4.17	2.50	2.78	6.25	3.57	5.00	1.56	1 : 4	2 : 5				1 : 5	GR
L0	4.17	2.50	2.78	6.25	4.17	4.17	1.56	1 : 4	2 : 5			1 : 4	1 : 4	GR
L1	4.60	2.30	2.88	7.67	3.83	3.83	1.53							2 : 3
L0	3.43	2.40	3.43	4.80	4.00	4.00	1.41				1 : 5	1 : 4	1 : 4	CH
L1	4.60	2.30	2.88	7.67	4.60	3.29	1.53							2 : 3

Note: CH = chinese ratio, GR = greek ratio

Although the results of the 7x8 comparison have been described above, the following table is given to show the relationship between the height of the facade and the underneath area of the *limas* house to other height components.

Table 15. Calculation Results of Height Ratio of the Façade + Underneath Area in *Limas* House (B')

	B1	B2	B3	B4	B5	B6	B	B1	B2	B3	B4	B5	B6	B
L08	3.00	1.50	1.88	5.00	3.00	2.14	0.65	1 : 3	2 : 3		1 : 5	1 : 3		2 : 3
L05	2.43	1.70	1.89	3.40	2.83	2.83	0.65							2 : 3
L03	2.43	1.70	1.89	3.40	2.43	3.40	0.65							2 : 3
L18	2.67	1.60	1.78	4.00	2.29	3.20	0.64		GR		1 : 4			GR
L09	2.67	1.60	1.78	4.00	2.67	2.67	0.64		GR		1 : 4			GR
L11	3.00	1.50	1.88	5.00	2.50	2.50	0.65	1 : 3	2 : 3		1 : 5	2 : 5	2 : 5	2 : 3
L04	2.43	1.70	2.43	3.40	2.83	2.83	0.71							CH
L14	3.00	1.50	1.88	5.00	3.00	2.14	0.65	1 : 3	2 : 3		1 : 5	1 : 3		2 : 3

Note: CH = chinese ratio, GR = greek ratio

3.3. Model Construction of the Three-Bengkilas Limas House

The results above show that there are a number of special ratios used by *limas* house architects to build *limas* house designs. Half of the three-*bengkilas limas* houses show a ratio of 2.70 for the ratio of width to height of the back room. The ratio between the width of the house to the height of the peak roof is always 3:1, while the ratio of the house width to the overall height of *limas* house is almost always 1:1. The ratio of the house width to the lower roof height is always between 1.5-1.7. The ratio of the house length to the back room height follows the ratio of 5:1. Half the *limas* house also shows a ratio of 1:1 in the ratio of the underneath area height to the front room height. A ratio of 5:3 is followed for the ratio between the back room height to the lower roof and front room height in 50% of the *limas* houses. A special ratio of 0.35 is found in almost all *limas* house in the ratio of the peak roof height to the total height of the building. Meanwhile, the 0.53 ratio is adopted in 50% of the *limas* house in the ratio of the peak roof height to the lower roof height. In addition, 50% of *limas* houses show a ratio of 1:1 in the ratio of the front room height to the lower roof height. Five of the eight *limas* houses showed a 2:3 ratio between the height of the house without roof to the total height.

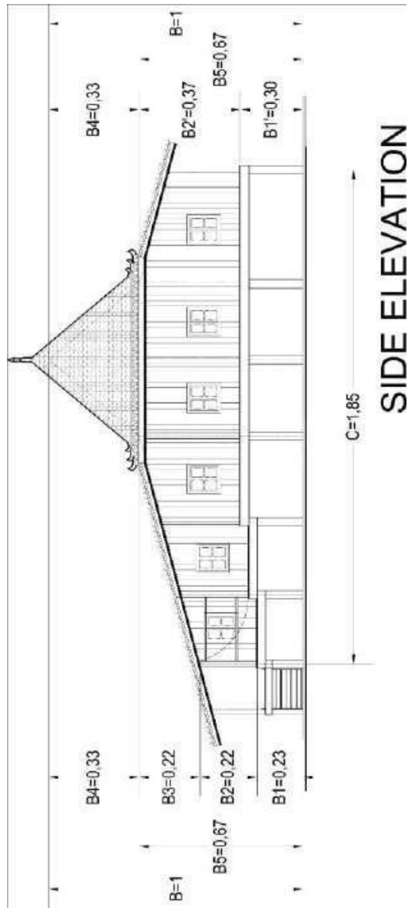

Figure 2. Model Height of Three-*Bengkilas Limas* House

Based on the above findings, we can determine an ideal proportion of the exterior of a three-*bengkilas limas* house by looking at the strongest ratios. If the house width is set at 1 unit, then the length of the house is 1.85 and the total height of the *limas* house is 1 unit as well. The height of the peak roof of *limas* house is 0.33 because it follows the ratio of 1:3 to the house width. Since the total height is set by 1 unit and the height of the peak roof is 0.33, the the height from the ground to the lower roof is 0.67. At the front, the lower roof and front room height has a ratio of 1:1 and 3:5 to the back room of *limas* house. The back room of the *limas* house itself follows a ratio of 1: 5 to the length of the house so that the size is 0.37 units. In line with this, then underneath area of *limas* house has a height of 0.30 to match the height of B 'of 0.67. Meanwhile, for the height of the front room, it becomes 0.22, the same as the lower roof height. The remaining underneath area have a height of 0.23 to match the value of B'. A picture of *limas* house constructed in this way is shown in Figure 2.

From the model in Figure 4, it can be seen that the ratio of *limas* houses is 2:3 for the lower roof height with the total height of the house. The peak roof height is 1:3 from the total height of *limas* house. The ratio of the lower roof height to the front room and underneath area is 1:1:1. The ratio of the height of the back room to the back underneath area is 0.37: 0.30. This means that there is an increase of 0.07 units from the forefront to the deepest *bengkilas* at *limas* house.

3.4. Discussion

Although not all elements have a fixed ratio, the three-*bengkilas limas* house seems to follow a number of simple ratios that allow the construction of *limas* house model with exact parameters, especially on the ratio of peak roof height. The existence of this simple ratio seems to be due to efforts to build uniformity and ease, as well as efforts to produce symmetry, composition, balance, regularity, unity, harmony, and rhythm [4].

The existence of a special ratio also implies an effort to maintain the symmetry lost from the side of the *limas* house. In contrast to palaces in the Malay region which generally contains a symmetrical front area [5,6] or the West and Chinese architecture [4], *limas* house architecture only has symmetry on the front and back area. The existence of symmetry, especially bilateral symmetry, in vernacular houses is something that reflects nobility because of the high degree of difficulty in symmetrical facade construction as well as formalities that are highly valued by noble groups [7]. Alternatively, the presence of symmetry reflects the individualism of the homeowner [8]. As the party who spent the most resources and stayed the longest in the house, residents felt entitled to reflect their individuality on the appearance of the house. This individuality is shown by how the occupants try to display the rules of rigid customs so that visitors cannot be careless in doing something at the house. With the existence of fixed and simple proportions, the architect of *limas* house creates an impression of regularity and formality in a different way by showing ratios that tend to be consistent in the construction of *limas* house.

However, the priority of formality reflects the priority of general appearance over the details [9]. It is said so because parts of the house must be adjusted to the ratio rather than function. The function of the building must be adjusted according to rigid rules to maintain the ratio.

Asymmetry in the side facade of *limas* house arises because of the presence of *bengkilas* and the roof that peaks at the back. That is why the front and back underneath area height of *limas* house is different. If the interpretation of individualism is taken, then this asymmetry reflects collectivism and how function takes precedence over regularity. Collectivism is provided by the *limas* house with the extention of *bengkilas* that extend longer to the front and by placing the center of the house slightly backward. That is, with the arrival of guests, the owner is willing to retreat far enough back in order to respect guests who visit.

Asymmetry of the side facade of *limas* house which arise from the presence of *bengkilas* emphasizes a new meaning which is repetition. Malay sculptors and engravers use symmetry combined with repetition to emphasize infinity [10]. Infinity is a characteristic of God in Islam so it is shown in repetitive symmetrical patterns in Malay houses. Repetition can be found in the symmetry and asymmetry of *limas* house. Symmetrical repetition can be found on the tenggalung fence in the front facade where the fence poles repeatedly symmetrically to cover the outer terrace. Meanwhile, asymmetrical repetition can be found in a rows of *bengkilas*. As a result, on the front and side facades, there are meanings about God's infinity.

IV. CONCLUSION

The proportion of the facade of three-*bengkilas limas* house shows the dominance of simple and special ratios - suggesting that some principle of proportion is needed to produce a beautiful and functional building. Future studies are needed to identify the proportion of the facade in the *limas* house with other amount of *bengkilas* to find the universality of the ratios found in the proportion of the facade in general. Perhaps the greatest message of this study is to remind the reader that proportion is not a single thing, especially in the design of complex buildings. There are various ratios that must be used in the building facades to improve the aesthetics and functionality of building designs. As this study has found, these ratios include simple ratios of 1:1, 2:3, 3:1, 5:1, and 5:3 and special ratios of 7:20, 53:100, 8:5, and 27:10.

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