The Tradional Architecture of Palembang Limas House Evaluation of Physical Proportion of Palembang Limas House with Three Bengkilas in Seberang Ulu Palembang

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Abstract: The Palembang LimasHouseis traditional house that has an aesthetic based on ornament and proportion of buildings but in the last two decades fails to give the impression of aesthetic because their proportions are used differently from the old LimasHouse. The ideal proportion is the size ratio associated with the physical elements of the main building and the core building. The purpose of this study is to reveal the relationship between the empirical proportion with the theoretical proportion of the LimasHouse with three bengkilas at Seberang Ulu Palembang. This research uses quantitative rationalistic methods, 30 LimasHouse is purposively taken as sample using the criteria of having three bengkilas and at least 100 years old. The search for the elements' sizes in physical LimasHouse is done by comparing the space inside the house with the simple ratio in each sample.The result shows that LimasHouse follow simple ratio proportions based on 1:1 ratio, and in minor extent, 2:3, and the dimensional proportions follow some of the most beautiful ratios.Moreover, the most harmonic dimension is the floor-roof dimension, whichimplies that the house fit for private living, than for meeting or semi public purpose.

Keywords: Proportions, Traditional Architecture, Palembang Limas house.

I. INTRODUCTION

In the history of the past in Indonesia, there have been created peaks of creations and cultural works which until now still attract admiration. These creations and cultural works are scattered in regions throughout Indonesia, spread over so many ethnicities. One of the cultural works in Indonesia is the traditional architecture of Palembang *Limas*-House.

Siswanto (1999) says that, in early settlements, Palembang did not only had traditional *Limas*Houses, but also other houses such as rafts and warehouse. *Limas*House warehouse is a combination of house space and storage area. Although some types of traditional houses have the form of houses on stilits, each has a different type of stilts system and is adaptive to the surrounding environment.

Vitruvius Pollio (1960) said that in order for temples to be magnificent, they must be constructed in the analogy of a well-shaped human body, which in the analogy of the human body has a perfect harmony between all its parts. The constructed human model has the same height as the two arms stretched. These two similar sizes produce a square that covers the whole body, while the hands and feet touch a circle centered on the navel. The idea of this model comes from the mindset of the Greeks who considered that humans, with all their boundaries, had the capacity to reflect boundless harmony and beauty. Furthermore, this starts from the assumption that humans have divine nature and therefore, humans must be the basis for the measurement of all things.

Wittkower (1951) stated that the basic axiom of the Renaissance architect was that every part of a building, inside and outside, must be integrated into one in the same system of mathematical ratios. This axiom was relatively found in various other cultures. Ratio systems can be found in ken and tatami cultures in Japan (Paine & Soper, 1961), China (Jaya, 2012), and various anthropometric systems in other cultures. This means that there is a standard system in proportion to buildings made by humans in a culture. Some of these standards are anthropometric, especially because humans are builders and users of buildings. The correlation with the belief of cosmology and cosmogony can be seen as a cultural justification for inheriting a standard system of building proportions in oral and written cultures.

However, it can be understood that this standard system will continue to change, especially due to modernization and cultural contact. The emergence of modern culture for example, produces a system of proportions that are more practical, not only for socio-religious considerations, but also for consideration of costs, materials, and many other factors. This does not mean that these considerations do not appear in traditional culture. But buildings that are formed on the basis of socio-religious are more preserved by the community because they are considered to contain sacred meanings and become cultural identities in inter-ethnic relations.

II. LITERATURE REVIEW

The revivalism of traditional values in modern architecture is tried to be brought back by a number of thinkers.Doczi (1981), for example, tried to restore modern architecture to natural proportions for aesthetic reasons.

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Doczi (1981) argued that natural proportions were the most basic proportion and were most capable of lifting aesthetic aspects through harmonic relationships. This opinion makes sense. Humans have evolved over hundreds of thousands of years in a natural environment thus they understand that natural forms have their own charm and the buildings they made are trying to imitate those natural forms, which of course, with a number of variations brought about by local conditions and the socio-religious system they develop.

The general ratio expressed as the natural ratio determining the aesthetic form is the ratio of 1.618 or its inverse 0.618. This ratio is commonly referred to as the golden ratio, denoted by φ (phi) (Livio, 2002). There is a reputation from mathematicians for the position of the golden ratio in nature (Falbo, 2005). Even so, as a standard, the golden ratio has been used by various architects from the Euclid era to the contemporary with the belief that this ratio has its own aesthetic advantages. For example, Le Corbusier uses this ratio as the basis of his design philosophy (Frings, 2002).

Because the golden ratio is an element of Greek culture, it is very unlikely that this ratio is also applied to *Limas*House-in Palembang. Even so, the ratio approach is rational enough to be used. The mindset of ratios such as in Greece can also be applied in the Palembang community. Rather than using non-standard anthropometric-based units, *Limas* architects can use certain ratios, at least in the simplest form, to build pyramid. For this reason, we use simple ratios to check whether *Limas* architects use ratio systems to construct buildings, rather than anthropometric systems. All simple ratios are tested. For the purposes of this study, a simple ratio is defined as the ratio between two integers ≤ 5. This ratio includes 1: (1,2,3,4,5); 2: (3,4,5), 3: (4,5), and 4: 5. We limit the value of 5 as the highest value for simplicity because this value has good practicality. The use of ratios with integers above 5 will increase complexity for someone with a non-standard oral culture who is familiar with anthropometry. This is influenced by the use of fingers to count and fingers in one hand only consists of five.

This picture is in line with Palladio's opinion in Wittkower (1951) that there are seven most beautiful shapes, namely circle, square (1: 1), 1: 2, 3: 4, 2: 3, 3: 5 and 1: 2. The root of this opinion is the harmonic ratio theory. Harmonic ratio theory is a theory developed by Ancient Egyptian civilization. This theory emphasizes that architectural design must follow simple ratios such as 2:3, 3:4, and 3:5. Simple ratios are used because they are seen as most likely to produce harmonious forms that are perceived beautifully by humans (Pile, 2005, p. 18). The use of simple ratios is obtained from experience in music. Musicians find that the sound that sounds the most harmonious is the sound produced by tones with a modest frequency of vibration. The more irregular the ratio of music is, the rougher and more chaotic sounds are heard. This proportion was then used by Egyptian architects to build various architectural forms, including the Pyramid (Pile, 2005, p.18).

The view that aesthetics can be approached quantitatively, such as through ratios, is the basis of the theory developed by Cohen (2011). Contrary to the two opinions above, Cohen (2011) offers a definition that broadens proportions more than mere ratios, while rejecting the definition of proportion as a qualitative taste. Understanding as a set of proportions is stated as follows: "proportion is a group of geometrical, numerical or arithmetical correspondences among important dimensions throughout a building or major part, placed there by the architect with the intention of imbuing the built form with desirable qualities, physical or otherwise "(Cohen, 2011).

With geometric, numerical, and arithmetic, Cohen intended to state that proportions contain geometric aspects (real building forms) such as Pitagorean-Platonic geometry, numerical aspects (numerical values), and arithmetic aspects (addition, subtraction, multiplication, and division symbols) , selected from the Renaissance and classical periods. More precisely, as Cohen stated (2011, p. 24), numerical correspondence is correspondence that focuses on certain numerical qualities of integers, such as numeric series, while arithmetic correspondence is correspondence that highlights certain relationships between numbers that can only be obtained through simple calculations. , such as integer approaches for a ratio of 1: √2. In this theory, ratio is a form of arithmetic correspondence.

This simple ratio-based proportion can be understood to appear in *Limas* architecture because it makes it easier to construct buildings in the oral community, especially because the anthropometric system has a very large variation problem. Therefore, instead of using an anthropometric system that does not have clear standards, *Limas* architects can use a standard system with a simple ratio. They can use flexible materials such as cloth or ropes to build one side after one side is made. It is also rational to state that simple ratios represent anthropocentrism because they are in line with a number of comparisons of human posture, as further developed by Le Corbusier in the modulor system.

If *Limas* does have a ratio-based metric system, *Limas* conservation efforts can be easier because they rely on a simple system. More than that, it makes it easier to remember and therefore, to learn, for society. The existence of the ratio itself has an aesthetic meaning that cannot be ignored and can be one of the advantages for the inheritance of traditional architectural works in Indonesia and elsewhere.

III. METHODOLOGY

To find the *Limas* ratios, measurements are taken on the building elements, namely: length (C0, C1, C2, C3, C4, C5, C6), width (A0, A1, A2, A3, A4, A5) and height (B1, B2, B3, B1', B2', B2"), (Figure 1).

Each building is measured three times in the same time frame with the following procedure:

1) Measuring the length of the building (C), measuring the length between the *bengkilas* (C0, C1, C2, C3, C4, C5 and C6), then measuring the length of the room.

2) Measuring the width of the building (A), measuring the width between columns by the columns axis as the provision for measurement (A0, A1, A2, A3, A4 and A5), then measuring the width of the room.

3) Measuring the height of the building (B) by measuring the height of the pillar from the ground surface to the surface of the floor (B1), measuring the height of the wall and sako from the floor to the ceiling (B2), and the height of the sunan pillar from the ceiling to the top of the *Limas* roof (B3), then B = (B1 + B2 + B3), and (B1' + B2' + B2").

4) Search and record the information about the homeowner, orientation and age of the building and what year the house was built.

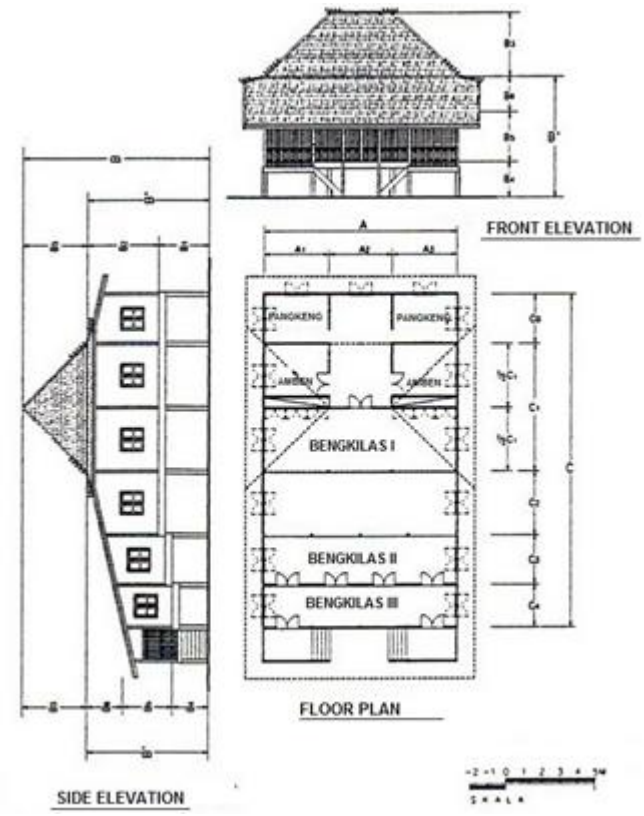

Fig. 1 Limas House Three Bengkilas Plan and The Instructions for Measurement

The data source is the traditional building of Palembang *Limas*House with the characteristics of having three *bengkilas*. *Bengkilas* is the floor level of the house. In addition, the criteria of *Limas* taken are *Limas* which are at least 100 years old. The research location is the Seberang Ulu Area of Palembang City which is known to have a high *Limas*House population. There are 200 *Limas*House in this area. After the exclusion process, 30 *Limas*House with three *bengkilas* were at least 100 years old.

Of these 30 houses, there are eight types of house that have different sizes, namely L-8, L-5, L-34, L-18, L-9, L-11, L-4 and L-14 type. L-8 type is represented by one house, L-5 type is represented by five houses. L-34 type consists of 16 houses, L-18 type consists of three houses, L-9 type consists of two houses, and L-11, L-4, and L-14 types each one house. Table 1 shows the type of house and the group members which have the same type.

Table. 1 LimasHouse Three Bengkilas Typology

No	*Type*	*Quantity*	*Member*
1	L-8	1	L-8
2	L-5	5	L-5, L-33, L-27, L-22, L-24
3	L-34	16	L-34, L-35, L-38, L-40, L-39, L-41, L-42, L-3, L-19, L-20, L-28, L-12, L-24, L-26, L-29, L-30
4	L-18	3	L-18, L-21, L-13
5	L-9	2	L-9, L-25
6	L-11	1	L-11
7	L-4	1	L-4
8	L-14	1	L-14

Compared to *Limas*Housewith four *bengkilas*, *Limas*-House with three *bengkilas* is simpler. This house does not have jogan, only has three *bengkilas*, and is not divided into two masses. In total there are 13 rooms that can be measured, each with three measuring fields: length x width, length x height, and width x height. Details of measurements for *Limas*House with three *bengkilas* are shown in the following table 2.

Table. 2 Simple MeasurementRatio of LimasHouse Three Bengkilas

No	***Room***	***Length***	***Width***	***Height***
1	Left *Amben*	A1	1/2 C1	B2
2	Right *Amben*	A3	1/2 C1	B2
3	Left *Pangkeng*	A1	C0	B2
4	Right *Pangkeng*	A3	C0	B2
5	*Bengkilas* I	A	1/2 C1 + C2	B2
6	*Bengkilas* II	A	C3	B2
7	*Bengkilas* III	A	C4	B5
8	*Amben* hallway	A2	1/2 C1	B2
9	*Pangkeng* hallway	A2	C0	B2
10	Total hallway	A2	C0+1/2C1	B2
11	*Bengkilas* I + hallway + *Amben* + *Pangkeng*	A	C2+C1+C0	B2
12	*Bengkilas* I + hallway *Amben* + *Amben*	A	C1	B2
13	Overall *Limas*	A	C	B

IV. RESULT AND DISSCUSION

After the measurement and the overall calculation of the eight types of *Limas*House with three *bengkilas* were carried out, the ratio distribution as shown in the following table was obtained. It can be seen that the most commonly used ratio is the 1:1 ratio found in 10% of room field. This ratio is far more than other ratios. There was no usage found of a 1:3, 1:5 and 2:5 ratio at all.

The total calculation is 1170 which is the result of multiplication between the number of houses, the dimensions, and the number of rooms (30 x 3 x 13). The total calculations that contain simple ratios are 827 calculations or 71% of all calculations.

Table. 3 Calculation Results of the Total of Simple Ratio for Limas House with Three Bengkilas

No	1 To 1	1 to 2	1 to 3	1 to 4	1 to 5	2 to 3	2 to 5	3 to 4	3 to 5	4 to 5
1	82	0	0	0	0	1	0	3	0	4
2	82	0	0	0	0	1	0	3	0	4
3	28	1	0	0	0	23	0	21	1	26
4	28	1	0	0	0	23	0	21	1	26
5	3	1	0	0	0	22	0	1	1	1
6	0	0	0	16	0	16	0	1	0	3
7	13	0	0	20	0	0	0	0	0	0
8	78	0	0	1	0	0	0	3	0	4
9	28	1	0	0	0	23	0	21	1	26
10	26	13	0	0	0	3	0	2	5	2
11	0	0	0	0	0	2	0	8	0	19
12	1	11	0	0	0	19	0	10	1	0
13	22	8	0	0	0	3	0	0	6	2
	391	**36**	**0**	**37**	**0**	**136**	**0**	**94**	**16**	**117**
	33 %	**3 %**	**0 %**	**3 %**	**0 %**	**12 %**	**0 %**	**8 %**	**1 %**	**10 %**

Source: calculation results, 2018

The 1:1 ratio is most commonly used for *amben*dimensions (no.1 and 2) and *amben* hallway (no.8). Interestingly, the *pangkeng* (no. 3 and 4) and its hallway (no.9) are built with several ratios in a balanced manner, namely 1:1, 2:3, 3:4, and 4:5. Another interesting thing is that if you only look at the fields that contain simple ratios, there are some rooms that have special ratios. *Amben* are almost always built at a 1: 1 ratio. *Bengkilas* I is almost always built with a ratio of 2:3.

When viewed based on the typology, L-34 typed *Limas*H-ouseis the most harmonious with a simple number of dimensions as many as 29 pieces or 74% (of 3 dimensions x 13 rooms = 39). Another fairly simple type is L-9 with 28 (72%) ratios followed by L-4 and L-18 types of *Limas*House with each has 27 or 69%. The type of *Limas* with the most members or the most common, namely type L-34, is classified *Limas* with the largest simple ratio. The *Limas* which have the lowest simple ratio is L-8 with 23 simple ratios. On average, a *Limas* has 67% of space which has at least one simple ratio.

Table. 4 Simple Ratio Based on the Type of *Limas* Three *Bengkilas*

No	Type	Quantity	Total	Percentage	Age (year)
1	L-8	1	23	59%	150
2	L-5	2	24	62%	100-150
3	L-34	16	29	74%	100-150
4	L-18	3	27	69%	100-125
5	L-9	2	28	72%	115
6	L-11	1	25	64%	115
7	L-4	1	27	69%	115
8	L-14	1	26	67%	100

When connected with the prioritization of the harmonic ratio, L-34 *Limas* are old *Limas*, aged 100-150 years. Younger *Limas* have fewer simple ratios but it can also be seen that the oldest *Limas*, type L-8, have the least number of ratios. Therefore, the image that simple proportions of *Limas*, as an aesthetic proxy and ease of construction, which is decreasing over time, is less supported.

If you look at the dimensions of measurement, the most common dimensions of getting a simple ratio are dimensions of length (Ai) with width (Ci) with 82 ratios. The number of ratios for other dimensions is quite equivalent where the length dimension (Ai) with height (Bi) contains 62 ratios and dimensions of width (Ci) with height (Bi) with 69 ratios. This means that the harmonious focus of the *Limas*House three *bengkilas* is in the fields of the side of the floor and roof of the room. The dimensions that rarely get the harmonic ratio are the front and back dimensions. This is quite interesting because it is counter intuitive. The front and rear dimensions should be the most common one's field of view because it faces the entrance to the bridge. This can happen if someone is more silent, especially to relax and lie down, so many of their views are directed to the floor or to the roof.

Table. 5 Simple Ratio Based on the Fields of Limas Three Bengkilas

No	Dimensi	Jumlah	Persen
1	P:L	82	38%
2	P:T	62	29%
3	L:T	69	32%

V. CONCLUSION

Limas architect uses an intensive 1:1 ratio along with other simple ratios, especially 2:3. The use of this simple ratio reflects two of the seven most beautiful fields according to Palladio. In line with this, it is also known that *Limas* architects avoid the use of 1:3, 1:5, and 2:5 ratios, which is not the most beautiful field in Palladio's theory. Therefore, it can be concluded that *Limas*House does have a high aesthetic value in proportion theory. Furthermore, the dominance of simple ratios in the floor and roof area reflects the function of the *Limas*House as a private residence that allows residents to enjoy more being inside the house.

This finding has implications for the importance of *Limas* preservation. The *Limas* with three *bengkilas* that can be used as a standard are L-34 type *Limas* which is also the most common *Limas* three *bengkilas* compared to other types of *Limas*, comprising about half of the *Limas* three *bengkilas* in Palembang.

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Authors' contributions

The authors collaborated on the design and execution of the study, including data collection and analysis. Both authors read,edited, observation, in-dept interviewand approved this manuscript.

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