

# ***Meru* as a Hindu Sacred Building Architecture with a High Roof and Resistant to Earthquakes in Bali, Indonesia**

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**Abstract** *Meru* has meaning as a symbol of Mount Mahameru, symbol of God and the universe that serves as a place of worship of the gods and ancestors. *Meru* is found in large temples in Bali, Indonesia with its trademark characteristic that the roof has a high overlapping reaching 10 meters or more with the number of roofs always odd so that *Meru* becomes a landmark in every temple in Bali. *Meru* is a very beautiful sacred building that was built based on the accuracy of proportions, the logic of construction techniques and the beauty of decoration, which holds fast to local wisdom based on Traditional Balinese Architecture. This study aims to explore the meaning and philosophy of *Meru* and why the construction of *Meru* as an earthquake resistant building. With a qualitative explorative study of primary data collection such as: surveys, observations and interviews and combined with secondary data in the form of old legacy writing, study shows that *Meru* not only has beauty as a sacred building but also is an earthquake-resistant building construction that has proven its reliability compared to other Hindu sacred buildings.

**Keywords** *Meru*, Hindu, Sacred Building, Architecture, High Roof, Resistant, Earthquakes

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## **1. Introduction**

*Meru* is one of the sacred buildings for Hindus in Bali, which is very regal, majestic and monumental, loaded with symbolic meaning and religious power contained therein. *Meru* is found in large temples in Bali with its characteristic high-overlapping roof (the roof reaches 10 m or more) and the number of roofs is always odd (1, 3, 5, 7, 9, 11) and only one roof overlaps 2, so *Meru* became a

landmark in a temple in Bali [15] [16]. *Meru* as a very great local work, is not only found in temples in Bali, but can also be witnessed at cremation ceremonies in Bali as corpse (*sawa*) containers at the *Pitra Yadnya* ceremony [8] [9] [18].

*Meru* is a very beautiful *sacred* building that is built based on the accuracy of proportions, the logic of construction techniques and the beauty of decoration, which holds fast to local wisdom of Balinese Traditional Architecture (*Hasta Kosali Kosala, Hasta Bumi, Andha Buana Lontar, Lontar Jananthaka, etc*) [23] [25] [42].

*Meru* construction is earthquake resistant construction that has proven its reliability compared to temple buildings or other forms. A very powerful earthquake with enormous power has ever happened in Bali (such as in Seririt District, Buleleng Regency in 1976), where many modern construction buildings have collapsed, but sacred buildings in Bali, especially *Meru* still stand firmly, strong, stable, and upright [19] [20] [43]. Understanding the power behind the local wisdom, this paper wants to explore the philosophy of *Meru* and why the construction of *Meru* as an earthquake resistant building.

## **2. Research Method**

This research was conducted with a qualitative exploratory method by collecting data through observation, a direct survey measuring several cases of *Meru* objects in the biggest shrines in Bali [21] [29] [36]. Understanding of *Meru* is also done with secondary data, especially old writings (*Lontar*) and also supported by interviews with Balinese craftsmen (*Undagi*) who understand the concepts and philosophy and construction of *Meru*. From these results, the data are analyzed and expected to be able to dissect the meaning and concept of *Meru* and why *Meru* is very sturdy and resistant to earthquakes in Bali.

### 3. Results and Discussion

#### 3.1. The Meaning of *Meru* as a Symbol of the Mountain, Worship of Gods and Ancestors

The meaning of *Meru*, based on quotations listed in the *lontar*-ancestral heritage, as stated in the *Lontar Andha Bhunana*, explained that the symbolic meaning or philosophy of *Meru* comes from the word 'me' means *meme* = mother = *pradana tattwa*, whereas 'ru' means teacher = father = *purusa tattwa*, so that the *Meru* has the meaning *batur keletak plot* (forerunner to ancestors). *Meru* means the symbol of *andha bhuana* (universe), the level of the roof is a symbol of the level of the natural layer, namely the *bhuana agung* (universe) and *bhuana alit* (human) [16] [22] [38].

Further explained that *Meru* has two meanings: First, *Meru* as a symbol or manifestation of "Mount Mahameru" and the mountain is a symbol of the universe as a *stana* (shrine) of the Gods, *Ida Sang Hyang Widhi* (God Almighty) or *Papulaning Sarwa Dewata*. *Meru* has the symbolic meaning of the mountain also described in *Lontar Tantu Pagelaran*, *Kekawin Dharma Sunia* and *Usana Bali*. In this case, *Meru* as a *Pratista* God is functioning as a place of worship or *pelinggih* of the Gods. *Meru* as God is found in a complex of pretenses such as: *Sad Kahyangan*, *Kahyangan Jagat* and *Kahyangan Tiga Temple* [1] [2] [23] (Figure 1).



Source: <https://www.shutterstock.com>, 2019

**Figure 1.** *Meru* as Hindu Sacred Building

Second, *Meru* symbolizes "mother and father" as described in the *Lontar Andha Bhunana*. Mother contains the meaning of "mother earth" which is the element of *tattwa pradhana* and you have the meaning of "*aji akasa*" which is the element of *purusa tattwa*. The development of *pradhana* (woman) and *purusa* (man) is the great power that is the source of everything on earth. This is the basis of *Meru's* function as a place of worship of ancestral holy spirits in *Pedarman Besakih Temple* complex [15] [23]. In this case, *Meru* as *atma pratista* is functioning as a place of worship of ancestral holy spirits or as a *stana* (shrine) of the God of *Pitara*. (An ancestral spirit is said to be sacred when it has passed through the ceremonial process, which is the first cremation then followed the measuring ceremony

which is the ceremony of the *atman*, and the last order of ceremony is the departure of the God of *Pitara*. After this last level ceremony *Meru - Gedong Kemimitan* was made [16] [24][46].

#### 3.2. Philosophy of Levels Contained on the Roof of *Meru*

The beauty and majesty of *Meru* is highlighted by the beauty of its stratified roof forms called the overlapping roof, and can be distinguished into: *Meru* roof one, *Meru* roof two, *Meru* roof three, *Meru* roof five, *Meru* roof seven, *Meru* roof nine, *Meru* roof eleven (Figure 2).

*Meru* as symbolic of the universe, the level of the roof is symbolic level of the natural layer, namely *bhuana agung* and *bhuana alit* (large and small nature or macrocosm and microcosm) from the bottom up as many as eleven levels. These levels are: 1 (*Sekala*), 2 (*Niskala*), 3 (*Cunya*), 4 (*Taya*), 5 (*Nirbana*), 6 (*Moksa*), 7 (*Sukmataya*), 8 (*Turnyanta*), 9 (*Ghoryanta*), 10 (*Acintyataya*), 11 (*Cayen*). But there is also a *Meru* with a roof of 21. *Meru* with 21 roofs are very rare and usually this *Meru* can be seen in the container (*bade*) at the *Ngaben (Pitra Yadnya Ceremony)* in Bali, which has the understanding of the *Dasa Dewata* as the basic, then added 11 *atma* (soul) stairs as it goes.



Source: <https://www.shutterstock.com>, 2019

**Figure 2.** The Beauty of *Meru* with a High Roof

Furthermore, the levels of the roof of the *Meru* are symbolic of the adoption of the *dasa* script (the union of the ten holy letters) as the soul (*urip*) of *Meru* or the universe [26] [23] [33]. The ten sacred letters are *urip bhuana* (universe soul), located in the ten corners of the universe, including the middle, the ten letters are the sacred letters of *Sa*, located in the East, the God *Iswara* and the color is white; the sacred letters *Ba*, located in the South, the God *Brahma* and the color red; the sacred letter *Ta*, it is located in the West, its God is *Mahadewa* and its color is yellow; the sacred letter *A*, located in the north, is God *Vishnu* and the color is black; the sacred letter *I*, located in the middle, the God of *Ciwa* and the colors are mixed (five colors); the sacred letter *Na*, located in the Southeast, its God *Mahesora* and its color pink (dice); the sacred letter *Ma*, located in the Southwest, the God *Rudra* and the color orange; *Si* holy letters, located in the Northwest, God *Sangkara* and green color; *Wa* sacred letters, it is located in

the Northeast, *Sambu's* Dew and the color is blue and the last is the Sacred *Ya*. The ten letters singularity becomes a symbol of the sacred scriptures for Hindus, namely *Omkara* (the holy letter *Sanghyang Widi Wasa*, God Almighty).

**Table 1.** Number of *Meru* Roofs, Sacred Letters and Symbols

Number of Rooftops	Sacred Letters	God Symbol
11	<i>Sa, Ba, Ta, A, I, Na, Ma, Si, Wa, Ya + Omkara</i>	<i>Eka Dasa Dewata.</i>
9	<i>Sa, Ba, Ta, A, Na, Ma, Si, Wa+ Omkara</i>	<i>Nawa Sanga.</i>
7	<i>Sa, Ba, Ta, A + I, Omkara, Ya</i>	<i>Sapta Dewata/Rsi</i>
5	<i>Sa, Ba, Ta, A+ Omkara</i>	<i>Panca Dewata.</i>
3	<i>I, Omkara, Ya</i>	<i>Tri Purusa</i>
2	<i>I, Ya</i>	<i>Purusa Pradhana.</i>
1	<i>OM/Omkara</i>	<i>God Almighty</i>

Source: Author Analysis, 2017

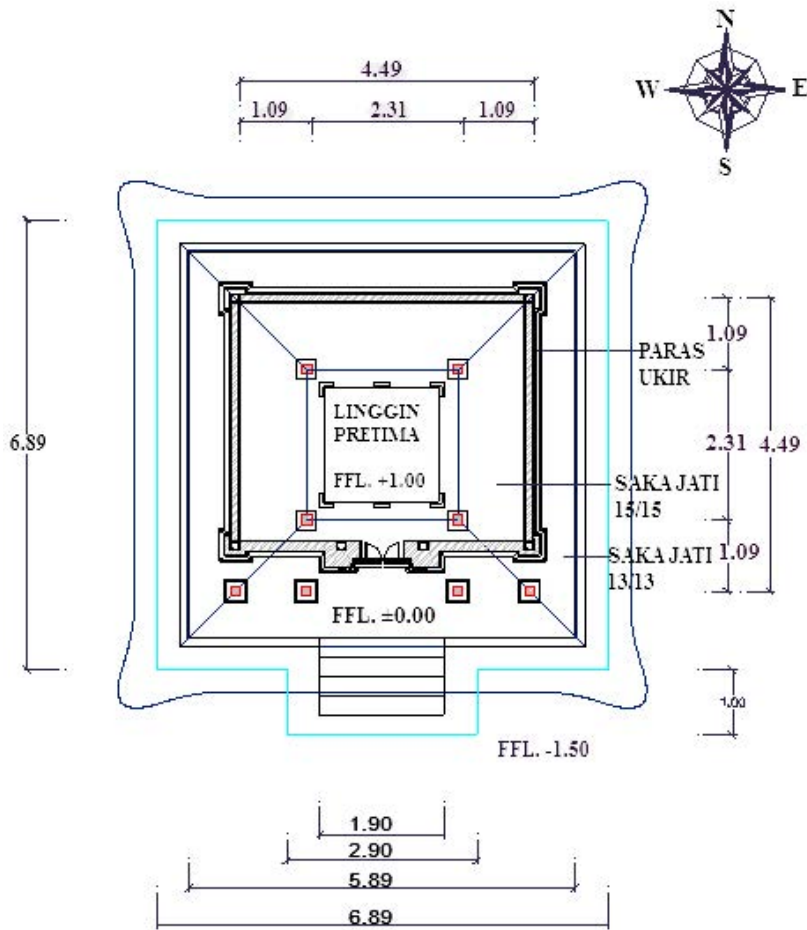
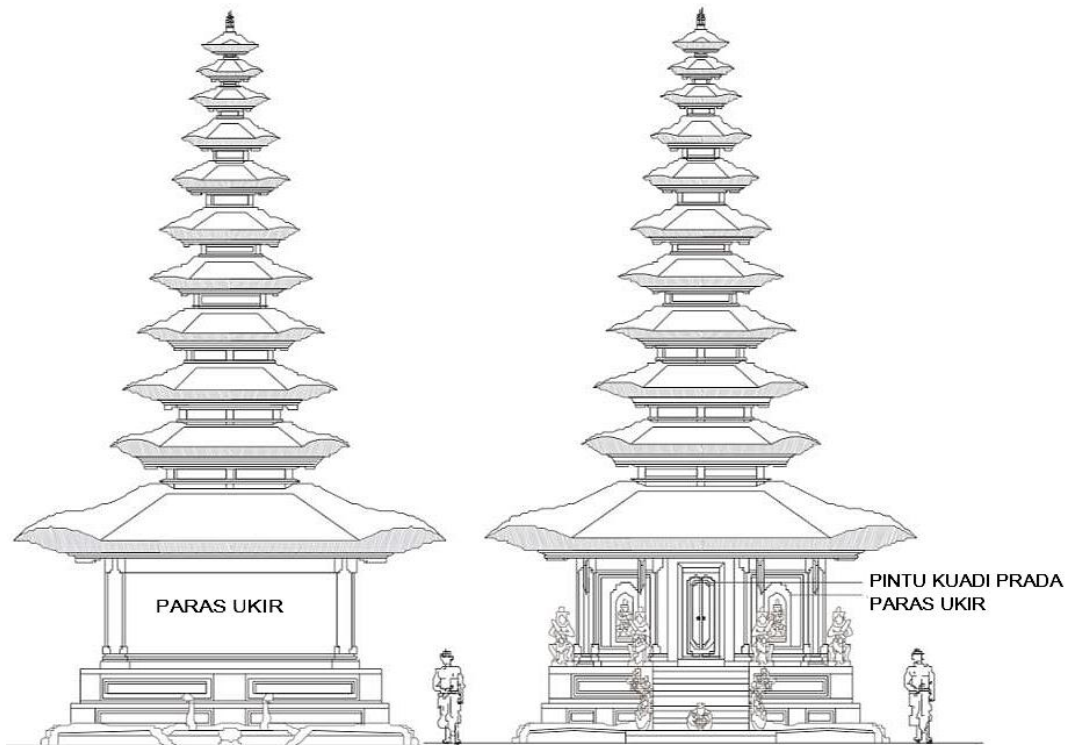
The number of *Meru* roofs and sacred letters (as seen at Table 1) can be described as follows:

- Meru* roofed eleven (11) is a symbol of eleven holy letters, namely ten sacred letters (*Sa, Ba, Ta, A, I, Na, Ma, Si, Wa, Ya*) plus *Omkara* sacred letters as a symbol of *Eka Dasa Dewata*.
- A nine (9) roof is an 8 letter symbol in all directions (*Sa, Ba, Ta, A, Na, Ma, Si, Wa*) plus one *Omkara* letter in the middle, 9 letters are symbols of the Gods *Nawa Sanga*.
- A seven (7) roof is a 4-letter symbol throughout East, South, West and North (*Sa, Ba, Ta, A*) plus three letters in the middle (*I, Omkara, Ya*). These seven letters symbolize the *Sapta Dewata/Rsi*.
- Five (5) roofs are symbolic of the five letters namely East, South, West, North (*Sa, Ba, Ta, A*) plus one *Omkara* letter in the middle, these five letters symbolize the *Panca Dewata*.
- Three (3) roofs are symbolic of the three letters in the middle (*I, Omkara, Ya*) as a symbol of *Tri Purusa*, namely *Parama Shiva, Sada Shiva* and *Shiva*.
- The two-story roof (2) is symbolic of the two letters in the middle (*I, Ya*) that are the symbol of *Purusa* and *Pradhana*.
- One roof (1) is symbolic of the unification of the ten sacred letters, namely '*Om*' or *omkara* as a symbol of the *One God* (*Sanghyang Widi Wasa* or *God Almighty*).

### 3.3. Layout and Form of *Meru* Based on *Hasta Kosala Kosali's* Rule

*Meru* in layout is in a place of worship on the main yard (*jeroan*) of a temple [12] [17] [33]. In terms of orientation, *Meru* generally faces west as the main place of worship lined on the east side from north to south (*kaja-keled*) with *padma, gedong* and other sacred worship buildings so that the direction of worship faces east toward the sunrise. But in some temples in Bali related to the special natural and philosophical conditions of the temple, there are *meru* facing south (*keled*) such as *Kehen Temple, Bangli* and facing northeast (*kaja kangin*) like *Uluwatu Temple, Badung* so that the direction of worship faces towards north (*Kehen Temple*) and *Kelod Kauh/Southwest* (*Uluwatu Temple*).

In terms of form, *Meru* like other sacred buildings are distinguished from the head (roof), body (worship room or place to put *pratima*) and feet (*bebaturan*) or known as the *Tri Angga Concept* [16] [23]. Although *Meru* can be divided into three parts, namely the legs, body parts and roof section, the proportions and settlement are very different both in the settlement of the proportions of the body, visible body (worship space), completion of the overlapping roof and the use of ornaments and materials also vary accordingly with the condition of each region in Bali (*desa, kala, patra*) based on observations on *Meru* in the *Besakih Temple, Batur Temple, Taman Ayun Temple, Kehen Temple, Lake Beratan Temple*, etc. Whereas in terms of dimensions, the *Meru* floor plan is rectangular in shape with a base size varies, 5 m x 5 m, 3 m x 3 m, up to 7 m x 7 m and its height varies to reach 10 m even more depending on the number of overlapping roofs (Figure 3).



Source: Author, 2017

**Figure 3.** Layout and Elevation of *Meru* Sacred Building

On the part of the body that is the place of worship, covered by using wood or a pair of bricks, river stones, sandstone (according to site conditions) and in it there is a *pepaga* (altar) or *bale-bale* that serves as a place to put *pratima* in the form of phallus, statues of gods and goddesses as a symbol of the manifestation of the power of *Hyang Widi Wasa* (God Almighty), and offerings at the time of the ceremony and are equipped with an entrance for humans to pray in the room/body of *Meru* [37] [41] [44]. The character in this worship room has a high verticalism, so as if we are pulled up, this is caused by the influence of the shape of the space inside it continuously from the bottom up, so that there is an upward air pull which blows through the gaps between the overlaps *Meru* roof.

In terms of the shape of the body (feet), *Meru* is distinguished from *Meru* with *bebaturan* tall and short shapes. In terms of mass stability, the form of *Meru* with a short shelf will be more stable than a tall shelf. This stability is closely related to the center of mass of the building. Generally, *Meru* with a short shelf is often found in temples in the mountains, besides being more stable also because the ornament or ornamental decoration on the legs (*bebaturan*) will be less or more economical. But in general, the shape and dimensions of *Meru* are based on the rules of *Hasta Kosala Kosali* (Balinese Traditional Architecture Script) so as to produce harmony between the accuracy of proportions, strength of construction and beauty of decoration [10][23][47][48].

### 3.4. Meru's Ornaments Symbolize the Harmony of Man and Nature

The ornaments on *Meru* are almost similar to other sacred temples which are laden with ornaments in the form of *kekarangan* (fauna ornaments) and *pepatraan* (flora ornaments) which show the harmony of humans with nature, symbolizing flora and fauna. Ornaments on the tip of the *Meru* peak roof are classified into the head, we generally find ornaments called *murdhas* such as the *Murdha Bantala* at *Meru* in Besakih Temple, which at the same time function as the top of the roof cover, while around the roof there are ornaments on the listplank called *ring-ring* with variations in the form of carvings in the form of *papapatraan* like *patra sae*.

Ornaments of the body parts of *Meru*, especially at the top of the *gedong* door, usually have coral ornaments. The doors usually use carved motifs *patra olanda*. Furthermore, on *sendi* (joints) or *tatakan saka* (column) using a lion statue like the one in *Meru* of Besakih Temple, there are also those who wear ordinary joints like those in *Meru* in Batur Temple.

Ornaments is found in the legs (*bebaturan*) in the form of *pepalihan*, *karang asti/Karang Gajah* in each corner, *karang tapel* in the middle on all four sides at the most basic on the edge of the rain. Then at the top there are *karang goak* in all four corners and *karang bunga* and

*simbar gantung* in the middle. Ornaments in the form of statues of *Naga* (dragon) and *Bedawang Nala* (turtles) can usually be seen at the base of the feet and stairs of *Meru*, where the dragon and turtle as a symbol of prosperity is also equipped with other statues in accordance with the conditions of each temple such as: statue gods, human statues and others.

### 3.5. The Use of Materials in Meru Refers to Local Materials

The material for the head that is the roof cover is generally adapted to the natural condition of the location of the sacred building such as, in the northern Bangli regency the roof cover consists of bamboo shingles, the roof covering in Sebatu-Gianyar Village is derived from enau wood (*bon jaka*) and in Taro Village the roof cover consists of palm fibers, and in some villages it is easy to get the reeds using the dried *alang-alang* leaves. However, in some regions or villages there are written provisions for the roof covering of sacred buildings such as *Meru* required to use a palm roof, philosophically it is believed that the palm fiber has magical religious powers, and the strength of the palm fiber material has very strong durability compared to traditional roof coverings the other.

Parts of the body such as material in *saka* (column), horizontal beam (*lambang, sunduk, sineb*), *titi mamah* (pedestal beam) and *canggihwang* (supporting beam) use wood as the main material. Whereas for *gedong* (*pratima* storage area), some places use wood materials such as in Batur Temple and some temples use solid stone or brick material such as in Besakih Temple and Jati Temple [13] [14] [23].

*Meru* buildings include or are classified as *parhyangan* buildings, so the types of wood used should come from the sandalwood kingdom with classifications such as: *Prabu* (sandalwood), *Patih* (*menengen* wood,) *Arya* (*cempaka* wood), *Demung* (*majegau* wood) and *Tumenggung* (*suren* wood). Then the quality of the wood that is used both strength and durability must also be of high quality considering that there are lots of overlapping *meru*. It will be very difficult to carry out repairs if damage occurs [7] [5] [6] [11].

In its processing basically the above material is also considered as a living organ so that its location should not be reversed at the base and its designation, for example sandalwood as a *prabu* (king) class is generally used for disasters (peak construction roofs). Besides the requirements mentioned above, other important matters relating to wood material that must be considered are at the time of logging, namely the procedure for felling timber in its felling (northeast/main, north and east/middle and southeast, south, west, southwest, northwest/*nista*) and checking the quality of wood that is classified as defective according to traditional Balinese rules such as: wood that grows on shrines plots and graves; wood that grows on

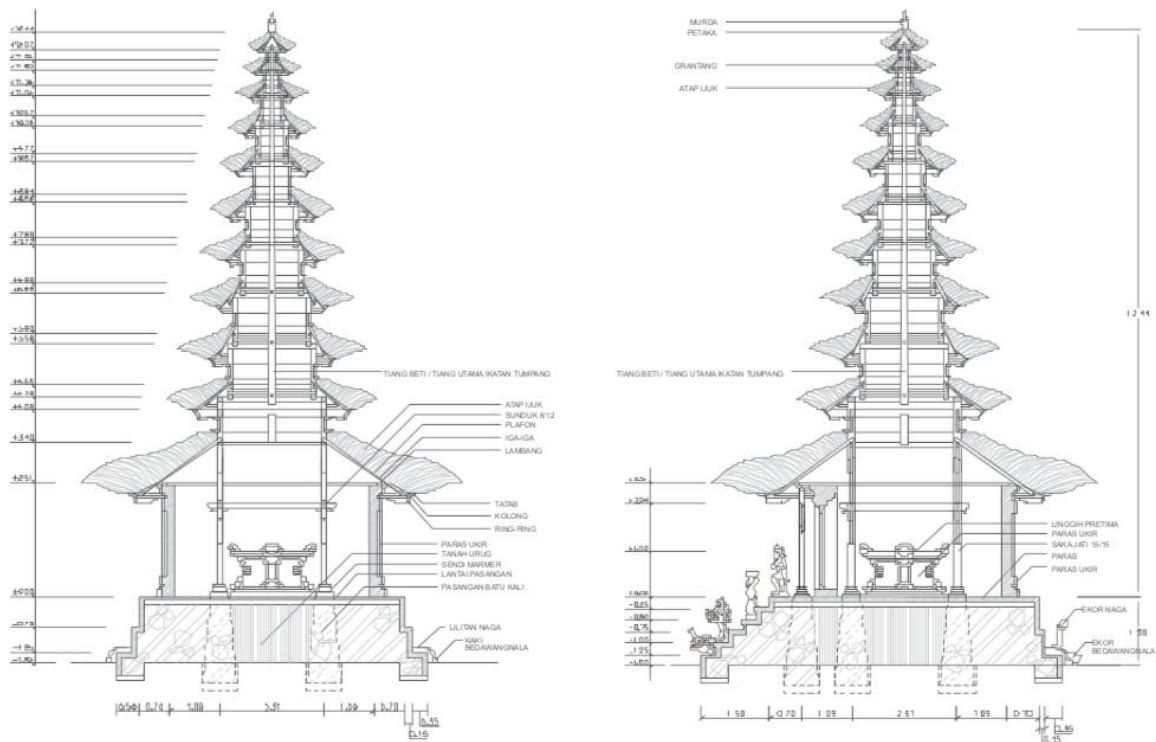


stems that have been cut down; wood growing on the border of the yard, on the edge of a cliff, alongside a river; old wood drifted away; burnt wood/lightning; felled wood crosses a river or road; the felled timber fell on the base; and wood that collapses or is blown by the wind against other trees or collapses against a wall [3] [4] [15] [23].

At the foot or *bebaturan* use stone *padas*, river stones, sea rocks, hill rocks, bricks such as in Batur Temple and Taman Ayun Temple, and there are also temples that use Karangasem *tabas* stone. But in general the stone material used is adapted to local conditions.

### 3.6. How do Meru's Structure and Construction Make It Resistant to Earthquakes?

*Meru* is a *parahyangan* building where the shape of the building uses the form of overlapping roofs. The structure of the building uses a very efficient frame structure system to withstand the load in the presence of a pole (*saka*) as a distributor of vertical loads and *sineb-lambang* beams, diagonal beams as a pedestal pole (*titimamah*) as a horizontal load divider (Figure 4).



Source: Author, 2017.

**Figure 4.** Structure and Construction of *Meru* which is Holy and Earthquake Resistant

On the roof, the construction consists of ribs (*usuk*) with dimensions and installation distance that is able to withstand the weight of the roof made of palm fiber. Then the existence of *petaka* (ridge beams) as a binder of ribs (*usuk*) on the top of the roof overlap which has a very large role in holding the load so that the dimensions of the disaster are generally made with large enough dimensions [15] [31] [32].

Overlapping construction is placed on the *titimamah* (pedestal beam) which is the pedestal of the overlapping mast load channel which decreases upward at each overlap. The corners of the pyramid roof with the pyramid form are stuck. The roof body on it stands on the roof of the roof below, the pillar rests on the beam. The roof at the top has one peak with a bond in the form of *petaka* (ridge beams) that is closed *murdha* as the top of the roof covering.

Considering that *titimamah* (pedestal beam) has a very important role as a distributor of loads on it, the placement must be exactly in line with *sukat* (traditional Balinese dimension) and the planned *meru* roof overlap, so that even if the overlap is a little the proportion will still give the impression of mounting. In some areas in Bali, *meru* roof overlaps, especially those with high lifts, in addition to *titimamah* bonds, some also use *beti* poles, one main room in the middle of the trunk as a whole roof overlap to overcome large wind loads that will endanger the construction whole [15] [23] 27][51][56].

After that, the load will be channeled to the beam of *sineb* and *lambang* as a horizontal load channel, which then the load is channeled to the pole (*saka*) made with dimensions according to the rules from top to bottom considering *saka* as a large vertical channel distributor. In traditional Balinese rules (*Hasta Kosala Kosali*), the cross section of the pole (*saka*) is of *amusti* size, along the grip and the base line to the tip of the finger  $\pm 15$  cm [15] [23][52]. Then the measurements of the distance of the pile to the pile and the height of the pile at each overlap level and other parts are determined from the multiple of the *rai* or cross section of the *amusti* pile at the very bottom. Overlapping levels above the proportion also decreases to the top. Each measure of the multiples of the cross-section of the pillars, called *rai*, is given an excess called *pengurip* (soul) from the parts of the fingers [23] [34][49][50].

*Meru* construction with bonding holes reinforced with pegs or wedges without nails. Roof construction with clasps and ties. The bottom frame is a series of four corner pillars and reinforcement, stiffener and complement constructions. For large *Meru*, in addition to the angle pole, there is also a side pole. The row poles are another supporting edge of the roof below.

Part of the *gedong* is as a place of worship and place of *pratima*, formed by four corner pillars arranged by *sunduk-lait* below and *lambang sineb* beam above. The board walls are on the back and right and left sides, while the front is the entrance to the *gedong* with traditional Balinese form and construction. But in some areas, worship

spaces are formed by masonry or brick walls. The shape of the *sunduk* and *lait* is usually done in an attractive manner so that it has aesthetic value in the building. Likewise, between the *sineb-lambang* beam and the pole (*saka*) connected by supporting beams called *canggahwang* (supporting beam) so that it adds strength in bearing the burden and has beauty. As for sub-structures, *meru's* foundation uses local foundations at the point of placement of the pillar (*saka*) and a continuous foundation around the boundaries of the rocks which are attached to the rocks and *kekarangan* (fauna ornaments) [35] [40].

All elements of the structure are made with dimensions that are in accordance with the procedures or rules of *Hasta Kosala-Kosali* (Balinese Traditional Architecture Script) and good quality materials so that their construction is able to withstand the burden of both wind, earthquake, thermic, and other loads very effective, sturdy, strong and stable [15] [23] [45][51]. Besides that, the completion of some parts of structural elements have very beautiful shapes so that the elements are not only sturdy and stable to withstand the load but also have a very high aesthetic value [28] [30] [39][52][53][54].

## 4. Conclusions

Based on the description above that *Meru* has a meaning as a symbol of Mount Mahameru, a symbol of God Almighty and Mother-Father functions as a place of worship of the Gods and ancestral holy spirits. All structural elements in *Meru* are made with dimensions that are in accordance with the procedures or rules of traditional Balinese architecture (*Hasta Kosala Kosali*) and with good quality materials so that the construction of the *Meru* is able to withstand wind, earthquake, thermic, and other loads. The completion of some structural and construction elements has a very beautiful shape so that the elements are not only sturdy and stable to withstand the load but also have a very high aesthetic value. So that the structure and construction of *Meru* is a building with sacred meaning and symbolic and structurally construction as an earthquake resistant building that has proven its reliability compared to other sacred buildings.

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