

Mandapa: Its Proportion as a tool in Understanding Indian Temple Architecture

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Abstract- Proportion and measurements were the guiding tools for Indian temple construction starting from the 5th century onwards and it continuous even now. Through out the history proportion dominated as a tool, which determined the monuments both spatial arrangements as well as form. The ancient texts, therefore, insist on a high degree of precision in their measurements. The standard text Mayamata mentions- "Only if the temple is constructed correctly according to a mathematical system can it be expected to function in harmony with the universe. Only if the measurement of the temple is in every way perfect, there will be perfection in the universe as well." In this paper Mandapas in Indian temples are studied with respect to various parameters like its expression, function, proportion, orientation, chronology etc. Proportions of Mandapas both spatial and in form is studied and taken as a tool to understand how it influences various other parameters of mandapa or how its been influenced by others. This study analysis proportion of mandapa in Indian temple architecture, especially focusing on Nagara style as mentioned in ancient texts. The evolution of Mandapa and other parameters are discussed in general. These factors are studied with respect to a selected sample. Temple between 8th C to 15th C is taken for the study as Mandapas were added proportionately from 8th Century onwards. This comprises the literature part, and expressed through drawings and diagrams. The same is tried to understand through the case study done in Ashapuri Temples. The same is examined through a case study- that is Ashapuri Temple complex. This is analyzed with help of few selected temples out of the complex. The study will end by examining whether the proportions and design of mandapa in Ashapuri follows Nagara Style.

Index Terms— Ashapuri Temples, Indian Temple Architecture, Mandapa, Proportions

1 INTRODUCTION

1.1 Indian Temple Architecture

India "Land of Temples" - A land of intense spirituality and religious faith reflected in the profusion of temples present in this subcontinent. Temples are found everywhere in India from large monumental structures to small stone buildings, each having certain significance and greatly influencing the lives of the people who regard the temple as a place where they could be close to god. The Hindu temple architecture developed over two thousand years. The architectural evolution took place within the rigid frameworks derived entirely from religious thoughtfulness. Architect was bound to keep to the ancient primary dimensions and strict configurations, which remained unaltered over the period of time. The ideology behind the designing of Hindu temples is to link, man with the gods. The architect and sculptor were allowed a great deal of freedom in the embellishment and decoration of the prescribed underlying principles and formulae. It evolved from simple rock cut architecture in Lomas Rishi Cave (300 BC) to complex temples as Kandariya Mahadeo Temple, Khajuraho and Meenakshi Amman Temple, Madurai in 11th & 16th C respectively. Distinctive architectural styles of Hindu temples have so developed due to broad geographical, climatic, cultural, racial, historical and linguistic differences between the northern plains and the southern peninsula of India. Broadly based on geography, Hindu temples have been classified into three different styles; the

Nagara or 'northern' style, the Dravidian or 'southern' style,

and the Vesara or hybrid style. There are also other distinct styles in Bengal, Kerala and the Himalayan valleys.

1.2 Proportion In Temples

Proportion being an important tool in analyzing individual buildings, also plays an important tool in the study of temple Architecture. Like in Greek Architecture the Orders of pillars served as a tool for proportion proportion based on column diameter, here in India also we possessed proportionate arrangement for temple Architecture. All of them receive a character of harmony, leading to aesthetic beauty, peace of our inner soul due to the proportional relationship. The perspective effects in the visual frames and their strategic alignment often provides a basis for the proportioning of spaces.(Pandya Yatin 2013). Indian architecture is considered as true style by Fergusson in his book History of Indian & Eastern Architecture in 1876.

Mandapa- gathering space in temples, evolved later on became also sacred. They initially developed as a porch, which became large mandapa later on, became a part of temple plan and affected the temple form as well. From 8th C onwards mandpa also possessed mandala character as that of shrine.(Hardy Adam 2007). Mandapa became a part of the temple entity affected its plan and form. In this paper, study mainly focuses on Mandapa - its features like orientation, expression, function etc, how it affects the proportion of mandapa or vice versa which determines the proportion of that temple. The same is examined through literature study of one temple - Kandaria Mahadeo temple in Khajuraho. This temple is selected on the basis that Khajuraho temples were the

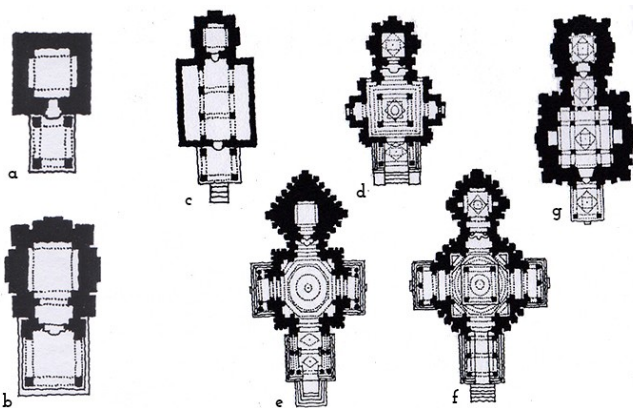
culmination in Indian art & architecture. It was also selected on the basis of availability of proper data and drawings. The study finally ends up with examining the mandapa proportions of the case study -Ashapuri temples.

2 MANDAPA

2.1 Evolution & Features

Mandapa-audience hall of God's palace (Hardy Adam 2007). They are sacred pillared hall or pavilion for assembly of those paying their devotions. Mandapa established a separate hall, preparatory and subservient to the purpose of prasada. Ancient temples consisted of a square cella with a small porch in front of it especially temples before 6th C. Initially Mandapa originated as small porch in front of the prasada as in Tigawa temple Gupta period. They were entrance porches consisting of one, two or three. In most of the temples these porches were added separately after the construction of temples. Later they evolved into mandapas- may be enclosed by thick walls, or open like an extended porch (fig 1), but still they were not in rhythm to that of their prasada. Wooden halls of post and beam construction where prototype for mandapa construction. By 7th and 8th C mandapa had massive roof slabs as in early Chalukyan temples in Karnataka & Andhra Pradesh. A centaur or more had to pass before the Sthapati arrived at the perfect solution showing the Prasada as the main building and temple proper, with mandapa as the lesser part of the sacred structure, following its rhythm in the particularities of its own form. (Kramrisch Stella 1946). From 8th C Mandapa had mandala like character reflecting that of shrine. They were added in proportion, whose proportion was

Figure 1: Evolution of mandapa from a) porch to b) Mandapa c) closed mandapa d), e), f), g) one to three porches attached to a mandapa. (Source: Hardy Adam (2007))



regulated by the proportion of Prasada. This integrity is clearly visible in Orissan temples where it is more strongly retained than elsewhere and only indicates their separateness by a deeper recess produced by the buttresses of the wall of two structures. With in this lies the porch

(antrala) of the prasada or garbhagriha, fulfills the function of Mukhamandapa of more ancient temples. This small porch is marked on the outside of the Prasada by a buttress carried on to the Sukanasa at the prescribed height which regulates the height of the Mandapa. (Kramrisch Stella 1946). Mandapas were initially added as a porch but later on as the temple developed into a complex the number of Mandapa also increased. They were added for different purposes and functions like dance, offerings, habitation, upanayanam, marriage, festivals etc. In Orissan temple one could see the gradual development in temple plan and form. The Mandapa started as gathering space ie Jagmohan as in Parasurameswar temple and Muktheswar temple, in the former one the pillared hall was added later on after the construction of Garbhagriha but in the later one the Mandapa structure was constructed along with the Garbhagriha in proportion to it. In later Orissan temples one could see that Mandapas increased in number they were added according to different function like hall for dance called Nat mandir, hall for offerings called Bhog mandir. Open mandapas of scale greater than that of simple porch where known in western India by end of 8th C and were widespread in most regions by 11th C. (Hardy Adam 2007). They were added especially for recitations and dance performance, a central platform will be provided, either attached, closed or stand free. Later on the Mandapa got detached as in Sun temple Konark, marking a transition from exterior to interior. In south Indian temples like Madhura Meenakshi, Vithala temple hampi also one could see detached Mandapas added for various functions. According to Benjamin Roland culmination of Indo Aryan style is seen in Khajuraho temples with properly developed temple plan and form. In that also one could see series of Mandapa starting from Mukhamandapa- the porch to Mandapa and Mahamandapa (larger hall with transepts) which seems to be the part of a same mass externally but separated internally by construction of wall planes. Storied open mandapa appeared by the end of 11th C.

According to Mayamata Mandapa should be positioned in front of shrine and they should follow the same orientation as that of temple proper. Mandapas are placed on elevated plinth and even if they might be detached as in South Indian temples they are connected together by visual juxtaposition, adjacency, organizational axis and implied route of movement (Pandya Yatin 2013).

2.2 Mandapa - a general overview

The classification of Indian temple Architecture into three major distinct style is the base for the comparison of mandapas also. Till 6th C North and South styles where of the same after that they evolved. Nagra style is most prominently seen in Orissan temples. Addition of mandapa to temple started in 8th C, till then there was only Garbhagriha, ambulatory path and portico, with its width of central bay corresponding to that of sanctum and antrala. In Nagara Mandapa were added linearly whether detached or attached, with proportion same as that of Garbhagriha in plan irrespective of their function and in

elevation Sukhanasa determined the height of Mandapa giving it a mountain appearance. Later Nagara style developed over time into Latina, Valbhi, Shikhari, Bhumija etc. In South before great temple complexes of later centuries Mandapas are unimportant. It was only by 11th C large, rectangular, flat roofed halls began to appear including open ones. (Hardy Adam 2007). There was more detached Open Mandapa, were larger in proportion to that of Garbhagriha indicating the function they were to perform. In South India open Mandapa gradually get more and more enclosed nearing the sanctum reducing the light as well as giving a sacred feeling. Mandapa in shrine compound are arranged in front of the shrine and are flat roofed giving emphasis on linearity. In Deccan region a temple may have several shrines adjoining a single Mandapa or several interlinked Mandapa. 2 to 5 shrines can be arranged even 9 around a Mandpa, later on more Mandapas were added. Here also Mandapa seems to be larger and rectangular but the basic square in Mandapa is aligned to the size of Garbhagriha and in elevation the roof of Mandapa are flat.

2.3 Mandapa - Proportion in Nagara Style

In Indian temple Architecture Indian temples are represented in symbolic language. Hindu philosophy views cosmos to be self similar in nature. According to ancient architecture tradition, Hindu temples are symbols of models of the cosmos. To maintain harmony with cosmos all temples are fashioned with the same principles and measurements with which cosmos is made. According to myth Mount Meru is considered as axis of Cosmos. To resemble this above the central zone of wall proper rises the roof consisting of series of graded peaks. To express this symbolically in diagrammatic forms basic geometrical figures were used. Square represents manifest world and circle the Universe. 'Mandala' is a Sanskrit word signifying wholeness. (Trivedi Kirti 1989). Proportion also plays a greater role in this. Till 9th C Varahamihira's Brahtsamhita was the standard text followed for temple construction, by early 11th C Nagra temple proportions began to follow a new text Samaranganasutradara. Modification was made in the proportionate measurement of Prasada.

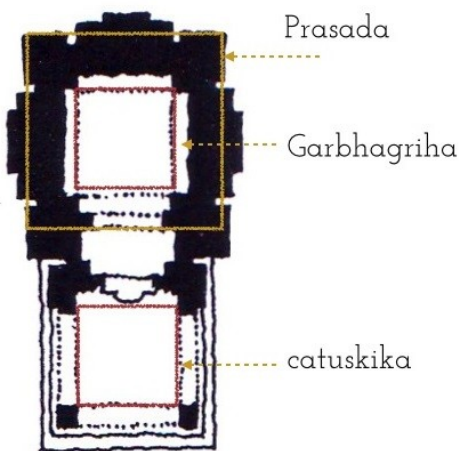


Figure 2: Proportionate arrangement of Mandapa to Garbhagriha

In plan Mandapa proportion was regulated by Garbhagriha. The center of Mandapa is in a fixed proportion to the garbhagriha, its center square has the same area. The central space is marked by four pillars forming catuski. The superstructure of the Mandapa must not exceed in height the Sukanasa of the Prasada. (Samaranganasutradara). Thus the height of Mandapa will depend upon the height of temple and its sukhanasa which varies always according to temple, thus it is not a fixed one.

3 PROPORTIONS OF MANDAPA TO GARBAGRIHA

Another method is for example the distance from the square of garbhagriha to Catuskika is the diagonal of these Squares. Here the Center of garbhagriha is the corner of the Square on edge, formed by connecting the angles of the offsets of the wall of Mandapa. (Kramrisch Stella 1946). In case of Mandapa separated from the temple same theme is applied but varied in their proportionate application, link the Mandapa, built in one other of the 8 to 27 possible varieties, to the Prasada.

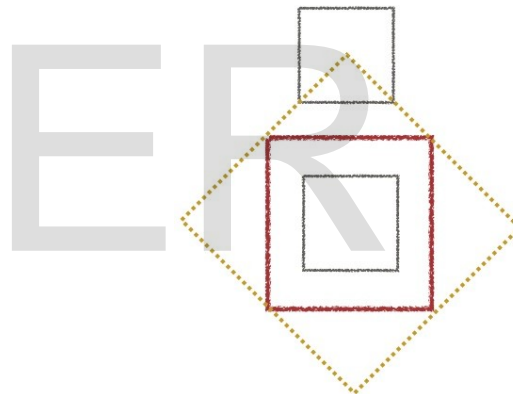


Figure 3: Proportionate arrangement of Mandapa to Garbhagriha

4 KANDARIYA MAHADEV TEMPLE, KHAJURAHO 1030 AD

Kandariya Mahadev temple at Khajuraho sets the benchmark of Hindu art and Architecture in India. This temple was constructed when Indian temples had attained the highest point of matured design in the middle of 11th century. Kandariya Mahadev temple has a height of 31m. It is elevated above a lofty plinth which makes the temple structure sanctity and monumental. The temple is faced to the east to welcome the first rays of sun and the structure is 30.5 m long and 20 m wide. It consists of four major parts.

1. Grbhagriha, i.e., sanctuary where the main deity has been kept.
2. Pradakshina path, i.e., circumambulatory path having three sides balcony bringing ventilation and light to the interior.

3. Mandapa, i.e., columned assembly hall having two sides balcony.
 4. Artha mandapa, i.e., entrance porch.
- Mandapa, Mandapa and Maha mandapa one could see three Mandapas in an axis both in plan as well as in elevation, internally they are divided by intermittent walls whereas

In Kandariya Mahadev Temple starting from Ardha

TABLE 1:
PROPORTIONS OF MANDAPA TO GARBHAGRIHA

SamaranganaSutradara	Mayamata	Manasara	Matsyapurana	Agnipurana
For Nirandhara (prasada(P) 4x4) Pillard porch W=3 parts of P D= 2 parts of P	W= W of Prasada Or W= 3/4 or 1/2 W of P	Small temples Whole L = 4 parts Or 4 1/2 or 6 parts G.G = 2or2 1/2 or 3 parts Antrala = 1 or 1 1/2 or 2 parts Ardha mandapa = 1 or 1 1/2 parts	X = side of Q Area of P = 16Q Mandapa W 4X = W Depth 3X = 3W/4 Mukhamandapa 2X = W/2	"Do"
For Sandhara C Q of Mandapa = C Q of G.G W= P or ht of P or diagonal of P (most perfect) L= redoubled the L of P W= 2W of P Or L= 1 3/4 W of P		Large temples 3 to 4 porticos W= 1 1/2 or 2 W of G.G		
Kramrisch, Stella. 1946. The Hindu Temple (Vol 1). Montilal banarsidas: New Delhi			Kramrisch, Stella. 1946. The Hindu Temple (Vol 1). Montilal banarsidas: New Delhi	Kramrisch, Stella. 1946. The Hindu Temple (Vol 1). Montilal banarsidas: New Delhi

externally they seems to be the part of the same mass. The Maha Mandapa, largest of the three man- dapa is linked to the Garbhagriha through antrala inside and outised its height is determined by the Sukhanasa over antrala. It is pillared hall in front of the Garbhagriha fo the assembly of devotees, used by them to sit, pray, chant and meditate. Like the Prasada, the Mandapas are also oriented in the East West axis and are located in front of the prasada expressing themselves as a development in temple plan from the simple small temple to a complex one.

Self-similarity or fractal geometry is another feature of Indian temples to represent an evolving cosmos. Fractal geometry is the technique of repeating similar shapes in varied scales but in same proportion. In Knadariya mahadev temple it is visible in plan, elevation as well as in decorations. In plan the basic square of Garb- hagriha is used for all the Mandapas with their over all sizes varying in proportion to it. In Elevation self similar repeating structures are the roofs over Mandapas. Even the smallest Mandapa has a roof in decreased size of the largest one in proportion to it which is in overall proportionate the Shikhara. They resemble series of graded peaks that resemble a mountain range to which a Hindu temple is frequently

compared. These peaks, arranged along the axial line, a rise and fall alternately while maintaining the over- all upward accent, and culminating in the tallest spire (shikhara). (Trivedi Kirti 1989). Even the minute decorations on shikhara and mandapa roofs are examples for fractal geometry.



Figure 4: Left: plan of Kandariya Mahadev temple (11th century): (1) Garbhagriha, (2) Pradakshinapath, (3) Mandapa, and (4) Arthamandapa. Right: EastâAˆS,West section of Kandariya Mahadev temple.(Source: Rian. Isef (2007))

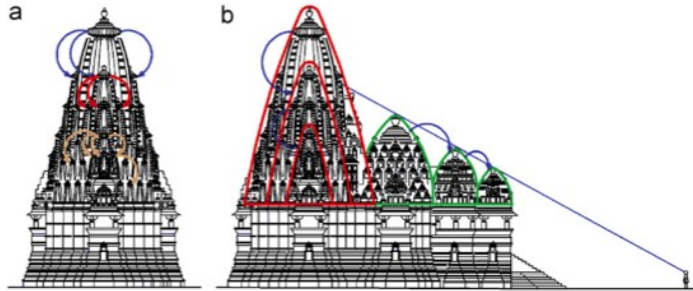
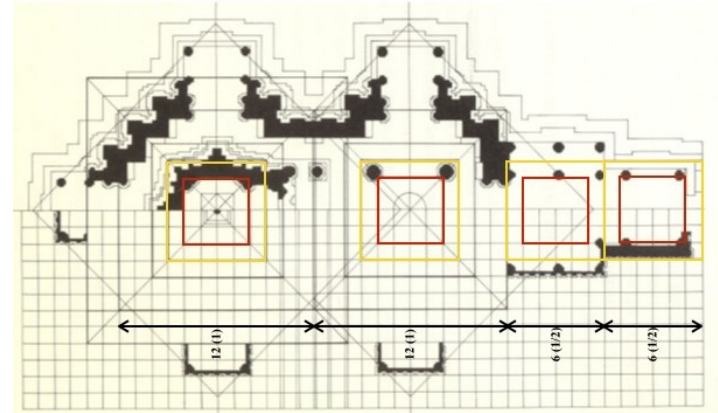


Figure 5: whole form of shikhara is repeated in a part within another part (marked by red color). Repetitions of tower above the mandapas (marked by green color) create angle for upward eye movement to the summit of main shikhara.(Source: Rian. Isef (2007))



center of mandala is the source of all energies which are radiated outwards to the physical world. The image of cosmos is reflected through this divine diagram by its fractal qualities. The square shape maintains the energy equilibrium. (Rian Isef, 2007). In

5 ANALYSIS OF KANDARIYA MAHADEV TEMPLE

5.1 Floor Plan

In the foundation of any Hindu temple, cosmos is embodied by laying down the diagram of Vastupurusha mandala on a selected ground which grasp cosmic energies beneath the structure. The

Mandapa Parameters	Relation with mandapa	Influence on mandapa	Proportion or vice versa
Orientation	Follows orientation as temple	same	Doesn't have any influence
Location	In front of the temple		Being located in front of the sanctum its follows the same proportion of Garbhagriha or Prasada or its proportion is determined by that of Garbhagriha or Prasada.
Function	Mainly for gathering, dance, offerings etc.		Proportion is not influenced by function but it proportionately decrease in size from Mahamandapa to Mukhap- mandapa guided by the dimension of Garbhagriha
Expression	Mandapa affects the temple form as well as plan gives an expression of cosmos		Its self similar nature(Fractal) both in plan and elevation achieved through the proportionate arrangement of each Mandpa.

early stages temple plans where direct copy of Vastupurusha mandala later on they became complex by bumping the sides of square sideways depicting cosmic energy radiation. Thus temple plan has become a visual expression of energy radiation before it was only a symbolic expression. Lastly, during the 11th century, the plan of Hindu temple had attained its final shape as the result of third fractal iteration of mandala. This modified and matured plan was widely adopted in the North Indian temples; among those Kandariya Mahadev temple at Kahjuraho is the most remarkable. The plan of Kandariya Mahadev temple is the result of third iteration of pitah mandala (36-squares grid).

TABLE 2
 MANDAPA PARAMETER

Figure 6: Proportion analysis of the plan- Kandariya mahadev Temple

(Rian Isef, 2007). Analyzing the plan considering the Mandapa proportion, inner square of Garbhagriha is in accordance with the inner square of Mahamandapa, Mandapa and Ardhmandapa. Width of Mandapa platform is same as the width of Prasada and it is the limiting factor for the smallest Mandpa irrespective of the function they where suppose to handle. The center of Garbhagriha is formed by the corner edge of the square of Mandapa's offset wall. Length of Mandapa is also redoubled considering the length of Bhahyabhitti of Garbhagriha. (fig 6)

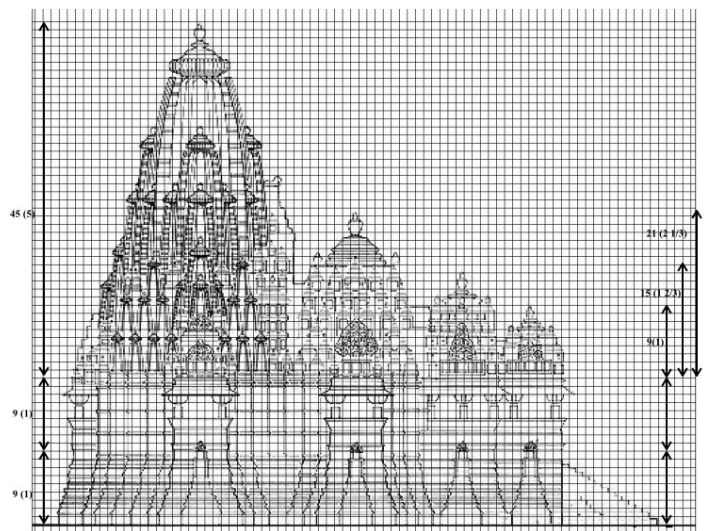


Figure 7: Proportion analysis of the Elevation- Kandariya mahadev Temple

5.2 Elevation

Hindu cosmology, manifested in the plan of Hindu temple two dimensionally, was also manifested in its elevation but three dimensionally and more symbolically. Here the sthapati has employed this with the help of Fractal geometry which is a proportionate arrangement of self similar structure i.e the roofs of Mandapa with that of Shikhara. The sthapati has taken the model of mountain for the fractal object where self similar mounts are repeated and recurred pointing towards the sky. They resembles series of graded peaks that resemble a mountain range to which a Hindu temple is frequently compared.

These peaks, arranged along the axial line, arise and fall alternately while maintaining the overall upward accent, and culminating in the tallest spire (shikhara). (Trivedi Kirti 1989). In the case of Kandariya mahadev temple it resembles Mount Khailash being aboded to lord siva. Above the assembly hall, i.e., mandapa the main tower is repeated within its own body and at the same time its whole body is repeated along the axis of mandapa to the entrance. This arrangement of repetitive towers above the mandapa (assembly hall) and arthamandapa (entrance porch) is such that it makes to move up one's eyes automatically to the main tower above sanctuary and from that travel up through the summit of finial to the axis of cosmos (Fig. 5). (Rian Iasef, 2007). They follow a proportion of 1: 1.6: 2.6. This highest point of the shikhara above sanctuary is believed as the ultimate point of liberation from the physical world. Thus the proportionate arrangement of Mandapas provide an expression of cosmos to the whole temple form.

6 ASHAPURI TEMPLE COMPLEX

The village of Ashapuri is about 32 km south of Bhopal, and 6 km from the famous, unfinished Shiva temple of Bhojpur. Its now under the protection of the Directorate of Archaeology, Archives and Museums (DAAM), Government of Madhya Pradesh. Ashapuri seems to be a urban settlement near Bhojpur when Bhoja the king of Bhojpur started the construction of Shiva temple, bhojpur. The site ashapuri has now discovered with 26 temple remimance. Now the site is known as Bhuthnath named after the name given locally to temple no:21. (Hardy Adam 2007) The temples where constructed between 9th to 11th C. Out of the remains only two temples could be reconstructed, temple no: 17 Surya temple and temple no:5 both from pratihara period. So these two temples where only selected for proportion study. They follow post Gupta Nagara tradition.

7 ANALYSIS OF TEMPLE NO: 17

Temple no:17 is the earliest of the group, built in first half of 9th C also known as Surya temple. Its oriented towards east. It has a Mukhaman- dapa leading to the antrala then to Garbhagriha. It was said that it belongs to latina mode of Nagra temple construction and is Pancharatha plan by Adam Hardy in Ashapuri: Resurrect- ing a Medieval Temple Site. The diety and its disposition are unusual for a surya temple.

7.1 Floor Plan

In plan it consists a Mukhamandapa, antrala leading to Garbhagriha. By early 9th C Mandapa started to be added in proportion. Mandapa is connected to Garbhagriha through antrala which acts a separation between the two or may like the projections on the three sides of Garbhagriha mandapa is added after the fourth projection towards the entrance. Ashapuri temples were constructed before the text samarangana sutradhara was written but they seem to follow the proportion as mentioned in the text. Width of Mukhamandapa is 3 parts the width of Prasada and its depth is 2 Parts of its width. (fig 6) Masons might have had their proportion in mind and it coincides with the proportion as said in the ancient text.

7.2 Elevation

Just like complex temple now a day they also resemble to a mountain by their proportionate arrangement allowing the spectators eye to move upwards. The decorations over the roof of Mandapa and shikhara is again an example for fractal geometry which symbolize cosmos in 3D. Externally they seem to be a single mass where the height of mandapa restricted by Sukhanasa over antrala which is half the height of Shikhara as mentioned in ancient texts. (fig 7) From the analysis it is clear that the temple 17 have followed the proportion as mention in ancient texts.

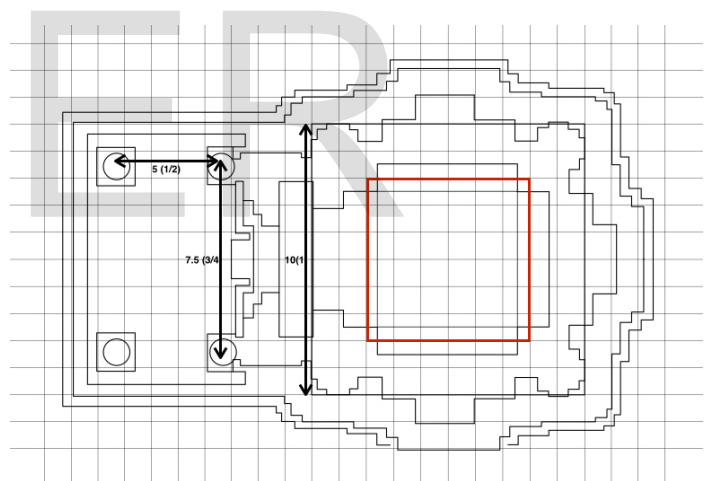


Fig. 6. Proportion analysis of the Plan temple 17

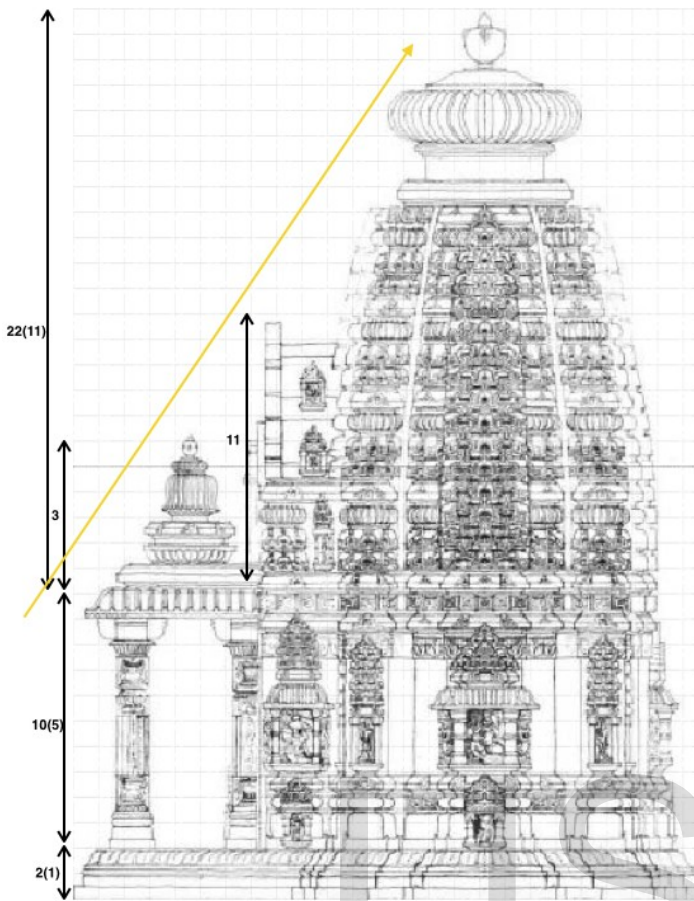


Fig. 7. Proportion analysis of the Elevation temple 17

8 ANALYSIS OF TEMPLE NO: 5

Temple no:5 built by the end of 9th C or in the early beginning of 10th C. Its oriented facing West. It has a Mukhamandapa leading to the antrala then to Garbhagriha like temple no:17. The exact size were not known but can be estimated with accuracy from available studies. This temple is a composite temple of Nagara tradition developing into Shekhari form used in Khajuraho temples. It exhibits a beautiful precursor of Shekhari concept. (Hardy Adam 2007)

8.1 Floor Plan

In plan it consists a Mukhamandapa, antrala leading to Garbhagriha. Mandapa is connected to Garbhagriha through antrala which acts a separation between the two like in the previous temple. Ashapuri temples were constructed before the text samarangana sutradhara was written but they seem to follow the proportion as mentioned in the text. Here the inner square of Mandapa seems to have the same proportion as that of Garbhagriha (fig 8) as in a fully developed temple or its is similar to that in Kandariya mahadev even if it's a Nirandhara plan. Which again proves it be shekahari form.

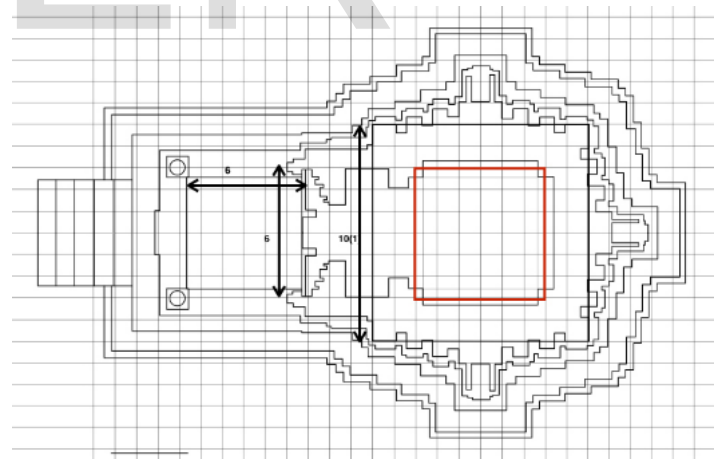
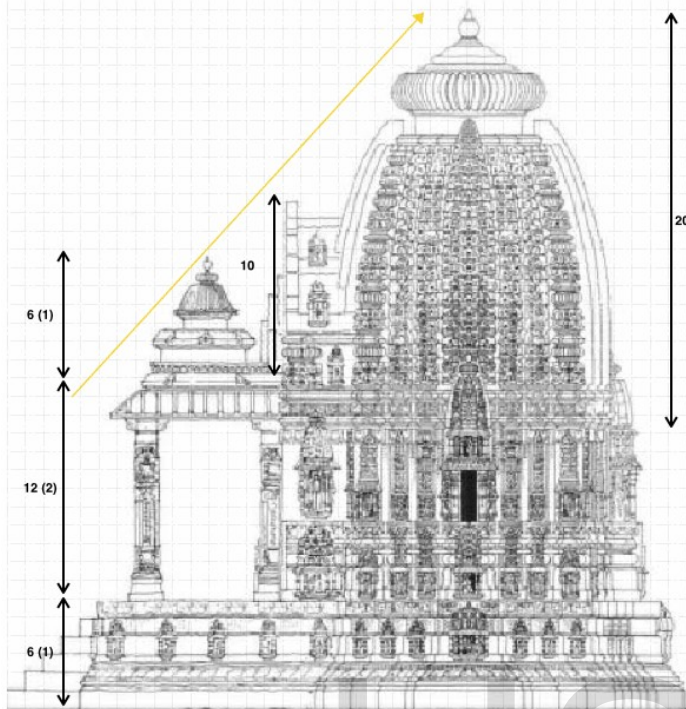


Fig. 8. Proportion analysis of the Plan temple 5

Fig. 9. Proportion analysis of the Elevation temple 5



8.2 Elevation

This temple also resembles to a mountain by their proportionate arrangement allowing the spectators eye to move upwards. Fractal geometry is visible in the decorations over mandapa as well as shikhara resembling cosmos. Externally they seem to be a single mass joined by Sukhanasa outside and divided by antrala inside. (fig 9) From the analysis it is clear that the temple 5 have also followed the proportion as mention in ancient texts.

9 CONCLUDING REMARKS

Indian temples are microcosm of Cosmos, acting as a connecting bridge between physical world and divine world through their proportional arrangement.

Mandapa, which were entrance porches in the beginning became an integral part of the temple plan in providing additional functions and in form providing an expression of cosmos especially in elevation.

Ashapuri temples analyzed here, corresponds to Nagara temple proportions varying in proportionas they belong to two different styles of nagara Architecture.

From the study of Adam Hardy it is said that they possessed temples of different styles in Nagara other than these two.

The site of Ashapuri seems to be a place for the development of Nagara school of Architecture.

10 CONCLUDING REMARKS

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