

Ancient Architectural and Civil Engineering Aspects of Kakatiya Monuments

Hari Krishna Padavala

Department of Civil Engineering, National Institute of Technology, Warangal, India &

Advisor, Academic Board, Bhaktivedanta Research Center, Kolkata, India

Corresponding author email: phari@nitw.ac.in

Abstract

Ancient India presents many important aspects of architecture and engineering based on the observation from the nature and other living beings. Our ancestors have used many such aspects in the construction of many monuments, temples and buildings which are serving their purpose for over 1000 years as symbol of their great technology. Architecture is one of the very important aspects of civil engineering which deals with the form and function of all the buildings. Vedic texts presents many important aspects of construction based on the principles of orientation (procedure used to get maximum benefits from the nature) for a proper physical and mental health of the inhabitants. In the present study, an effort is made to present the great aspects of Indian architecture and civil engineering that were adopted by the Kakatiya Dynasty of Southern India.

Keywords: Architecture; Civil Engineering; Indian Heritage; Kakatiya Dynasty; Ramappa Temple; Thousand Pillar Temple.

1. Introduction

The ancient Indian history presents a special and surprising aspects of art, science, architecture, engineering and technology that were adopted by our ancestors based on their rich experience on the natural, social and cultural aspects. In the olden time periods, most of the buildings were constructed with the aim of getting maximum benefits for the inhabitants from the nature through the popular science of "Vaastu Shastra". These two words, Vaastu and Shastra are derived from Sanskrit, where in Vaas means live or reside, whereas shastra means science. Therefore, the literary meaning of Vaastu Shastra is the "Science of Living", which in the modern terminology is termed as Architecture.

Along with the concepts of Astronomy and Geography, this Vaastu shastra reveals the main principles for arranging different components of a building / structure. Our great Indian

history provides great literature/ texts on such principles of Vaastu used in the construction of various monumental structures during the olden periods. Some of the ancient scriptures like like Mayamatam (believed to be written by Mayamuni / Mayasura in the 5th Century); Samarangana Sutradhara (written by Bhojadeva of 11th century) are considered as some of the major technical literatures having detailed aspects of architecture and engineering.

The entire universe and human body, is composed of Panch Mahabhoot containing five basic elements like Air, Earth, Fire, Space and Water as shown in figure 1.



Figure 1: Arrangement of Pancha Mahabhoot with respect to the Cardinal directions (Source: Internet)

The principle of Vaastu is to maintain balance between the structures with these elements. Indian temples / monuments were constructed by taking into consideration the principles of this Vaastu shastra and they are even serving the humanity effectively even after 1000 years of their construction. The ancient temples which were considered to be the centers of Peace and power were built all over Indian territory with great pillars of architecture and engineering. Some of the Indian temples were built according to prevailing traditions depicting the culture, social aspects, principles of engineering and architecture under the direction of great saints & sages along with pious kings. It is observed that the ancient Indian Vaastu shastra intrinsically has no place for any kind of religious fundamentalism but followed the expertise in the fields of civil engineering design and architecture features.

In this paper, an attempt is made to explore the kind of knowledge that existed during the Kakatiya dynasty in the areas of civil engineering and architectural aspects that were used for the temple construction. It is strongly felt that the observations that are shared in this paper may help the present generations for a better understanding on the architecture and civil engineering aspects of this great Kakatiya dynasty.

2. Kakatiya Dynasty

Twelfth and Thirteenth centuries witnessed the emergence of the Kakatiyas as one of the major ruling kings in the Southern Peninsular India. These kings were initially the rulers of the western Chalukyas of Kalyani, ruling a small territory having capital at Kalyani today's Basavakalyan in the Bidar district of Karnataka state. Their first king was Gundaya Raju who ruled between 956 and 996 CE, while his son Beta Raju who succeeded his father had his capital city at Kakatiya Puram. These kings used to worship Goddess Kakati as their tutelary deity as shown in Figure 2 and hence the dynasty came to be called "Kakatiyas".

During the rule of Kakatiyas (956 CE to 1323 CE), which can be called as the golden age of Telugus, all the telugu speaking people were united geographically the places of Kanchi, Bellari, Raichur and Ganjam were annexed to Warangal promoting the telugu culture in these areas as shown in Figure 3.



Figure 2: Goddess Kakati Devi



Figure 3: Kakatiya Dynasty

During this period, there was an abundance of charities, religious practices, dance, music, literature, art, architecture, sculpture along with agriculture. Agriculture was given top priority and they were pioneers in irrigation and water management. They had the expertise and acumen to harness water by way of building ponds, reservoirs and canals. Some of the ponds & reservoirs built by them are still in use and serving the society even today. Their ideas in creating / developing these interconnected water bodies without any adverse impact on the environment narrates volumes of their intelligence along with their foresight in solving the water problem to

a city like Warangal, which is not having even one river to meet the demands of the people in this area.

3. Architecture & Civil Engineering aspects of Kakatiya Monuments

During their ruling period, they constructed several magnificent temples in a special and unique style identified as the Kakatiya architecture as shown in Figure 4. The spiritual places were considered as a meeting place for social and cultural interaction of the citizens of the kingdom. Unlike the other south Indian temples built by the Pallavas, Cholas, Pandyas etc, Kakatiya temples are not in gigantic in form but they exhibit exquisite and intricate internal features.

Most of the temples have the outline of the structure in the form of a star, especially in the plan. The roof portion of most temples was formed through the Corbelling technique where in the central opening was covered initially with four corner rectangular pieces leaving a central square open to the sky, which used to be plugged by single square block of rock as shown in Figure 5. And among the many temples constructed by the Kakatiya kings, two temples were selected for the purpose of discussions to explain some important architectural and civil engineering aspects which is relevant to the present subject matter.



Figure 4: Architectural Excellence of the Kakatiya Dynasty

Figure 5: Corbelling technique used by the Kakatiyas

4. Ramappa Temple

Ramappa Temple is an archaeological wonder and is the only temple which is named after the name of the architect / sculptor / craftsman who designed and constructed this temple. This temple is also called as Rudreshwara temple, which was built by Racharla Rudra of Kakatiya Dynasty, who is the commander in chief during 1213 CE at palampet village which is 65 kms from Warangal district in Telangana state of India. This temple is considered to be the brightest gem in the galaxy of Indian temples and is the most elaborate and striking example of the intricate carving by the Kakatiya sculptors depicting the legendary tales, dance forms and a variety of musical instruments. It stands on a 1.8 m high star shaped platform which was constructed using three types of rocks like Sand stone, Granite and Dolerite. They also have used innovate sand box technique for all the foundations of this temple (Figure 6).

This temple hall has numerous carved pillars which are positioned to create glorious ambience interms of light and space. Red Sandstone is used in the construction of the main structure of this temple and the pillars are made using Dolerite, the hardest rock in the world on which they carved female dancers and musicians which are considered to be the “master pieces of sculpture depicting the Kakatiya Art as shown in Figure 7. For the visitors, it is amazing to observe that a fine thread could be inserted through the sculptured figurines that are carved on the temple pillars and the exquisite icons along with perforated screens brings the majesty of the Kakatiya’s craftsmanship. Marco Polo, a Venetian merchant admired the delicate carvings, sensuous postures of dancers along with their elongated bodies and heads and called this temple as “the brightest star in the galaxy of temples”.



Figure 6: A view of the Ramappa temple



Figure 7: Great sculptural aspects of Ramappa temple

Another great feature of this temple is that it has a pyramid shaped Shikara, which is unique unlike other temples of the Kakatiyas having flat roofs. This shikara is made up of feather weight bricks with a specific gravity of about 0.9 g/cc and are able to float on water as shown in Figure 8. These bricks are found to have compressive strength of about 40 – 45 kg/cm² which is more than that of normal clay bricks (specific gravity of about 2.1 to 2.2 g/cc) having a compressive strength of around 20 – 25 kg/cm². These light weight bricks were used with a specific purpose of having slab load on the stone roof and they have porosity of 45% and their transmissibility is very low along with lesser water absorption because of their smoothened surface. Therefore, this light weight brick technology which is a great example for the genius creativity and skill craftsmanship of Indian engineers existed well before 800 years ago.

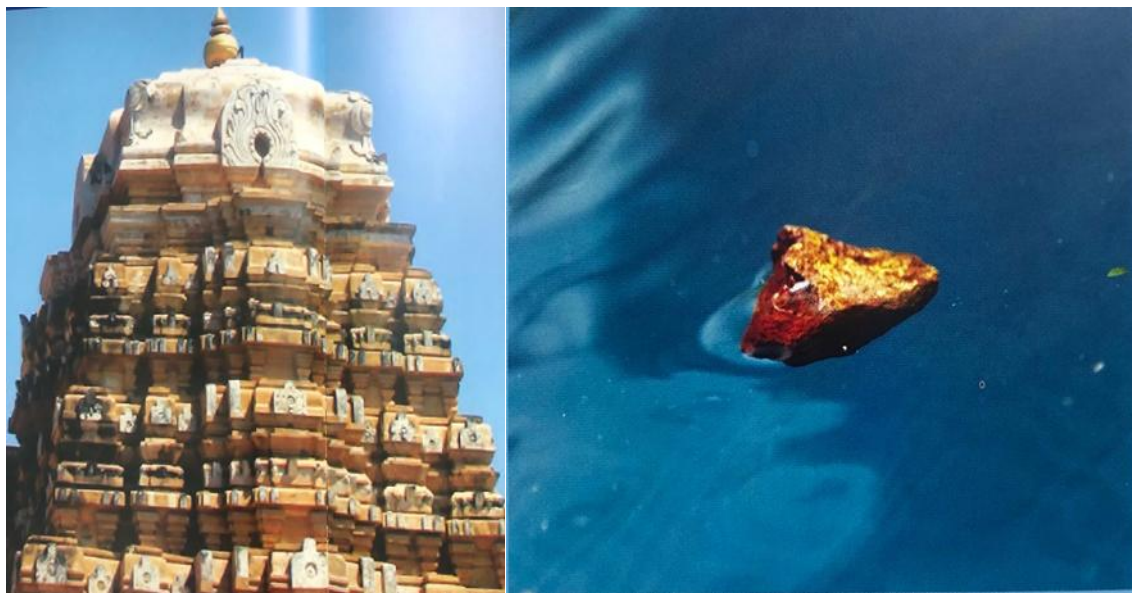


Figure 8: Shikaram and Floating bricks used in the Shikaram of Ramappa temple

In addition to the architectural and civil engineering marvels, this temple also depicts the love of art, music and dance which were patronised by the Kakatiya dynasty. This temple depicts the scenes from great episodes like Daksha samharam Girija Kalyanam, Gopika Vastraharanam, Samudra Manthanam etc. The sculptures of dwarapalakas and Lord Sri Krishna playing on flute were found to be the specimens of expert sculptors with mirror like appearance on the Dolorite stones. This temple of India was inscribed as “UNESCO world Heritage monument”, depicting the greatness of its sculptures during June 2021.

5. Thousand Pillar Temple

The thousand pillar temple located at Hanumakonda in Telangana state is observed to be the earliest of the most celebrated temples built by the Kakatiya kings during 1162-63 CE. This temple comprises of a Trikuta temple having the deities of Rudraswara (Lord Shiva), Vasudeva (Lord Vishnu) and Surya (Sun God) along with a Kalyana mandapa and Koneru - a stepped well as shown in Figure 9.

The temple is named as thousand pillar temple because totally 1000 pillars were used in the construction of this temple, yet no pillar obstructs a person standing at any point of temple from viewing the deity in the other temple. The pillars of this temple were uniquely built so that they are tightly knit and form its walls resulting in an impression of good space and uniformity. All the walls of the temple are made like huge and massive cavity walls meant for thermal insulation technique to have cooling effect within the temple premises. All the parts of the temple are made with Black Dolerite rock. Unlike most of the Indian temples that face east direction, this temple faces south direction. The temple base is star shaped and the deities were arranged in such a way that the Lord Shiva’s shrine faces east and the other two facing South and West. The fourth side is occupied by Lord Shiva’s vahanam – Nandi (Bull) which looks in east direction, which is unique among all Indian temples. Unlike the Ramappa temple, which was built with Vimana over the sanctum sanctorum, the roof of thousand pillar temple is semi-flat as shown in Figure 10.

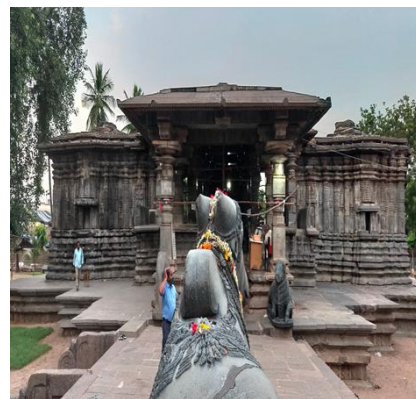


Figure 9: Aerial view of Thousand pillar temple **Figure 10:** Front view of thousand pillar temple



Figure 11: A view of the Antarala



Figure 12: Sculptural details on beams and columns

The main deities are constructed in square sanctums fronted by an Antarala, which in turn lead to a common Natya mandapa / Recreation hall as shown in Figure 11. This thousand pillar temple depicts a rich architectural legacy and skill in the stone sculpting of the Kakatiya period. The richly carved pillars of the temple, the six feet high Nandi along with the two elephants on either side of the main temple are made with a black Basalt Rock and shows the fine carving skills of the craftsman of that period. Similar to the Ramappa temple, there are many stories from Puranas and Itihasas are depicted on the temple pillars, lintels and the roof portions through variety of dance poses and musicians playing various instruments as shown in Figure 12. To the south of Trikuta mandapa and behind the Nandi, there exists a splendid kalyana mandapa with nearly 300 pillars which had experienced lot of damages in the recent times as shown in Figure 13.



Figure 13: Details of Kalyana Mandapa

Geological, geotechnical, geophysical and structural investigations along with remote sensing surveys were carried out at these premises and it was observed that the temple is situated on the pediment slope extending from the foot of the ridge towards the North. The collapse of the kalyana mandapam was attributed to a thick layer of expansive clay beneath the foundations and similar to Ramappa temple, sand box foundation technique is used for the foundations here also. There was a fault under the foundations of this Kalyana Mandapam, which is responsible for draining the confining sand which has led to differential settlements causing lot of damage and collapse of some part of the structure.

Recently, this structure was reconstructed by Archaeological survey of India for which the department of civil engineering of National Institute of Technology Warangal helped in the design for the rebuilding of the foundations. The entire restoration was done using the principles of agama shastra and without using modern materials like cement, concrete and iron. All the existing materials including the sand from the sand box used by the Kakatiyas were used for the restoration of the monument. Some of the missing members were recreated using locally available Granite rocks with similar colour and texture as that of other members. The entire restoration procedure was completed by March 2024, which took nearly 19 years for completing the entire project. And it was constructed in such a way that it would sustain for another 1000 years.

6. Contemporary structures from Chola Dyansty

Almost in the contemporary times, the great Chola Dynasty who ruled during the period of 907 to 1215 at a nearby state of Tamilnadu another state from southern India also have constructed many marvellous temples in places like Thanjavur and Gangaikonda Cholapuram etc. The Brihadevara temple at Thanjavur is considered to be one of the largest Hindu temples and exemplary examples of tamil architecture and are recognized as world heritage site structures as shown in Figure 14 a. These temples were constructed during 11th century and includes a gopuram (the main temple) accompanied by its massive tower along with inscriptions and sculptures predominantly related to Shaivism and Vaishnavism.

This temple was constructed with Granite stone and will be having a vimana tower above the actual shrine. The temple at Thanjavur has a massive and longest corridor (prakara) along with a tallest gopuram in the southern India. In addition to the main diety of Lord Shiva (in the form of Nataraja – dance form of Lord Shiva), the temple includes shrines of Parvati (the consort of Lord Shiva), Ganesha & Murugan (the two sons of Lord Shiva) along with Nandi (the bull vahana of Lord Shiva).



Figure a: At Thanjavur



Figure b: At Gangaikonda Cholapuram

Figure 14: Brihadevara Temples of Chola Dynasty

The Brihadevara temple at Gangaikonda Cholapuram which is about 70 kilometres from the Thanjavur Brihadisvara Temple was completed during the year 1035 as shown in Figure 14 b. And this temple also resembles the same architecture as that of Thanjavur with a small difference. Although the main deity of the temple is Lord Shiva, it also has deities of Lord Vishnu, Durga, Sun God, Ardhanarishwara etc. This temple has a number of smaller shrines, gopura, and other monuments, with some partially ruined or restored in later centuries. The temple is famed for its bronze sculptures, artwork on its walls, the Nandi and the scale of its curvilinear tower.

7. Conclusion

The study of ancient literature regarding the architectural and civil engineering aspects that existed in the olden times like Kakatiya dynasty enriches the younger generation about the great Indian cultural heritage. The procedures used, methods developed and the skills / techniques / technology adopted incorporating great knowledge and vast experience during the ancient times really inspires us to do great things with the available natural elements. The details of the construction procedures along with architectural aspects and sculptural craftsmanship is very much essential for the present day society to understand the rich knowledge and dedicated workmanship of our ancestors.

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