

# "Bangla" Roof and the various "Chalas" in Bengal Vernacular Architecture

Dr. Janmejoy Gupta<sup>1</sup> and Alisha Sinha<sup>2</sup>

<sup>1</sup>Department of Architecture, Birla Institute of Technology, Mesra, Ranchi

<sup>2</sup>Final Year Student, M. Arch (By Research), Sir J. J. College of Architecture, Mumbai

E-mail: <sup>1</sup>janmejoy71@gmail.com, <sup>2</sup>alishasinha09@gmail.com

**Abstract**—India holds a unique identity in the world because of the diversity in its culture, which is composed of rich phases of its history. History has therefore played an important role in framing the architectural identity of the country, which is vernacular in its character. This paper talks about the evolutionary story of vernacular architecture in Southern Bengal, a warm humid region in the eastern part of India. Bengal's inherent vernacular style is found to commence at the end of the 10th Century A.D. and the Mughals further contributed to it on a large scale. Later in history, the British started settling in east India, and they took several design measures to adapt to the environment. This contributed in the evolution of the vernacular forms from one to another, and to what they are today. It also brought in the concept of a bungalow. The modern history of India and the history of evolution of architecture in this region go parallel, as the most significant turning point is the colonialization of the country by the British. The form of these vernacular structures is very interesting and totally justifies the climatic adaptation. This paper is a small part of a much larger research that intends to create a knowledge base of vernacular building traditions of Southern Bengal, which bears information about the energy performance of traditional building techniques, additionally considering factors such as local material availability, culture, lifestyles and traditional sentiments of the inhabitants. Hence, it aims to be an interesting read for professionals interested in climate responsiveness of traditional vernacular structures and the evolutionary design process behind the different typologies thereby present.

## 1. INTRODUCTION

Bengal is the region lying along the eastern end of the Indian peninsula. On attainment of national independence of India in 1947, the region was divided into two parts, the eastern forming the new nation of East Pakistan (now Bangladesh), and the western forming the political state of West Bengal. The state of West Bengal has an unusual geographical profile, resembling the geography of India. It is a longitudinally spreading region, consisting of snow-capped mountains in the north, swampy rainforests in the centre, and sea on the south. It can therefore be called a representation of the Indian subcontinent. This study has been focused on the lower part of West Bengal, which will be referred to as "Lower Bengal" here onwards in the paper.



Fig. 1: Topographical Similarity of West Bengal with the Indian subcontinent

Lower Bengal has a unique architecture of its own, which is primarily focused on roof typologies. In other words, roofs are the main identifying features of the vernacular architecture in this region.

## 2. CLIMATE OF LOWER BENGAL

The Southern part of Bengal climatologically falls into the Warm-humid climatic zone of India (as per NBC 2005 Climatic Classification; Refer Fig. 2).

Spring, summer, monsoon, autumn and winter are the five major seasons experienced in this region. However, majorly taking into consideration the seasons experienced in a region with a Warm Humid Climate, the predominant seasons are only three – Hot and pre-monsoon, Warm-humid monsoon and Moderate and cool winter.

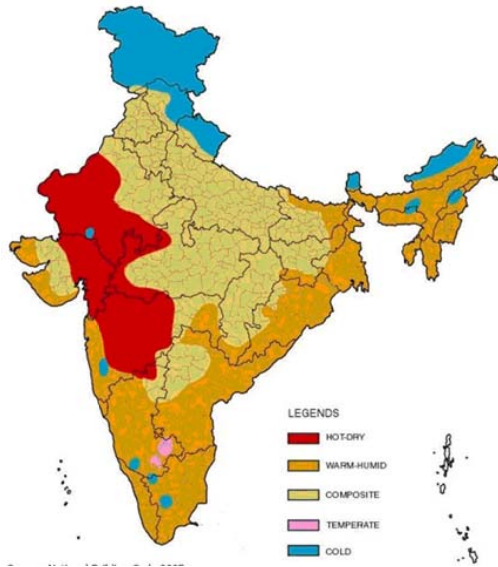


Fig. 2: NBC Climate Classification (Source: NBC 2005)

The central region faces extremely high temperatures in summer, and heat exists as the dominant problem. The southern coastal areas experience heavy cyclones in the monsoons, while heat remains the prime concern in the warmer months of the year. During monsoons, cloudy sky, moderately high temperature, humidity and rainfall are regular climatic factors experienced, whereas in winter, clear sky, bright sunshine and low temperature are usual occurrences. The average rainfall in the various regions of Southern Bengal for the past 100 years ranges from 114mm to 136mm. However during monsoon, weather condition of any one day can act as a fair sample of the season. Looking at the seasonal trends of rainfall, during pre-monsoon, rainfall is decreasing in Southern Bengal, except Purulia and it is completely reversed during post-monsoon period (Mukherjee, 2017).

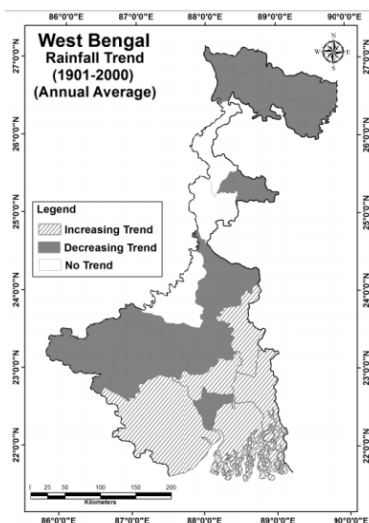


Fig. 3: Annual Average Rainfall Trends in West Bengal (Source: Mukherjee, 2017)

This brief idea about the climate of this region is essential because vernacular architecture is solely based on climatic adaptations and is moulded as per the customized needs of the inhabitants.

### 3. CONCEPT OF BANGLA AND CHALA ROOF SYSTEM

Over many centuries, various designs and building techniques have developed across the world in different climatic zones, bringing forth structures that provide comfortable living conditions without the use of sophisticated mechanical devices. Although housing typologies are a result of multiple determinants, climate and culture are the two most important determinants. Without good information and understanding of the local climate, it is not possible to study and achieve optimal building design. Most building technicians in the past were familiar with the climate in which they were building. They were aware of the ways they could benefit from certain climatic features and overcome those that were less favorable, by opting for appropriate building shapes, location, orientation, and the use of appropriate building materials. It is characteristic of primitive and vernacular buildings that they typically respond to climate very well. (Rapoport, 1969).

A Bangla Roof is a canopy defined by a uniquely bent roof meant to thwart the intense sun as well as torrential rain and directional wind (Barua, 2004).

A “Chala” is a roof in the local language of the state. Hence the roofing variations are called Dochala (two-roofed), Charchala (four-roofed) and Aatchala (eight-roofed). These forms of roofing have a very interesting evolutionary story and have modified with changes in the history.

Table 1: Historical Timeline

Historical Events		Consequences in terms of the Architecture of Bengal
15 <sup>th</sup> -16 <sup>th</sup> century AD	Terracotta Temples of Bengal were constructed as a sign for revival of Hinduism. These temples absorbed Islamic architecture and blended it with the local material and architectural identity of Bengal.	First Bangla roofs were seen on these temples which created the distinct architectural identity.
1608 AD	First Ships of the East India Company arrived at Surat.	
1615 AD	Got permitted by Jahangir to establish first factories in Surat.	
1664 AD	The ports of Bombay, Madras and Calcutta also got involved in trades of the East India Company; Many English Communities start developing around these presidency towns.	This marked the advent of the British to Eastern India (Bengal). As the trade continued to grow, English families started settling in Bengal, mainly urban.

1717 AD	East India Company received a royal dictat from the Mughals exempting it from the payment of custom duties in Bengal.	This escalated the business of the East India Company in Bengal majorly. As a result of which the British population there increased substantially and they even started settling in rural areas.  However they kept restricted to Southern parts of Bengal, analyzing the lifestyles, cultural and social scenarios of India at that time.
1760s	The English settled in lower Bengal facing a major challenge in terms of the weather conditions.	Struggling with the heat, they started living inside Canvas tents. It was not comfortable because the temperature within the tent used to rise very quickly and substantially.
1820s	The tents got evolved into more durable structures.	Here evolved the huts with the now called Bangla roof. A mat called 'Jhanp' used to cover the doors and windows to allow comfortable ventilation.
1860s	Further design development into a distinctive bungalow- "Bangla" house.	Bangla house improvised and the roof took a distinctive shape.
1890s	Improvisations in the design of a Bangla House.	Eaves became more projected forming verandah like spaces.  Galleries developed on the sides of the structure.  Thick paddy straw on the roof protected the house from heavy rains and provided shade.
1900s	Simplification of the house forms	Curved roofs evolved into pyramidal roofs with square plans.  These forms gradually metamorphosed into rectangular forms.
1930s	Concept of Charchalas	These forms continued to be used for the next few decades because of their affordability and needs, and came to be known as Charchala (four-roofed).
1940s	Concept of Verandahs	The verandahs were expanded to all sides of the house, at times semi-enclosed.  The Jhanps were modified to form Venetian Louvers.

1960s	Concept of Aatchala	The Charchala roof evolved into a unique structure with Eight roofs, forming a double roofing system known as aatchala.
Present	There exists a combination of all the above typologies under different building conditions in Lower Bengal.	

Different areas within the same geographical region of Bengal possibly have different building typologies, based on their roof profiles. These buildings may have evolved one after another, and some may have developed simultaneously as per customized requirements. Thereby, they behave disparately with respect to thermal comfort, visual comfort and aural comfort.

Also, these typologies vary in terms of their usage, not only depending on the comfort conditions, but also the affordability of the occupants. This is a very important and influential factor, when the context is confined to any part of Rural Domestic India.

This classification has been evaluated through a considerable time period. A study has been conducted on various diversified parameters, on the basis of architectural aspects as well as bioclimatic aspects, which formulates the entire story behind the evolution.

#### 4. THE EVOLUTION OF THE CHALA ROOF (TRADITIONAL TO CONTEMPORARY ARCHITECTURE)

During the Medieval Period in Indian history, Bengal witnessed the revival of Hinduism after a powerful Islamic influence. Terracotta Temples of Bengal were constructed as a result of this revolution. These temples absorbed Islamic architecture of domes and multi-lobed arches and blended it with the local materials of brick and terracotta that formulated the architectural identity of Bengal. Therefore, the first Bangla roofs were seen on these temples, which was later taken inspiration from and adapted in residential bungalows and houses of the region.

The East India Company established its first factories in Surat in the beginning of the 17th century. Gradually as the trade levels increased, the ports of Bombay, Madras and Calcutta got involved in the activities of the East India Company. Consequently, many English communities started developing around these presidency towns. This marked the advent of the British to Eastern India (via Bengal). As trade continued to grow, English families started settling in Bengal, mainly urban. Hence, it can be stated that the Earliest British settlers got introduced to Eastern India in the mid-17th century through its coast along the Bay of Bengal. They settled along the Southern parts of Bengal, thereby analyzing the lifestyles, cultural and social scenario of India at that time.

In 1717, the East India Company received a royal dictat from the Mughals exempting it from the payment of custom duties in Bengal. This escalated the business of the East India Company in Bengal majorly. As a result of which the British population there increased substantially and they even started settling in rural areas. However they kept restricted to Southern parts of Bengal, analyzing the lifestyles, cultural and social scenarios of India at that time. To these invaders, weather conditions in India was a new challenge. They had no environmentally appropriate building model for the Indian warm-humid climate. Consequently, struggling with the scorching heat, they started living in Canvas service tents, generally used by the military

It however, was not comfortable for a long time because the temperature within the tent used to rise very quickly and substantially. Therefore, the design for these tents evolved into a structure much more permanent and durable. This curved roof came to be known as the "Bangla" Roof. These huts developed in the early 19th century, as pictorial sources of information indicate. A Bangla Roof developed as a canopy defined by a uniquely bent roof meant to thwart the intense sun as well as heavy rains and strong winds.

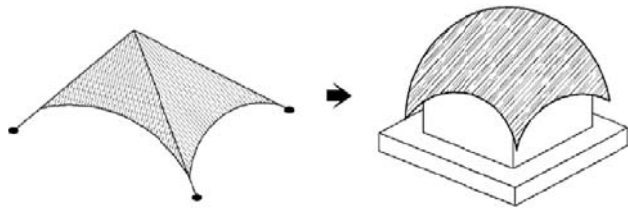


Fig. 4

The doors used to be the only openings, mostly covered by a mat "Jhanp", tied to the upper part of the door. If windows would be present, they were also covered with Jhanp. Its main function was to allow comfortable ventilation.

This kind of a hut is still prevalently used, mainly built of thatch and mud walls, or straw mats with bamboo framework. The buildings were mostly small in size, and consisted of single households.

*"Another possible explanation for this peculiarity may be climatic adaptation, as in the humid region of Bengal, small buildings scattered to allow air movements between them could help to maximize the effects of any available breeze."*

—Olgay, 1963

Further it was also assumed that the peculiar shapes of the roofs, with the absence of ridges on each slope, made it less vulnerable to any kind of leakage in the rainy season.

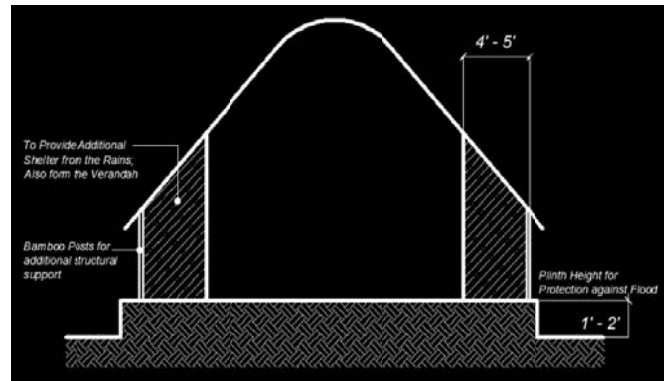


Fig. 5

The design gradually improvised from its initial phases and by the 1860s, developed in a distinctive roof shape. As the eaves grew more projected forming verandah like spaces, galleries began to develop on sides of the structure. The eaves descended lower at the corners. Extended roof of thick paddy straw thatch protected the mud walls from heavy monsoons as well as provided shade.

Verandahs were created to form a transitional space between the indoor as well as the outdoor environment, providing shade, and making the indoors more livable and comfortable.

Pros –

- No penetration of sun heat, glare and light
- Transitional Space
- Cons –
- Gloomy Interiors

With the passage of time, verandahs became such a comfortable space within a built environment that the occupants preferred living on them only, thus defeating the intention of the designer (Please refer to Figure 4).

By the advent of the 20th century, house forms in the region became simpler. Pyramidal Roof Structures with square plans developed, and gradually metamorphosed into rectangular forms.

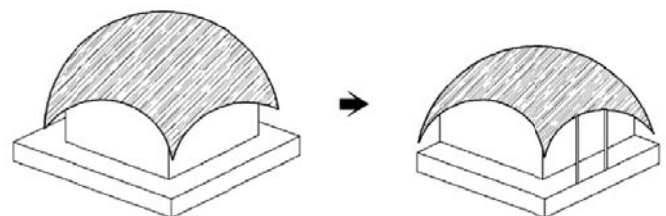


Fig. 6

However, both these built forms continued to be prevalently used as per individual affordability and requirements. This type of Roof came to be known as the “Charchala”Roof.

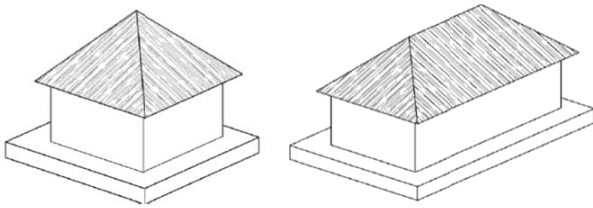


Fig. 7

The British further modified the building design to make it more adaptive to the local climatic conditions.

- They expanded the verandahs, encircling the house, sometimes semi-enclosing them for privacy with mat / brick walls.

- The roller shades or “Jhanp” continued to be used, transformed into Venetians. They were often were often splashed with water to cool the passing breeze.

Plans gradually transformed in such a manner that each room opened into a verandah or at least two sides to take advantage of the cooled air and allow access to the available breeze.

As time passed and technology developed, the Charchala roof modified in certain aspects to form a unique style of roofing, called Aatchala. This roofing was prevalently followed in the warmer parts of the country.

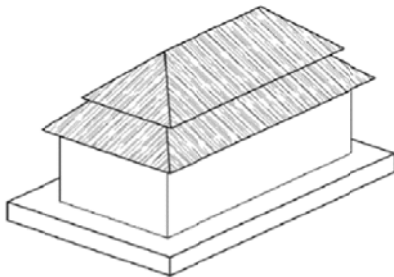


Fig. 8

This Aatchala roof was composed of eight slopes, forming a double roofing system. This was mainly done to increase the roof depth as well as formation of clerestories within these houses for natural lighting as well as ventilation.

Table 2

Type	Remarks
Aatchala	<ul style="list-style-type: none"> <li>House having roof with eight slopes;</li> <li>Such type of construction usually not afforded by people having lower economic stature;</li> <li>Can conveniently fit in one or more rooms in the plan;</li> <li>In more advanced profiles, may have courtyards in the centre</li> </ul>
Charchala	<ul style="list-style-type: none"> <li>Suitably used by lower as well as middle income groups of the rural society;</li> <li>Can conveniently fit in one or more rooms in the plan;</li> <li>In more advanced profiles, may have courtyards in the centre</li> </ul>
Dochala	<ul style="list-style-type: none"> <li>One of the initial forms of rural architecture developed in Bengal;</li> <li>Inspired from tents;</li> <li>Roof forms have refined with time;</li> <li>Roofs of many famous temples in Bengal</li> </ul>

## 5. CONCLUSION

This vernacular study of the built forms was essential to understand the roots behind the architectural styles and the factors that helped in shaping them. This study helped to connect the links between the architecture and the historical events that affected it.

This entire analysis is composed of information gathered and put down from different pieces of literature on the subject, to form a base for any kind of further study. It will help in creating an inventory and adding to its specifications and requirements.

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