

# HOW TO CONTROL CLIMATIC CONDITIONS BY VERNACULAR ARCHITECTURE IN BIDADA VILLAGE, KUTCH, GUJARAT.

**Abstract:** This paper discusses the specific climatic conditions of Bidada Village. Bidada Village is a small village of Kutch. Kutch is one of the hottest areas of Gujarat. The region experiences more than 49°C during summers and in January which is the coldest month of the year, the temperature recorded 2°C. There has been no year of scanty rainfall in 35 years from 198° to 215°. It is one of the extreme climatic zones for human survival. Despite such extreme conditions humans have continuously inhabited the region for centuries. Here, we are discussing, how they people sustain in this climate with their building construction technology and Vernacular Architecture.

**Keywords:** building construction technology, climatic design, hot and dry climate, vernacular architecture.

## INTRODUCTION

Bidada is a village near Mandavi, Gujarat State, India. It belongs to Kutch division. “Kutchua” that is what the northwestern part of Gujarat is named as. With a rich treasure of tradition, it is a delight for tourists and pride for the inhabitants. The northwestern Gujarat has its own vernacular architecture which are developed throughout the ages and has been an inhabitants themselves with locally available material, the traditional building are time tested, sustainable and sensitive to the microclimatic conditions and natural calamities, including earthquakes which the northwestern region is prone to.



Figure 1: Location of the Bidada Village, Kutch, Gujarat.

## CLIMATE

Apart from its unique and rich cultural heritage, it is the survival of human beings in the extreme climatic conditions that intrigues any scholar of architecture and settlement studies. It has hot and dry climate and one of the hottest places in Gujarat which is continuously inhabited by the human beings. The summers are extremely hot and the temperature exceed more than 49°C, posing challenges for the survival of humans or for that matter any life forms. However, the nights in Kutch are pretty cool, with the night temperature falling considerably. Summer prevail for almost eight months in a year. As a result sky is clear in most of the months with 345 sunlight days per year. When winter comes, January is the coldest month of the year and the temperature recorded 2°C. It means in winters, days are shiny and the nights are very much cold.



Figure 2 Culture of the Region.

## SETTLEMENT PATTERN

Bidada Village is in Mandavi Taluka- the southern coastal part of Kutch District. It is situated near the river and a highway runs perpendicular to it in east-west direction. The river is almost dry except during monsoon. The Village has about 500-550 houses and People are of various castes and communities. The zoning of public and private activities in the village gives references and shows resemblance to a typical old Indian town. The settlement is based near water source. The major population is of Hindus, Jains and Muslims with a firm hold of caste system.

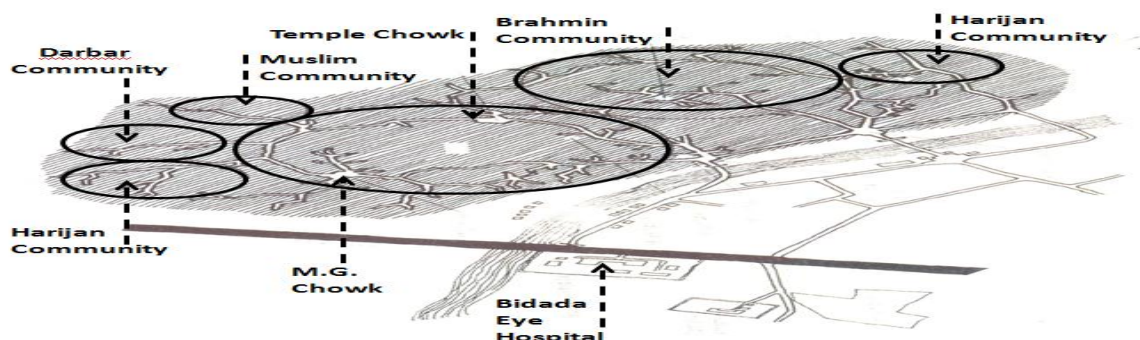
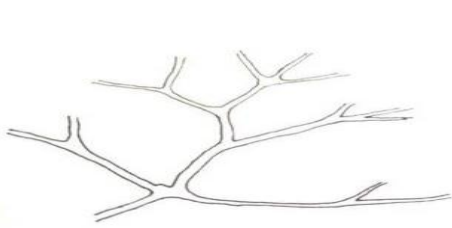
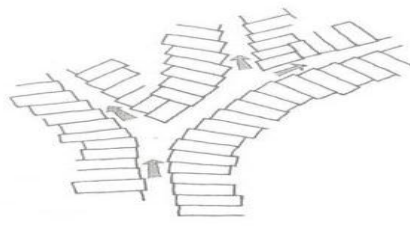


Figure 3 Village Settlement of Bidada

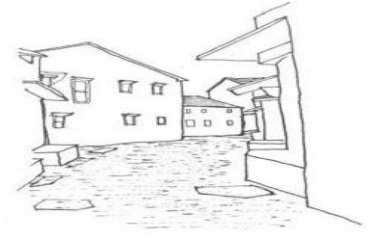
The Streets of Bidada village have a streetscape of Unique pattern. They constantly turning in curves, never remaining straight, in a particular direction through smallchowks of Y Shape- where it branches out in 2/3 Directions and again keeps turning. The entire village is a mesh of these curvilinear streets which connect the chowks.



**Figure 4: The Street network like a Water stream.**

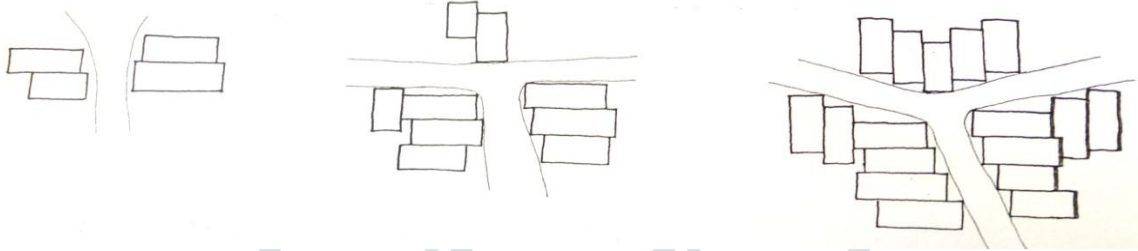


**Figure 5: Y shaped branching of Streets Forming small intersection At regular interval**



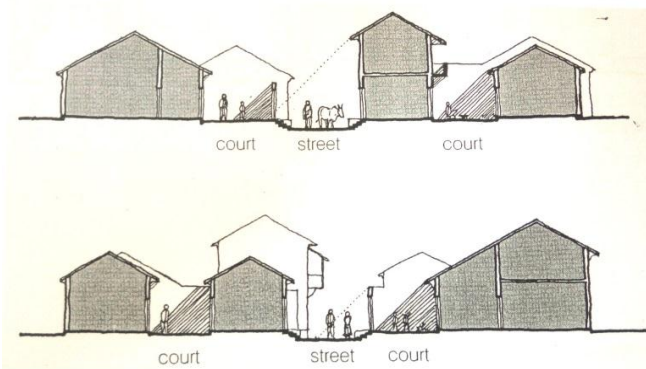
**Figure 6: Narrow curvilinear streets for the smooth Flow of breeze.**

It is like water stream line flowing smoothly in various direction and as they go ahead the width goes on decreasing, forming alleys. At a large scale the entire village street network has a distinct advantage that the curvilinear Streets behave like channels of winds throughout the village. Breeze can be discreetly felt on any street in the village justifying the curved street pattern. It is amazing that streets are predominantly oriented along the southwest direction, as is the wind directions for most part of the year. It is an incredible organic model of built form like a perfect machine to catch breeze throughout the day.

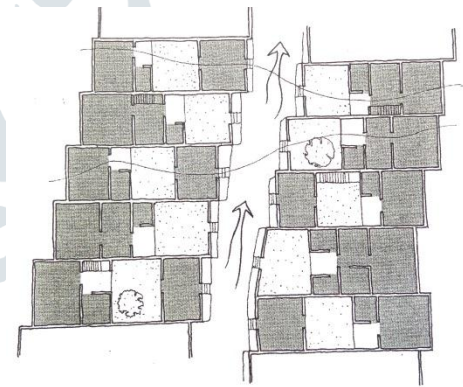


**Figure 7: Row Houses with Y shaped chowks which further form the village settlements.**

All Houses of the village are row houses on both sides of the streets. Many features like doors and windows, colours, textures, carvings on lintels distinguish a particular house and the group. Row housing pattern reduces the exposure of external wall surfaces to sun as the houses share a common wall. The movement of warm air around the house too is minimised and helps to keeps the Interiors cool and Comfortable.

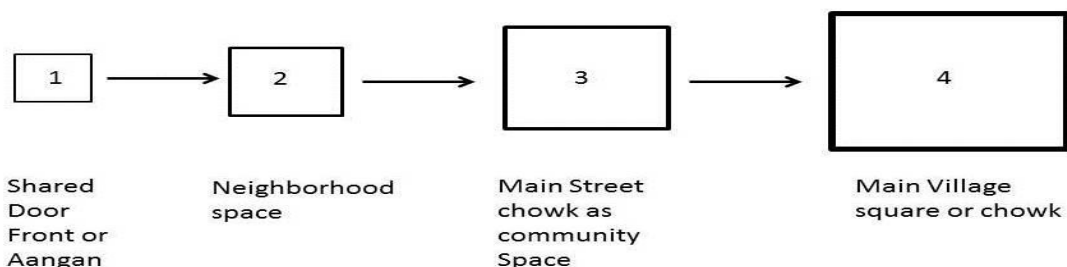


**Figure 8: A dense row house typology taking care of light. Streetscape.**



**Figure 9: changing heights and with it the**

The curvilinear streets are formed by staggering each house by few feet. The Narrow street width varies from 8 to 18ft serving pedestrain, carts and cattle movement. The house have a frontage of 10-15ft width with the height of street façade walls change as per the number of storeys. A typical feature is that if we enter a house on one side of the street the entry is in a room while on the opposite side of the street the entry is into a court of the house. The opposite main entrance never face in straight line avoiding direct sight in the house. The width of Streets and the heights of houses have a proportion such that the curvilinear streets are mostly protected by shades during the day. This makes walking on the streets comfortable in the scorching heat.



**Figure 10: Hierarchy of space at Village level.**



## ARCHITECTURE- SPATIAL LAYOUT

The row house is located near Darbari chowk, north of village darbar chowk. It belongs to a darbar family of six persons and is entered from streets by small steps called delly with Platform. The Guests or the visitors are entertained at the steps and as per the familiarity is welcomed inside the courtyard or living room or Osari.

The Basic form of house is tube row house, an elongated rectangular space with central courtyard and single story have sloping Mangalore tile roofs supported on wooden members. All the space and Most of Daily activity are concentrated around the courtyard and organized in a system from public space to most Private spaces.

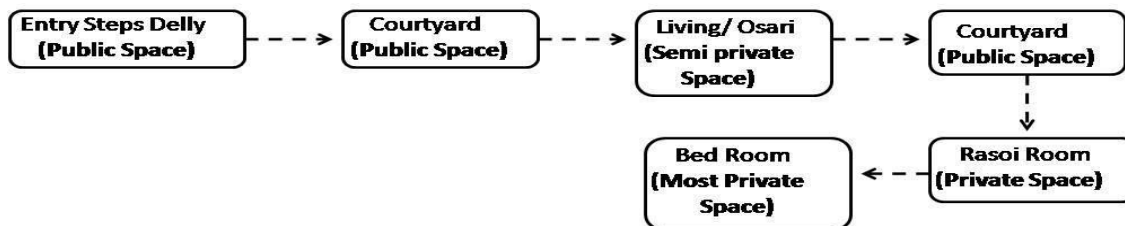


Figure 11: The Sequence of Spaces in House.

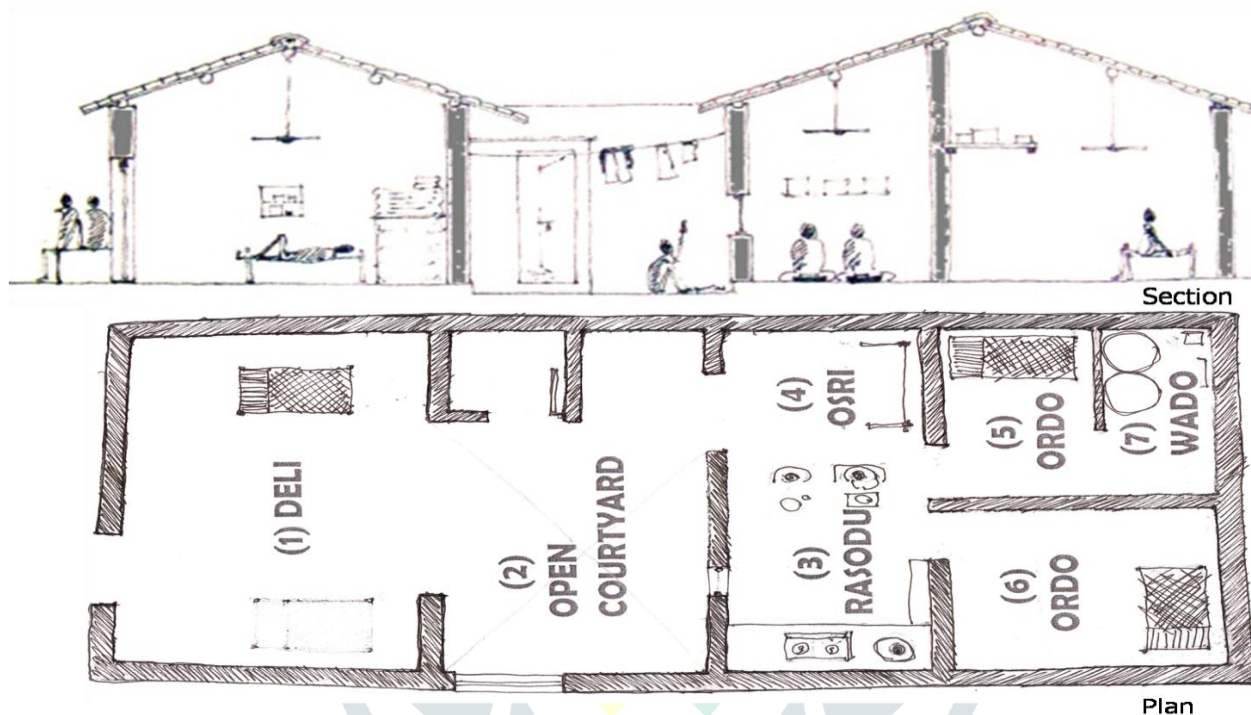


Figure 12 Plan and Section of the Bidada Village (house)

### COURTYARD

The Court lights and helps ventilation for all the rooms of the house and by its proportions it is in proportions it is in shade for most part of the day. The open to sky courts brings nature inside the house and create an inner microcosm of the family. In the evening time family members sits together and sleeping in summer time and throughout day most active space.

### STORE AREA

It is usually attached with a room for and there is no ventilation. It is used for storage purpose.

### KITCHEN

There are mostly open kitchen connected to Courtyard because of ventilation. All other rooms are usually 3 to 4 m in sizes perhaps due to the limitations of the building materials and also helping in maintaining a climate comfort inside. In this houses, windows are not provided on south face and window is kept closed most of the times and never opened during summers in order to trap the solar radiation.

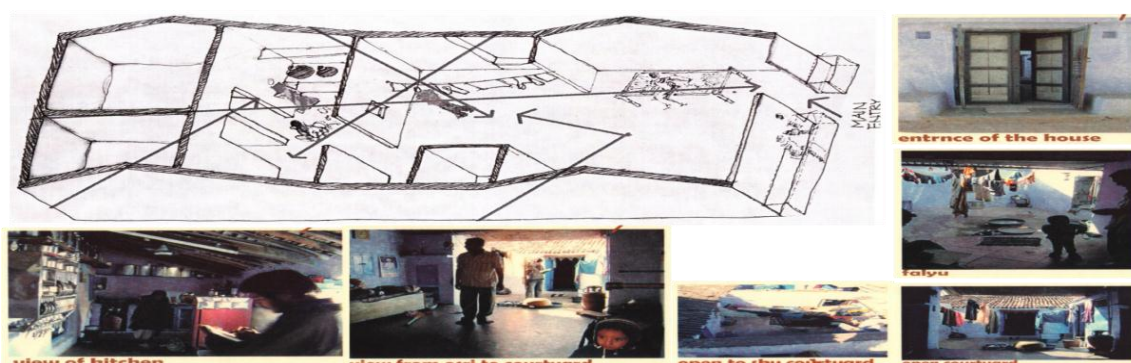


Figure 13: Axonometric view & Photograph of house.

## BUILDING MATERIALS AND CONSTRUCTION TECHNIQUES

Architectural Typologies have developed in the Kutch region as Factor of Tradition, Climate and Functionality. The materials used are locally available materials like Mud, Bamboo, cane cane leaves, of late Bricks, stone etc. Bhungas are traditional houses unique to the Kutch region in Gujarat. The houses are circular walled with thatched roof. According to the limitation of material and construction techniques.

These houses essentially made from organic renewable resources such as mud, grass, cow dung cane etc. The plinth and the foundation consists of consolidated earth with stone and bamboo posts, the walls consists of mud wall, split grass, earth, cane etc., and the roof is thatched, made of wheat or maize straws.

The Structural System consists of mud load bearing wall and the wooden nuts truss which supports the roof. The wooden columns are in house in the mud wall. Much of the behaviors of the structure depend on the load bearing mud walls. The structure Integrity is dependent upon Monolithic wall of mud.

The corner Junction are woods Sticks and the Foundation are simply filled with earth with the depth 2-3feet. The wood in the house is locally available from nearby. The major Structure failure in the region is due to reaction and erosion of walls due to salinity.

The Salinity erodes the bottom part of the wall in the outward side, so the cross section decreases due to erosion so the whole structure is pulled in the opposite. So this reaction due to salinity causes the structure to distort and eventually fail.

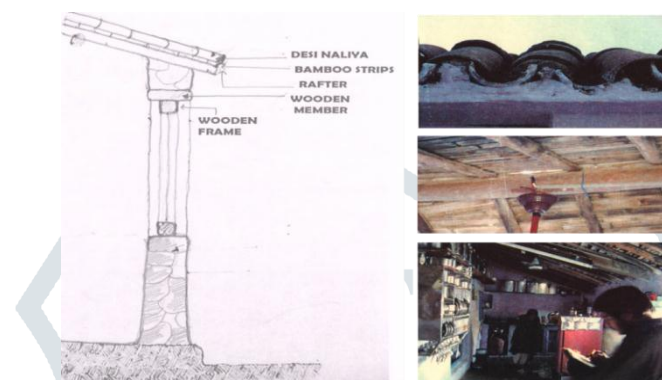


Figure 14 Structural Detail

## INFRASTRUCTURE AND SANITATION

This village is struggling to full fill their basic needs. There is no adequate water supply from Municipal Corporation. People have no option other than own boring to full fill their water requirement. Electric supply is inadequate as per the requirements of the village and is a major concern. Apart from few new settlements, overall area of urban comfort is missing. Sanitation of this village is not good. Sewer is missing 15% of the village.

## CONCLUSIONS

The architecture of Kutch region relates to the socio-economic setup, the cultural identities and a good climatic responsiveness. A good number of climate responsive design features are revealed during the study of the traditional architecture including temperature control, enhancing natural ventilation, protection from natural calamities such as flood, earthquake etc. However certain features that lack in the traditional housing are mostly fire proneness and termite infestation due to usage of non- treated material and lack of damp proofing and use of non- stabilized soil for construction too pose problems like dampness of walls and washouts during rainfall.

The notion of energy efficiency in architecture cannot be implemented from outside but by incorporating the indigenous techniques. Indigenous techniques are time-tested and sustainable. Thus, greater emphasis should be laid upon the documentation and research of indigenous techniques to generate a repository of knowledge. This knowledge base will help in formulating the best practices in the Architecture in conjunction with the traditional practices.

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