

# “Courtyard as a Building Component” its Role and Application in Developing a Traditional Built form, Creating Comfort: A case of Athangudi Village, India

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**Abstract**— Openings play a major role in any building. Most of the buildings designed in modern day lack openings based on factors like ventilation, thermal comfort, wind flow etc. In openings, courtyard places a major role in the maintaining the comforts in the residence in terms of lighting, ventilation and thermal comfort. This study analyzes thermal conditions of residential buildings in coastal regions. Analyzing the role of courtyard and its influence in indoor thermal conditions with specific reference to indoor air temperature.

**Keywords**—courtyards, opening, lighting, and ventilation.

## I. INTRODUCTION

**COURTYARD** Houses in India The first courtyard houses, according to historical evidence, appeared to have originated in India probably around 6500-6000 BC. Evidence of the earliest village is from Mehrgarh (6500-6000 BC). The settlement consisted of an irregular scatter of mud brick houses and the material for house construction The idea of settlement planning was well established at Harappa at a very early phase, Kot Diji (prior to 2600 BC). The basic overall layout of the settlements is distinguished by the orientation of the streets to cardinal points. [1]

Most private houses had rooms arranged around a central courtyard. Doors and windows opened out into side lanes. Stairs led up to the roof or the second storey. Windows had shutters and latticework.

Sir John Marshall describes the courtyard houses as follows:

*“To the right of the porter’s lodge a short passage led to the central courtyard of the house, which was open to the sky and provided light and air to the rooms grouped about it on both the ground and upper floors. And here, let me say parenthetically, that the principle of the open court encompassed by chambers was just as fundamental to – Planning at Mohenjo-Daro as it was throughout the rest of prehistoric and historic Asia, and as it has continued to be in India until the present day.”* [2].

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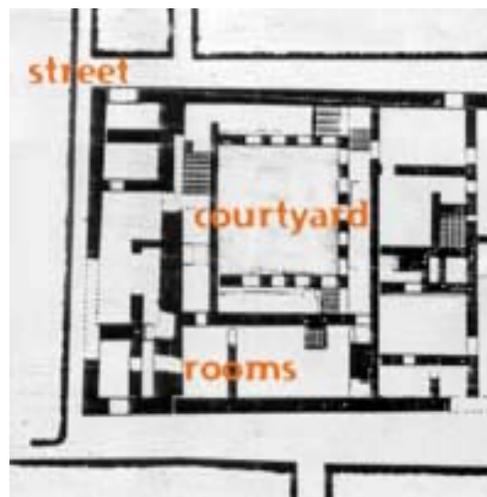


Fig. 1 Courtyard house in Indus Valley Civilization

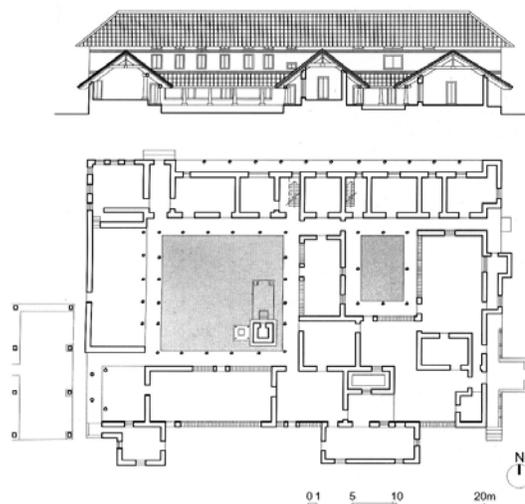


Fig. 2 Courtyard house in 18<sup>th</sup> century

“Architecturally a courtyard is better. It draws in cool air, which is useful in the hot and humid climate. Another necessary factor attributed in the courtyard area in the house plan is to have a vedika (sacrificial altav). It is a place for sacrificial pooja and family marriage.” The courtyard is climatically ideal for the tropics as it draws in cool air, which is circulated within the interior, replacing foul air. In non-tropical countries, the courtyard may have different

utility and type, which could be treated by different size of opening depending upon the location. [3]

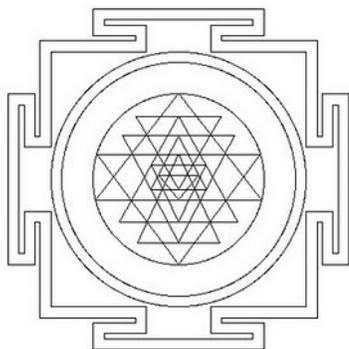


Fig. 3 Sri Chakra is the Yantra of the Cosmos. It is believed that the Angan(courtyard) represents the four corners of the Universe

This form of architecture met with the requirements of the traditional joint family system as well as the climate. The courtyard functioned as a convective thermostat and gave protection from extremes of weather. A dust storm could pass overhead with little effects on the inmates. The courtyard moderated the extreme effects of the hot summers and freezing winters of the Indian sub continent, and averaged out the large diurnal temperature differences. It varied from being a narrow opening to a large peristyle one in the interior zone of the house, with perhaps another or more near the entrance and the rear section. The total number of courtyards in one residence could sometimes be five to six. The courtyard house in India was not based on blind conformity and there was tremendous innovation over the intervening centuries.



Fig. 4 Chettinad central courtyard house



Fig. 5 Court yard house at Delhi

## II. CASE OF ATHANGUDI:

### A. Topography of region

The type of weather prevailing in region is hot and humid with relative humidity of 63% and average temperature of maximum of 37 degree centigrade and minimum of 24 degree centigrade. The average rainfall for this region is 75mm. In northern hemisphere near to equator regions the day temperature is high particularly during the summer season. Topography here benefits the micro climate variations. The rain water is collected in the manmade reservoirs and the ponds in order to provide water for the whole year to the village.

The soil here is formed due to the erosion from the nearby elevated ground, as it is a red morum soil and due to the little rainfall received the major vegetations is paddy, bananas, mango grooves and palm trees. The terrain is predominantly flat.

### B. Nattukottai chettiars:

The term nattukottai chettiars means people with palatial houses in the country side they are also referred to as “nagarathas” meaning city dwellers. As they lived in a city called poompuhar on the east coast of tamilnadu, a part of which went under the sea.

The nattukottai chettiars hail from a place called chettinad in South India an area situated in the south- eastern region of tamilnadu approximately 35kms to the west of the coastal line of the bay of Bengal in the district of sivangangai, during the initial stages chettinad consists of 96 villages but now due to the movement of the people out of certain villages it has diminished to 75 villages in the near past.



Fig. 6 Entrance of the chettinad house

The architecture of the chettinad region is well known and appreciated for its unique combination of various styles in the buildings. The house itself is built on the raised level with 6-7 steps leading to the entrance. The resemblance of the house with a temple is observed in the carving at the main entrance and paneled windows.

*C. Typical House of Athangudi :*

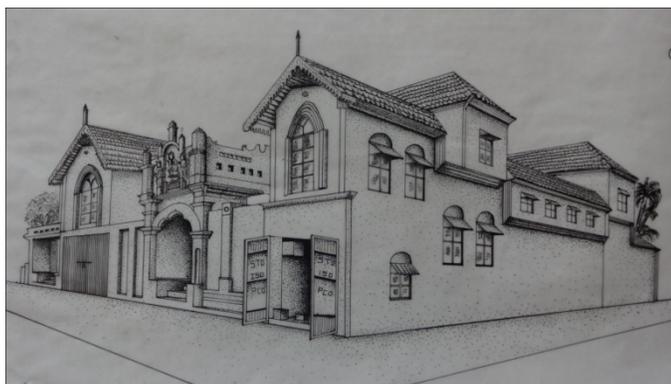


Fig. 7 View of the chettinad house

The foundation is laid for the house is rubble work done in stone combined with mud and mortar. The foundation is the step foundation.

The houses at Athangudi are mainly differentiated by their style of roofing, the front façade and the big entrances. This particular house represents a typical south Indian tamilnadu traditional house. The house faces the main road leading to the nearby town. As we enter the house we have a façade from where the steps lead to the sitting space. The entry to the private zone of the house is reached by passing through two main doors which intrinsically designed and a corridor with

elevated floor platforms on either side have pillars placed at regular intervals to support the roof. The scene of the private zone is observed firstly by elevated floor platforms and a central courtyard with a level difference. The family members use the courtyard for collecting rain water for the regular usage. The central courtyard is surrounded by a corridor which provides access to the rooms and the other part of the house and also these rooms are used for preserving the valuables and clothes. To reach to the first floor staircase is provided on either sides of the courtyard. As we move further, a spacious hall is viewed after which a smaller courtyard for carrying out the household activities is present. Three small rooms are present on one side of this small courtyard for storage of groceries. One phase of the courtyard leads to the kitchen. The kitchen has an exit door which leads into a narrow long corridor that directly meets the road in the front. A huge garden is planted behind the house which is rooted through the kitchen.

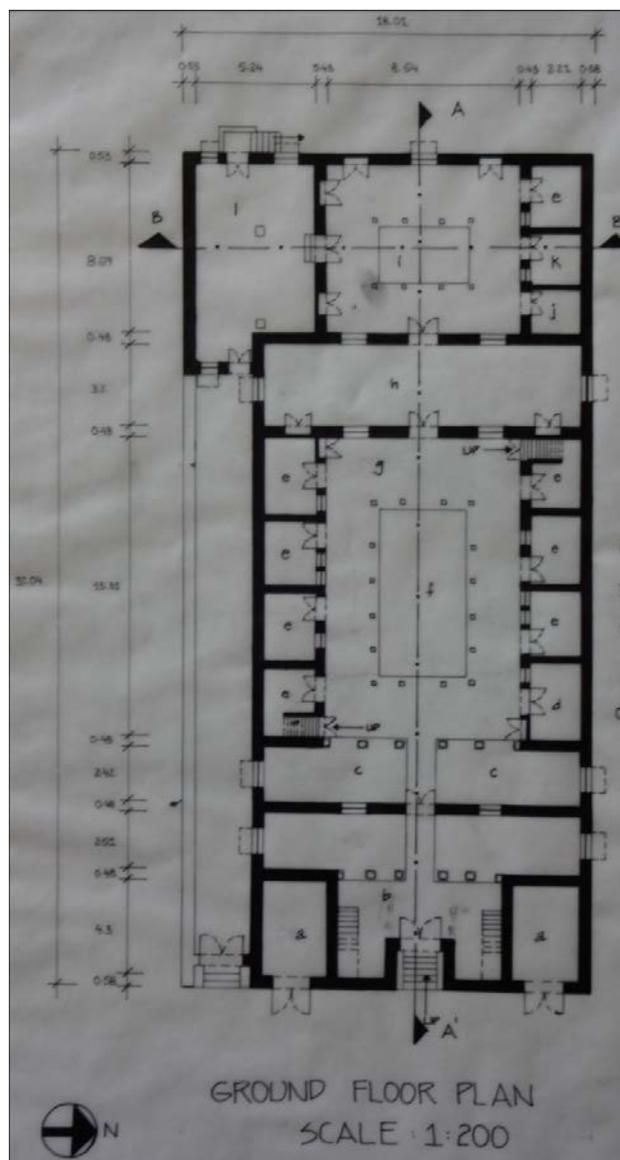


Fig. 8. Ground floor plan of the chettinad house



Fig. 9 Ground floor of the chettinad house

The house has three main levels

- Ground
- Mezzanine
- First floor



Fig . 12 Section of the chettinad house



Fig.10 Entrance foyer leading to the courtyard

Tiles are basically used for flooring. They are the typical Athangudi tiles which are locally manufactured. The color of the tiles is attained by the usage of paints imported from Italy. The process of manufacture of these tiles is done with a glass slab and dry cement. The flooring of the mezzanine floor and the central courtyard is cemented. Some part of the central courtyard is covered with mud tiles.

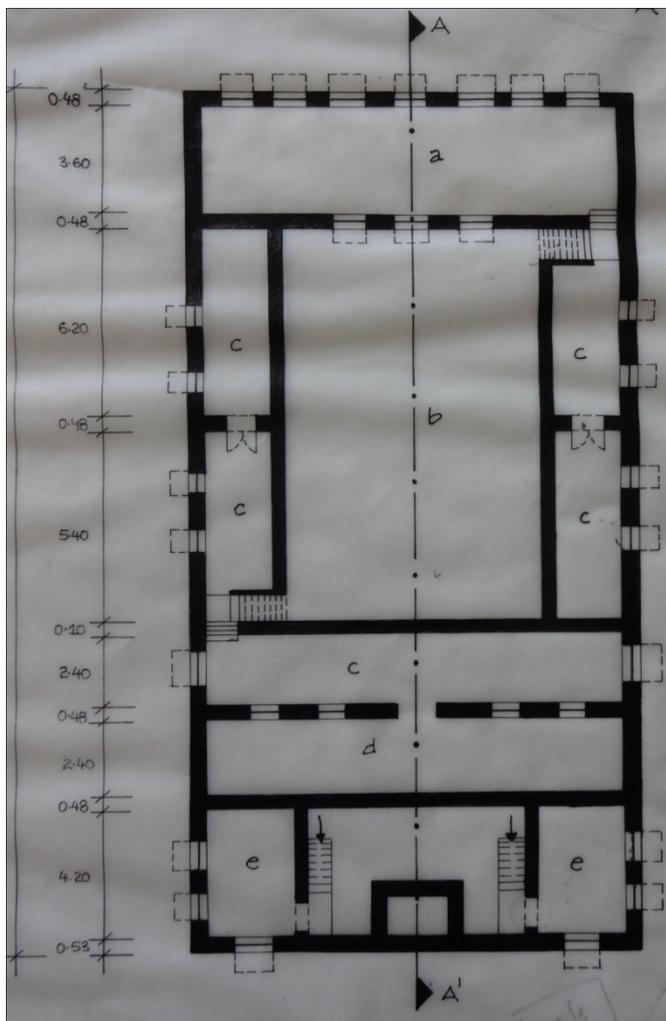


Fig. 13 Mezzanine and first floor of the chettinad house



Fig. 11 Corridor surrounding the courtyard

We have steps in the front sitting area that diverge to two different mezzanine floors. They were once used as kitchen, which now been used as a bedrooms. As we enter the private zone, we have steps leading to the mezzanine and the first floor respectively. The steps are hidden behind the door which

from an exterior view appears as a cupboard. As we go further up we reach the mezzanine floor where it is used for storage. As we move further upwards, we have a long hall that is used as interaction space and the family members usually sleep together. This long hall has windows that open up to the central courtyard. The hall which is on the front part is even opened to a balcony in the front.

The level differences created become the most interesting part of this house. This makes the place inside more interesting and creates a kind of interest in the mover. The walls of this house are made of mud and lime mortar and is then plastered and then painted to give a neat finish.

*D. Orientation of the house:*

The entrance of the house is towards east. The main ventilation by which the light enters the house is through central courtyard. On the Westside of the house there is a garden which also acts as a main source of fresh air into the house which promotes warmth in the house, and in the night the absorbed heat is radiated out through the courtyard.

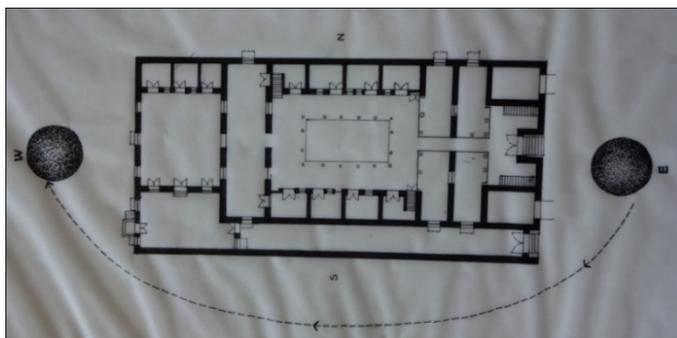


Fig. 14 Orientation of the house facing towards east

The courtyard acts like a thermostat which controls the temperature of the house. Negative pressure is created in the courtyard as it is surrounded by rooms and less exposed. This low pressure helps to draw more air towards it.

*E. Day analysis:*

As the temperature in the day time is high, little amount of heat is absorbed by the ground due to the top opening of the central courtyard and the light is reflected in the awkward direction resulting in the rise of temperature inside the house.

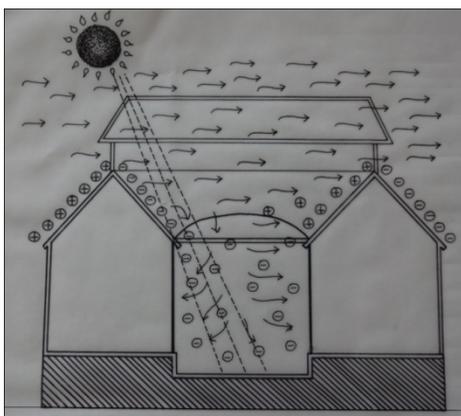


Fig. 15 showing the positive and negative energy

Due to the sloped roof, the heat and light from the sun travels towards the central courtyard creating and developing negative energy.

*F. Night analysis:*

The negative pressure and effect created inside the house during the daytime escapes out during the night time due to the floor materials of the courtyard projections.

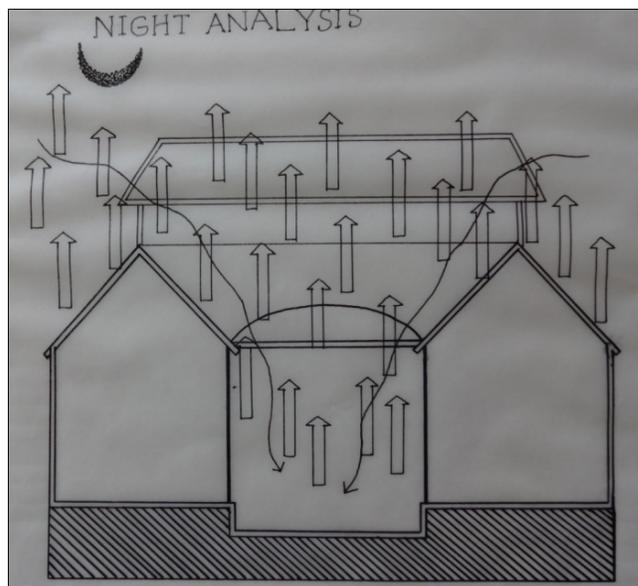


Fig. 16 showing the negative energy emitted from the house during the night

*G. Window projections:*

There are different types of projections used in the house depending on the length and size of the window. The projections of windows are built in such a way that they prevent the direct entry of sunlight which helps to reduce glare effect and radiation without obstructing the airflow into the room.

*H. Courtyard projections:*

The courtyard roof is projected 0.26m into the courtyard such that all the rainwater accumulates in the courtyard itself and to provide shade to the surrounding corridor. By this projection the roof provides ample shadow to the corridor as well as the room surrounding the corridor, in turn reducing the intensity of heat.

*I. Walls:*

The walls are of baked bricks, plastered over by sand and lime mortar with a mix of fiber roots which acts as a bonding agent and also coated with egg white to give silken smooth walls which are washable.

The bricks are made up of red soil available in the local area. These bricks reduce the temperature surprisingly, giving a cool and comfortable atmosphere inside the house and also providing an immense stability.



Fig. 17 Photograph showing the placement of bricks and mortar used to bind the mud bricks

*J. Roof:*

The roof of the house is very complex. The level differences in the house actually make it very complex. The house has pitched and slant roofs. The pitched roofs are made with alignment of country tiles over wooden bars which rest on wooden logs connected to the wall. The roofing of the ground floor is done with mud mortar, mud bricks and properly finished with Calicut tiles along the edges of the wall. The wooden logs to the roof are joined with side walls with the help of a small wooden strips, the angle of inclination varies from place to place in the roof. The central courtyard is left open and grills are attached to the ends of the slant roof surrounding the courtyard so as to prevent the entry of birds, animals, and thieves. The roofs are covered with terracotta tiles.



Fig. 18 photograph showing the different roofing levels



Fig. 19 photograph showing the view of courtyard

III. MODERN HOUSES ARE COURTING COURTYARDS

AHMEDABAD: Architect P H Majmundar's house near Law Garden remains about three degrees cooler in the middle of May. He may have an air-conditioner all right, but the real 'air-conditioner' that has been regulating the heat in his house since 1995 is the rooftop 'chowk' or courtyard.

One might call it a revival of the Indus Valley Civilization. Open-to-the-sky 'chowks' or courtyards in houses were the 'Brahmasthan' during the civilization; the soul of a house. Primarily used for community-based activity or sacred rituals, courtyards were instrumental in regulating the temperature. "Each courtyard had multiple environmental advantages. They were linked to 'tanks' for harvesting rain water. Besides, the sunlight illuminated the houses yet did not heat it up.

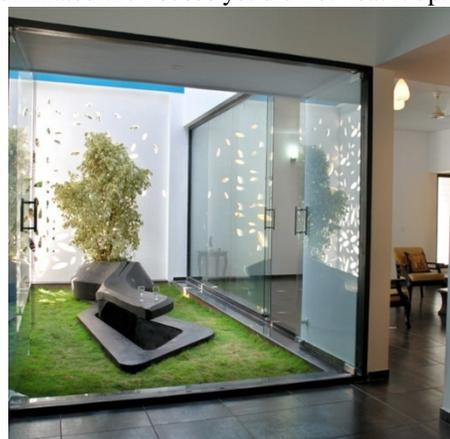


Fig. 20 Court yard in Modern Building

Evolving over the centuries, courtyards have been used for a variety of purposes. Cluster houses in medieval India were made as a defense against invading armies. Courtyards were inevitable in these houses with shared walls. In 'pols', courtyards help to 'connect' with family members on other floors of the house.

"Integration of indoors with outdoors and the unbuilt with built space provide for mutual counterpoints. Unbuilt space such as courtyard functions independently within themselves as individual foci and yet interconnected systems of courtyards create a large space structure, as an integral part of overall space organization. [4]

#### IV. CONCLUSION

Thus, courtyards have been playing a major built component, since the past in creating better lighting, ventilation and thermal comfort. It also plays a major role in creating a social space within homes or group of homes. It also acts as a space to gather and space to interact and space with lot of activities, whether in groups or personnel or occupational. The modern day homes, lack the ideology of creating a better living and creating nature as part of design, to create sustainable solutions. Courtyards could also be part of our modern home. Creating better living solutions with adapting and learning lesson from past, to create sustainable solutions is the need of the hour.

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