



# THERMAL PERFORMANCE OF COURTYARD IN POL HOUSE OF AHMEDABAD



Mihir Vakharia

*The tradition of having a courtyard in hot-dry and hot-humid climate has been in practice since medieval times. This study focuses on the presence of courtyard in residential unit – “Pol-House” as it is known in vernacular language, in the city of Ahmedabad. This study is an endeavour to understand the thermal performance of a courtyard and its effect on adjacent and indoor spaces of traditional Pol House.*

TEXT & PHOTOS COURTESY: Mihir Vakharia

In the old city of Ahmedabad, the residents of each neighbourhood tend to belong not only to the same religion, but also to the same caste or occupation group. The gate into the neighbourhood could be closed for security and each house had capacity to store its own water and grains. These neighbourhoods are called “pol” after the Sanskrit word ‘pratoli’ meaning gate or entry and the houses in such neighbourhoods are popularly known as “Pol houses”. The traditional house form of pol neighbourhood is primarily for joint families with three generations staying together.

Pol houses typically have minimal frontage on the street, which is quite narrow. The environment in these neighbourhoods is quite dense. The linear structure of the pol house and a sequential organisation of spaces with respect to the level of privacy, from the most public spaces towards the front side of the access road to the most private spaces deep inside the house away from the road, the Pol house plan represents the spatial characteristics that are most suited to the climate of the region.

The public and the private spaces

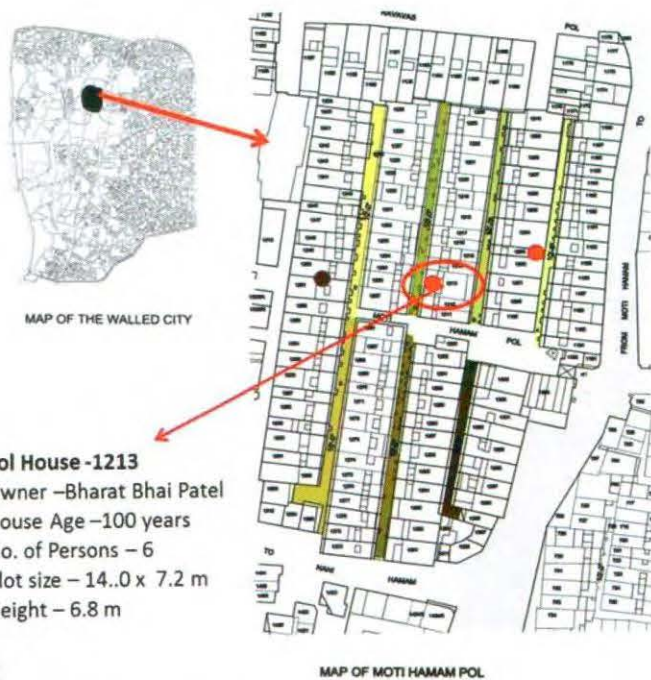


are separated by an open-air *chowk* (courtyard), which acts as a thermal regulator for the house. The public spaces are social spaces, whereas private spaces are functional spaces. The linear organisation offers this type of separation. Here, the *chowk* becomes the hub of all the activities and binds the other spaces together. The interior rooms tend not to be designated as living room, dining room or bedroom, but rather to be flexible in their use. Easily movable furniture and bedding allow migration from room to room as necessary for changing to find comfort during the seasonal changes.

*Pol* house construction is generally based on a structure of wooden posts and beam infill walls of brick. The brick walls are not exposed to weather, but rather are plastered on the interior and exterior sides. Side walls of the house tend to be shared with the house next door and the house occupies the entire plot of land.

### Analysis : Looking at a case study

Residence of Bharat Bhai Patel situated in "Moti Hamam ni *Pol*" area was selected as part of study to understand the thermal performance of a courtyard. The building is placed between two streets and is east-west oriented. It shares the



north and south wall with the adjacent buildings. Hourly dry bulb temperature and relative humidity measurements in each of the houses were monitored for three continuous months, April, May and June and the following was observed:

### Open Spaces (courtyard):

Being the central open-air part of the house and holding all other spaces together; it also acts as the activity hub in a house. All the

1. A street view of the pol houses of Ahmedabad

2. House 1213 in 'Moti Hamam ni *Pol*'

Small, unused attic space at the back of the house acts as a buffer space for the four rooms on the first floor behind the courtyard.

Courtyard is partially shaded at top by overhang of the pitched roof, which minimizes the solar gain.

Semi open spaces around the courtyard are used for different activities depending upon time and season.

Ordo (a bedroom): The ordo is the inner most space of the house, deep inside from the street; essentially, it is a private space used for sleeping and storage.

West facade (front) constructed of wood contains bigger openings while east facade (east) contains smaller openings.

Chowk (a courtyard): It is the central open-air part of the house and holds all other spaces together; it also acts as the activity hub in a house. All the activities take place in and around the chowk. The narrow proportion of the chowk acts as an aperture in a compact layout and serves as the climate regulator of the built form.

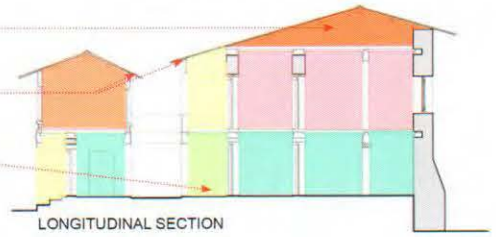
Utility areas The water closet is placed in front and is attached to the otla or khadki rather than to the private spaces in the house.

Khadki/Baithak (a living space): It is a sitting space for guests, and many times, it is equipped with a traditional swing called a Gujarathi swing.

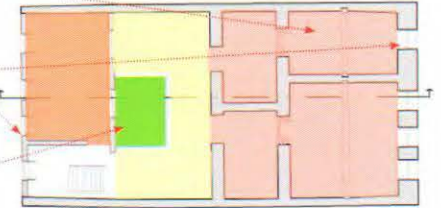
Parsal (a family space): The parsal is multifunctional space deep inside the house behind chowk and is considered a private space for family members.

Resodu (a kitchen): The resodu is the kitchen of the house that is adjacent to the osri, chowk, or parsal.

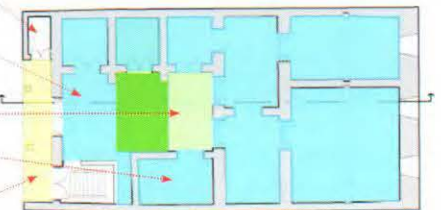
Otla (a veranda): It is a semi-covered space, shaded by the projections of the upper floor balcony.



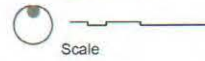
LONGITUDINAL SECTION



FIRST FLOOR



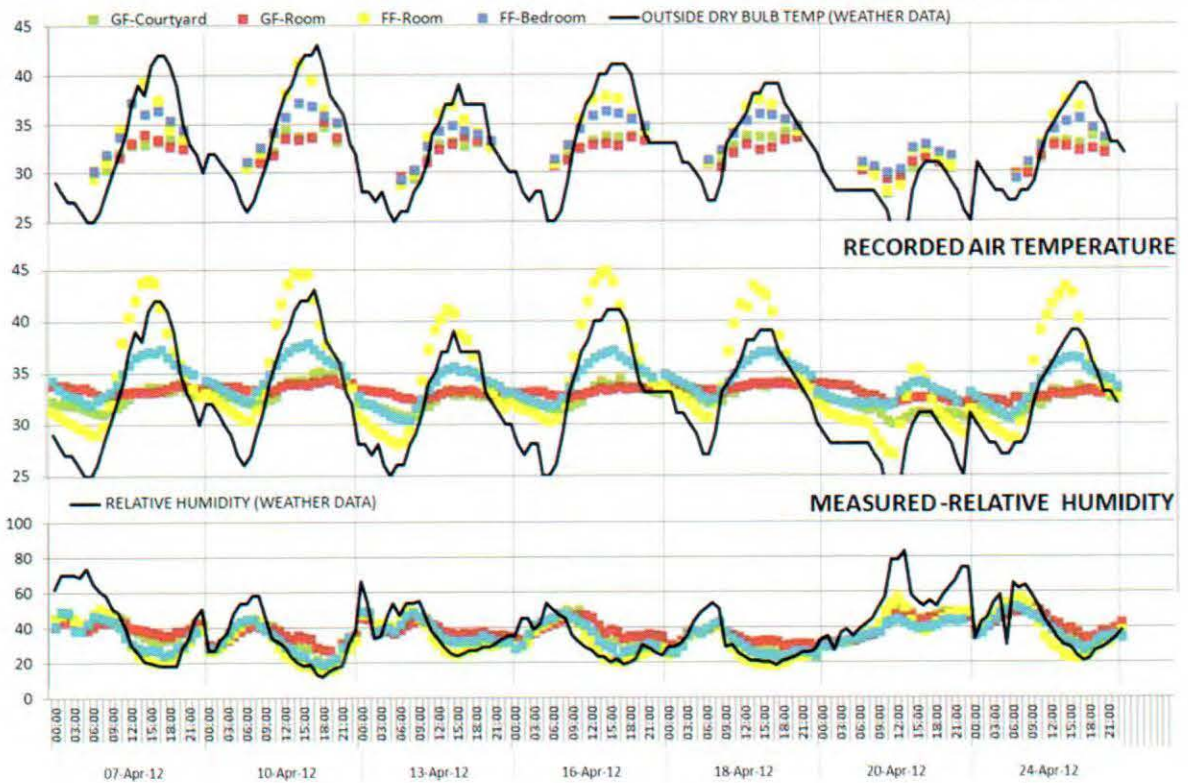
GROUND FLOOR



3

4

CALCULATED OPERATIVE TEMPERATURE



activities take place in and around the chowk. The narrow proportion of the chowk acts as an aperture in a compact layout and serves as the climate regulator of the built form. Reading shows courtyard has higher diurnal temperature changes than other spaces, with greater temperature in daytime and lower temperature at night time. Since opening on east and west façade is closed during day time, courtyard acts as air shaft also playing a major role for ventilation of indoor spaces. Courtyard also improves humidity levels in the indoor spaces due to which, though there is rise in outdoor temperature, people in the house feel more comfortable by increasing airflow.

### Spaces adjacent to courtyard:

Spaces adjacent to courtyard are divided into two categories: ground floor rooms, first floor rooms. Due to maximum solar incidence on the roof, the front rooms on the first floor without attic floor and thin roof shows maximum temperature during daytime and minimum temperature during night. Reading for ground floor rooms show minimum impact of outdoor temperature hence these spaces are used during daytime for living and dining purpose. While first floor rooms below attic floor receiving direct solar radiation on external wall surface show rise in indoor temperature during daytime.

### Attic spaces:

The attic floor with pitched thin roof is a top most floor in the house which is typically used as a storage space. In *Pol* house attic space acts as a buffer space for first floor spaces and protects first floor spaces from direct solar radiation. Readings show impact of solar incidence on first floor with thin roof. Attic floor shows maximum operative temperature during daytime and



minimum temperature during night. These spaces are mainly used during night for sleeping.

Incidence of solar radiation on building roof surfaces is the main source of heat responsible for raising the temperature of exterior surface of the envelope and also for creating temperature gradient across the thickness of the envelope. As a result, heat is conducted from outdoor to indoor surfaces and causes a rise in the interior air temperature. Ground floor courtyard is shaded throughout the day and acts as shaft for ventilation, hence improves thermal environment of adjacent and interior space. The inside surface temperature remains same throughout the day and shows minimum variation with outside dry bulb temperature, on the walls of ground floor rooms. However, performance of *pol* house is also dependent on flexibility of usage of the spaces which plays important role to achieve comfortable temperature conditions throughout a day and year. ●

.....  
*This research is part of the study conducted by Mihir Vakharia under the guidance of Prof. Rajan Rawal at Masters of Interior Architecture and Design course at Faculty of Design, CEPT University*

*Mihir Vakharia is independent Architect and assistant Professor at Dr. D Y Patil College of Architecture Akurdi, Pune.*

© [mihirvakharia@yahoo.co.in](mailto:mihirvakharia@yahoo.co.in)

3. Plans and sections of the house 1213 in Moti Hamam ni pol detailing the architectural features of the house

4. Detailed graph for House-1213 showing hourly data of dry bulb temperature, operative temperature, air temperature and relative humidity in April 2012

5. Front view of the selected house showing the *otla*

*“The public and the private spaces are separated by an open-air chowk (courtyard), which acts as a thermal regulator for the house”*