

Pol's houses in Ahmedabad: the evolution of architectural elements and their influence on community living

Amit Kumar Jaglan

Assistant Professor Dr., School of Planning and Architecture, New Delhi
Email: footprint1109@gmail.com, amit.cf.arch@spa.ac.in

Neha Korde

Assistant Professor, School of Planning and Architecture, New Delhi
Email: neha.korde@spa.ac.in

Prachi Patel

Assistant Professor, Institute of Architecture and Planning, Nirma University, Ahmedabad
Email: prachi.patel@nirmauni.ac.in

Abstract

Traditional and vernacular architecture may be found in India, a country with a long history, where medieval typologies have had an influence on residential housing. Gujarat's Pol's dwellings are distinctive community housing designed for the local climate and social requirements. The 1990s had a huge influence on lifestyles and social structures from globalisation and liberalisation. People believe that the current demand for inhabitants cannot be met by Pol's dwellings. Pols were originally established in Ahmedabad during the Mughal-Maratha era (1738–1753) to bolster security during racial unrest. In addition to fostering social cohesiveness and protection, the network of curving roadways also creates shaded places that may adjust their location according to the weather. With its shared walls and shaded rooms that resemble open spaces, the architecture of Pol's houses is an amazing evolution of urban life. With a particular urban sense and a special blending of urban and open settings, this urban experience may be distinguished from gated plots in contemporary suburbs. Insightful architectural knowledge may be gained from Ahmedabad's distinctive Pols. They might take inspiration from the design of their tight-knit communities, which emphasises compact organisations, shared walls, courtyards, and areas for interaction to produce sustainable and humane settlements. Social media networks provide tangible proof of the enduring need for humankind to interact with one another in order to survive, a necessity that was formerly met by the inherent design of Pols. In this study, the physical layout, social structure, and history of Pol's houses in urban environments are examined using a survey of the literature. The paper analyses the spatial character of these design elements and principles of spatial organisation to analyse characteristics of pol houses which underlines the sense of community living. The dwellings are a crucial component of the building since they also adhere to aesthetic standards and have logical embellishments. Local governments must take part in and preserve vernacular built heritage since it is an essential component of a place's history, culture, and lifestyle.

Keywords: Ahmedabad, Dwellings, Urban Environment, Vernacular Built Heritage, Physical Layout, Social Structure.

1. Introduction

Pol houses (pols) were built during times of community conflict and social upheaval in the old city of Ahmedabad, hundreds of years ago. The pols are not just vibrant and energetic but were purposefully constructed for protection and security during the war, with large courtyards, finely carved wooden facades, paintings, and coloured exteriors. When sectarian unrest necessitated enhanced security under Ahmedabad's Mughal-Maratha administration (1738–1753), pols were developed as a safety measure. A typical pol would only have one or two entrances, along with a few private entrances used solely by inhabitants. While the men utilized the front door to face and negotiate with the enemy, it also allowed women and children to escape to the network of passageways that connected the pols. Since that time, these Poles have fostered life and culture while paving the road for the urban way of life. Some pols have historic, opulent mansions with indoor courts that have frescoes painted on the walls or ceilings and intricately carved wooden facades and columns. Pol houses display a fascinating progression of urban community living. Pol dwellers can see and communicate with other inhabitants because of the tiny streets. An intimate community is fostered by the interwoven network of meandering streets. Urban compact setting with shared walls creates shaded regions standing upright as human habitat that is responsive to the climate as a result of the need for social cohesion and protection. Unlike the gated plots of the modern suburbs, it has a wonderfully defined urban sense and is almost like an infinite fabric where the mass proportions are practically the same as the open regions. Between this urban setting, architectural character, and the human asset, these pol houses exhibit their distinctiveness and authenticity, and the traditional notion of community living. What is unjustifiably ignored is the fact that these settlements have never been frozen in time. Rather, they are a product of multi-layered additions of cultures, styles, and social and economic development (Mistry, 2018). Along with these guiding planning principles at the macro level, a typical pol house displays intricacies featuring architectural elements such as such as Otlo (semi-covered verandah at the entrance), Khadki or Baithak (drawing room), Chowk (courtyard), Rasodu (kitchen), Parasal (semi-covered corridor around the courtyard), and Ordo (bedroom) moving from exterior to the interior of a housing unit. The paper analyses the spatial character of these design elements and principles of spatial organisation using a survey of the literature and live case study. These two lenses are discussed in the paper to understand the changing character of each space with respect to the time, user, natural light, and its relevance today in the community living. The research also tries to identify the pragmatic design and construction methods adopted in Pols houses exploring its complex but confined urban setting, climatic adaptability, use of local building materials, and local construction techniques exhibiting the vernacular characteristics of the community housing.

2. Research Methodology

The paper explores two lenses at the macro and micro scale to analyse spatial characteristics of pol houses which underlines the sense of community living through its principles from historical times to current times. The qualitative analysis is conducted to demonstrate the timeless character and its resonance with community engagement at both scales (macro and micro) through identifying planning principles adopted and changing the spatial character of design elements of a typical pol house. Also, the paper analyses the transition of spaces

moving from exterior to interior; from public space to private space and how the play of natural light affects the design principles in the layout.

2.1 Origin of Pol houses: Social and cultural reverence

Since 1411, the city of Ahmedabad has existed, having a history of embracing contemporary living. In July 2017, UNESCO designated it as India's World Heritage City. Ahmedabad's old city features "Ahmedabad pol housing," which demonstrates an example of community living following distinct architectural elements and planning principles in its design. The Gujarati word "pol," which means "gate" or "entrance," designates a group of dwellings built around a central courtyard. It may be approached through a small entrance gate. The "Pols" are a collection of dwellings that are/were often occupied by people and families connected together by caste, culture, or profession. The pattern of Pol settlement has its origin from the rural villages of Northern Gujarat. In a rural settlement, all families along one Khadki (street) belong to the same caste and are also related by blood. However, in an urban setting, the Khadki belong to different castes (Gaurav Gangwar, Prabhjot Kaur, Inderpal Singh, 2020) Political authorities and wealthy merchants deliberately founded the walled city of Ahmedabad. From the very beginning, various castes were invited to settle in one ward, e.g., in handloom business, one caste made yarn, the other dyed it, third worked it into cloth, fourth painted it, fifth financed the various stages of work and ultimately sold the finished product. Castes and religious communities built their settlements as per their respective architectural tradition, and thus, the settlements resembled the rural pattern. (Gaurav Gangwar, Prabhjot Kaur, Inderpal Singh, 2020)



Figure 1 (a): Typical layout of Pols spread across the main road in old city of Ahmedabad, Gujarat showing dense urban fabric of community housing. **(b):** Pol houses layout seen in Fad Pol in house 3003 is marked in red which is documented under measured drawing activity for study purpose.

Pols are the representation of the culture and traditions of the Walled City of Ahmedabad. The typical organisational layout at macro scale can be seen in Figure 1(a) and 1(b) at micro level. Even today, life in pols continues to thrive as it always has throughout the centuries. Hence, it is imperative to preserve these structures and neighborhoods. The pols and the pol houses have evolved through time to the changing needs of the communities living there. The changes are in the form of new construction materials and techniques, the introduction of modern amenities like vehicles and required parking spaces, and the increasing need for privacy among the younger generations. Today, there is an urgent need to develop a critical culture in which heritage is to be accessible and understood as a mediator between past and present: heritage must belong to the present in the same measure as it belongs to the past. Heritage is about the present, it lives in the present and is received, practiced, and consumed by people today (BEMIS, 2011) . Architectural practice and regulations in traditional vernacular settlements have become counter-productive and misleading, when it comes to the future of historical contexts. Local governments must take part in and preserve vernacular built heritage since it is an essential component of a place's history, culture, and lifestyle.

2.2 Introvert Planning Principles: Courtyard as a node

The sense of enclosure and privacy highlights the traditional pol houses in Ahmedabad. The cosmic-square philosophy of the Mandala guides the relationship and orientation of the different spaces in the house with the central node in the form of the open-to-sky court. Courtyards in Pol houses are the direct expression of the socio-cultural values of the times and society. The organization of space within the household reflects the social relations between men and women, elders and young in the family, and also, most importantly, the social structure. In India, like in most other cultures, the courtyard form was a direct response to the social preference for privacy and seclusion in family life as well as the climate. The need for privacy, light, and ventilation in the interior spaces, paved the way for the form and spatial character of these courtyards. It allowed daily life functions to happen cohesively and concurrently without disturbing the outer social functions of the male fraternity. In India, the courtyard houses (wadas) are highlighted by two courtyards, the outer court or baithak which served as the visitors' sitting area or public space; and the inner court which was mainly the women's area or specifically the family members which is also being followed in larger pol houses. The courtyard is the central focus of the house which is enlivened by different daily activities. The spaces around the court are used for various functions. Towards the exterior are living rooms where friends, neighbors, or guests may be entertained without giving them total access to the interiors. In general, the main door in all pol houses is usually offset in the home façade and opens into an anteroom from which a largely unornamented doorway leads into the courtyard or house interior. Thus, the main entrance is located in a manner that does not allow the outsider to directly gaze into the courtyard. Window openings of a room face towards the courtyard or towards the street outside, though the number of such openings on the ground floor is restricted. This inward view helps to provide privacy within the house with each opening behaving like a one-way mirror that is screened from the exterior by the strategic positioning of jaalis or jharokhas. The jaalis help in filtering diffused light into the rooms while effectively ventilating it. The window openings are smaller near the street level

but expand as one moves to higher levels. At the upper levels, windows become centers for socialization and places to observe street activities. The level of intimacy, and publicness reduces and increases and decreases respectively when moving from exterior to the interior of a typical pol house.



Figure 2 (a): Ground floor plan of the pol house 3003 showing the hierarchy of spaces moving from the exterior to interior part of the house: 1. Entrance, 2. Otlo, 3. Baithak, Rasodu, 5. Staircase leading to first storey, 6. Utility, 7. Parasal, 8. Ordo, **(b):** longitudinal section showing the intricate detailing and vertical massing.

3. Architectural design elements and their spatial character

The pol houses are between 12 and 18 meters deep and 5 to 6 meters broad. These houses have a trait that makes them more permeable and keeps them together. These peculiarities in their spatial structure, which is quite distinct in typical shapes, are straight and practical being distinguished by its use of wood and its elaborate carvings. The linear and narrow form of these houses are the outcome of the safety issues while living in the community in the beginning. The typical elements that make the pol house are shown in Figure 2(a) and 2(b) such as, otla, baithak, chowk, rasodu, parasal and ordo. The relationship between these spaces, its quality of responsiveness for the different functions, and the events that happen in the space are explained here.

3.1 Otla (Semi covered Verandah)

The entrance space as a transitional zone is an important concept in the cultural study of any traditional house form. A transitional space, open or semi-enclosed, is an otla; an essential component of the dwelling in the Indian context. It should be viewed in its plurality. At one level, it is an architectural solution to the problem of connecting the dwelling to the street. At another level, it is full of social meanings symbolizing welcome, auspiciousness, and status. This necessary in-between realm is also an indirect form of passive control that shapes people's behaviour on a day-to-day basis (Desai 2007, 70). In traditional pol houses of Gujarat, otla is a common element - dense, traditional neighbourhoods consisting of a single, usually dead-end, street and protected by a gate. The otla serves an important social function in these neighbourhoods. Madhavi Desai states, in her study of Muslim Bohra dwellings, "Unlike the Hindu otla that becomes a physical extension of the house/street, the otla in Bohra dwellings is seldom used as an activity or interaction space. The relatively higher plinth of the otla not only reveals the resident's social status but also protects their strong notion of privacy that is essential in an Islamic community" (Desai 2007, 73-74). However, Desai

does note the otlá's role in conveying social meanings symbolizing welcome, and emphasizes that the otlá "remains an aesthetic and symbolic part of the house as far as the social activities of the Bohra families are concerned" (Desai 2007, 70).

Otlá becomes the primary element which acts as a receiving space for the pol house. The elements that define the entrance of the space as well as connect the street with the house. A semi-covered space with column supports at the edges and sometimes in the center acts as a transition space between inside and outside. The social life of the people in the pol is largely woven around the otlás. Also, it holds the front facade of the house due to which it is generally highly ornamented by wooden carvings. Each ornamented element is the main structure of the house. The use of wooden columns, wooden beams and brackets, lintels, and clerestory windows make the front facade magnificent. Due to the scale of the narrow street, the otlá receives natural light, and at the same time, it remains shaded for different activities. It becomes an important space of the house where during the different times of the day it offers a space for varied activities. In the morning, activities like reading the newspaper, having a cup of tea, children studying and playing, women braiding hair, etc. During noon hours; chopping vegetables, weaving on clothes, etc. During the evening hours; residents occupy it the most for sitting, interacting and socializing, having tea, children playing, etc. This element becomes the most public part of the house, where people from the neighborhood can come and sit. Also, some women of the pol work together at the otlá, especially at the time of festivals like making snacks during Diwali. This way, the neighborhood becomes a larger community who have a mutual dependency on each other and, hence, they behave as a large family. The otlás also has a small chowkdi (washing space) beside it facing the street. At the time when the pol houses were built, it was difficult to have plumbing lines inside the buildings. Each house has a provision of plumbing lines for the water supply and drainage till the beginning of the house. Hence all the functions and spaces like bathing, toilets, washing, etc. were located near the entrance of the house.

3.2 Baithak (Drawing room)

Passage from the otlá leads to the baithak which acts as a lobby for formal sitting and gathering space for the guests visiting. On one side it is connected to the main entrance of the house while on the other side, it is connected to the courtyard. Both the edges light up the space and have a comfortable temperature due to the cross ventilation through the court. This space becomes semi-public in nature where guests and visitors are entertained, the interior facade acts as a backdrop for various activities and is hence decorated accordingly. A unique characteristic of the traditional pol houses is the inclusion of the hinchko (swing), the gentle motion of which in a warm-humid climate creates a breeze with minimal effort allowing one to take a rest, a nap or just to sit and relax. Most of the time the hinchko becomes the focal point of the space, which adds little informality to the baithak.

3.3 Chowk (Courtyard)

The concept of the central space is distinct and clear in the manifestations of Indian built form as the conceptual, ideational, and manifested center but not always necessarily as the geometric or physical center of the entity. The basic concept is that the center or the assigned central space of any entity, natural or created, absorbs and disperses all contradictory energies, and therefore it determines the generic core of that entity. This, combined with the

region's hot and dry climate, resulted in the densely built fabric of the settlement with deep, long houses in a continuous row, with walls shared on almost three sides and an open-to-sky inner court. For the people who are living in the pol house, the courtyard becomes the space to reflect themselves inside the house. The courtyard connects to different elements of the houses like rasodu, baithak, and parasal on the same floor. The windows on the upper floors also open up in the courtyard, which connects the spaces and creates a dialogue between the vertical spaces. Rainwater from the roof is collected through the courtyard in the underground storage tank below it. In most houses, the tank is placed below the courtyard and in some cases, they also have a small well in the corner of the courtyard, where the water for the entire year can be stored, due to which the space above and around it remains much cooler than usual. People in the house use the courtyard the most for multiple activities throughout the day.

A courtyard is a system in itself, rather than an isolated element. It integrates and connects to other subsystems such as windows and courtyard; rain, vegetation, wind, and courtyard. As a window to the sky, the courtyard is the most critical element for life energies such as sun, wind, water, and vegetation, and has been traditionally used for water harvesting, ventilation, and heat and light control. The courtyard served as a critical element for negotiating light and air ventilation within the house without inviting the vagaries of the intense and harsh climate. The internal courtyard also aptly supported the notion of privacy maintained by the introverted lifestyle and domestic routine. The courtyard becomes the activity center of the house, accommodating sacred and important functions such as cooking, eating, worshiping, water storage, and relaxing. Courtyard is the threshold demarcating the family space from the outsiders' realm. Based on these considerations, the courtyard is rendered as the most characteristic component of the built form underlining the sense of community living in the pols of Ahmedabad.

3.4 Rasodu (kitchen)

Since the courtyard is the living and socio-cultural space in the house, the rasoi ghar, or cooking place (kitchen) is usually located in and around the chowk (courtyard). When located in the courtyard, it becomes a focal point of many activities in the house. The courtyard also offers good ventilation. Kitchen activities spill out into the court and blend with the different activities taking place there (Pandya 2022). The traditional kitchen has a separate space to place the drinking water, which is called Paniyaru, a place to store drinking water. In some of the houses it is on the edge of the court near the kitchen and it acts as the most decorative element of the house. At the time of festivals, this place becomes the focal point for conducting rituals. As per the Hindu belief system, people start their day after lighting the lamp at this place. During occasions of birth and death, this place is cleaned and the earthen pots used to store water are changed.

3.5 Parasal (Semicovered space around the courtyard)

From the entrance, on a linear axis as one goes towards the inside, just after the court the semi-covered space aligned with the courtyard is termed Parasal. This space may have the same level as the courtyard or be one to two steps elevated than the courtyard. The level difference between the court and the floor of a parasal creates a very comfortable threshold where people can sit and perform various activities. This becomes the most lively living space

in the house for all purposes. Long ago people used to sit on the floor for a meal in this space; now some of the houses use a separate space as a dining space with tables and chairs. More or less the daily routine takes place in and around this place. The hinchko sometimes finds a place in parasal around the chowk in the larger and comparatively well-off pol house. A few other loose traditional artifacts and furniture pieces with intricate carvings are found in and around the courtyard.

3.6 Ordo (bedroom)

Ordo in the innermost room which is utilised as a bedroom or a storage being the most private corner of the house with the least amount of light and ventilation. It is the most private space in the house. Here, people also store the grains for the entire year for the family. Also, the jewelry, savings, or whatever has more value to it used to be kept here.

4. Observation and discussion: Relation between light and level of privacy

The built fabric of the pol is compact through parallel walls having one end acting as an entrance in the street and another adjoining to the houses at the back or opening into another pol through a small window. This design principle for neighbourhood remains the main reason for forming a closely knit layout of compact pol houses. Here, the source of natural light becomes very important. The semi-covered space “otla” facing the street has good daylight and becomes a major space for sitting and socializing. This element which is there outside the house by nature becomes a public space of the house, where people from the neighborhood come and do certain activities together. The dense fabric and narrow street create a kind of neighborhood which has a sense of security within the pol between the people who live there. This scenario allows people to keep the main door of the house open from morning until night, due to which light can penetrate inside the house. As you move further inside the house through the main door, a space termed “baithak” comes. Here the indirect light from the main door lights up the whole area, and the light coming through the courtyard makes this space livable enough throughout the day. This area becomes semi public in nature due to an adequate amount of light. The daily practice is the neighbor and the guest come to baithak, which has a spatial arrangement of the space in such a manner that people can sit and interact with each other. In ancient times any of these areas didn't have a set of furniture defining the space. Each space has a character that can be used in a multifunctional manner. The setting used to be on the ground on the elevated wooden sitting which is movable. “Hinchko”, a wooden swing is a major piece of furniture in pol houses and becomes the focus of baithak. The “chowk”, courtyard becomes the place to hold the majority of the activities in and around it. This acts as a gradual transition space from public to private. The “parasal” (semi-covered space around the courtyard) behaves as a semi-private space in nature. The level of the courtyard is a step or couple of steps down from the rest of the area due to its quality of space which is open to the sky. At the threshold of the courtyard and parasal, this step becomes the most occupied space on the ground for several kinds of activities. As the “rasodu” (kitchen) and “paniyaru” (a place to keep drinking water in a pot) are attached to the courtyard, the parasal acts as an informal living, eating, playing, relaxing, and interacting space within the house. The quality of light it holds and its introvertedness due to the courtyard make it semi-private space in nature. Further inside the house, ordo becomes a space where no light or very little light penetrates through a small window.

5. Conclusion

There is a need to think about how Pol houses can become an actor in benefiting the community living in the future to deal with the upcoming challenges of dense urbanisation. The traditional settlements of the pol houses display two distinct spatial features, public and private, underlying the crucial principle of community living. It is seen that the spaces towards exteriors of the pol houses towards the main entrance are meant to be for interaction and community engagement. Whereas, towards the interiors, spaces like baithak (drawing room), and chowk (courtyard) display the semi-public character but become a common space: "public" for the family members living within the house. The reach of the natural light also plays an important role in the intricate detailing of the house such as windows, roof, and upper storey planning. At the same time, the chowk (courtyard) also acts as an invisible separator between the public and the private activities in the house.

Acknowledgement

The documentation exercise that took place at Nirma University has provided the base for this paper for further research. The drawings are produced by the students of the second academic year in Bachelor of Architecture (2022-23) under the supervision of assistant professor Prachi Patel and her team.

References

- "Amdavadi Pols: The Doors That Still Welcome You." GoUNESCO | GoUNESCO. September 21, 2017. Accessed April 02, 2018. <https://www.gounesco.com/pols-ofahmedabad/>
- A. I. García, & F. Desai, Madhavi. (2007). Traditional Architecture: House Form of the Islamic Community of Bohras in Gujarat. Hyderabad: National Institute of Advanced Studies in Architecture.
- Agarwal Kanika. (2009). Residential Cluster, Ahmedabad: Housing based on the traditional Pols. PLEA2009 - 26th Conference on Passive and Low Energy Architecture, Quebec City, Canada. June 2009.
- Agarwal, K. (2009). Residential cluster, Ahmedabad: Housing based on the traditional Pols. In: 26th PLEA Conference on Passive & low energy architecture, Quebec city, Canada, 21–24 June 2009, Canada: Université Laval.
- Bandyopadhyay, A., & Merchant, A. (2006). Space Syntax Analysis of Colonial Houses in India. Environment and Planning B: Planning and Design December, 33, 923-942. <http://dx.doi.org/10.1068/b32082>
- Benedict, L. H. (1979). To Take Hold of Space: Space and Isovist Fields. Environment and Planning B, 6, 47-65. <http://dx.doi.org/10.1068/b060047>
- Bhatt, M., Joglekar, P., & Pandya, Y. (1997). Jethabhai ni Pol, Khadia, Ahmedabad; A Documentation of the living environment. Vastu shilpa Foundation, Ahmedabad, India.
- Desai, Madhavi. (2007). Traditional Architecture: House Form of the Islamic Community of Bohras in Gujarat. Hyderabad: National Institute of Advanced Studies in Architecture.
- Gaurav Gangwar, Prabhjot Kaur, Inderpal Singh. (2020). A Study of Passive and Active Strategies through Case Studies for the Composite Climate Zone of India. Civil

- Engineering and Architecture, 8(6), 1370 - 1389. DOI: 10.13189/cea.2020.080620. Available from: https://www.researchgate.net/publication/320557142_Conserving_the_Relevance_of_Heritage_Corrective_actions_for_sustainable_historic_fabric_of_the_Arab_city
- Conserving the Relevance of Heritage: Corrective actions for sustainable historic fabric of the Arab city. Available from: https://www.researchgate.net/publication/320557142_Conserving_the_Relevance_of_Heritage_Corrective_actions_for_sustainable_historic_fabric_of_the_Arab_city [accessed Sep 20 2023].
 - De Aparajita. (2015). Spatial structure and social interactions in the core area of Indian cities, a case study of Ahmedabad. Ph.D. thesis, Department of Life Science, Gujrat University. July 2015. online available from <https://shodhganga.inflibnet.ac.in/handle/10603/45447>
 - Foster, S. (1989). Analysis of spatial patterns in buildings (access analysis) as an insight into social structure: Examples from the Scottish Atlantic Iron Age. *Antiquity*, 63(238), 40-50. <http://dx.doi.org/10.1017/S0003598X00075566>
 - Frampton K. (1983). Towards a critical regionalism: Six points for an architecture of resistance. In: Foster H (ed.) *Anti-Aesthetic. Essays on Postmodern Culture*. Seattle: Bay Press, pp. 16–30.
 - Hanson, J. (1998). *Decoding Homes and Houses*. Cambridge: Cambridge University Press. Hillier, B., & Hanson, J. (1984). *The social logic of space*. Cambridge University Press, UK. <http://dx.doi.org/10.1017/cbo9780511597237>
 - Hillier, B., & Kali, T. (2006). *Space Syntax: The Language of Museum Space*. In S. Macdonald (Ed.), *A Companion to Museum Studies* (pp. 282-301). London: Blackwell. <http://dx.doi.org/10.1002/9780470996836.ch17>
 - *House form and Culture*. Prentice-Hall, Inc, USA. Turner, A., & Doxa, M. (1999). From Isovists to Visibility Graphs. *Environment and Planning B*, 28(1), 103-121. <http://dx.doi.org/10.1068/b2684/>
 - Kaur Amanjeet. (2012). Adaptive Reuse of Pol Houses in Ahmedabad, M. Arch Thesis, IIT Roorkee. 2012. pp.6-7, 29-31. Online available from <http://shodhbhagirathi.iitr.ac.in:8081/jspui/handle/123456789/2012>
 - Knight T. (1981). The forty-one steps: The language of Japanese tea-room designs. *Environment and Planning B* 8(1981): 213–238.
 - Lambe Neeta, Dongre Alpana. (2016). Analysing Social Relevance of Spatial Organisation: A Case Study of Traditional Pol Houses, Ahmedabad, India. *Asian Social Science*. 2016, Vol. 12, No. 9: pp 38, [10]
 - Thakkar Jay. (2004). *Naqsh: The Art of Wood Carving of Traditional Houses of Gujarat: Focus on Ornamentation*. SID Research cell, CEPT University.
 - Lawrence, Duarte JP. (2005). Towards the mass customization of housing: The grammar of Siza's houses at Malagueira. *Environment and Planning B: Planning and Design* 32(3): 347–380.
 - Mistry, Nilika, (2018). "The Walled city of Ahmedabad: Proposing a new framework for the conservation and maintenance of pol houses through analysis of the roles of different stakeholders" (Unpublished Master' s Thesis, Columbia University, Graduate School of Architecture, Planning and Preservation).

- Mohamed MS. (2005). Creative approach to design formulation: Shape grammar as a tool in architecture design analysis & synthesis. PhD Thesis, Alexandria University, Egypt.
- Nayak, Debashish. "Revitalizing our Walled Cities." <http://www.india-seminar.com/2003/530/530%20debashish%20nayak.htm>
- Nilufar, F., & Eshika, P. (2015). Searching the genotypes Architectural morphology of urban houses in the ancient city of Panam. SSS10 Proceedings of the 10th International Space Syntax Symposium.
- Oliver, P. (2006). Build To Meet Needs: Cultural Issues in Vernacular Architecture. Elsevier Ltd., Italy.
- Pandya, Y. (2022). Courtyard Houses of India. Mapin Publishing, ISBN-13 978-9385360091. Ahmedabad.
- Pokharan K.P. Can character and communities survive in an age of globalization? Culture of the enterprise. Online available from <http://www.cultureofenterprise.org/essays/0> Civil Engineering and Architecture 8(4): 433-443, 2020 443 6/06 pokharel
- R. J. (1987). Housing Dwelling and Homes; Design Theory. Research and Practice, Chichester: John Wiley & Sons Ltd.
- Sthapak Swasti, Bandyopadhyay Abir. (2014). Courtyard houses: An overview, Recent Research in Science and Technology. 2014, 6(1): PP 70-71.
- Ubbelohde M. Susan, loisos George. The Ahmedabadi Pol House: Courtyard Strategies in a Hot-Dry/ Hot-Humid Climate. pp. 4- 6, Online available from: http://coolshadow.com/research/Pol_House.pdf