Plagiarism Checker X Originality Report

Similarity Found: 37%

Date: Friday, December 11, 2020
Statistics: 2263 words Plagiarized / 6111 Total words
Remarks: Medium Plagiarism Detected - Your Document needs Selective Improvement.

BREATHING SPACES IN ARCHITECTURE Multifunctional centre for all Relevance of courtyard open space SUBMITTED BY DESHMUKH AARTI VIJAY A REPORT Submitted in partial fulfilment of the requirements for the degree of Bachelor of Architecture. 2020-2021 Copyright © DESHMUKH AARTI, ANJUMANN-I-ISLAM KALSEKAR TECHNICAL CAMPUS, PANVEL 2020-21 CERTIFICATE This is to certify that the Design Dissertation titled _ MULTIFUNCTIONALCENTER FOR ALL_____is the bonafide work of the student DESHMUKH AARTI VIJAY from Final Year B.

Arch of AIKTC School of Architecture and was carried out in college under my guidance. Sign of the guide: Name of the guide: Prof. SANDEEP PRAJAPATI Sign of the Dean: Prof. RAJ MHATRE Date: DECLARATION I hereby declare that this written submission entitled " Breathing open spaces in architecture " represents my ideas in my own words and has not been taken from the work of others (as from books, articles, essays, dissertations, other media and online); and where otsid word beeincedI havad cedand efered the original sources.

Direct quotations from books, journal articles, internet sources, other texts, or any other source whatsoever are acknowledged and the source cited are identified in the dissertation references. No material other than that cited and listed has been used. I have read and know the meaning of plagiarism and I understand that plagiarism, collusion, and copying are grave and serious offenses in the university and accept the consequences should I engage in plagiarism, collusion or copying.

I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact source in my submission. This work, or any part of it, has not been previously submitted by me or any

BREATHING SPACES IN ARCHITECTURE

सहजीवन

LIVING WITH COEXISTANCE

SUBMITTED BY

DESHMUKH AARTI VIJAY

A REPORT

Submitted in partial fulfilment of the requirements for the degree of Bachelor of Architecture.

University of Mumbai

2020-2021

AIKTC
SCHOOL OF ARCHITECTURE

CERTIFICATE

This is to certify that the Design Dissertation titled _

सहजीवन **LIVING WITH COEXISTANCE**

_____is the bonafide work of the student DESHMUKH AARTI VIJAY from Final Year B. Arch of AIKTC School of Architecture and was carried out in college under my guidance.

Sign of the guide:

Name of the guide: Prof. SANDEEP PRAJAPATI

Sign of the Dean: Prof. RAJ MHATRE

Date:

DECLARATION

I hereby declare that this written submission entitled

"Breathing open spaces in architecture"

represents my ideas in my own words and has not been taken from the work of others (as from books, articles, essays, dissertations, other media and online); and where others' ideas or words have been included, I have adequately cited and referenced the original sources. Direct quotations from books, journal articles, internet sources, other texts, or any other source whatsoever are acknowledged and the source cited are identified in the dissertation references.

No material other than that cited and listed has been used.

I have read and know the meaning of plagiarism and I understand that plagiarism, collusion, and copying are grave and serious offenses in the university and accept the consequences should I engage in plagiarism, collusion or copying.

I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact source in my submission.

This work, or any part of it, has not been previously submitted by me or any other person for assessment on this or any other course of study.

Signature of the Student:

Name of the Student: **DESHMUKH AARTI VIJAY**

Roll No: 16AR04

Date:

Acknowledgement

This thesis owes its existence to the help and support of several people. First and foremost, I offer my sincere gratitude to my thesis guide Ar. Sandeep Prajapati, who has supported me throughout my thesis with her knowledge, who allowed me to work my own way. I would like to thank our principal Prof. Raj Mhatre for providing me with all the necessary help that he could. I would like to thank my parents and my family for supporting me and providing passionate encouragement throughout my life.

Finally, also gratitude towards my late. Grandfather to raise curiosity in culture from my childhood, I must express my profound gratitude to my brothers and friends for providing me with immense support and encouragement throughout my years of study.

ABSTRACT

In the rapid development of urbanization, along with the trend of globalization, the architecture and landscape have been affected by the arbitrary and westernized style. The loss of historical sense and blind imitation led to the decline of the regional cultural elements of the city. Traditional courtyard-space design is an expression of regional and national spatial models, it also means to awaken and nurture memories of history and culture, so it ought to have its attention in modern architecture. Traditional courtyard-space functions as a kind of space organization, strengthen the building penetration of indoor and outdoor atmosphere. It accumulates in the aesthetic perception of life experience from generation to generation, to some extent, to meet the aesthetic demands of people, which resonated with people. Its unique cultural value should be inherited and developed in modern architecture.

The essence of good architectural design is to achieve not only the visual aesthetics and functional fulfilment but more importantly human comfort in the buildings. An internal courtyard in the buildings of tropical climate has significant effects on the thermal performance of indoor spaces especially the adjacent areas. As an open space within a building, a courtyard is a design element in most of the vernacular buildings and was originally used in the Mediterranean, Middle Eastern, and Tropical regions. The courtyards may be classified concerning size, height, depth, typology, and several planes making an enclosure. The size of the courtyard is defined based on the proportional area over which a courtyard extends. The height of any open space or courtyard within a residential unit defines its spatial character and use. Courtyards play a major role in guiding the sun and wind movements in the buildings. The quantity of wind and sunlight required its quantity, till what time… can be calculated by knowing the exact volume of a courtyard. The courtyards were and will be sources for social and cultural integration.

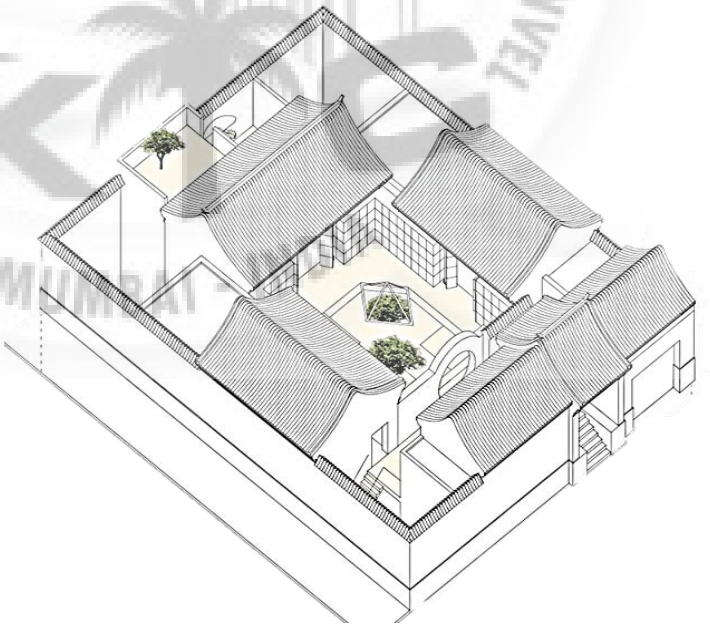


fig 1. graphical representation of courtyard

source: seven courtyards by David kohn architect

INDEX

List of figures

INTRODUCTION

"BREATH" space, in architecture, refers to the transition spaces which are connecting spaces between two confined spaces. It is a space of experience between the inner and the outer worlds; an intermediate or a third space. Transition space provides an opportunity for a person to interact and create a space that re-engages the person in that space or through that space, with some interruptions or pauses. Designing of internal spaces with openings, big or small which is also called courtyards. The 'courtyard' typology has existed for thousands of years in our country and can be traced back to the Indus valley civilization. Traditionally used as central space between houses/rooms owned by individual families, courtyard served as the focal point of a settlement and strengthened interior relationships while keeping the outside separate; it served as a protective barrier against the climate, enemies, animal and so encouraged social interaction and became an important interface for all communal activities. a comfortable and cool place for sleeping during the hot summers, a safe area for the children to play, a source of day light and natural ventilation for the surrounding rooms and a circulation core of the house linking all the spaces in a controlled manner. Despite all these advantages, the courtyard house has been neglected and ignored in the development of contemporary housing projects in the Indian-subcontinent. Observing newer construction today, this typology has faded away in most of our country's metropolitan/developing cities and only gives a vague notion of its origin. Change in social, climatic and cultural patterns have all contributed to the above-mentioned statement. Moreover, the change in family structure, housing policies, reorientation of the house to the street and the individualization of rooms has made the introduction of a courtyard space a difficult task. The relevance of the courtyard typology in contemporary times and ends with the conclusion that the courtyard house remains an appropriate built form, not only for the climatic conditions of hot-arid regions but also for Indian Culture. It could still fulfil the requirements of contemporary lifestyles, if redefined and considered in the light of technological and socio-economic changes. Architects could usefully redefine aspects of the courtyard, such as the degree of enclosure, spatial configuration, façade proportions, architectural details, materials and so on, in order to modernize the typology.

2.1 Background study

2.1.1 TIMELINE OF COURTYARD

(https://senacatal.wordpress.com/2015/12/31/timeline-of-courtyard/**)**

In 6400-6000 BC, in the Neolithic Yarmukian site, the houses consist of a central courtyard surrounded by several small rooms. After some time, in Skara Brae, people started to separate to their houses which stands on the far side of a paved open-air courtyard. Unlike the central courtyard in the settlement, it provided a private life inside the house. Among the Mesopotamian architectural accomplishments are the courtyard house was an important development. The house has an open courtyard which provided a cooling effect by creating convention currents. It was thought that the courtyard was the primary organizing feature of the house, all the rooms opened to it. When looking at the ancient city of Ur, it is seen that it had a particular order and all of the houses and palaces etc. which had courtyard system.

In the Egyptian architecture, we can see the courtyard style in the temples. We generally use the term courtyard to refer to such an area, reserving the word atrium to describe a glass- covered courtyard. This courtyard also has a central pool used to collect rainwater. When looking at the classical houses, majority of them opened at one side onto a small courtyard which enable light and fresh air. Larger houses have peristyle courtyard at the centre, with the rooms arranged around it. Its main feature was the central courtyard. When coming to the medieval age, the style of courtyard houses in the middle east reflect the nomadic influences of the region.

In the Romanesque architecture which combining features of ancient Roman and Byzantine and buildings and other local traditions used central courtyard in the monastery and cathedrals. They were enclosed, arched courtyard connecting the different buildings that made up the complex, and serving space for retreat and meditation, and for performing ablutions. Undoubtedly, courtyard style developed and used in Islamic architecture. Islamic architecture is the heart of the courtyard.

Undoubtedly, courtyard style developed and used in Islamic architecture. Islamic architecture is the heart of the courtyard. It was used in many mosques, madrasah, caravanserais, baths and palaces. in Medina in modern-day Saudi Arabia, was a typical 7th-century Arabian style house, with a large courtyard surrounded by long rooms supported by columns. This style of mosque came to be known as a hypostyle mosque, meaning ‘courtyard with many columns’ the courtyard called ‘sahn’ in the Islamic architecture. The layout is arranged around a large open courtyard. The courtyard was used for the transition between iwan mosques.

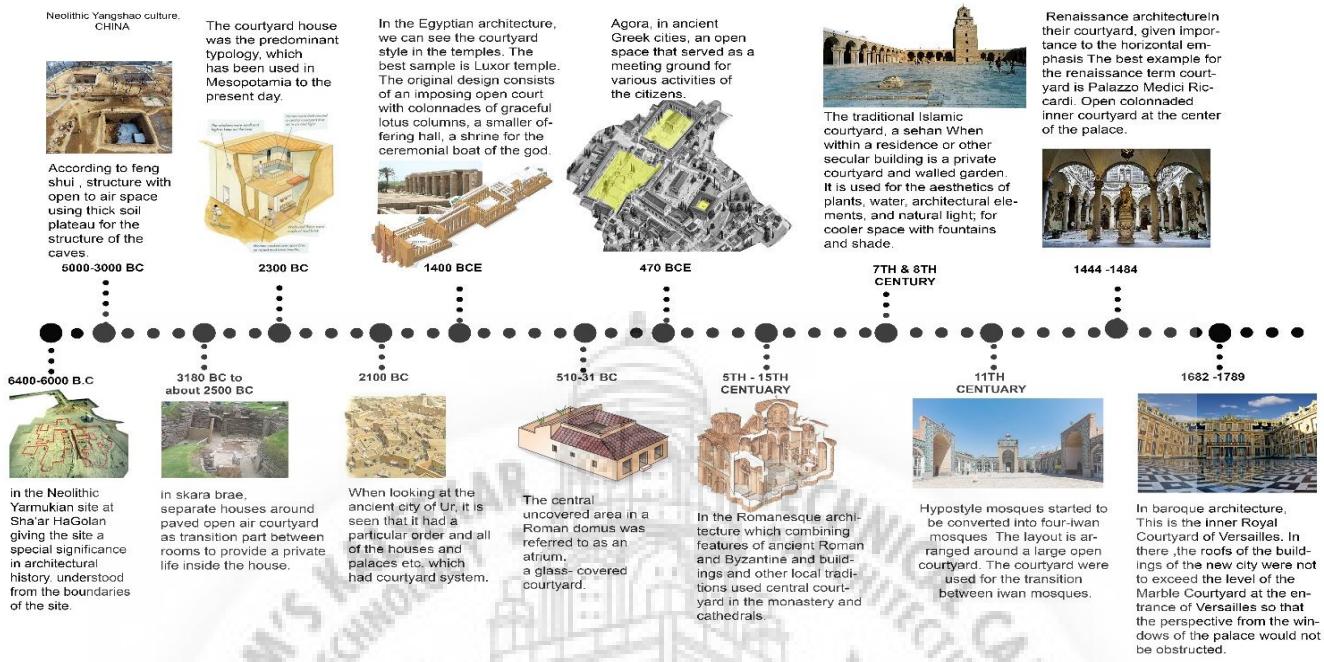


FIG 2: TIMEINE OF COURYARD EVOLUTION SOURCE: Author

A new residential typology started spreading in British India, 'the Bungalow'. According to Desai «A bungalow is free-standing, 'courtyard-less', 'outward-facing', one- or two-storeyed 'European-style' building. The bungalow typology was the opposite of the Courtyard typology present in traditional Indian homes. The compound was an extension of the bungalow's internal space, an outdoor room, fulfilling a multiplicity of social, political, cultural, and I psychological needs. Here, the compound served as the traditional courtyard. By the 19th century, most Indian families adjusted and embraced the bungalow as a new form of residence, however, they continued to live their daily lives according to local traditions as social changes were slower and more challenging.

This resulted in a new typology that combined the bungalow and the traditional courtyard house. New Indian residences displayed neo-classical facades and strong European influences in their visual character but were planned as twin- or multiple-courtyard houses which addressed the need for gender segregation and strict social hierarchy in Indian joint families. Before the end of British Raj in 1947, India had already entered into the new era of modernism, but at that time any Western thought and practice introduced or followed by the British were seen as «modern». This was because India had no uniform independent architectural movement in the early 20th century.

Ideas influenced by the Bauhaus School of Architecture and Le Corbusier brought to India were considered and known as 'modern'. The later Art Deco movement, influenced by both regional and exotic motifs, was also categorized under modern architecture. With strong visionaries like Rabindranath Tagore and Jawaharlal Lal Nehru modernism in India was more like an overall approach to life. Due to this, the traditional multi-functional courtyard served no unique purpose in residences. By the 1960s and 1970s, the bungalow in its new guise had become the modern house inhabited by many middle-class families. While it was still located in a walled compound it was very different in appearance and layout to the British Bungalows in India.

2.1.2 HISTORY AND EVOLUTION

2.1.2 WORLD WIDE STUDY OF COURTYARD

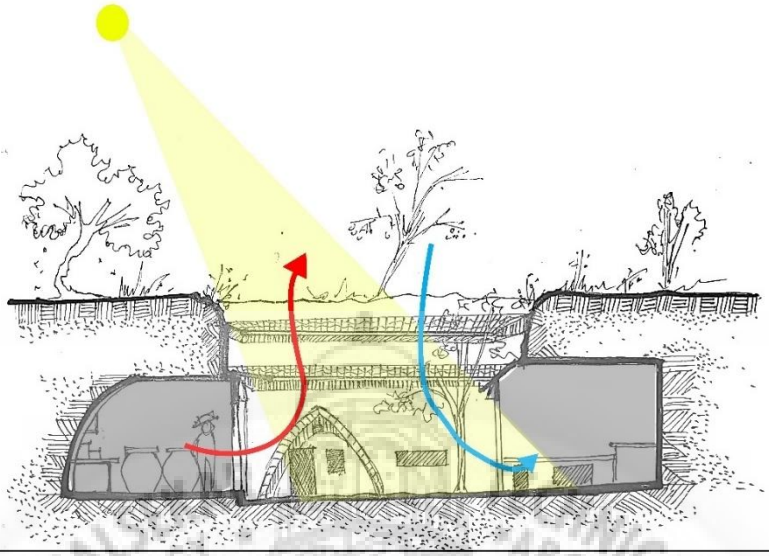
OBJECTIVES:

To study the evolution of courtyard, changes took place in architecture courtyard build form.

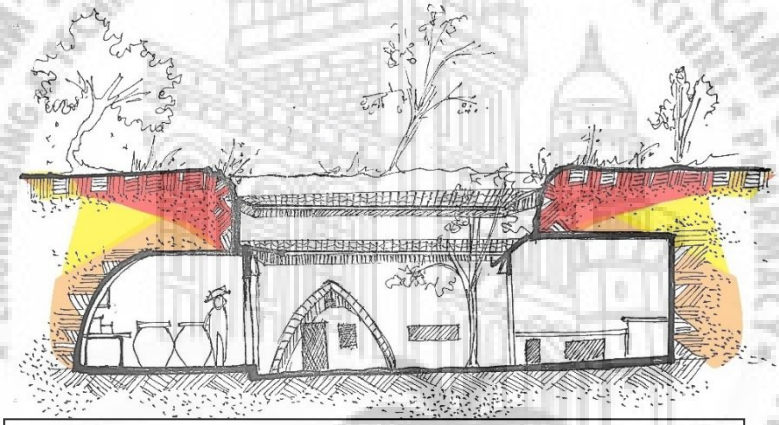
Analysis of traditional courtyard practices in world as well as in India and their current prevalence.

2.1.2.1 PIT HOUSES, CHINA

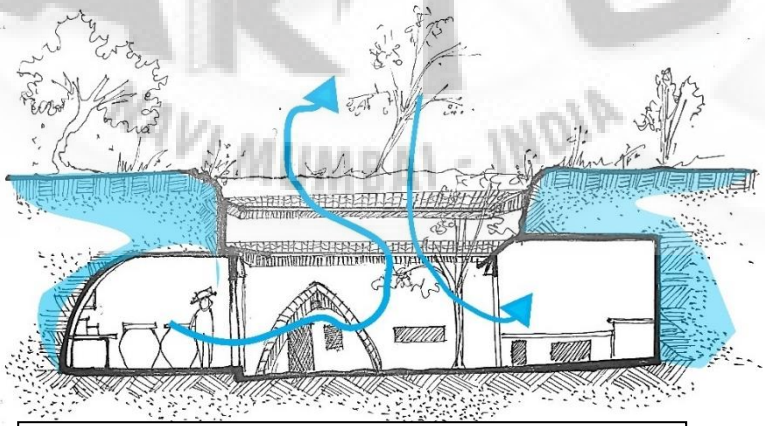
In this documentary Yun Shirang, pit home researcher was talked about the Chinese believe system of building a dwelling with central courtyard, they are believed to be the inspiration for much of china's classic architecture. square pit homes are made by digging a square pit in the earth. tunnels are then dug into the walls to forms rooms. Which are warm in winter as well as cool in summer. I was perplexed by the wide usage of pit houses amongst the various Ancient Chinese cultures. pit houses seemed to be much more prolific in ancient China. Surely one of the benefits of a pit house (better insulation from the elements) would be something equally liked by the peoples of other ancient states. pit houses were the common structures alongside vast amounts of storage pits (although by the Yangshao culture there exists evidence of above ground houses). the ancient Chinese tended to situate themselves alongside the various rivers that flow throughout China. I also ponder whether it was not just the environment temperatures and weather concerns that prompted such wide spread use of pit houses, but also the terrain. Certainly, the cold and harsh environment of North China, for example, would prompt the ancient Chinese living there to seek warmth and safety underground, but perhaps there was also a lack of suitable material to build dwellings about ground that could survive the elements at first. Perhaps it is instead simply just a matter of progression, although even today underground dwellings can be preferable in certain cases. I for one, living in the space that is considered underground for my home, enjoy not being susceptible to the elements as much (in lazy modernness I refer to not having the wind battering windows and shaking the room up). But now a days many pit houses in Sanmenxia lie abandoned due to the mass migration to china's cities.th local government has begun to convert this pit house into a museum for folk culture. These houses are very pleasant to live—cool in summers and warm in winters. When fitted with modern conveniences such as running water and electricity. The design abides by the theory that man is inseparable from nature.



Pit house section(a) showing that courtyard is as main source for light and ventilation.



Section (b) showing, house warm during winter.



Section (c) showing, pit house cools during summer.

FIG3: SECTION OF PIT HOUSE, CHINA

SOURCE: Author

2.1.2.2 ARAB CULTURE OF COURTYARD

(http://arkitekturforskning.net/na/article/download/1075/1015#:~:text=The%20Arabic%20courtyard%20house%20has,to%20serve%20two%20inseparable%20functions.&text=Although%20this%20type%20of%20house,fact%20go%20back%20into%20antiquity.)

The courtyard typology has a long history of uses around the world. The first records of courtyard settlements are found in the Middle East, in the delta of the Tigris and Euphrates rivers. With the rise of Islam and its emphasis on the principle of privacy, it comes to no surprise that the use of the courtyard typology, with its seclusion from the outside world, saw a huge increase. Muslim tradition places great emphasis on the principle of privacy, on the distinction between male and female social spheres, and of the definition of domestic and private space. All of these factors determined the arrangement of space within the dwelling as well as the relationship between the house and the space outside. In this notion, the courtyard had an important place within domesticity, namely a retreat that mimicked the characteristics of paradise on earth. With the extreme climatic conditions that Iran knows, the spatial distribution of the courtyard dwelling is probably mostly based on the climatic conditions. Because of the intensity of the summer sun and the extreme temperature differences, inhabitants do not use all rooms of the house at all times. For the warmer periods of the year, it is best to have the main living quarters in the shade on the south side of the courtyard. Conversely, the north side of the courtyard is most suitable for the winter months, since it is warmed by the low winter sun. The same logic of finding comfortable spaces to stay can be found over the course of the day. This hybridity of rooms based on the period in the year or during the day calls for rooms that are modular and repetitive, and can therefore switch functions easily. With its inward-facing rooms, the courtyard house lent itself to a high level of domestic privacy, being of great importance within the Islam. Fundamental to Islamic religious tradition is the control of social interaction between the sexes. The first measure is the sparse use of openings in the outside wall, and if so then the openings are above eye-level. The second one is the use of two door-bells, indicating male or female visitors. Furthermore, the house is usually split up into male quarters, situated close to the entrance of the house, and female quarters, well-protected at the back of the house. The entrance area was therefore shaped in such a way as to prevent direct views into the back of the house. This would mean that the entrance area does not provide the best welcome in terms of hospitality. That is in conflict with another principle of Islamic culture, which is that hospitality is also an important part of Muslim tradition.

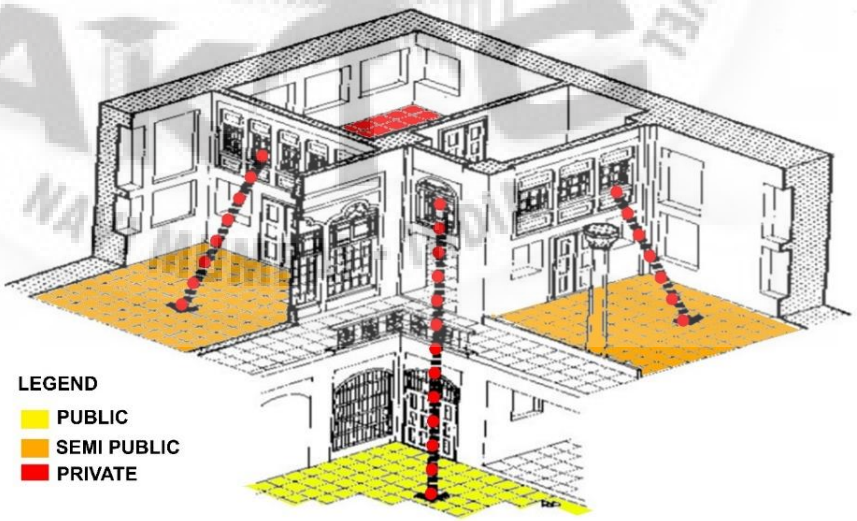


Fig4: Typical courtyard house found in Arab culture

source: worldwide courtyard typologies throughout the history

2.1.2.3 BEIJING COURTYARD HOUSE

(https://www.researchgate.net/publication/292735947_Classical_courtyard_houses_of_Beijing_architecture_as_cultural_artifact)

In the traditional Beijing houses, feng shui had a big influence on the design of the dwelling. The ideal feng shui site is supposed to balance Yan and Ying. In designing the dwelling, inspiration is taken from nature. In an ideal feng shui site, an open space (Yang) is enfolded by surrounding buildings (Yin). Mimicking these conditions that are usually found in nature is believed to bring prosperity to the inhabitants. A further emphasis lies on orientations and positions of the courtyard plan, as a good position in relation to heaven was believed to arrange vital energy for the whole family. The grandfather sat atop the pyramid of power, with the women and the servants at the bottom. This was also translated into the lay-out of the Beijing courtyard dwelling. The grandparents always occupied the major yard, and resided in the highest rooms that faced south and had the most steps. These were believed to have the best feng shui quality. The grandfather's family lived in rooms facing east or west with fewer steps, while the servants lived in rooms facing north. Furthermore, the grandparents lived in the major yard, that was always protected by a few other yards. This inaccessibility was not only for defence, but was also a symbol of his importance due to the distance between him and other members of the family. The allocation of specific areas within the courtyard dwelling to specific members of the family also helped in giving these members a sense of place, and thereby their position within the family.

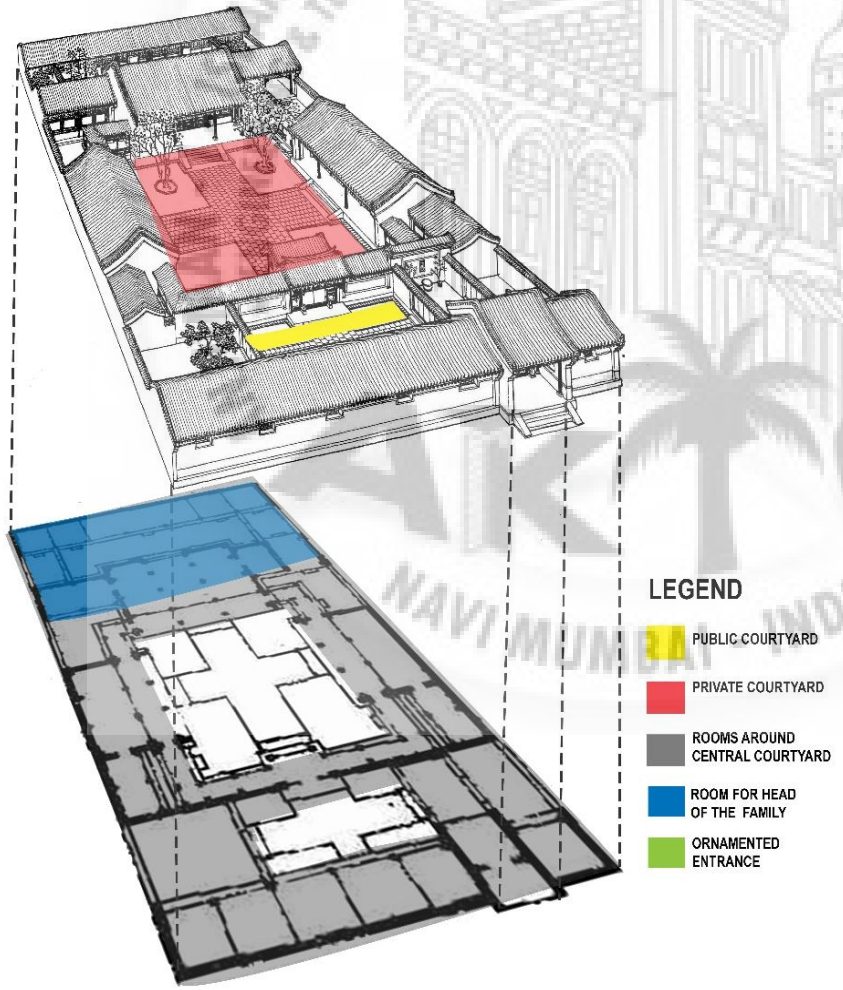


Fig 5: Traditional feng-shui courtyard house in Beijing

The location of a house gate is important in Feng Shui theory since a gate is the "mouth of qi" through which qi ("cosmic energy") enters or exits. Its orientation and size of opening have direct links to communication between the inside and outside. In Beijing siheyuan courtyard house gate way play an important role to depict the economic and cultural status of family. Traditional building materials in China also included rammed earth, sun-dried bricks, kiln-dried bricks, bamboo, and reed that were abundant in the south.

Source: worldwide courtyard typologies throughout the history and Author

In mountainous regions, stone was widely used for foundations, lower walls, columns, and window carvings. This article elaborates on four aspects of siheyuan with regards to their exterior form, interior space, building materials, and construction technologies, within which eight features, such as exterior walls, gate and access, windows, courtyards and gardens, roofs, floor levels, furniture styles and materials, and facility provision, are discussed in detail. There is a similarity in the addressing of climatic conditions in both typologies. Where the climatic conditions in the Arab courtyard house forced the layout to cater a flexible use of rooms, the Beijing courtyard house responded to natural phenomena due to their believe in the feng shui principles.

2.1.3 INDIAN CONTEXT

2.1.3.1 NALUKETTU COURTYARD HOUSE

(https://www.researchgate.net/publication/330395415_TYPOLOGY_STUDY_OF_VERNACULAR_COURTYARD-HOUSE_IN_KERALA_SOUTH_INDIA)

It is a common typology in India with various terms, such as, haveli in North India, Wada in Maharashtra, Rajbari in West Bengal, cathurmukham in Tamil nadu. In Kerala, it is called nalukettu, which means 4 -halls-house encircling an inner-yard. The design follows a book of traditional architectural, the Manusyalaya Chandrika to explore common principles of Southeast Asian architectures in the typology of Kerala courtyard-houses.It contains prescription of Kerala's traditional residential architecture, including courtyard-house or nalukettu. It contains prescription of Kerala's traditional residential architecture, including courtyard-house or nalukettu. Ideally, an abs-tract gridiron called mandala guides the configuration of nalukettu. A single proper hall is composed of the main hall which is structurally identified by a ring-beams or wall plate, extended beam to adjust the hall with the length of the building, and a connecting structure. Altogether, the multilayering principles of the mandala, marmamsutram, fourfold salas, and diksala-vidiksala constitute the structural principles of a nalukettu. Commonality of Kerala's Vernacular Courtyard House with Indonesia Architecture Courtyard-house is the signature of South Asian architecture. In general, in India, a courtyard is believed to be a navel-void containing primordial memory of trees, cut to construct houses. In Kerala, the memory is marked by basil flower planted in the inner yard the tulasi. Kerala's roof concept relates to the discussion about the insular Southeast Asian roof design. Wooden construction combined with foliage construction is not the nature of Vedic Architecture. The Vedic or pre-Aryan architecture is rather established on solid construction material, like brick mud and stone rather than temporary and foliage construction. Kerala architecture dedicates its space to feminine characters and the importance of granary. Like Mandala Typical of Marmam Scheme House Plan and Principle Geometrical Orientation Principles of nalukettu Four Sala Vidiksala Illustration of a Principle. It makes typology as research instruments that can provide explanations about manifestations, and processes in architectural concepts most courtyard-houses has a walled wooden hall containing raised granary in the middle, semi basement storage-pedestal or nilavara for storing utensils and farming tools, and one or two supporting rooms next to ara. Typology Study of Vernacular SIX TYPOLOGY OF COURTYARD CONFIGURATION IN KERALA'S

FIG 6: TYPICAL SECTION OF NALUKETTI HOUSE OF KERALA

Source: typology study of vernacular courtyard house in Kerala south India

ARCHITECTURE, Timber construction, hipped roof, hipped gabled bent roof, spaces under eaves or veranda, open layout living space, granary as centre gravity of dwelling space etc. All relates to paddy farming activities. From these common characters, more specific designs appear and classifiable in 6 typologies of courtyard configuration with the following percentage among the samples as elaborated below. Nalukettu with four Proper Halls. It may be obvious considering courtyard-house of this typology usually belongs to Brahmin communities. The dimension of the courtyard could reach as huge as 10 m widespan. The courtyard house generally maintains the south hall as open and floor raised for living space. Nalukettu with Open Living Space. Courtyard-house type 2 appears as nalukettu with open layout interior space and fixed wall only in the perimeter of the house.

In Kanyakumari district South Kerala, this typology is called arapura .
Under-lining the dominant use of timber, Thampuran considers this type indigenous South Kerala and Pre-Hindu. However, concerning spatial configura-tion the typology 2 are available in the entire Kerala, generally among the middle to lower class landlords, but using laterite material. Nalukettu with rooms and one hall opened.

Courtyard-house type 4 is not a proper nalukettu, but single hall house with annex connected by two parallel passages that consequently leave an inner-pit which is consi-dered as a courtyard. The single hall contains with living space surrounding it, but has no orientation towards the courtyard. They keep and principles, but ignore structural principles and orientation of nalukettu. The type is a regional style and so far, only found in South Kerala, among the Christian Syrian community, generally adhering to patrilineal and nuclear family. to geometrical orientation, and structural principles of nalukettu, but like other communities they put kitchen and female space in the most auspicious place inside the house. The courtyard is very small and insignificantly placed, but the space surrounding the courtyard is wide, considered auspicious, and designated for female.

Courtyard-house type 6 is residential units standing in arrays of units, like town house, called agraharam, belonging to temple-community and available in temple quarters. It existed in Kerala but considered Tamil Nadu's origin. The courtyard is at the back of the house, more as living space. The courtyard is available but very small, and demon-strate no proper geometrical order, as in nalukettu. Nevertheless, in Kerala they come from different traditions. The most common type of courtyard house that shared Indonesian architecture are type 2, type three, and type four. Nalukettu with open living space is the most typical that shared characters with Indonesian architecture.

2.1.3.2 WADA ARCHITECTURE

the features and characteristics of Wada architecture. Case study method has been employed to find out various aspects of design for continuing traditional architecture into contemporary architecture. Dhepe Wada, built in 2015 a case representing confluence of traditional and modern architecture was selected for study. Data was obtained by interviewing the owner Nitin Dhepe. Visit to Dhepe Wada was done in 2015. Dimensions of Wada have been measured and plan was drafted accordingly. Application of traditional features and characteristics in the contemporary design has been evaluated by referring the evidence of traditional architecture as 'Vishrambaug Wada', built during final phase of Peshwa by Peshwa Bajirao II. Two cases from different periods that are past and present have been compared in this study. Analysis has been done on the basis of plan form, facade design and various elements to explore traditional architecture embodied in the contemporary architecture.

The planning and layouts of the Wadas were built around the concepts of a courtyard. The basic planning of all Wadas was introvert and chowk based. Introvert planning provides the sense of enclosure and privacy to the residents of the house. There was a political agenda for adopting introvert planform by Marathas. Being warriors in order to protect their culture and religion against rulers (mainly Mughals), Marathas brought this style of planning. Security and defence were the planning strategy for a Wada. Number of chowks varied from a single chowk upto seven. For more than two courts, outer court used for Public and semi-public purpose and inner court was used for private. Zoning was the important aspect in Wada planning. Courtyard was also important symbolically, as it symbolised inwardness in the house. The centre space is the Brahma space as per vastu shahtra. Visrambaug Wada Figure a show the courtyard patterned layout with three main courtyards one behind the other. The first courtyard is square in plan; the second one which is bigger is rectangular in plan and the third smaller courtyard. Vishrambaug wada is magnificent in size and scale. It shows the grid planning design. Structural grid was called as Khan and the bay formed by number. There are various elements in architecture such as spatial element, construction elements, and structural elements. There are some elements related to decoration also. But

certain thematic space and its elements are significant in traditional architecture considering cultural, climatic and indicates similarities of façade design. Smaller openings above the wooden tall windows relate to both the Wadas. The idea of threshold always had a special significance in traditional architecture of India and Pune is not an exception. Courtyards Wada cannot be imagined without a courtyard in Maharashtra. It was a core element in design of wadas. Vishrambaug Wada has three large chowks. In Wada, the court was surrounded by a semi-open passageway with columns known as sopa.It was extended inside verandah. Sopa served as an un-programmed space in which activities held in enclosed rooms as well as in open court were spill out. Activities from Kitchen, storage was extended in the Veranda. In old Wadas, the dominating feature of the external facade was the large entrance doorway made of wood. This main entrance doorway had a smaller doorway within called the Dindi Darwaza. Full height wooden windows, having cupsed arch, extended from floor to height with smaller square opening on top with two shutters. In old Wadas, staircase usually dark and sandwiched between the two walls. This may be one of the ways of maintaining privacy so that women wouldn't be seen from the outside when moved around in the house. Every wada had one or much more halls for entertaining guests and private functions. It was called as Diwankhana. Free standing wooden columns were a feature of all the diwankhanas. Columns were usually of cypress shape and supported on stone base. The wooden cusped arches or Miharab were placed between these rows of columns. The ceiling had intricate carving. Ceilings were usually of wooden planks which thick brick walls accommodates staircase.

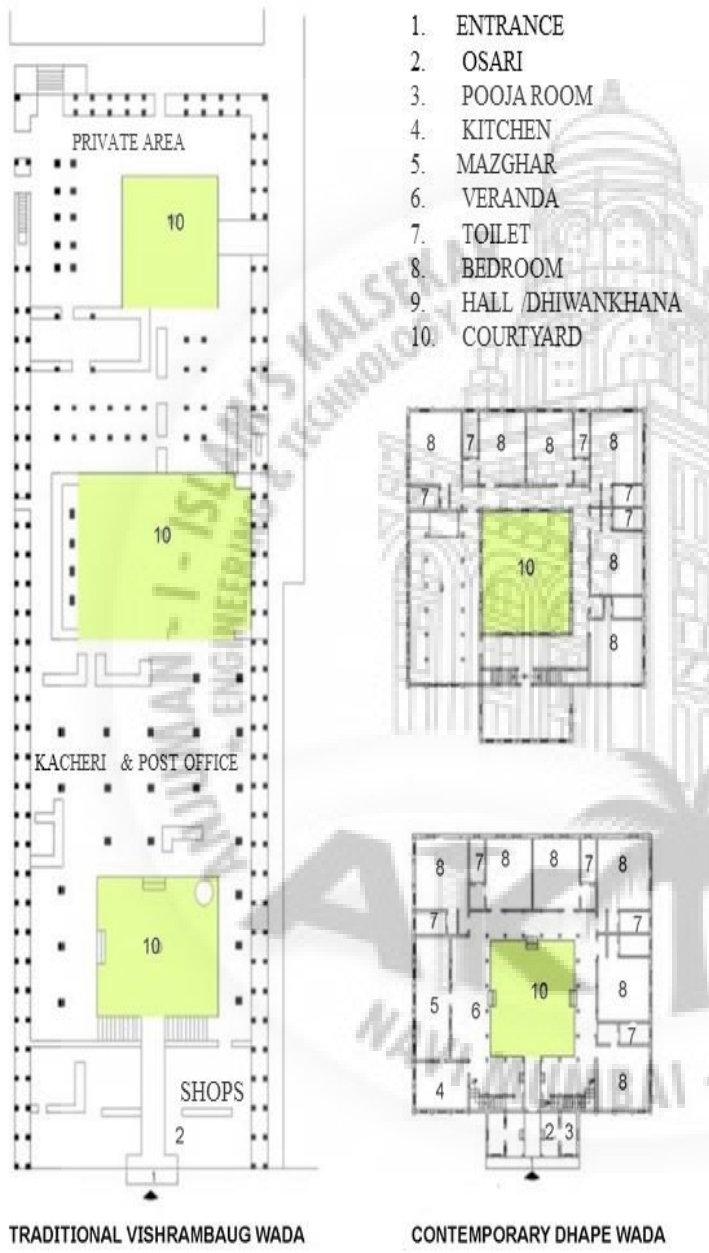


Fig 7: Figure 2 (a) Plan form of Vishrambaug Wada (Traditional Case) (Source: Gupta R.R. 2013, pp.71) (b)Plan form of Dhepe Wada (Contemporary Case)

Source: Traditional approach towards contemporary design: case study

INFERENCE:

Dhepe Wada has retained features and characteristics of traditional architecture in design. Plan to plan; room to room; facade to facade (interior and exterior); courtyard to courtyard, verandah to veranda (inside and outside); staircase to staircase and openings to openings (Door and windows) have been depicted the continuity of traditional architecture in Dhepe Wada. The table below shows continuities and changes irrespective of materials in design. Similarities indicate in retaining courtyard planning concept, spatial grid, spatial and constructional elements, style, pattern and aesthetic, scale and proportions etc. But the materials of structural elements have been changed. Using wood is not sustainable in today's context for structural members such as columns; beams and slab are replaced by RCC. Wood as a material is continued for doors and windows to fetch the clear image of the old house. The present case has illustrated that it's normal to imply traditions nowadays irrespective of material. Use of traditions and traditional methods has manifested in contemporary architecture by several ways such as using elements, characteristics, style, and expression. Continuity of traditional architecture nowadays, has been considered by the style as well as borrowing elements. An element includes spatial elements such as courtyard, verandas, threshold at entrance and visual elements consists door, windows, ceilings, columns, roofs etc. Stylistically integration made visual image of Peshwa Architecture through expressions of facade design and elements.

2.2 AIM

A primary aim is to understand and identify the transitional role of open-semi open spaces in architectural build form.

A secondary aim is to create an architectural intervention by merging traditional form with contemporary construction techniques to improve the social and cultural integration of the urban community.

2.3 OBJECTIVES

- To understand the history of courtyard through worldwide and with Indian context.
- To study the evolution of courtyard, changes took place in context-based courtyard build form.
- To understand the sustainability aspect of courtyard and the relation of courtyard with its adjacent build form.
- To understand functional behavior pattern of users in courtyard.
- To analyze of climatic responsive courtyard form according to regional variation.
- Comparative study of existing condition of traditional and contemporary courtyard.
- To study the socio-cultural and functional aspect of courtyard.

2.4 SCOPE

- Such place can act as socio-cultural platform for who interested in studying traditional sustainable architecture.
- The research part of the project could spread awareness about a sustainable approach to build a structure.
- Cultural sustainability is a very important aspect of the overall sustainability framework and is regarded as the fourth pillar alongside the other three: environmental, economic, and social sustainability.

2.5 LIMITATIONS

Due to current lockdown scenario, this project research is only based on the literature study. Courtyard architecture study will only emphasis on courtyard in Indian urban context.

Social interaction and the activity pattern of the place can be different depending on the type of people using it.

3.1. TRANSITION SPACES IN ARCHITECTURE

FIG 8: Transition spaces in architecture

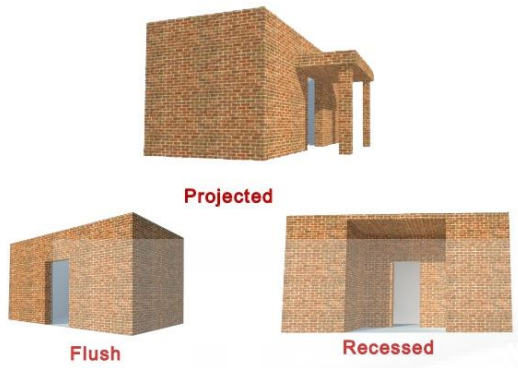
SOURCE: https://www.re-thinkingthefuture.com/article/transition-spaces-and-how-they-translate/

"Transition spaces" is the relationship between man and the environment. Most people have lost contact with nature and also have forgotten its importance and its positive effects on our lives. Because of this, it is important to study transition spaces. Transitional spaces create a 'Spatial opportunity' for a range of activities, rather than being built to serve a specific function. Apart from this, they can also take up the function of the nearby space. Thus, this focused out space can also act as a 'spill over' for the surrounding tasks.

In Indian architecture, the very ancient civilizations like Mohenjo-Daro and Harappa were constructed with significant usage of transition spaces. From a simple **corridor** connecting two houses to **the courtyards**, sophisticated **verandas,** and later to **lobbies, foyer, porticos** these spaces have evolved according to the change in architectural and cultural characteristics. Over many years transition spaces are glorified with efficient usage of landscape, lighting, colours, textures which add to the quality and experience of the whole space. Many factors are responsible for shaping these spaces such as Physical conditions of the environment, Cultural patterns, and climate. There are colonnades, aisles, courtyards, water bodies, openings like **doorways, pathways**, grounds, **patios**, gardens, trellis, **pergolas,** foyers, lobbies, etc.

According to spaces with transition space connects, transitional spaces are future divided into flowing three categories:

A) Transition Space between Two Destinations:



The most important transitional relationship between two distinct realms is expressed through **entrances.** The entrance space as a transitional zone is an important aspect that symbolizing welcome, auspiciousness, and status. A threshold has a dual function. Interestingly, these two functions are mutually exclusive. –"Linking as well as Separating inside and outside.

Fig 9: entry and approach for space

Source: Author

Any entrance not only stops at the doorway, but they can also be as elaborate as one needs it to be and the privacy and accessibility of the space depends on the user, community, their culture as well as their economic background.

FIG 10: a)entrance of traditional Beijing courtyard b)gopuram , traditional entrance of temple

Source: a) https://en.wikipedia.org/wiki/Siheyuan#/media/File:Maodunguju.JPG

b) https://en.wikipedia.org/wiki/Gopuram

B) Transition spaces between two static spaces:

These spaces are generally used as linking space between two or more spaces.
a) courtyards b) corridors c) veranda d) atriums e) staircase f) patio etc.
These spaces are important as they make other static spaces, relate to each other. These spaces are defined as 'A world within a world' or 'Part as a Whole and Whole as a Part" as they are a part of the whole house, yet can act as a whole individual space altogether. The most important characteristic of this space is its "Flexibility" to change according to the needs of the user.
Similarly, at a micro-level, Verandas the narrow pathways that run around a house or in the front of the house or around the central courtyards. These spaces connect and link all the spaces within a house. Veranda all around the courtyard creates "Stack Effect", which is a method of inducing natural ventilation. Thus, the wind movement inside the house is maintained, which is the major climatic relief for the humid regions. But in the case of cold regions, verandas provide a break or barrier from the harsh cold climates.

Fig 11: transition spaces in temples and in traditional houses
Source: www.wikipidia.com

C) Transition spaces between nature and built form:

This is the most challenging as well as the most intriguing type of transition space. From different types of pathways to sophisticated step-wells journey of transitions space, creates a magnificent experience for the user. The concept of the backyard has opened out various possibilities to connect to nature and landscape. From a very simple semi-open enclosure using pergolas in the gardens to an elaborate chhatri, pavilions, and trellis, there is a wide range of spaces that connects man, his abode, and Nature. They act as a link between inside and outside and let us experience the best of both spaces (Openness and Security).

3.2.TYPES OF TRANSITIONAL SPACES IN ARCHITECTURE

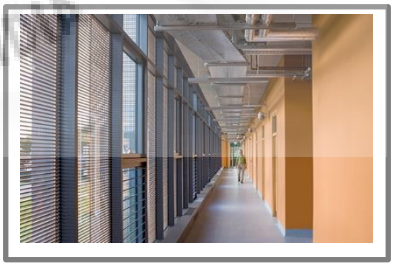
a) entrance: Entrances contribute positively to the streetscape and building facade design
Entrances provide functional and safe common areas.
It is regarded as "an ambiguous moment that defines the inside and outside".

Fig12: entrance of Rajasthan havelli
Source: Author

b) courtyards: A courtyard or court is a circumscribed area, often surrounded by a building or complex, that is open to the sky.

Fig13: traditional courtyard house

Source: Author



c) corridor: A corridor is a form of hallway or gallery which is typically narrow in comparison to its length and acts as a passage connecting different parts of a building. A corridor often has entry points to rooms along it.

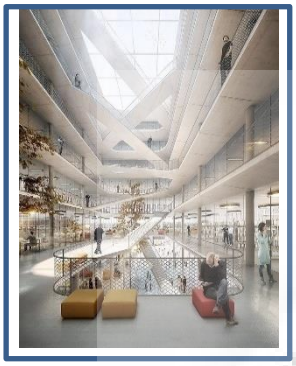
Fig14: corridors in building

source: https://www.payette.com/sustainable-design/energy-efficiency-and-the-thermal-corridor/

d)Verandah: veranda is a roofed, open-air gallery or porch, attached to the outside of a building. A veranda is often partly enclosed by a railing and frequently extends across the front and sides of the structure.

Fig15: front verandah in Indian traditional house

Source: Author



e) atriums: an **atrium** is a large open air or skylight covered space surrounded by a building. Atrium can be used as light courts. Utilize daylighting to reduce energy use through skylights and window walls. The **atrium** space type includes glazed courtyard spaces and multi-storeyed spaces.

Fig16: use of atrium space in architecture

Source: https://in.pinterest.com/pin/330381322655080403/

f) alleys: An alley or alleyway is a narrow lane, path, or passageway, often reserved for pedestrians, which usually runs between, behind, or within buildings. It is also a rear access or service road (back lane), or a path, walk, or avenue in a park or garden.

Fig17: alleys between two spaces which act as interactive space

Source: www.wikipidia.com

g) pergola: A pergola is an outdoor feature forming a shaded walkway, passageway, or sitting area of vertical posts or pillars that usually support cross-beams and a sturdy open lattice, often upon which woody vines are trained. The origin of the word is the Late Latin pergola, referring to a projecting eave.

Pergola spaces are also used to connect build space with nature.

Fig18: pergola pathway

Source: https://en.wikipedia.org/wiki/Pergola#/media/File:Rose_Pergola_at_Kew_Gardens.jpg

h) passages: a long, narrow way with walls on either side that connects one place with another. The connecting passage between two dwelling units creates a comfort level for the inhabitants. See the image below, it acts a pleasant sit out as well.

Fig19: connecting passage between spaces

Source: https://shwetadeshmukh.wordpress.com/2009/10/14/transition-spaces/

i)patio/porch: is an outdoor space generally used for dining or recreation that adjoins a residence and is typically paved. Patios are most commonly paved with concrete or stone slabs (also known as paving flags). They can also be created using bricks, gravels, block pavement etc.

fig20: types of patios as recreational space for premises.

Source: https://www.thespruce.com/difference-between-patio-and-deck-2736762

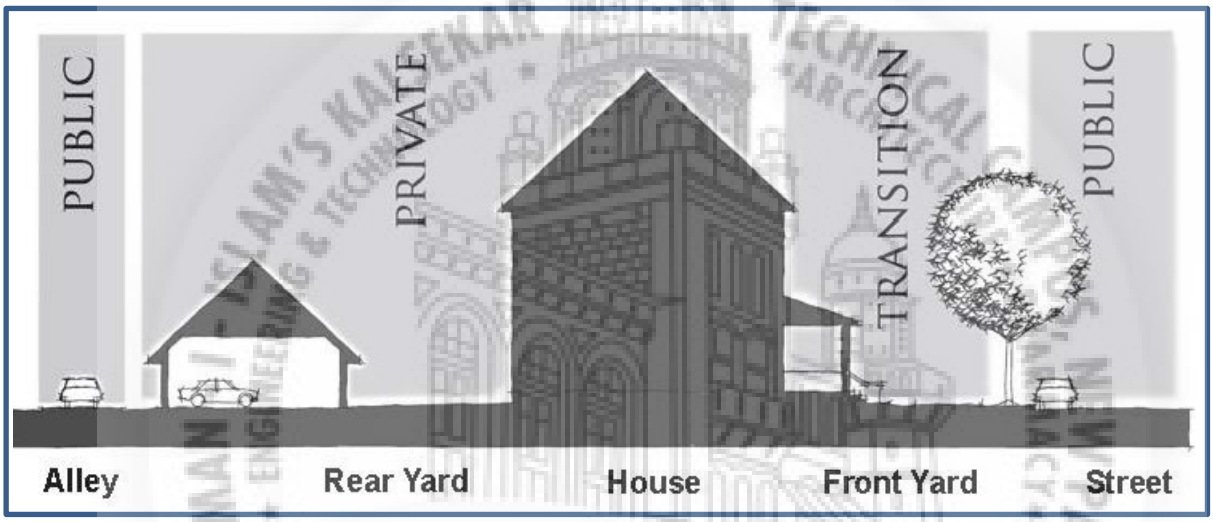


Fig 21: public and private transition space

Source: Author

"Architectural spaces that envelop us like a physical presence, simple and dense, defying description imitation and photography. . .. universal, yet present. The exterior is simple leading to greater levels of mystery surprise and memory, creating poetic changes of light and shade . . . guiding us through its spaces . . .."

-Alvarso Siz on Mexican Architecture

4.1. Understanding courtyard architecture

Transition space provides an opportunity for a person to interact and create a space that re-engages the person in that space or through that space, with some interruptions or pauses. Designing of internal spaces with openings, big or small which is also called courtyards, have been a practice in earlier times. Such spaces in inns and public buildings were often the primary meeting places for some purposes, leading to the other meanings of court. Generally, courtyard dwellings are found in rectangular or in square shapes. No standards are required to build courtyard space but we have to consider the height and length ratio of the courtyard.A central open-to-sky space inside the structure is to designed for light and ventilation. However, this form may be and has been altered to adapt to the topography, site restrictions, building orientation, size and shape of spaces, climatic aspect, etc. Following illustration showing the basic elements of courtyard architecture. it possesses numerous important and strategic features that are vital in its concept and form.

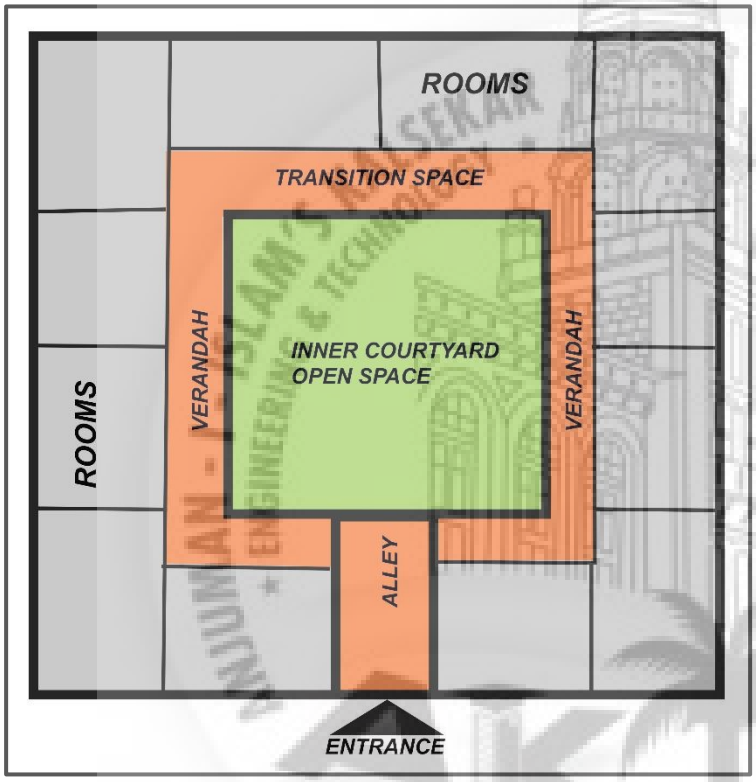
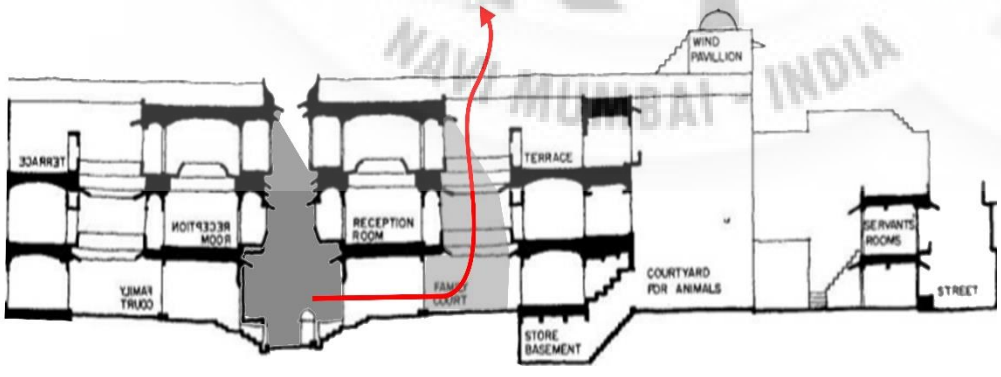


Fig 22: elements of courtyard architecture

Source: Author



These elements of courtyard may differ according to the region, culture, climatic condition of particular area of region. Surrounding wall provides security to the structure and spatial planning offers private space. The enclosed house efficiently eliminates the noise, dust, and urban composition of the street.

Fig 23: transition space in between narrow streets to cut down noise, dust etc. source: Author

The courtyard planning could be the best solution to address this environmental, social, cultural, psychological issue in Asian Countries and it can also address the high-density issue to large extent due to compact planning through the courtyard.

To understand the various parameters of courtyard design are majorly divided into three main categories are as follows:

- Climatic aspect
- Socio-cultural aspect
- Function and aesthetic aspect

4.2.TYPES OF COURTYARDS

A) based on levels:

various types of courtyards are found with different level according to the regional climatic conditions such as ground level courtyard, sunken courtyards, elevated courtyard, multilevel courtyard, front yards, backyards etc.

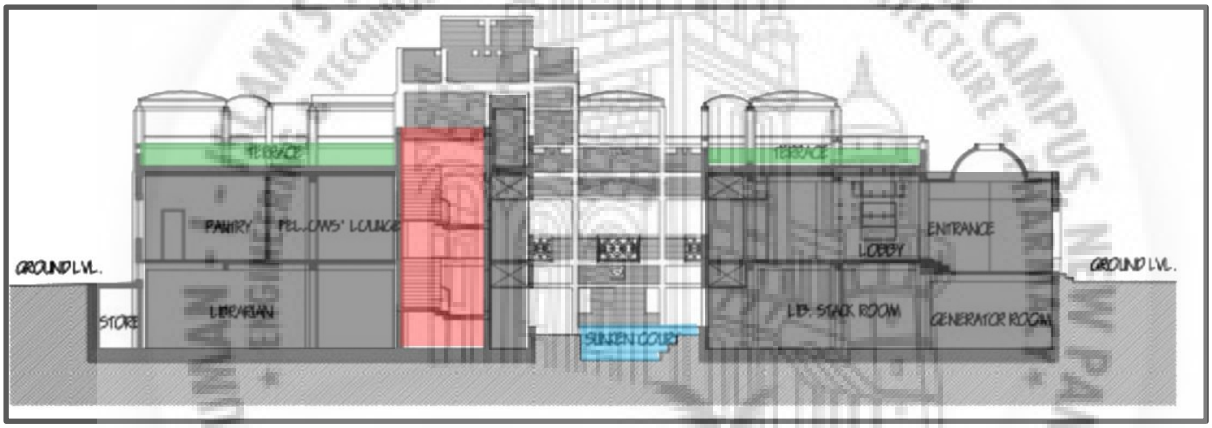


Fig 24: Section of sunken courtyard at American institute of Indian studies, Gurgaon

Source: Author

A **sunken courtyard** has the ability to combat the harsh climate and decrease energy consumption by 25–35% showed that "the temperature of the rooms facing the sunken courtyard was about 17°C cooler in mid-summer and 9°C warmer in mid-winter than the maximum and minimum outside dry-bulb temperatures respectively".

Multilevel courtyard inside the structure offers a different experience to the user through levels, landscaping, etc.

The elevated courtyard also offers visual connectivity between spaces that creates a socio-interactive atmosphere inside the structure.

Fig 25: multilevel courtyards at iim sports centre

Source: https://www.archdaily.com/917189/iim-sports-centermindspace/5cdc818d284dd19e33000277-iim-sports-center-mindspace-photo?next_project=no

Front yard: front yard in residential space are the space between public streets and private space. The area behind the house, usually more private, is the **back yard**. While the front yard's counterpart, the backyard, is often dominated by utilitarian features like vegetable gardens, tool sheds, and clothes lines, the front yard is often a combination decorative feature and recreation area.

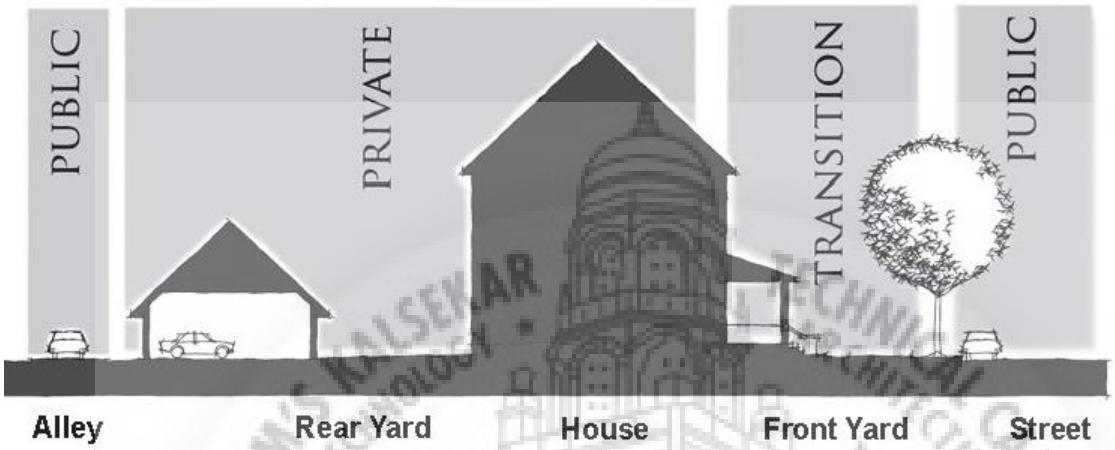


Fig 26 : public and private transition space

Source: Author

B) based on functions of building:

The courtyard form was initially used in private residential building but after knowing the importance and different benefits of form used in public buildings too. Residential courtyards are always depending on the human scale while public building scale of courtyard are in monumental scale. The residential courtyards are very functional in respect of climate while the courtyard of public buildings aims to have other utilities like public gathering spaces etc too.

Fig27 a): visual art institutional campus Rohtak by raj rewal Fig27 b): Jawahar kala Kendra, Jaipur

Source: a) https://www.architectural-review.com/today/visual-arts-institutional-campus-in-rohtak-by-raj-rewal-associates

b) www.wikipedia.com

courtyard open in public building are usually used for public gathering as well as to stable the spatial planning of structure which also encourage thermal comfort structurally as well as physically. And socio-interactive space serves for public activities.

C) based on the size and shape of the courtyard

The circular, polygons, rectangular, square, as well as organic forms, have been used through the historical evolution of courtyards. The most popular among masses were rectangular or square form due to the functionality of the building, limitation of structure innovation and less plasticity of the material, due to economical in nature. In China, the Tulou buildings were having a circular courtyard and these buildings were built of mud.

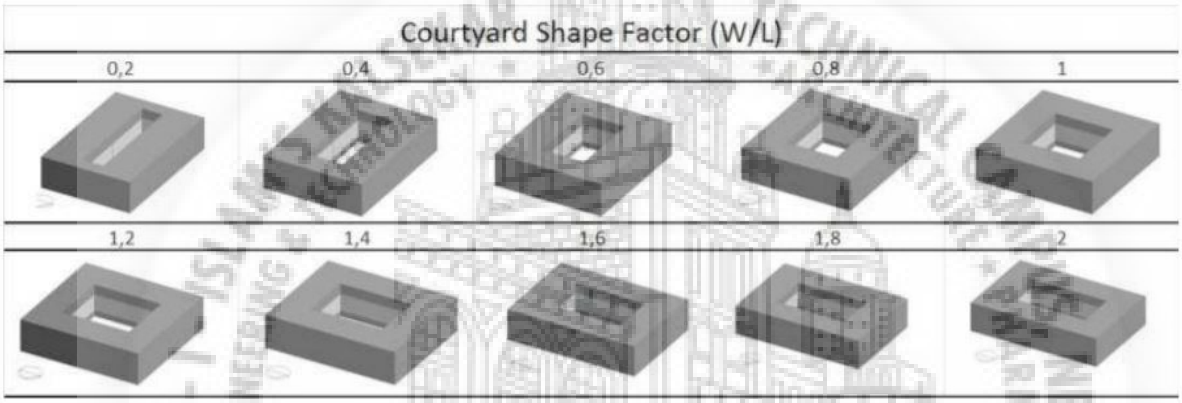


Fig28: Courtyard building form derived from different W/L

Source: effect-of-courtyard-shape-factor-on-heating-and-cooling-energy-loads-in-hot-dry-climatic-zone.pdf

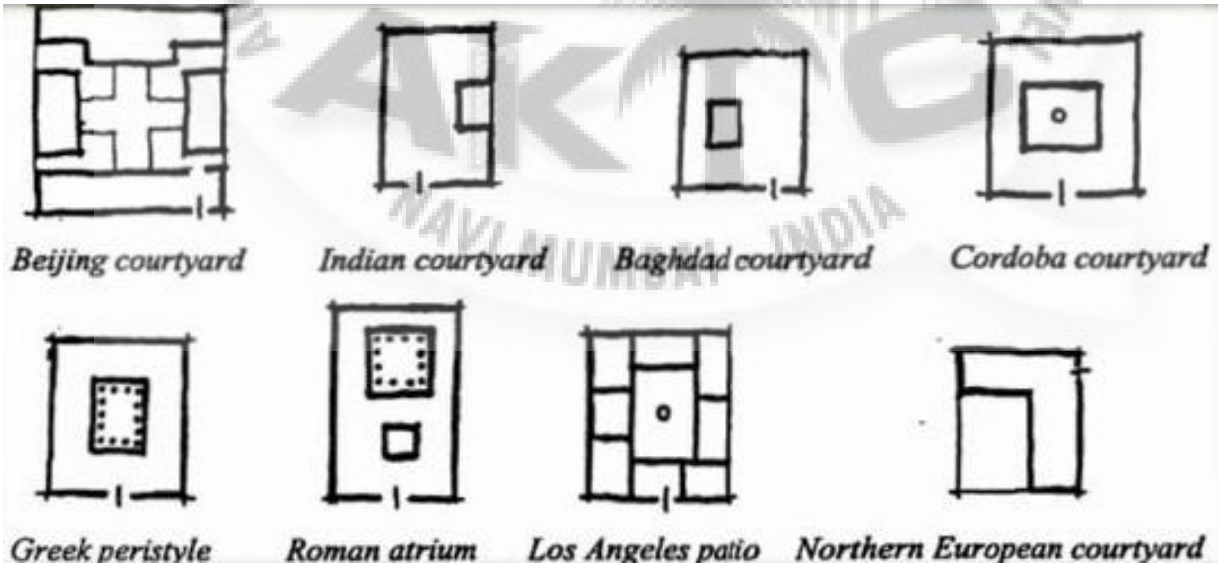


Fig29: types of courtyards in different region Source: author

The colonial architecture has also many examples of the circular courtyard in their palaces and public buildings due to aesthetic reasons.

Technological advancement and material innovations have finished the limitation of structure and all types of shapes are possible in the 21st century depending on need.

4.3. CLIMATIC ASPECT OF COURTYARD

A) SUNLIGHT

There is no established rule for deciding the size and the proportions of courtyards. However, these may be worked out based on geographical, cultural, regional, and climatic differences. The climate plays important role in determining the size, proportion, and orientation of the courtyard to allow the desired sunlight for creating comfortable conditions within the house.

The size of the courtyard for natural daylight will depend on the latitude place. The nearer one gets to the equator the smaller the width requirement due to the sun attains higher orbit. Conversely, the width of the courtyard is more required towards the poles of earth to enter the natural day light due to the low orbit of the sun. The height of the courtyard is required more for the equator and height may be progressively reduced towards poles. The concept of multi-storeyed housing is suitable for the equator to get shading in the courtyard and low-rise housing is required towards poles.

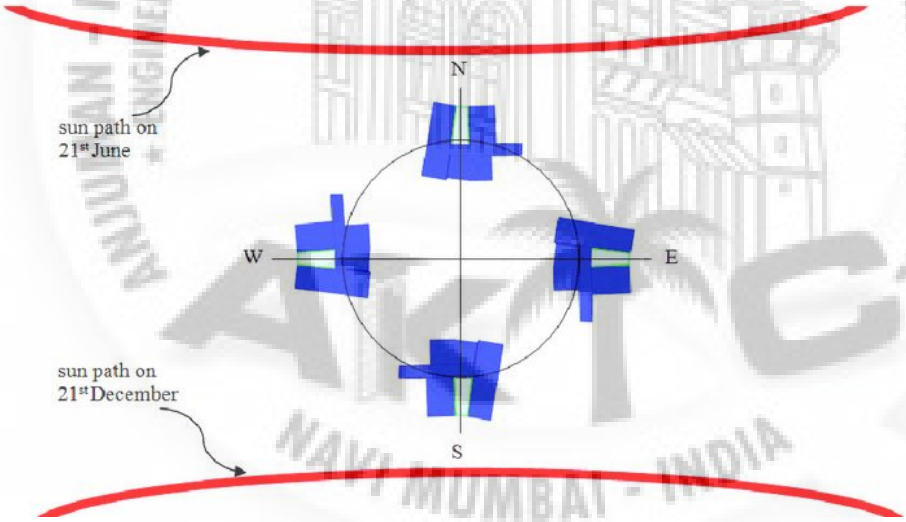


Fig30: courtyard orientation, sun path and their simulation scenarios

Source: author

The building form determines the volume of space inside a building that needs to be heated or cooled. Thus, more compact the shape, the less wasteful it is in gaining/losing heat. In hot & dry regions and cold climates, building's shape needs to be compact to reduce heat gain and losses, respectively.

Courtyard is laid in a SE- NW orientation. the prevailing wind which maximizes wind in the courtyard and cross ventilation through the building keeping the courtyard cool. occupies nearly 30% of the total haveli area.

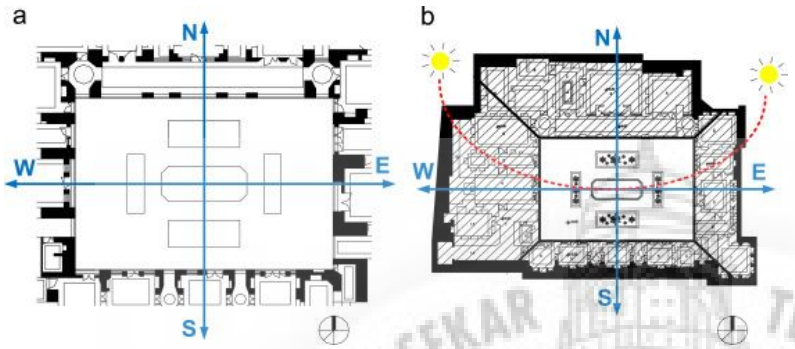


fig31: typical courtyard planning of Iranian traditional house for microclimate

source: https://www.scipedia.com/public/Soflaei_et_al._2016a

b) VENTILLATION

In hot arid regions where the temperature difference between day and night is large, the courtyards are a very effective solution to create comfortable conditions. In the daytime, due to the high temperature outside, the air gets warm and becomes lighter but the temperature inside the courtyard remains less, so the air becomes denser and cool as compared to the outside air. This cooler air gets inside rooms through the courtyard and warm air gets outside through rooms. At night time, the outside air becomes cool due to less temperature and dense, the building is still warm so courtyard air becomes lighter. The outside air gets inside through rooms and gets exhausted from the courtyard, so this movement of air creates a comfortable condition. In hot humid conditions, the heavy air outside enter from rooms and get out from the courtyard in the day as well as night. The movement of air in hot humid conditions is very effective for human comfort conditions because it reduces moisture content of the air.

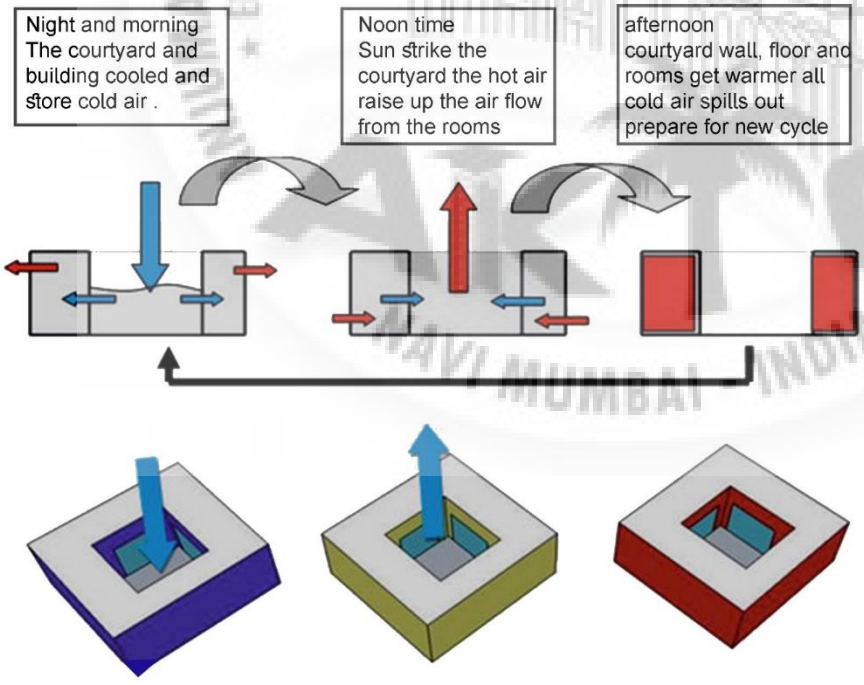


FIG32: Climate transformation inside the courtyard

Source: Author

Due to incident solar radiation in a courtyard, air gets warmer and rises, cool air from ground level flows through the lower openings radiation to sky landscape or water body section showing courtyard effect.

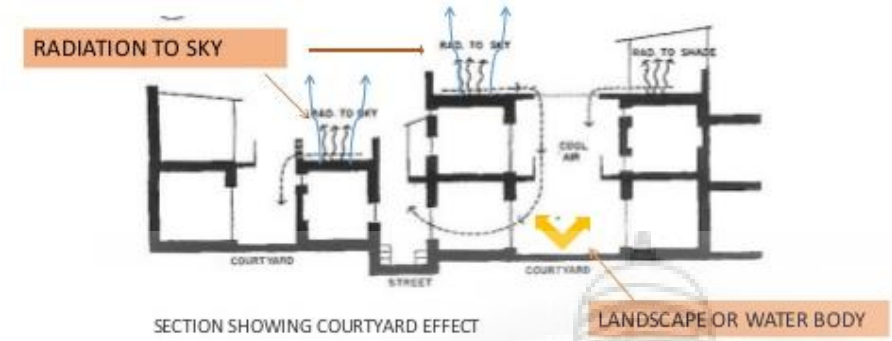


FIG 33; section showing courtyard effect

Source: author

4.4.SOCIO-CULTURAL ASPECT OF COURTYARD

a) multipurpose space:

The courtyard works as an extension of the kitchen during the morning and as a living room during the evening to entertain the guests. A space for interaction for all family members, and encourage the family to act as a group. Sleeping area during the night when the climate is conducive to outdoor activity.

Following diagrams showing the adaptation of courtyard space by users in different time period such as daily routine, yearly festival, and user age wise adaptation.

Fig34: adaptation of courtyard space in chawls

Source: author

Above section showing spatial planning of closed, semi open, and open space of chawls to understand the spatial relationship between spaces.

Inner courtyard uses to have less perforation because these are mainly for female of the house, only vendors selling products related to female are allowed in inner courtyard. This is usually to segregate the public and private spaces within the house.

b) Size and proportion of courtyard

The feeling of the enclosure is determined by the relationship of viewing distance to height as seen by the frontal view. When D/H=1 the the angle formed is 45 degrees, it is termed as the full enclosure. If D/H =2 the angle formed is 30 degree, it is termed as a threshold enclosure and if D/H =3 the angle formed is 18 degree, it is termed as minimum enclosure and if D/H=4, the angle formed is 14 degrees, it is termed as a loss of enclosure.

Different locations. Cultures and Situations require different/H ratios and the above-mentioned proportions should be considered as mere guidelines. The enclosures are weakened by the gap between walls, abrupt changes in the height of the cornice, and drastic variation in façade levels. In Arab courtyard D/H=1/2 or less is appropriate while Canadian courtyard D/H=3 or 4 is suitable.

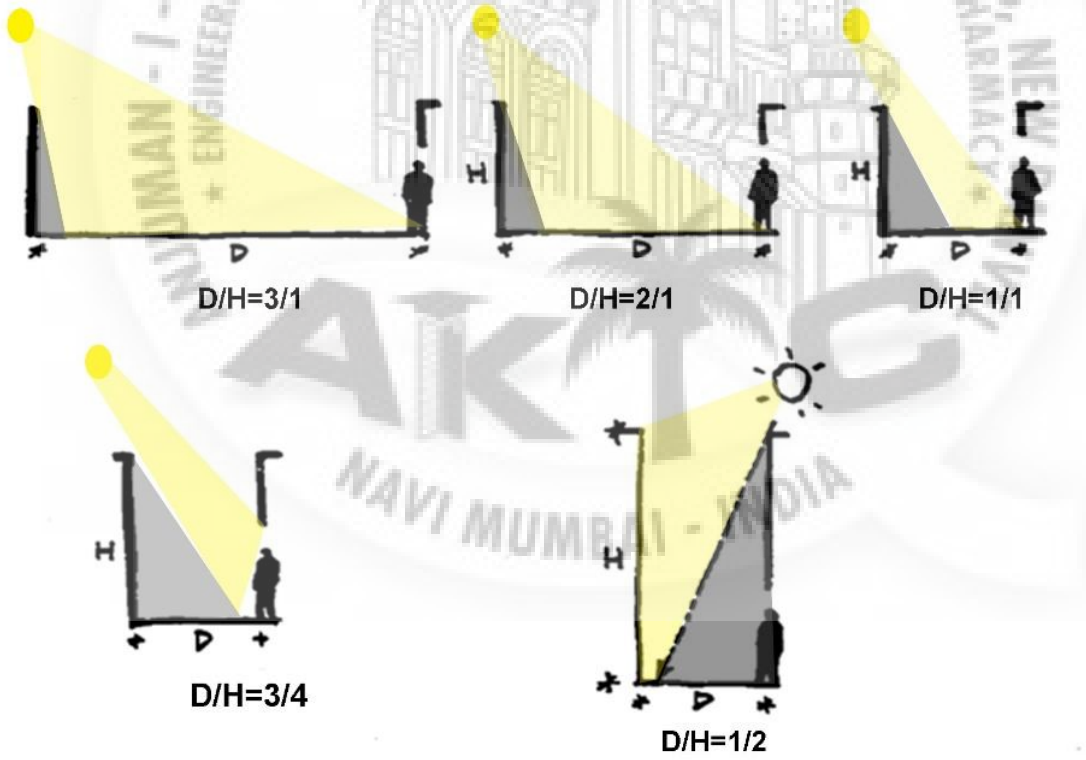


FIG 35: D/H Ratio of courtyard

Source: Author

The Psychological factors also are determinant for size and proportion of courtyards, different socio-cultural have the different feeling of enclosures thus having different the degree

of introverts. The Arab culture is having a lesser width D/H=1/2 or less sometimes due to interwovenness in nature while the Canadian courtyards are sometimes having D/H=3

or more having less interwovenness.

c) Street level Interaction in indigenous courtyards:

The courtyard houses in India are designed to have street interaction, most of houses were having platform next to entrance door and before entering to outer courtyard, people used to have sitting on this platform. Inner courtyard uses to have less perforation because these are mainly for female of
the house, only vendors selling products related to female are allowed in inner courtyard.

Fig 36: vegetable vendors selling vegetation in cluster courtyard space
Source: https://www.alamy.com/vendors-selling-produce-in-courtyard-of-hindu-temple-near-durbar-square-kathmandu-nepal-image246407945.html

d) Religious, Mythological beliefs

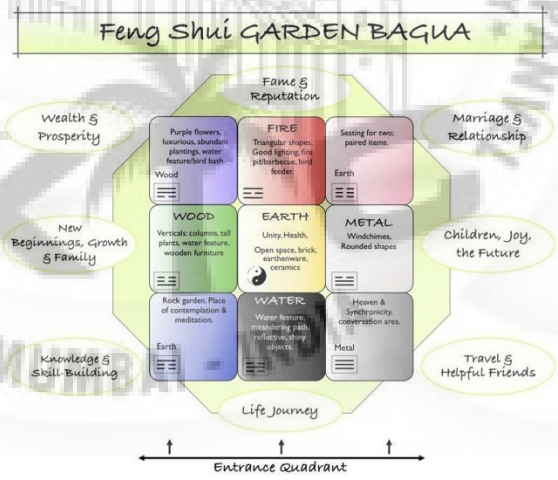


Fig 37a : Vaastu purusha mandala

Fig37b: Feng shui

Source: a) https://architectureideas.info/2008/10/vastu-purusha-mandala/

b) http://openspacesfengshui.com/feng-shui-tips/

The courtyard concept has also related to many religious beliefs or mythological beliefs for a different part of the world. In Chinese, the courtyard is used to work out of the principles of Feng -Shui, it is believed that the application of these principles will bring harmonization with their environment as well bring prosperity to the people. Feng-shui principles describe all design elements such as yards, rooms, walls, doors, steps, draining, orientation, positions, plants, etc.

The Indian courtyard system is based on Vastupurush Mandala; it is considered the house should be divided into a grid of 9 squares and the centre square should be left open. The centre portion is given a place of Brahma and it is the lungs and heart of the house. This place should be free from obstructing elements such as pillars, walls, or mechanical services. The courtyard should be almost cooled and shaded, so it can act on various activities of the household.

4.5.FUNCTIONAL AND AESTHETIC ASPECTS OF COURTYARD:

i)Accessibility and Circulation:

The courtyard minimizes the circulation area of the house and makes the house more compact. The unnecessary corridors may be avoided by the use of the courtyard.

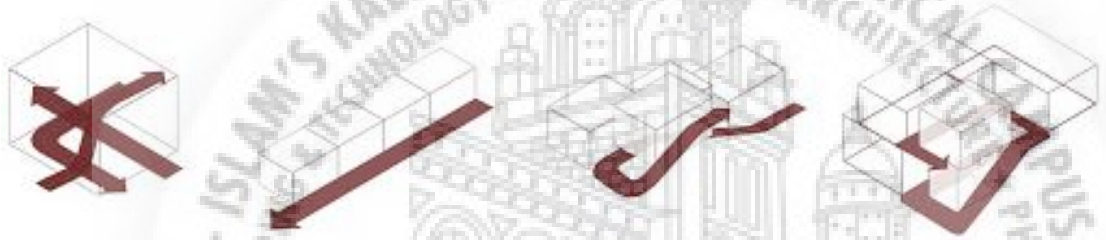


Fig38: 3d showing circulation pattern around courtyard

Source: author

ii) Use of Water in Courtyard:

Water is the element used in courtyard of hot arid climates especially the Middle East countries and this influence could also, be seen in India. In hot arid regions the moisture content in the air is less, so the use of water adds more moisture to create comfort condition within the house. Water is used in stagnated as well dynamic flowing water bodies, used in the form of fountains, cascades, etc.

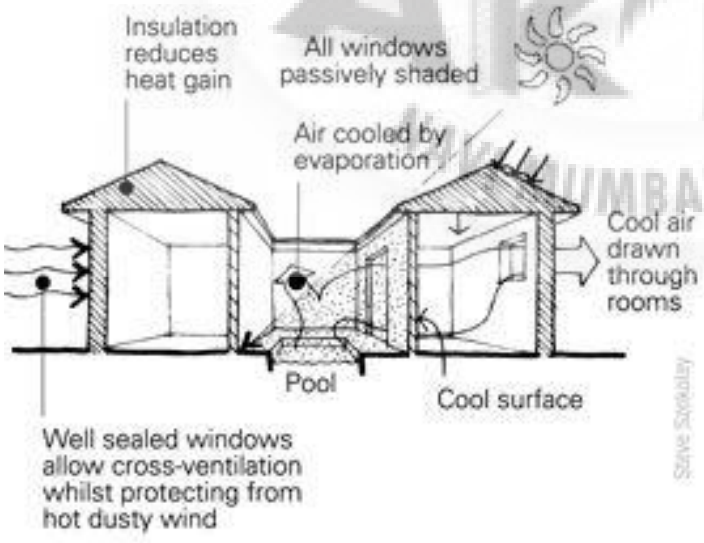


Fig 39: water body inside the courtyard

Source: www.wikipedia.com

iii) Acoustics:

The acoustics of the courtyard may be worked out depending on the location and culture of a place; few cultures tolerate more noise while others are not able to tolerate even the slightest noise.

The courtyard wall should not face another courtyard wall but it preferable that the blank wall of another house should face the courtyard wall, if the distance between the two courtyards houses increased; there is less possibility of noise. The length and width of the courtyard at least should be preferably twice or more than max height for acoustically viable noise control device.

iv) Dust Control:

The courtyards can act as dust controllers in the desert climate. The opening of rooms of the house could be open in the courtyard to avoid dust storm outside. The paving materials of the courtyard could collect dust and regular cleaning should be done. The jail on the walls of the courtyard is also used in the desert climate to avoid dust.

v) landscaping:

a)vegetation: The Islamic and Japanese architecture were using the landscaping as major component for courtyard design throughout centuries. Vegetation are use to create micro climate inside the structure.

Fig 40: types of vegetation found in courtyard for aesthetics

Source: author

Fig 41: pavement in courtyards

Source: www.wikipedia.com

fig 42: water body inside the courtyard

source: https://www.tfod.in/photo-space/7629/water_body

5.Checklist of design variants of courtyard

Previous studies have found that thermal comfort level in a courtyard is determined by microclimatic factors, particularly solar radiation and wind. The effects of these two main parameters have been evaluated by considering the orientation, dimensions, and proportions of a courtyard as the most influential design variants in providing optimal thermal comfort (Meir et al., 1995; Meir, 2000; Reynolds, 2002; Rajapaksha et al., 2003; Rajapaksha, 2004; Fardeheb, 2007; Almhafdy et al., 2013; Toe and Kubota., 2015). Hence, in the present study, a case analysis on the following six main criteria was conducted:

1)Orientation, extension, and rotation angle of the courtyard.
2) Dimensions and proportions of enclosed spaces

3) Dimensions and proportions of open spaces.

4) Dimensions and proportions of natural bodies (water and soil).

5) Dimensions and proportions of the physical bodies (opaque walls) of the courtyard.

6) Dimensions and proportions of the transparent surfaces (openings) of the courtyard.

a) FORM

- Square
- Rectangular
- Circular
- Triangular
- Others

b) SHAPE OF ENCLOSURE

- Fully enclosed
  a) o shape b) u shape c) square shape at centre

- semi enclosed
  a) L-shape b) I shape

c)ORIENTATION

- NORTH
- SOUTH
- EAST
- WEST

d) SHADING DEVICE

- ROOF
- PROJECTION
- OVERHANGS

6.CASE STUDIES

6.2.1 CENTRE FOR ENVIRONMNTAL EDUCATION

LOCATION: Ahmedabad
AREA : 14 Acres
ARCHITECT: AR. Neelkanth Chhaya (Dean of CEPT)
TYPOLOGY: institutional
YEAR : 1984

Cee is nationwide organisation which works to spread awareness about the environment among the masses of this country.

It does this by creating various media like printed materials, boards, models etc. Which are distributed among schools, national parks and other places.

The propagation of these media take place in the cee campus along with other activities related to the functioning of cee.

Ahmedabad has extreme temperatures. It is hot and dry in summer and cool and dry in winter.

The CEE-Ahmedabad campus houses several functions catering to the programs of sustainability and environmental education.

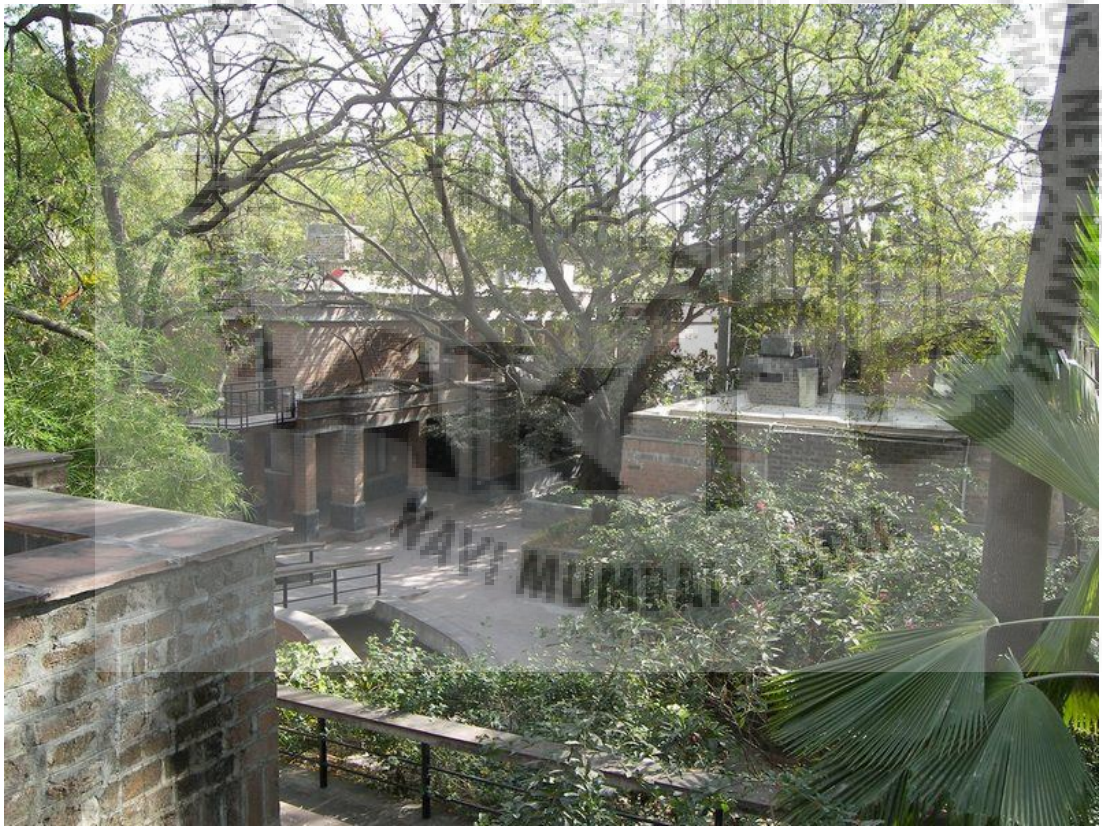
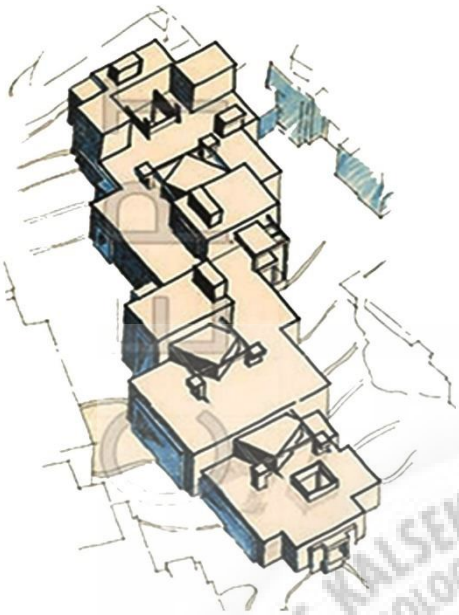


Fig 43: Centre for environmental education, Ahmedabad

Source: http://www.welcometoahmedabad.com/127/modern-architecture.html



SITE CONDITION

The structure is located in Ahmedabad. Ahmedabad has extreme temperatures. It is hot and dry in summer and cool and dry in winter.

The site was part of an established sand dune with 3 ridges sloping from NE-SW. There were a lot of existing trees on the site.

Built on a tetra - a mound in the north of the city - the structure follows the contours while embracing the natural landscape. Using the opportunity of the undulating site to create a variety of experiences, the building is almost a map of its landscape.

Fig 44: Isometric site plan of CEE, Ahmedabad

Source: Author

MAIN DESIGN INTENSION

The structure should blend in with the environment and not stand out. China mosaic tiles used on the roof to reflect heat.

Existing trees have been retained. They shade the buildings and the unbuilt space around them.

Fig 45: China mosaic tile on roof

Source: author

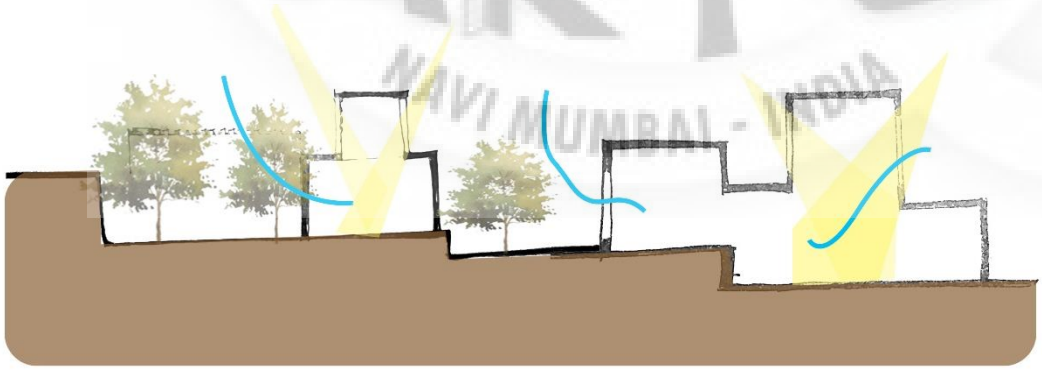
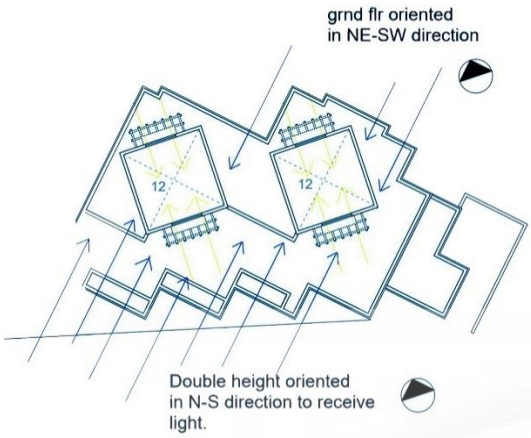


Fig 46: Schematic section of cee, Ahmedabad

Source: Author



Use orientation to generate a climatic response and therefore use as little mechanical cooling devices as possible.

Orientation of structure in north south direction for cross ventilation and sunlight.

Fig 47: Orientation of plan

Source: Author

Reflect the flexible nature of the organization's working in the plan, this resulted in a networked plan where each space is interconnected with the neighboring spaces.

FIG 48: planning of CEE, Ahmedabad

Source: author

Circulation outside the built spaces follows a linear spinal pattern.

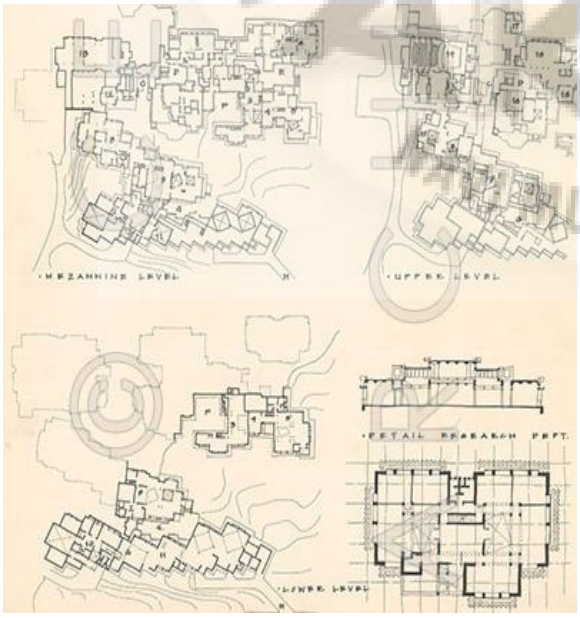
Through circulation structure create some amazing experience with the help of multilevel transition space.Within the enclosed space there is no formal circulation pattern-all spaces are interconnected with the adjacent spaces.

Fig49: circulation pattern of cee

Source: author

All the spaces forming the public interface are grouped together. Simple square cubic spaces nested within each other enclose spaces in varying degrees of openness. This resulted in a networked plan where each space is interconnected with the neighboring spaces.

Fig 50: Spatial planning of CEE source: author



The structure is sunk into the slope to create an 'earth sheltered construction' where the earth shields the west wall from the harsh solar radiation coming from the west. The temperatures at deeper depths in the earth are always at the average of the extreme surface temperatures.
Heights are multiples of the module of 4 bricks. The use of this module throughout the Structures gives them a sense of proportion and visual harmony with each other.
fig 51: planning strategies of cee

Source: www.ceptarchives.org

The entrance steps change in direction mid-flight which create an interesting architectural feature.

There is an entrance ramp provided alongside the entrance steps for the transport of heavy goods and also for the benefit of handicapped people.

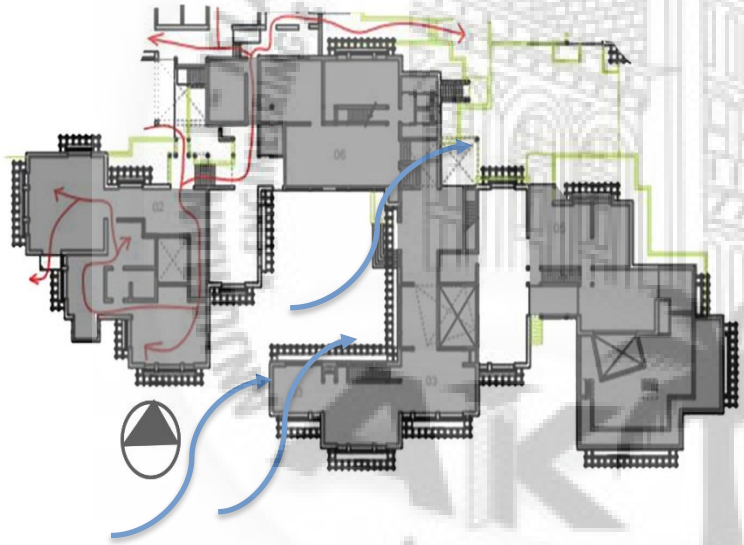
Fig 52: Entrance view of cee

Source: cee documentary work

TYPES OF COURTYARD INSIDE THE CEE

- Stepped courtyard
- Central courtyard
- Multipurpose courtyard space

ORIENTATION OF COURYARDS



The site was part of an established sand dune with 3 ridges sloping from NE-SW. courtyard spaces are arranging in between cluster of modules that it allow wind to get inside the structure.

Fig 53: orientation of courtyard of cee

Source: author

ENCLOSURE RATIO OF COURTYARD SPACE:

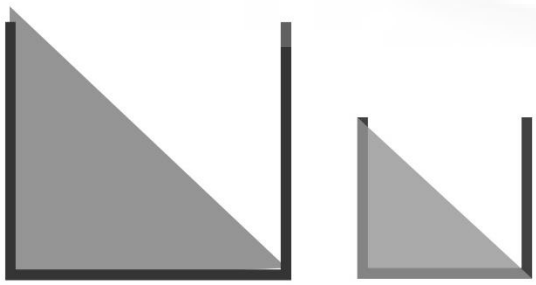


FIG 54: enclosure D/H ratio

a) D/H = 3/4
b) D/H=1/1

Source: author

Transitional spaces around courtyard

After the entrance steps, the user comes to a ramp which creates a sense of transition as the user moves down the steps over which the pergola is built.

Semi open space around the build space creates a break out spaces for user to connect with nature.Pergola semi open space blends with adjacent vegetation.

Fig 55: pergola semi-open space

Source: CEE documentary work

The pergola leads down to the canteen and the auditorium. Alongside the pergola is a ramp leading down to the reception area.

Spatial planning shows the visual connectivity between space inside the cee.

Fig 56: view ramp along with pergola transition space

Source: CEE documentary work

Below the ramp landing, there has been a space created for the children of the employees to play.

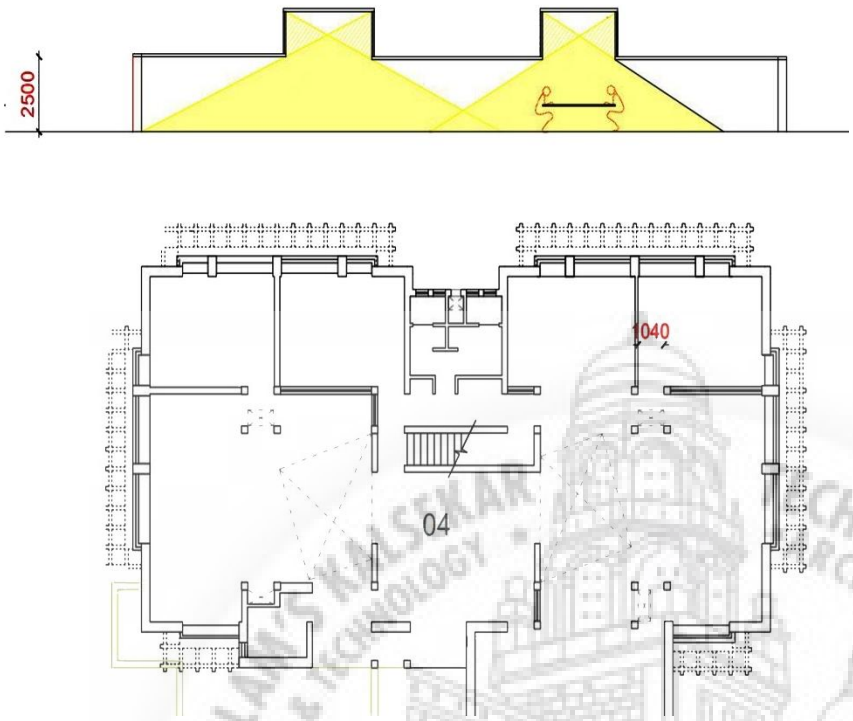
The ramp has an intermediate landing where one can stop and appreciate the view of the structures and their surroundings.

Semi open sitting space offer interaction around the courtyard.

Fig 57: Informal sitting and play area

Source: author

The ramp allows the user to visually appreciate the surroundings as he descends, without concentrating on where to put his foot down (as in the case of a flight of steps.)



The space under the double height is used for group working and the rest of the space is used for individual work.

The module of 1230mm is the size in which most partition screens, tables and tube lights are available in.

The double height is oriented north-south to let in light from those directions.

This space also serves as a space where the employees can carry out group work because the increased height provides a larger volume.

FIG 58: Double height spaces in cee

Source: author

MODULAR SYSTEM

- All heights are multiples of the module of 4 bricks.
- The use of this module throughout the structures gives them a sense of proportion and visual harmony with each other.

The temperatures at deeper depths in the earth are always at the average of the extreme surface temperatures.

The path leads from open-to-sky courtyards to semi-open verandas to enclosed spaces. Circulation outside the built spaces follows a linear spinal pattern.

Fig 59: module system

Source: https://anujdaga.blogspot.com/2017/03/centre-for-environment-education.html

Activities in and around courtyard spaces

An informal sitting around the space between courtyard and auditorium acts as a spill-over or transition space for the crowd that will use the auditorium at a time.

Fig 60: Spill out space adjacent to courtyard.

Source: https://anujdaga.blogspot.com/2017/03/centre-for-environment-education.html

A courtyard just outside the seminar room acts as a transition space for users before, during a break and after attending a seminar

Fig 61: courtyard near to seminar room

Source: https://anujdaga.blogspot.com/2017/03/centre-for-environment-education.html

The path leads from open-to-sky courtyards to semi-open verandahs to enclosed spaces.

Fig 62: connectivity between space through central courtyard

Source: author

Fig 63: The path leads to open courtyard space

Source: author

INFERENCE:

Responding appropriately to the climate, the building offers enough release spaces into its heavily landscaped outdoor, which is never too warm under the thick canopy of trees. The multiple terraces under the tree cover are seemingly more habitable than the inside. They give different degrees of privacy and proximity with people.
Three strategic inference give rise to distinct experiences:
1. Building fully / partially under the ground 2. Building leveled with the ground
3. Terracing the ground.

6.2.2.AMERICAN INSTITUTE OF INDIAN STUDIES

LOCATION : Gurgaon, India
FLOOR AREA: 1500 SQ.M
CLIMATE : Composite
YEAR : 1998
TYPOLOGY : Institutional

The aiis (American institute of Indian studies) is a consortium of American universities that provides scholars with facilities for research in Indian art, architecture and music.

Fig 64: American institute of Indian studies, Gurgaon, India

Source: https://space-design.com/aiis-gurgaon-1998/

Concept:

- Fusion of traditional architecture with modernism
- One of the differences between traditional Indian Architecture and European style buildings is in the Diversity of functional spaces that an Indian building

DESIGN FEATURES OF AIIS:

- Terrace garden
- light shelves
- glass brick
- courtyard planning
- long courbusian louvered slits
- expanded polyethylene insulation

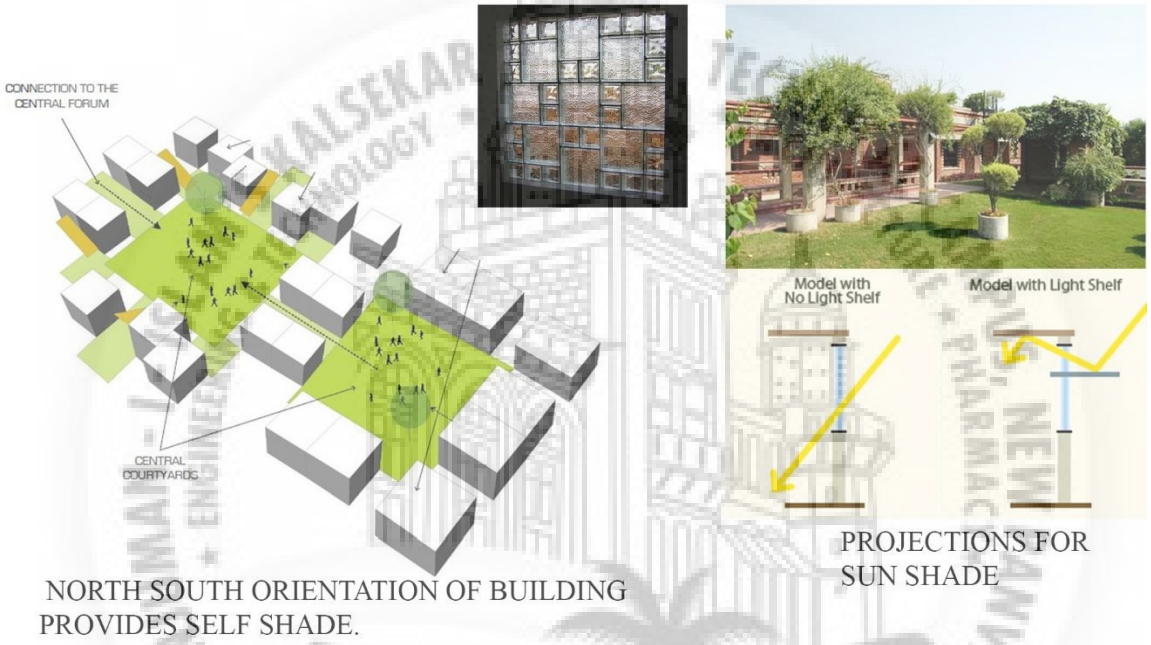


FIG 65: Design features of AIIS

Source: author**American Institute, Gurgaon (1998); A building with a title, 'earth sheltered', was designed considering sustainability as its first priority. Energy efficiency, material selection for reduction in wastes and pollution are the guides for designing. AIIS being traditional in its look, yet adopted innovative and simple energy conserving and passive cooling measures. The ambience is created by using vegetation and water bodies in courtyards for keeping the building naturally cool.**

FIG 66: view of aiis, Gurgaon

Earth contact

1. Since it is difficult to cool a multi-storeyed building by passive solar techniques, in the new design, the building was limited to basement and ground floors.
2. The work spaces are arranged around two sunken courtyards with water and plantations. The passages around the courtyards form a thermal transition zone between the outdoor and the controlled indoor temperature
3. The archives have to be maintained at a temperature of 18 degree and need to be air conditioned anyway.

The Work areas located at the ground floor are protected by specially insulated (expanded polyethylene) external walls and cooled by terrace garden.

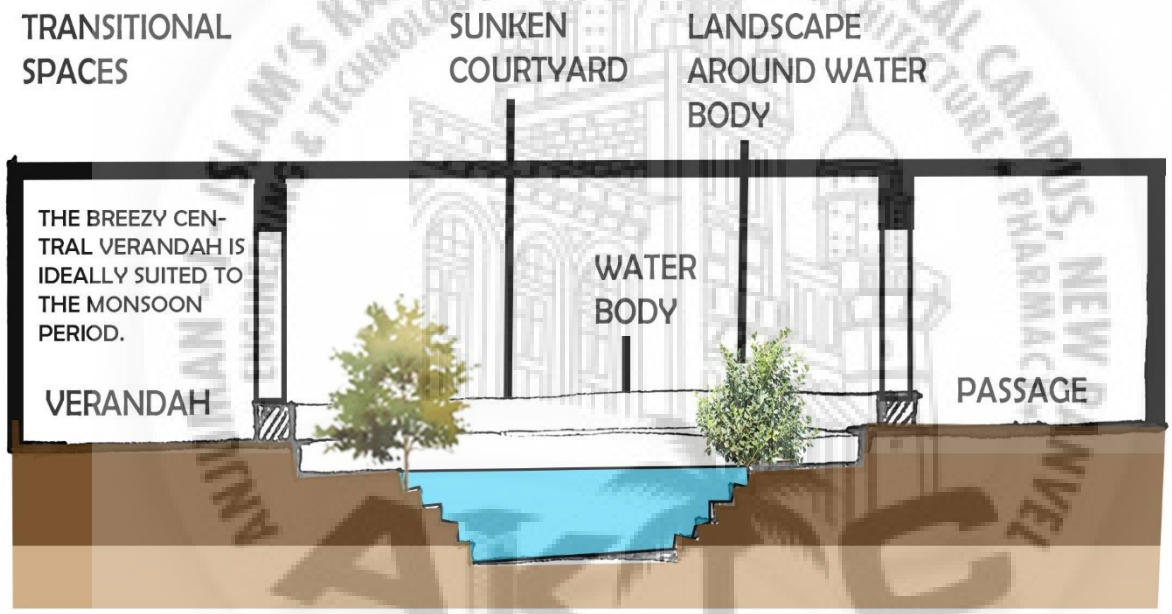


Fig 67: Schematic section of aiis, Gurgaon

Source: author

Natural materials like **brick, exposed concrete, and sandstone** add to this ambiance. Courtyards impart AIIS the look of **non-air-conditioned building, reducing the need for air-conditioning**. Courts also bring light and provide internal views.

Fig 68: exposed brick façade, aiis

Source : https://space-design.com/aiis-gurgaon-1998/

Fig 69: basement plan of aiis Source: author

The building is staggered 45 degrees on the site allows a perfect north- south orientation for all openings.

fig 70: ground floor plan of AIIS Source: author

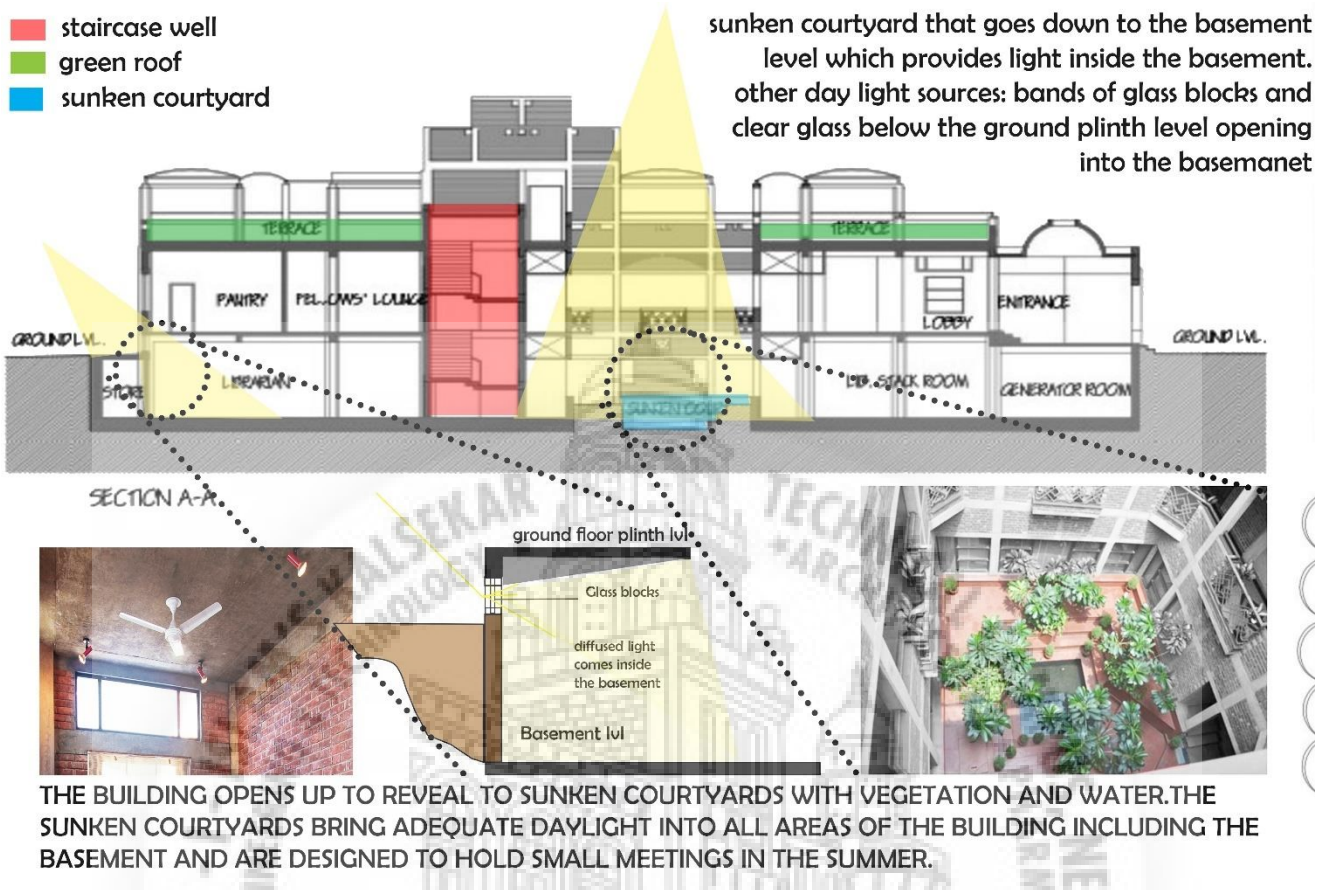


fig 71: sectional details of AIIS Source: author

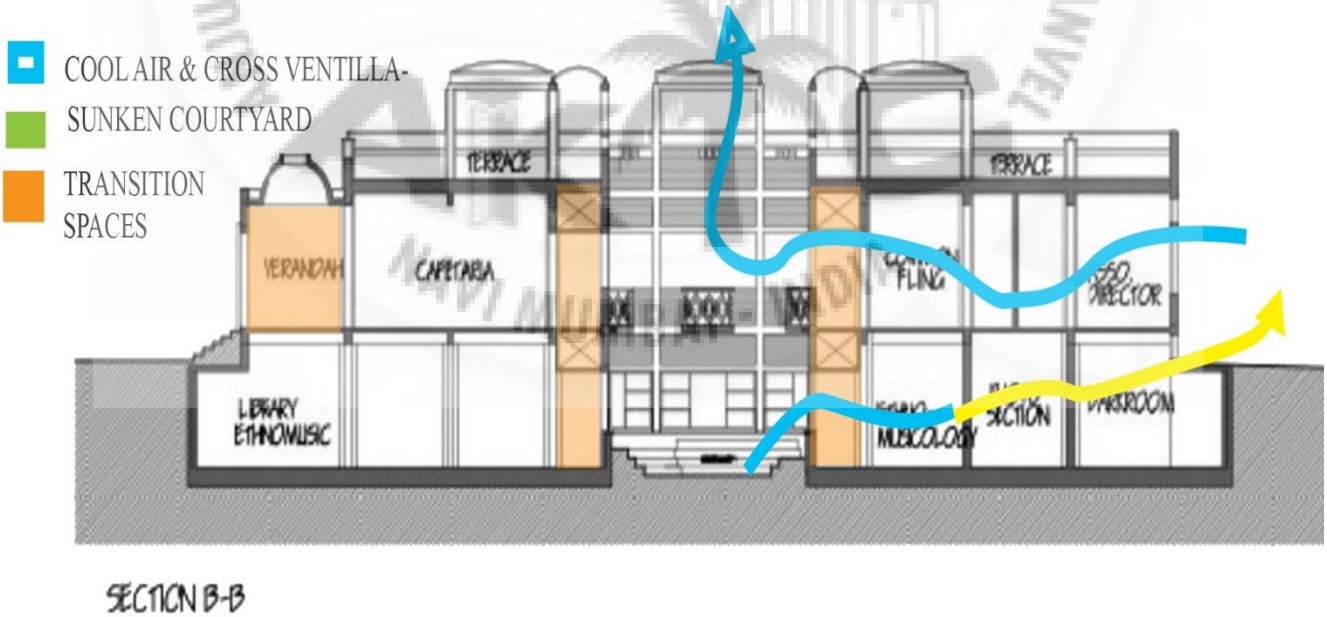


fig 72: Section of sunken courtyard with adjacent transition spaces.

Source: author

TYPES OF COURTYARDS IN AIIS

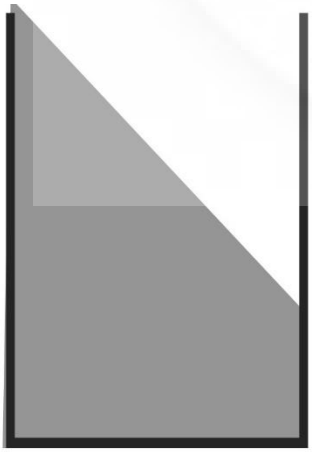
- CENTRAL COURTYARD
- SUNKEN COURTYARD
- SQUARE COURTYARDS

ORIENATATION OF COURTYARD

North - south orientation for self-shade and to create micro climate inside the structure.

FIG 73: orientation of courtyard, AIIS

Source: author



ENCLOSURE RATIO OF SUNKEN COURTYARD

Feeling of enclosure inside the sunken courtyard is full enclosure. Sunken courtyard with water feature create thermal comfort inside the structure

D/H RATIO OF SUNKEN COURTYARD IS 1/3

Fig 74: Enclosure ratio of sunken courtyard

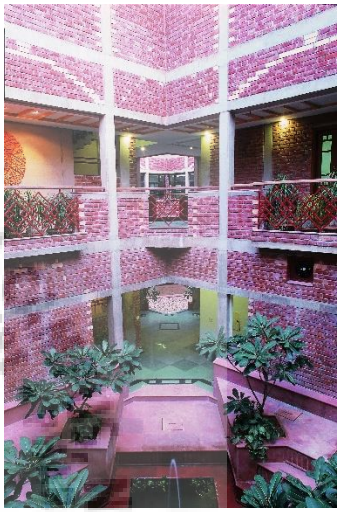
Source: author

TRANSITIOAN SPACES AROUND COURYARD

Corridor spaces around the courtyard helps to cut down direct sun and act as a buffer zone between indoor and outdoor spaces.

Fig 75: corridor space around courtyard

Source: author



Passage:

Passage around courtyard open space connect space with central landscaped courtyard and act as a recreational space for user to experience the courtyard.

fig 76: passage area adjacent to open space

source: https://space-design.com/aiis-gurgaon-1998/

INFERENCE:

Natural materials like brick, exposed concrete, and sandstone add to ambiance. Courtyards impart AIIS the look of non-air-conditioned building, reducing the need for air-conditioning. Courts also bring light and provide internal views. Brick walls with ornamental geometric patterns make the structures a treat to the eye, letting in light and enabling good ventilation. The sloping concrete roofs and red-oxide floors complement the walls in keeping the place interiors cool and comfortable.

use of sunken for light and ventilate to create micro climate inside the structure.
transitions spaces with vegetation and water features around the courtyard bring openness inside the structure.

6.2.3.FRIENDSHIP CENTER

LOCATION: Bangladesh
ARCHITECT: Kashef Mahboob Chowdhury
TYPOLOGY: NGO (Training centre)
YEAR :2011
AREA :2897 SQ.M

The Friendship Center near the district town of Gaibandha, Bangladesh, is for an NGO which works with some of the poorest in the country and who live mainly in riverine islands (chars) with very limited access and opportunities. Friendship uses the facility for its own training programs and will also rent out for meetings, training, conferences etc. as income generation.

FIG 77: friendship centre, Bangladesh

Source: https://www.akdn.org/architecture/project/friendship-centre

CONCEPT:

Center has been inspired by the monastic aesthetic of the 3rd century BC ruins of Mahasthangahr, the earliest urban archaeological site yet found in Bangladesh.

Whilst the simple, graphic forms of its brick construction present a slightly archaic aspect, its enclosure by a bund or embankment lends the whole site an inward-looking inverted feel, almost like an excavation. This sense of history and rootedness is a central one in the work of the Centre's architect Kashef Mahboob Chowdhury and his practice URBANA, with its forms and plan drawing on influences from Louis Kahn to Buddhist monasteries. We asked him about the project and its genesis.

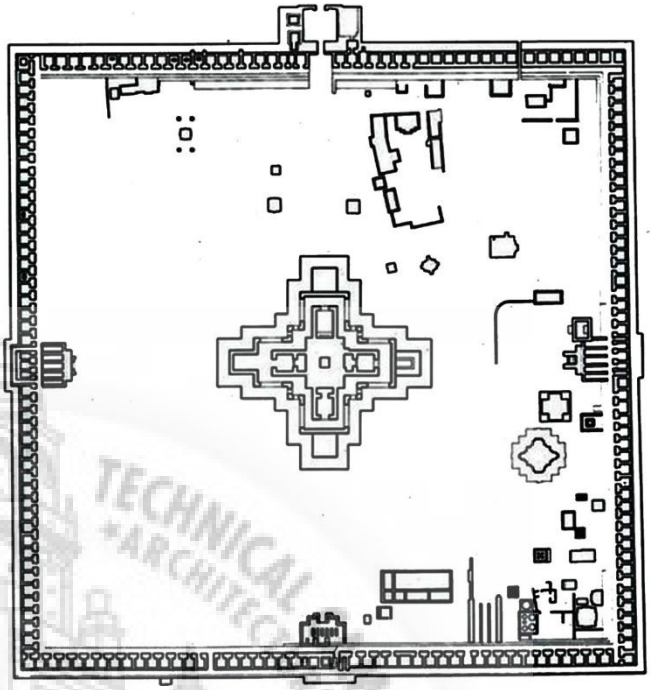


FIG 78: plan of mahastangahr

Source: www.wikipedia.com

Kashef Mahboob Chowdhury/URBANA's Friendship Centre in Gaibandha, Bangladesh, seems like a project that is not so much built up in the landscape but carved out of it. A labyrinth of arches, courtyards, pavilions, and pools, all carefully crafted from handmade bricks, define the space of a facility for a charitable organization—Friendship NGO—who work with remote communities with limited opportunities.

Fig 79 : a) arches b) ponds c) courtyards space in friendship centre

Source: https://www.akdn.org/architecture/project/friendship-centre

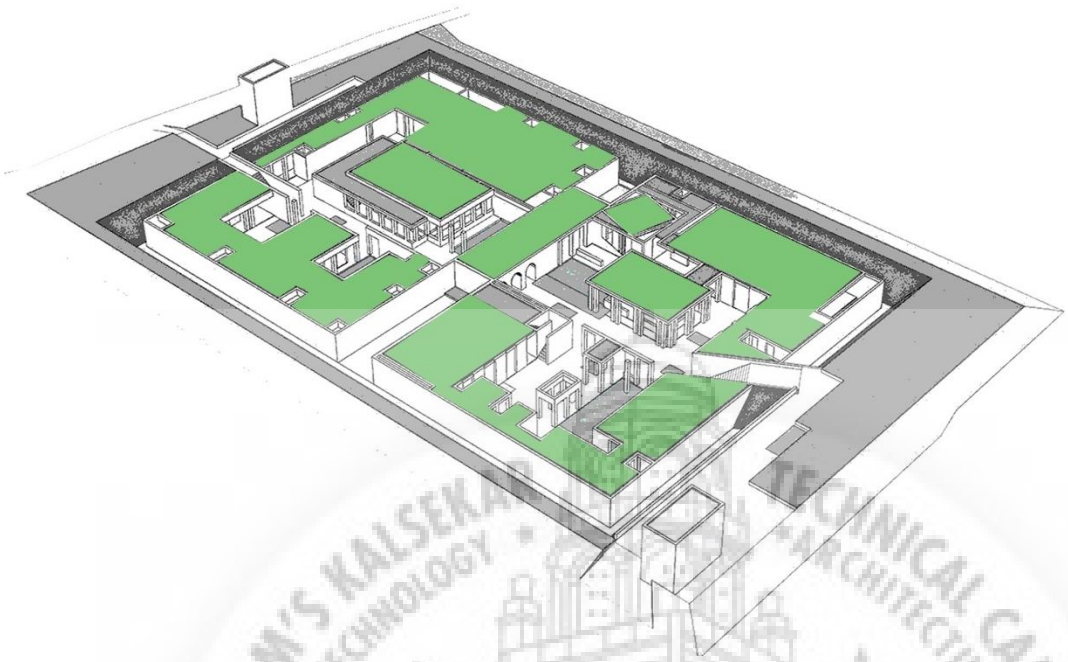


Fig 80: schematic isometric plan friendship centre

Source: author

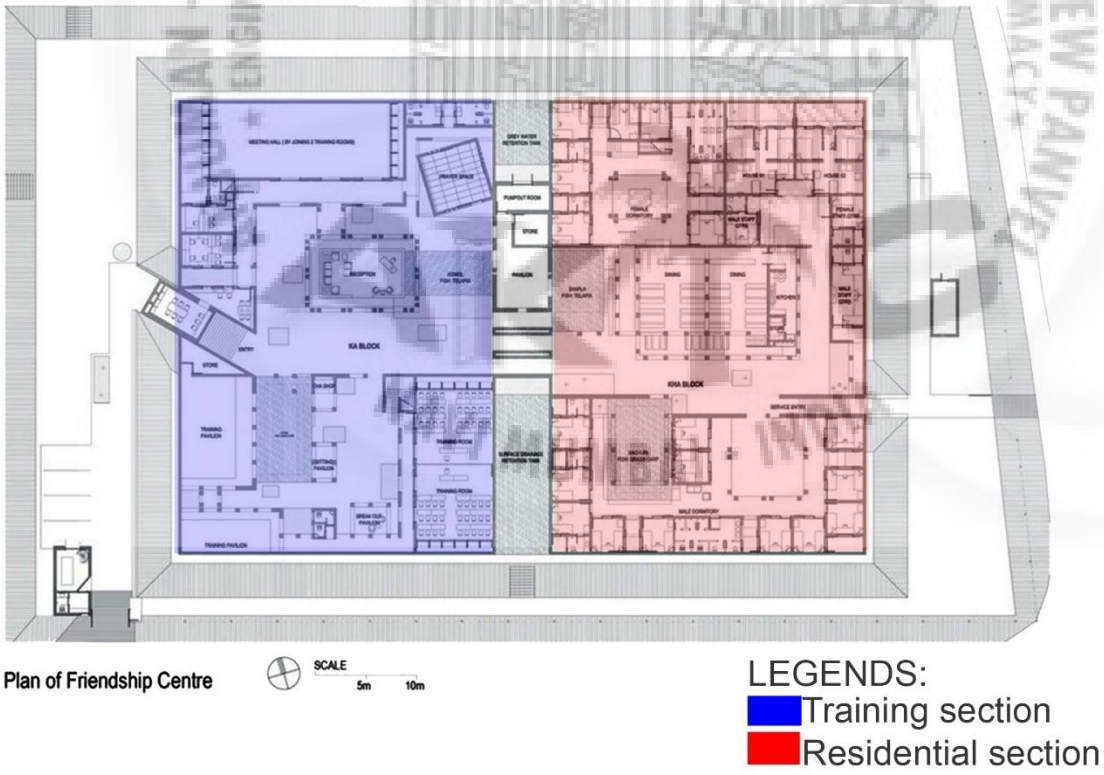


Fig 81: planning of friendship centre source: author

The Friendship Centre is divided into two sections, the outer Ka block for the offices, library and training classrooms and the inner Kha block for the residential section.

The third and final design relies on a surrounding embankment for flood protection while building directly on existing soil, in load bearing masonry.

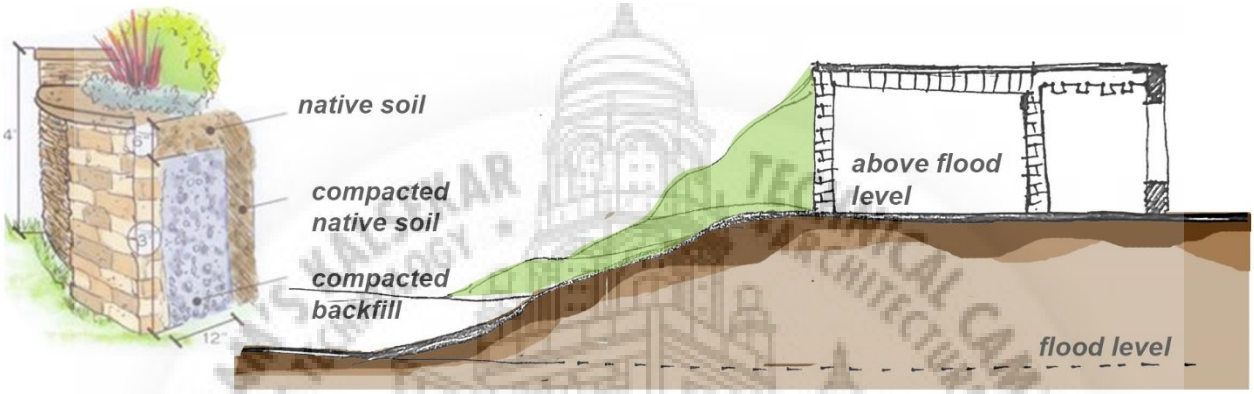
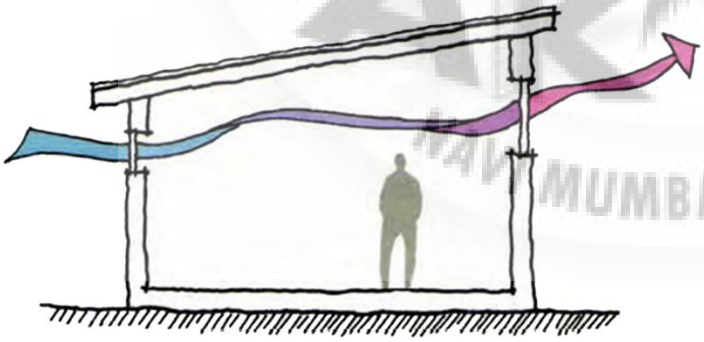


fig 82: earth covering strategy used for planning

source: author

The Centre is located in an agricultural area susceptible to flooding and earthquakes, and whose low-bearing soil has a low bearing capacity. As a result, an embankment has been constructed with a water run-off pumping facility.

To prevent flooding, the Friendship Centre is built directly on the low land and the entire site is protected with an embankment which could be built and maintained for much less.



Each building within the complex is constructed from a uniform brickwork, creating a maze of pavilion-like structures. Each block has the same height and every rooftop is covered with grass.

Fig 83: planning based on cross ventilation

Source: author

The project uses sustainable design approaches. From the architects,
"Rainwater and surface run-off are collected in internal pools and the excess is pumped to an excavated pond, also to be used for the fishery.

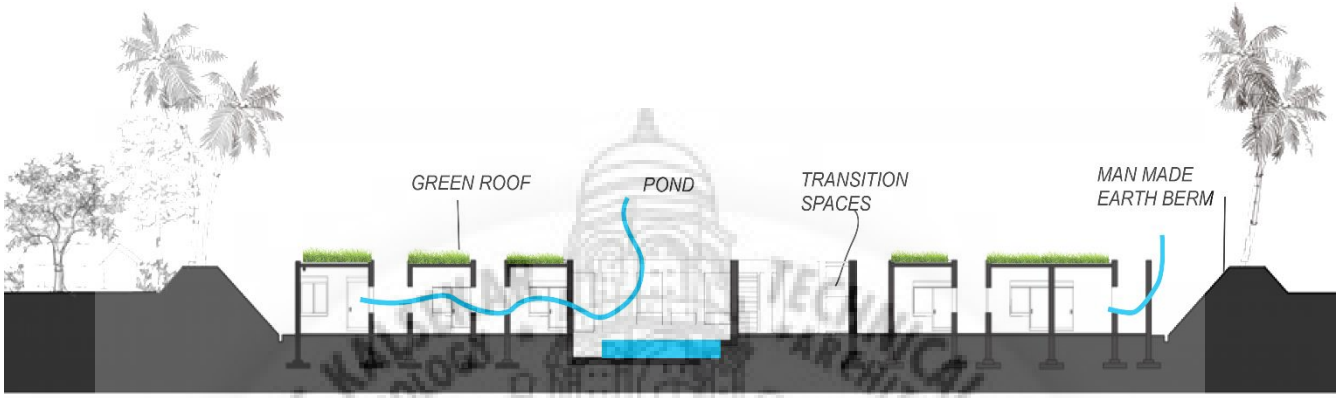


Fig 84: section of friendship centre through pond showing different space around pond courtyard

Source : author

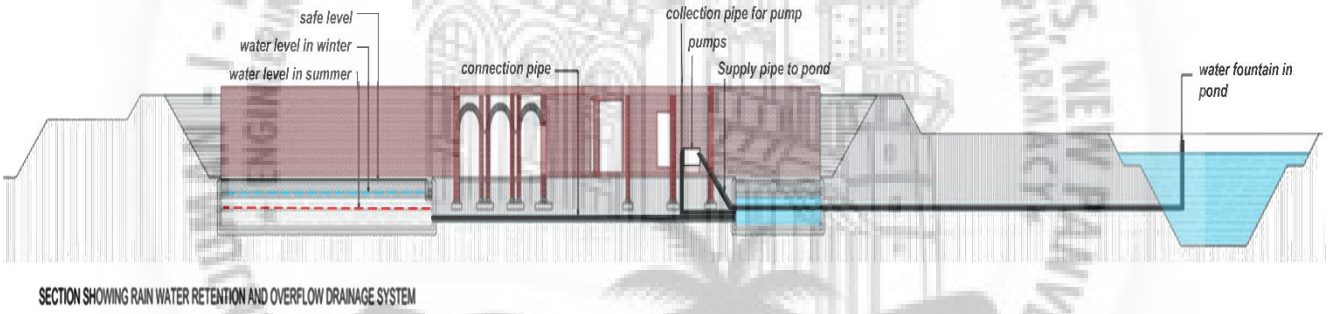


Fig 85: section showing rainwater harvesting system of centre

Source: author

As a result, an embankment has been constructed with a water run-off pumping facility. Excessive rainwater is collected in some of these pools and pumped into a nearby pond, while a complex network of septic tanks and wells prevents sewage mixing with flood water.

Large openings in the walls bring natural light and ventilation through the buildings, while a sequence of small courtyards and pools allow cool air to circulate.

Excessive rainwater is collected in some of these pools and pumped into a nearby pond, while a complex network of septic tanks and wells prevents sewage mixing with flood water.

TYPE OF COURTYARDS IN CENTRE:

- Pond courtyard
- Central courtyard
- Alley courtyard
- Stepped courtyard

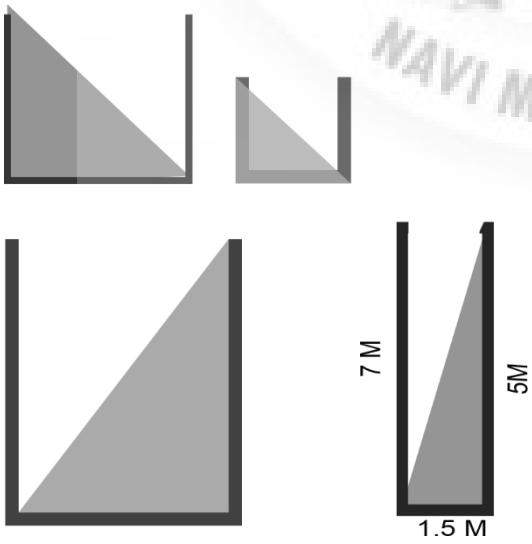
ORIENTATION OF COURTYARD

north east direction for cross ventilation to create micro climate. Orientation of courtyard have been done in such a way that it creates light and shadow patterns inside the structure to give continuous linkage between indoor and outdoor space.

Fig 85: build – unbuild ratio of spaces as well as orientation of courtyard

Source: author

Above plan showing build – unbuild ratio of centre. In this centre architect created lots of transition space to connect structure physically as well as visually.



Enclosure ratio of courtyard

In this centre we different all types of enclosure space from full enclosure till less enclosure.

Because of multiple transitional space alley courtyard type has created in some points. These enclosure ratio helps to identify public and private spaces as well as shaded and non-shaded space.

Fig 86: enclosure ratio of courtyards inside the centre Source: author

ACTIVITIES IN COURTYARD OF THE CENTRE

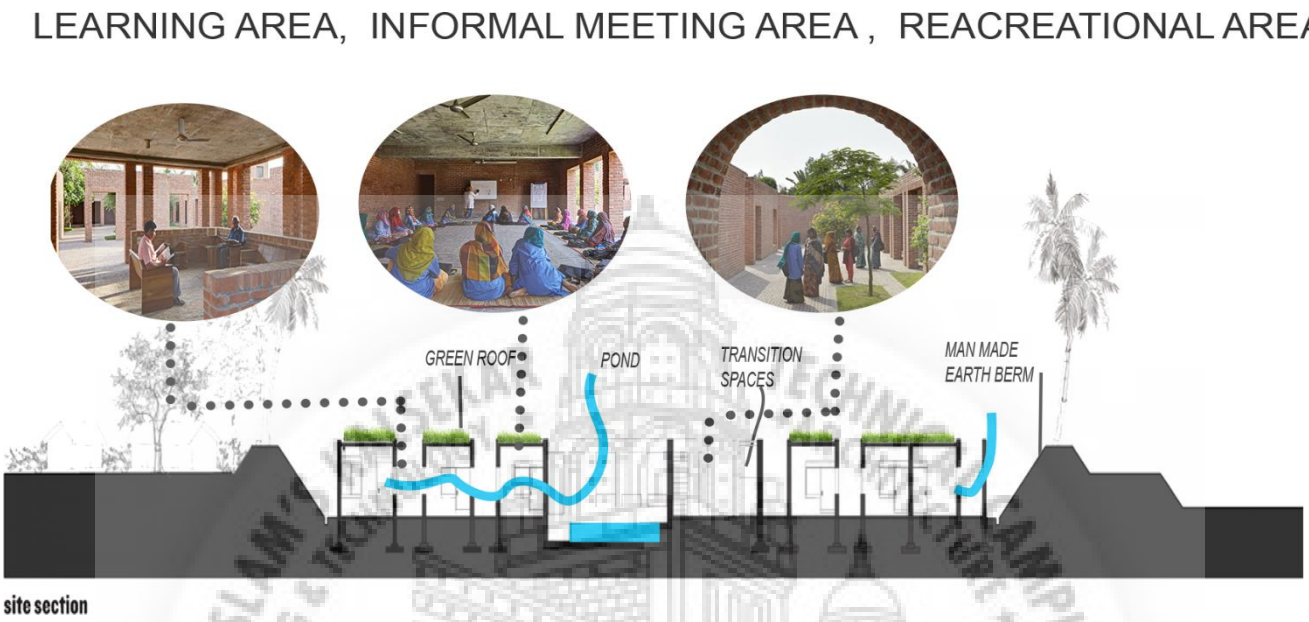


Fig 87: section showing adaptation courtyard, activities inside the courtyard

Source: author

Constructed and finished primarily of one material - local hand- made bricks - the spaces arc woven out of pavilions, courtyards, pools and greens; corridors and shadows. Simplicity is the intent; monastic is the feel.

The centre serves and brings together some of the poorest of poor in the country and -by extension - in the world, yet in the extreme limitation of means was a search for the luxury of light and shadows of the economy and generosity of small spaces; of the joy of movement and discovery in the bare and the essential.

INFERENCE

This project was chosen as my first precedent for its usage of the courtyard as gathering space and tool of building formation. It has open to sky courtyards with various degrees of privacy, which allows the courts to be enlivened by multiple activities. Its response to the site and context and the way of translating the concept into programmatic spatial organization are additional reasons to choose this project for precedent study.
after studying all types of courtyard and transition space and build space ,it proved that courtyard space can develop with the help of adjacent build form such as transition space ,closed, semi closed space

6.2.4.KHAMIR ART MUSEUM, KUTCH, GUJARAT

LOCATION :KUTCH,GUJARAT
AREA :2200 SQ. M
ARCHITECT :NEELKANTH CHAYA
YEAR :2017
TYPOLOGY :ART AND CRAFT CENTER

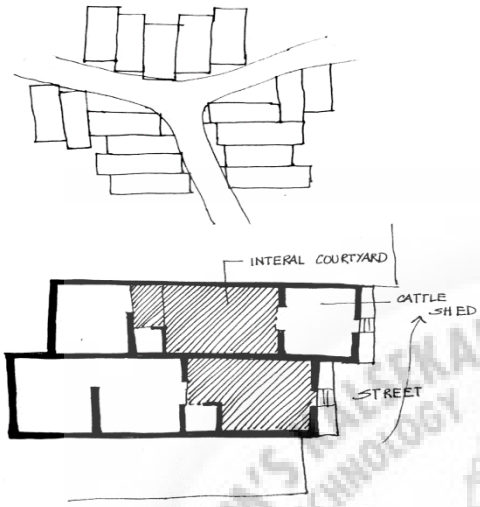
The planning is done in staggered arrangement which strongly can be seen from plan. modules are repeat to form cluster design which represent heplanning of traditional kutch village. Orientation of each block provide proper light and air breeze ventilation in spaces.

Situated in the midst of a vast arid expanse in Kutch, the architecture of Khamir Crafts Resource Centre in Kukma is one of participation in the celebration of the crafts from the region. Designed to facilitate a network with the artisans by responding to their way of life and work, the place builds upon the complex cultural relationships therein. In a region that faces natural extremities, craft, in Kutch, is a means of self-reliance. Where every community is distinctly different from the other – the Meghwals and Sodhas as **weavers and embroiders of cloth, Khatris as block-printers and fabric dyers, MultaniLohars as makers of copper plated bells, and Sonis as makers of exquisite silverware and jewellery**among many others; Kutch is home to some of the finest traditional craftsmanship in the country.

Fig 88:

khamir craft resource centre, Gujarat
Source: http://www.hunnarshala.org/khamir-craft-facility.html

Concept:



The design planning this center is derived from the local streetscape and village pattern noted before earthquake Y shaped branching of streets forming inter-connections at regular intervals. Chowks which further form village settlement.

Fig 89: typical street section of Gujarat

Source: author

Typical street layout
The planning of khamir is done in chowks and courts streetscape manner.
It establishes a kind of urban approach having intergrity and involvement.

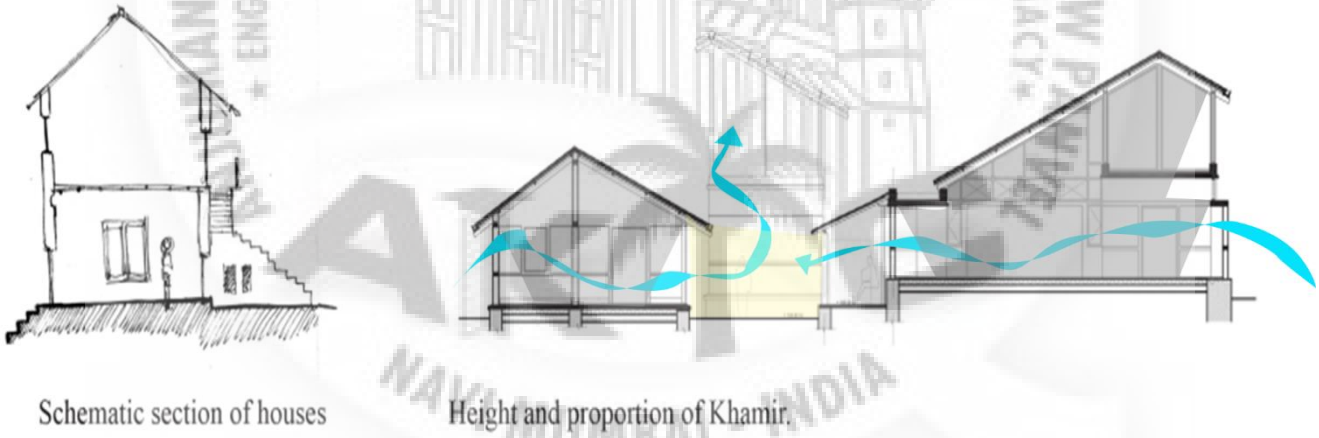


Fig 90: adaptation of tradition Kutch house in khamir structure

Source: author

The courtyards of khamir are planned similar to the courtyards in the houses such that it has both semi covered, covered and internal courtyards which are connected to each other which becomes the major activity areas.

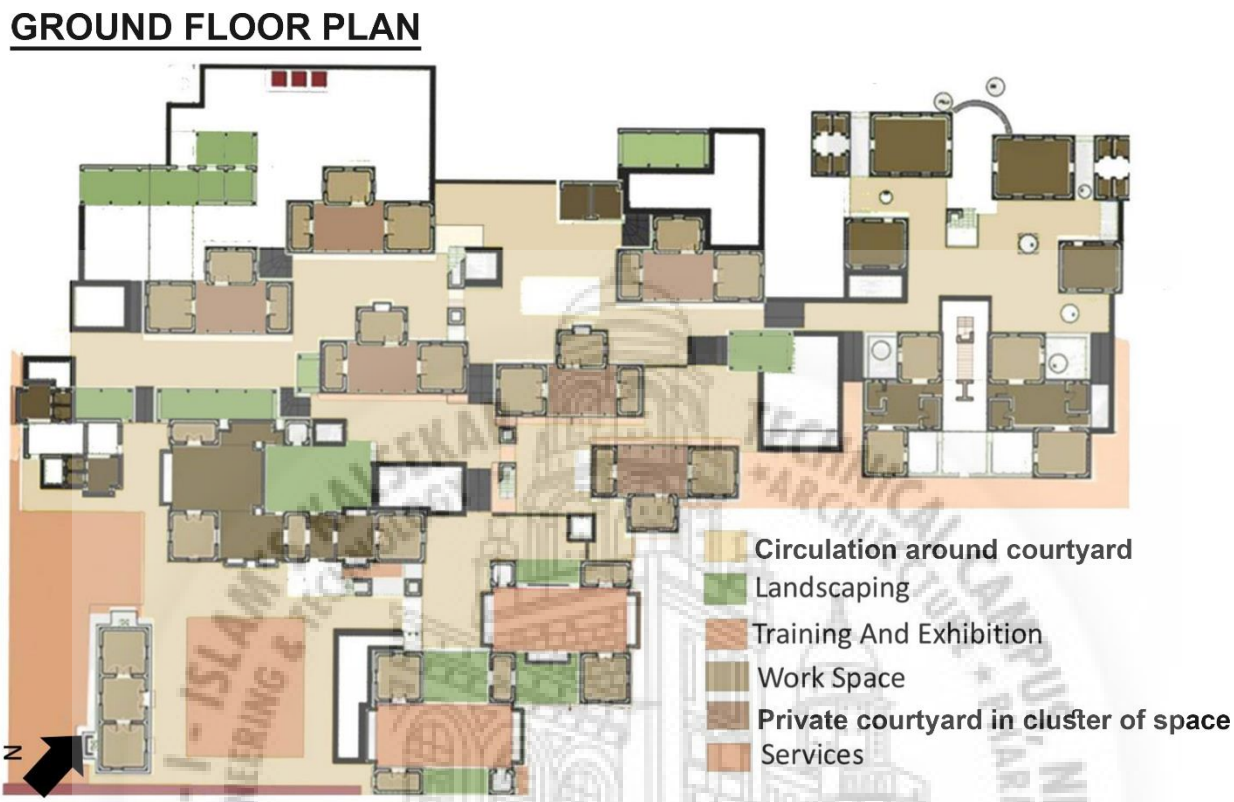
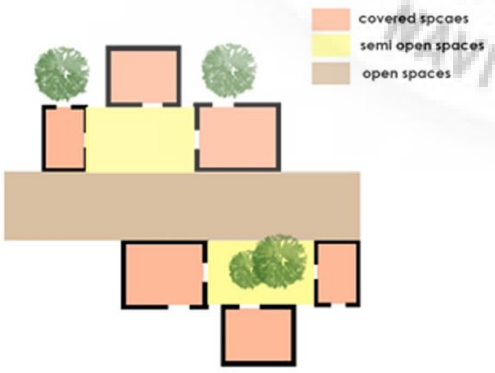


Fig 91: ground floor plan of craft centre

Source: author

An important innovation that was done at this campus was that the walls on the 1st floor were made with Wattle & Daub panels. These panels were plastered with lime. On the ground floor all the construction is rammed earth.



workshop areas are made by making modules and repetition of it six times to create chawk, alley space in between the clusters.

private courtyard space for cluster used to interact as well as serve working space

Fig 92: planning of workshop space

Source: author

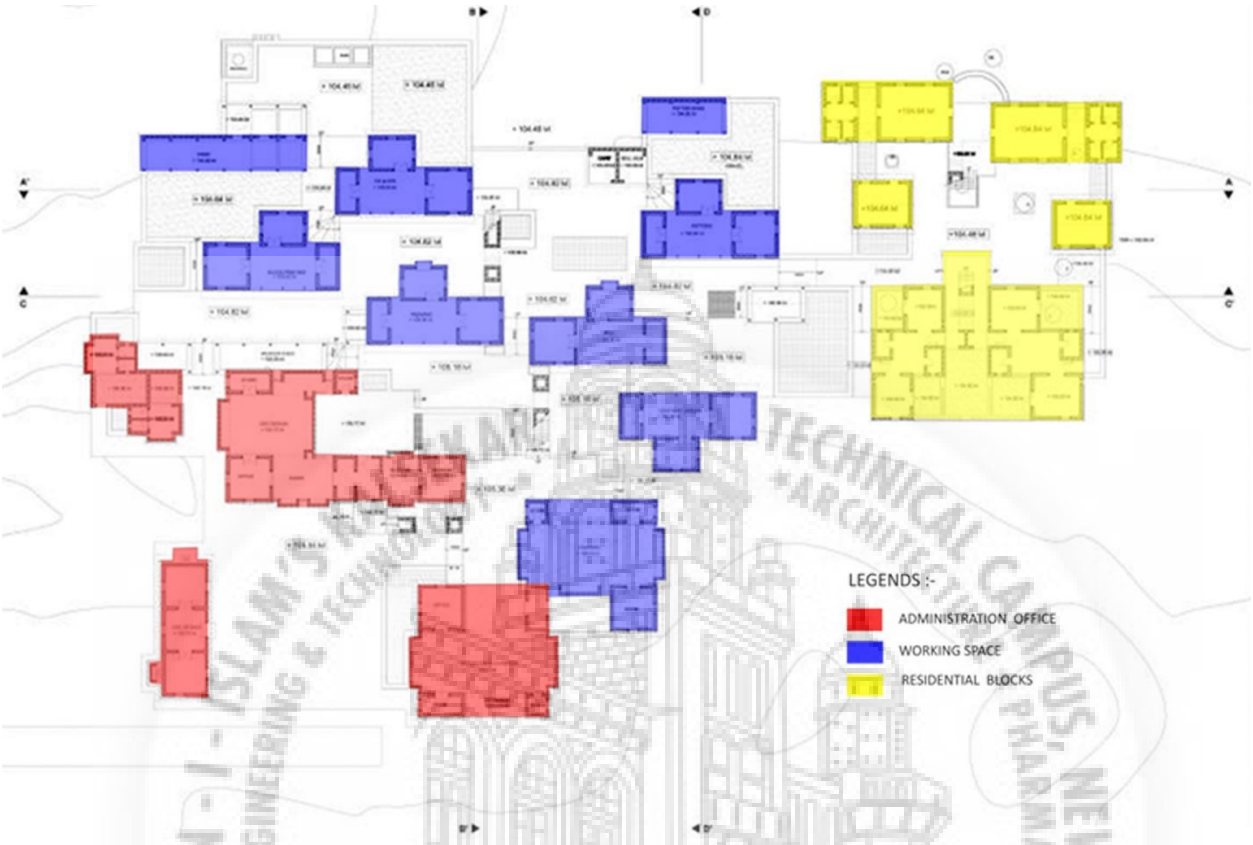


fig 93: spatial planning of different space in craft center Source: author

Fig 94: circulation, relation between landscape and build spaces source: author

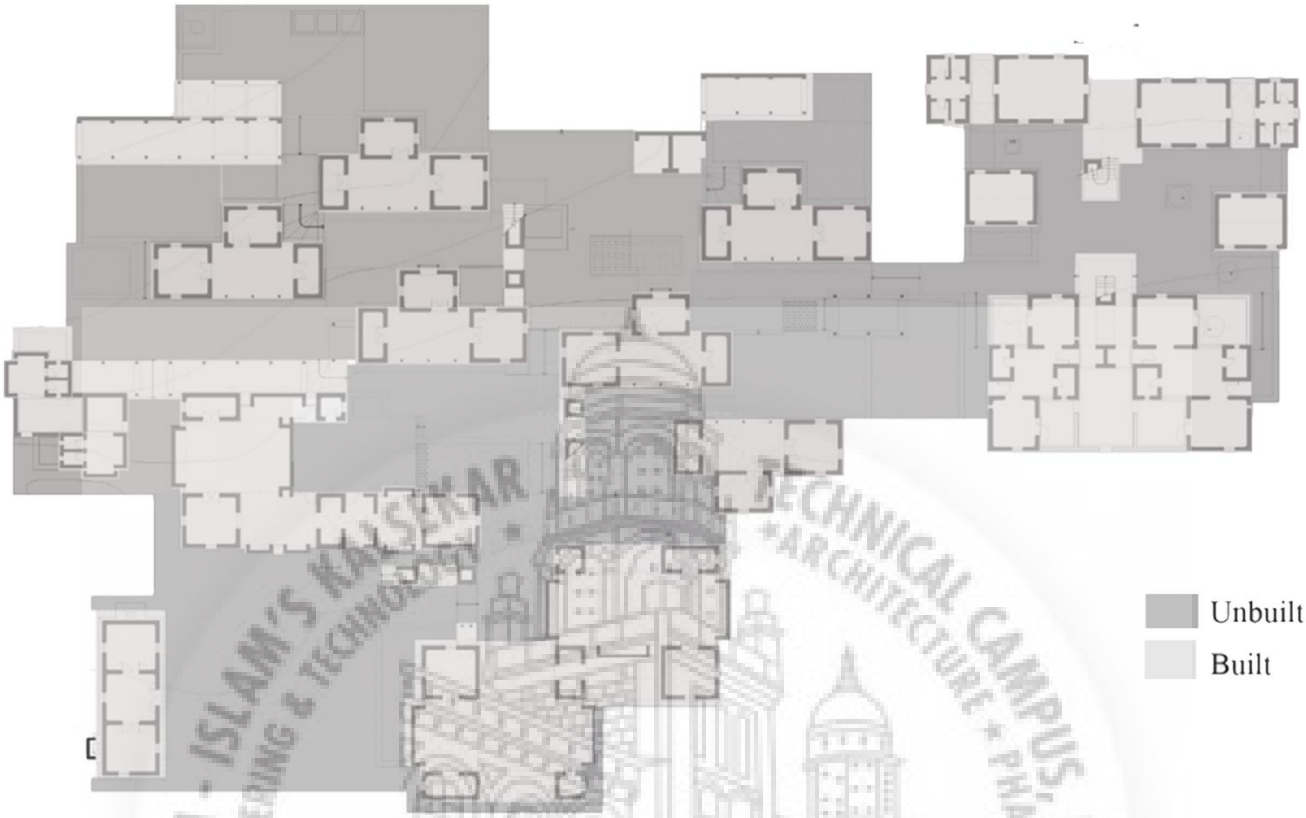


fig 95: plan showing build -unbuild space ratio of khamir craft centre

source: author

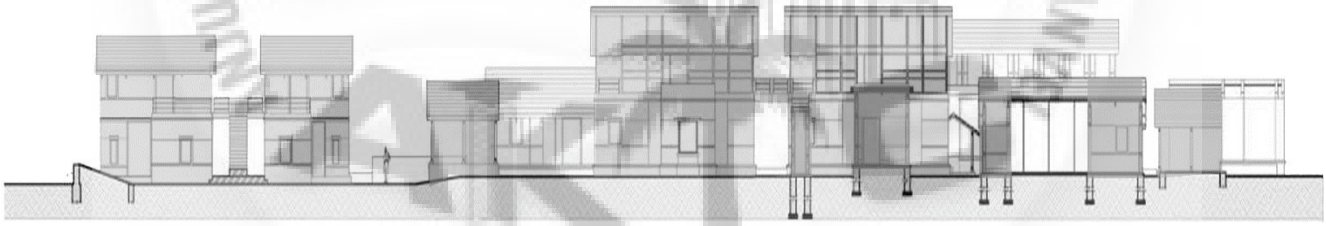


fig 96: build – unbuild space, height ratio of structure and open space in section

source: author

Interrelation between closed, semi-open and open spaces to create natural and fresh environment for people working there.

• Building module are placed in such a way to form narrow pathways and shaded spaces

• Courtyards are connected by shaded pathways.

Types of courtyards

- Rectangular courtyard
- Square courtyard
- Alley courtyard

Orientation of courtyards

EAST -WEST DIRECTION FOR SUNLIGHT AND VENTILATION.

ENCLOSURE RATIO OF COURTYARD

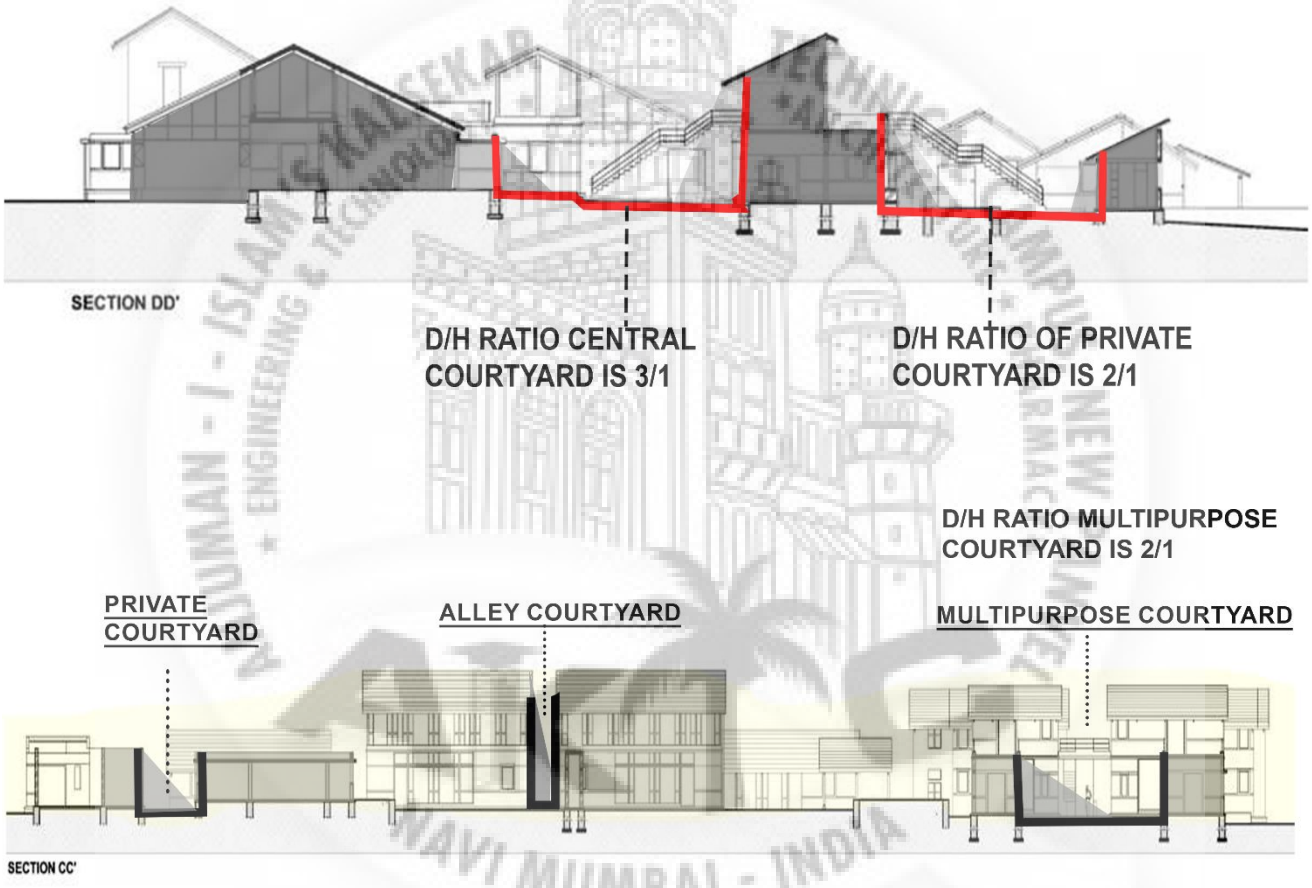


Fig 97: enclosure ratio of courtyards of khamir centre

Source: author

Two types of roof can be seen – Lean to and Couple Roof.

• Height Variations to provide shade and shadows.

• Small openings to avoid harsh sunlight.

Adaptation of courtyard space

Fig 98: user adaptation of courtyard space

Source: author

Landscape element used n and around courtyard

There are a number of courtyards connected by pathways.

• Pathways are made up of sandstones.

• Trees are planted along courtyards to provide shade.

• Trees are planted in front of windows to create proper screening.

• Many levels are created for people to have interesting pathways.

• Trees are planted along exterior wall of admin block to create buffer zone.

The design is organic which puts together of independent buildings that make interlocking courts and streets.

• Materials are in combination of random stone, earth, and lime technologies.

• Roof is covered with Mangalore / country tiles.

• The doors are made of local wood with metalwork.

• Rain water harvesting system is present.

Analysis

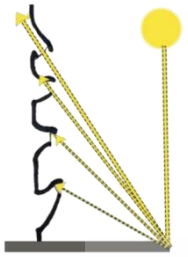


Fig. 99: sculpted wall section

Source: author

Fig.100: sculpted wall from internal

Source: http://thinkmatter.in>khmir

Use of Sculpted wall underneath gable roof bring indirect sunlight also helps in ventilation. while designing the orientation pf wall taken into account.

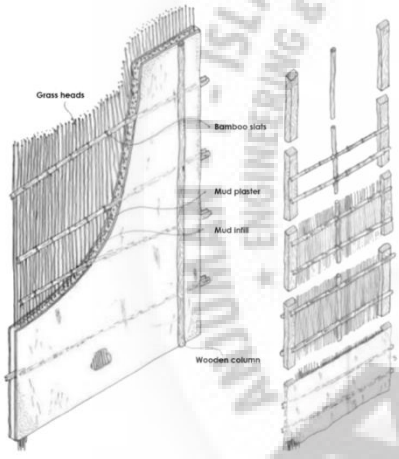


Fig. 101: wattle and daub wall

Source :author

While ground floor of building constructed in rammed earth the upper floor is made of wattle and daub to reduce cost and reduce the dead loda on wall.

INFERENCES

- Walls and ground floor made in rammed earth to sure stability to structure through load Bearing.
- Roofs are in gable and lean to achieve cooling by shading.
- Such intervention helping in reviving the art and crafts of region.
- Mix use of open and semi open spaces provide flexibility to user to perform work.

6.2.5.SUP ATELIERS HAINAN

LOCATION :Chengmai, Hainan

AREA :10980 SQ.M

TYPOLOGY :MULTIPURPOSE BUILDING

YEAR :2019

ARCHITECT :SUP Atelier, Xiaojuan Chen, Yehao Song

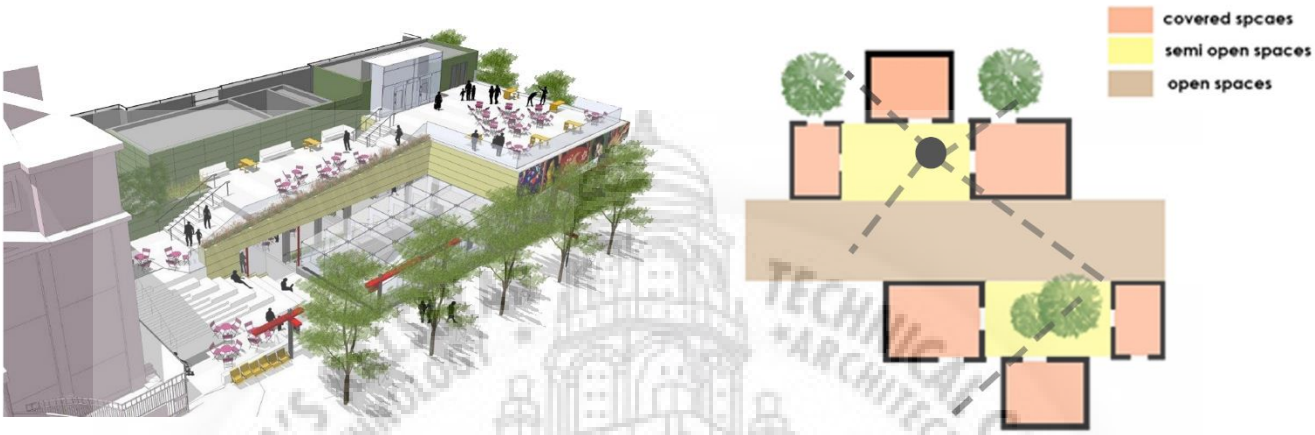
Designed by SUP Atelier, the Hainan Smart Ecological New City Digital City Hall, themed "Garden & Courtyard", is a multi-functional building available for exhibition, creative industries, and commercial offices. The design, starting from climatic strategies for subtropical zones, has introduced terraced fields, a series of interconnected courtyards at various altitudes, outdoor atriums and cooling alleys into the building. Taking the abstract prototype of Eastern gardens and courtyards as a reference, these spaces are integrated into the multi-functional city hall to form a multi-dimensional public space with gardens and courtyards, where people can enjoy various scenes with changing viewpoints through the winding paths.

FIG 102: sup ateliers multipurpose building, hainan

Source:https://de51gn.com/sup-atelier-designs-sustainable-multipurpose-building-in-hainan-inspired-by-the-areas-red-soil/

CONCEPT

Designed by SUP Atelier, the Hainan Smart Ecological New City Digital City Hall, themed "Garden & Courtyard", is a multi-functional building available for exhibition,creative industries, and commercial offices.



Multilevel courtyard created for visual connectivity through interconnected transitional courtyard spaces.

ARCHITECTURE PLANNING

The stacked texture of pumice seems to have merged into the landscape, impressing the design team with the power of nature. The architects working on the project found the gaps, holes and colours of pumice to be no different from those of red soil and vegetation in essence.

Fig 103: planning of sup atelier multi-purpose centre

Source: author

Build -unbuild ratio

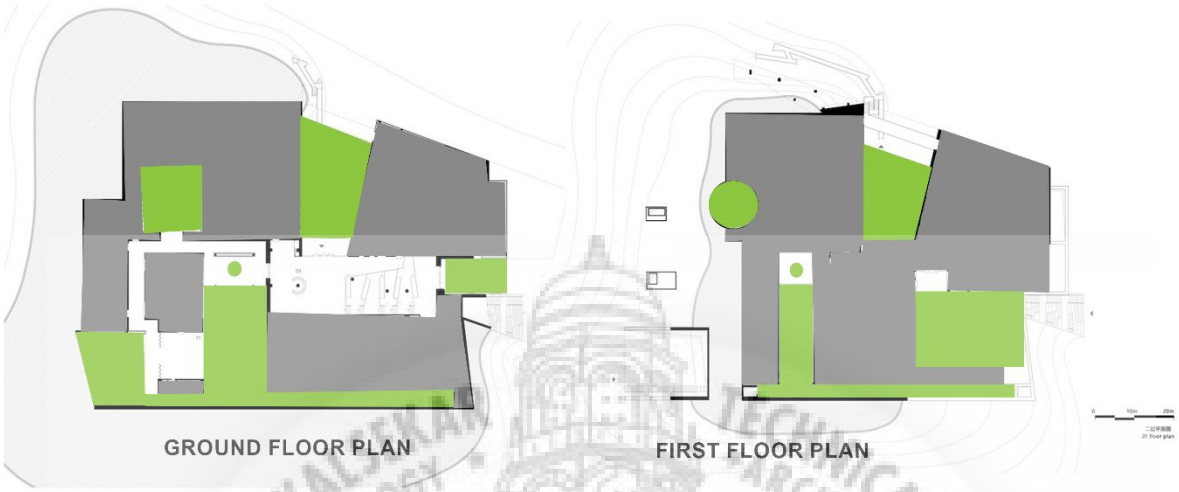


Fig 104: build -unbuild ratio of space in ground floor and in upper floor

Source: author

Balanced 60-40% ratio of build unbuild space allows sunlight and ventilation inside the structure through various courtyard and transitional spaces.

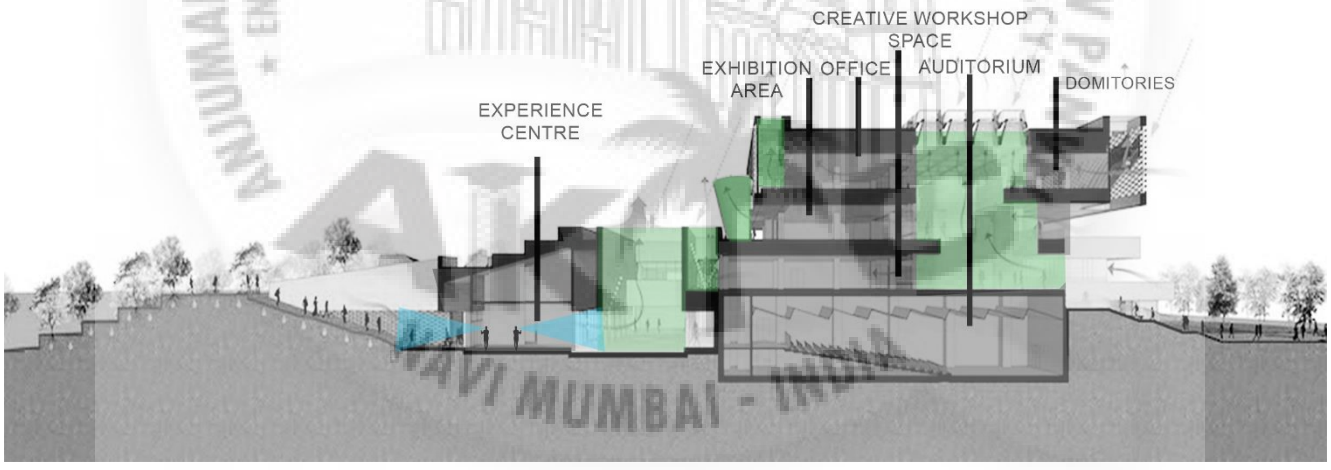


Fig 105: section showing closed and open space ratio

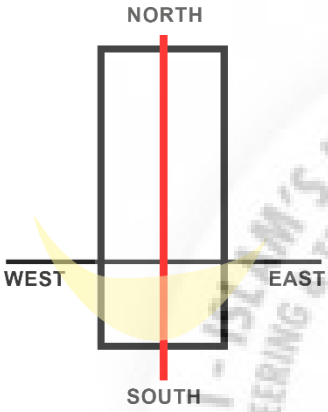
Source: author

Closed -open space ratio helps us to understand the enclosure ratio inside the structure.

TYPES OF COURTYARD IN SUP ATELIER

- TREE COURTYARD
- POND COURTYARD
- POLOGONAL COURTYARD
- CIRCULAR COURTYARD
- MULTIPURPOSE COURTYARD

ORIENTATION OF COURTYARD



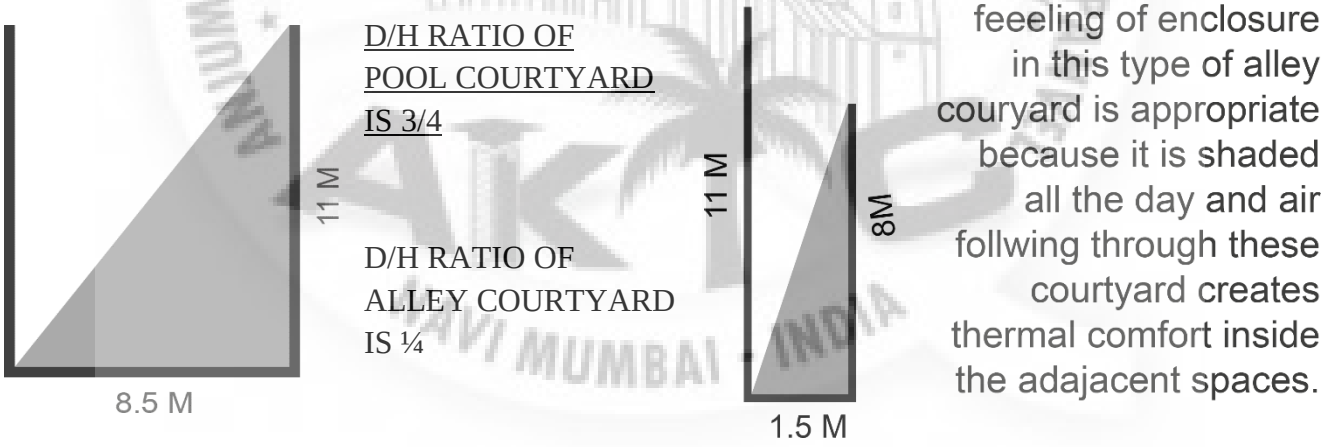
north–south, northeast–southwest, or northwest–southeast directions, which are the best orientations

spaces are mostly located in the northern part of a courtyard, which faces south, to absorb maximum radiation for passive heating and daylight during cold seasons.

Fig 106: orientation of courtyards

Source: author

RATIO OF FEELING ENCLOSURE



D/H RATIO OF POOL COURTYARD IS 3/4

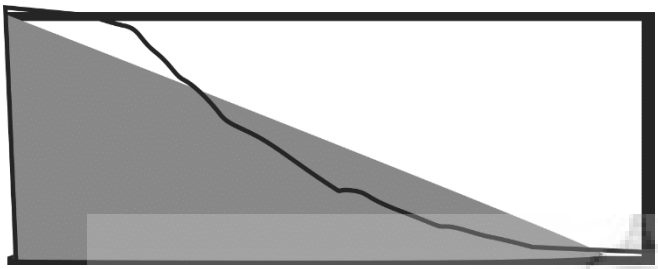
D/H RATIO OF ALLEY COURTYARD IS ¼

feeeling of enclosure in this type of alley couryard is appropriate because it is shaded all the day and air follwing through these courtyard creates thermal comfort inside the adajacent spaces.

FIG 107: a) pool courtyard D/H ratio b)D/H ratio of alley courtyard

Daylighting systems are implemented in each core area and earth-covered areas for ample natural light, and each courtyard can serve as a channel for ventilation, reducing air-conditioning load in spring and autumn with the help of sun-shading system.

water feature in courtyard allows evaporative cooling inside the structure to create micro climate.



D/H RATIO OF STEPPED COURTYARD IS 2/1

Feeling of enclosure in this type of courtyard is less

Fig 108: enclosure ratio of stepped courtyard

Source : author

TRANSITION SPACES AROUND COURTYARD

Fig 109: transition space around courtyards

Source: https://de51gn.com/sup-atelier-designs-sustainable-multipurpose-building-in-hainan-inspired-by-the-areas-red-soil/

- Pathways around courtyard for outdoor sitting
- connecting passage with staircase act as buffer spaces.
- Connecting corridor around the exhibition and atrium space
- Atrium space at centre as major source of light

ADAPTATION OF COURTYARD SPACES

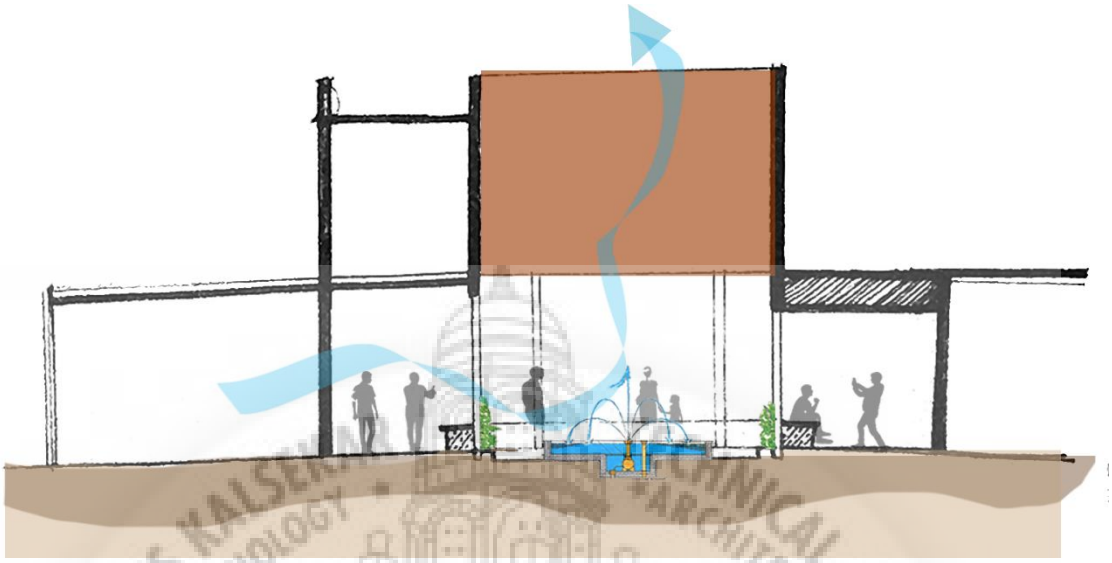


Fig 110 : adaptation of pool courtyard space for recreation, gathering , meeting etc

Source: author

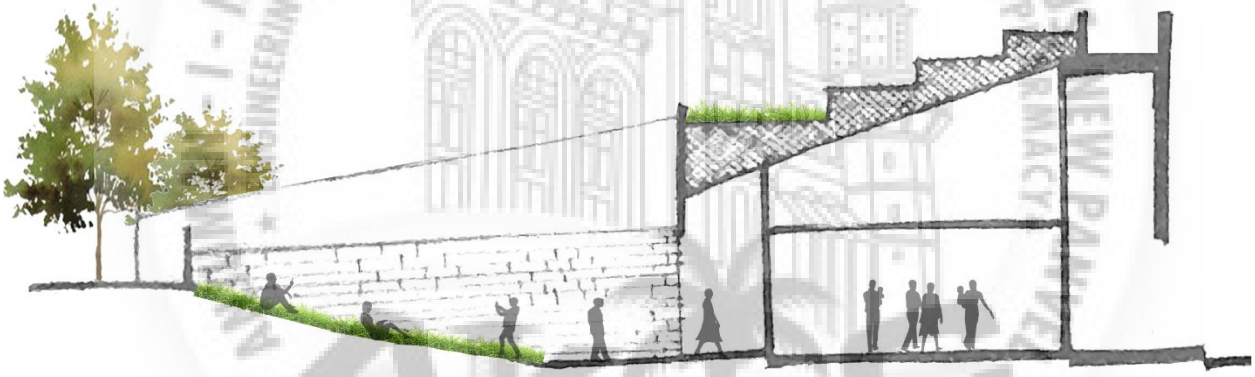


Fig 111: adaptation of stepped courtyard for performance, gathering, act as amphitheatre etc.

Source: author

INFERENCE

Spaces are inter- connected with different types of courtyard offers continuous play of build and unbuild spaces.

Types of courtyard used to stabilize atmosphere inside the structure. Connection of man and nature is reflected through landscape that merges with structure.

Use of local material with modern construction techniques interpret the architecture intervention at next level.

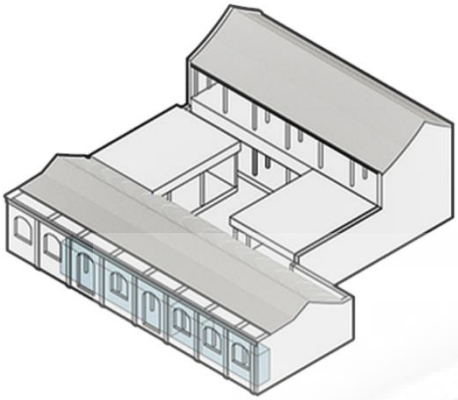
6.2.6.LAYERING COURTYARDS

LOCATION :BEIJING, CHINA
AREA :530 SQ.M
ARCHITECT :ARCHSTUDIO
YEAR :2018
TYPOLOGY :COMMERCIAL

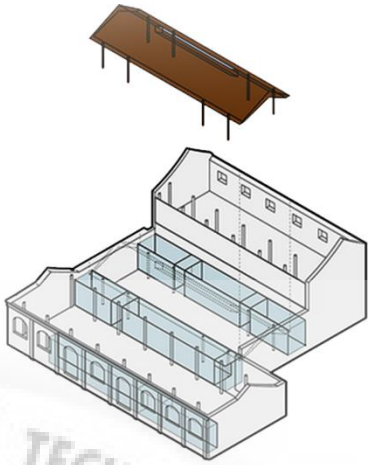
"Layering Yard" is hidden in a traditional commercial block near the Qian men of Beijing, with an area of about 500 square meters. The original architecture was a quadrangle courtyard commercial building with the characteristics of houses in the Republican period. Compared with residential houses, the houses here are bigger and higher. There is a row of arched doors and windows on the south along the street, and two-story houses on the north. Before the renovation, the housing structure was completely rebuilt; with the courtyard there were no doors, windows or walls, but exposed rough wooden structure beams.

Fig 112: layering courtyard by arch studio
Source: https://www.floornature.com/blog/layering-courtyard-di-archstudio-pechino-14771/

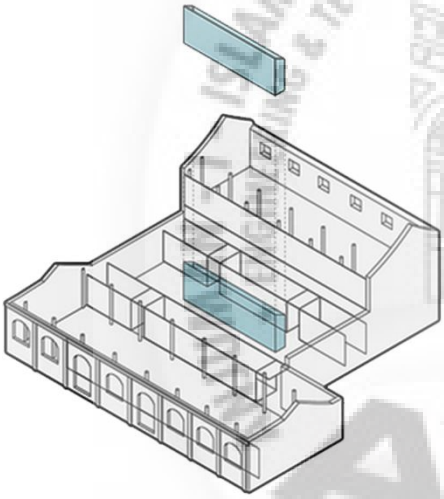
PROCESS OF DESIGN EVOLUTION



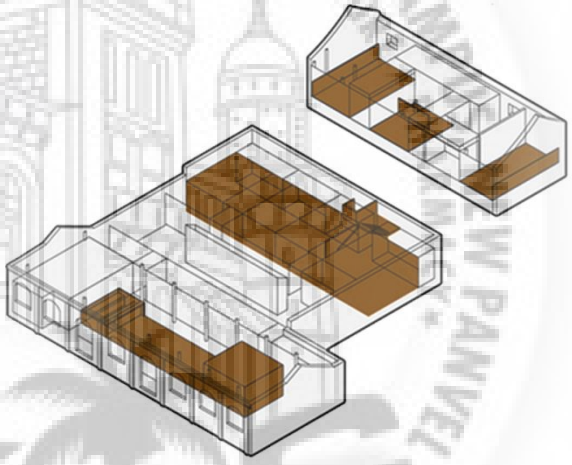
a) Add transitional space at entrance i.e pergola with creepers



b) construct middle space with three layered courtyard multipurpose space



middle courtyard with water features to create micro climate



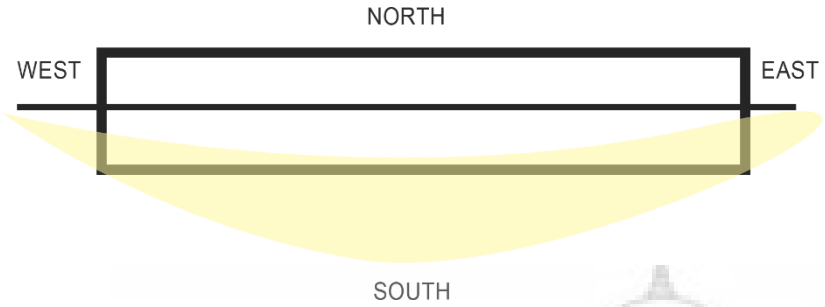
multipurpose space around courtyards

fig 113: process of design evolution of layering courtyard

source: author

Han Wenqiang and Huang Tao, the architects from Archstudio have given it a complete makeover to improve the intrinsic qualities of the architecture and to attract the urban population to this multipurpose complex reminiscent of other typical scenarios involving Hutongs in China's capital.

ORIENTATION OF LAYERING COURTYARDS



Spaces in the southern part of a courtyard face north to gain minimum radiation and maximum
suitable airflow for passive cooling and natural ventilation during hot seasons.

Fig 114: orientation of central layering courtyard

Source: author

Build- unbuild space ratio

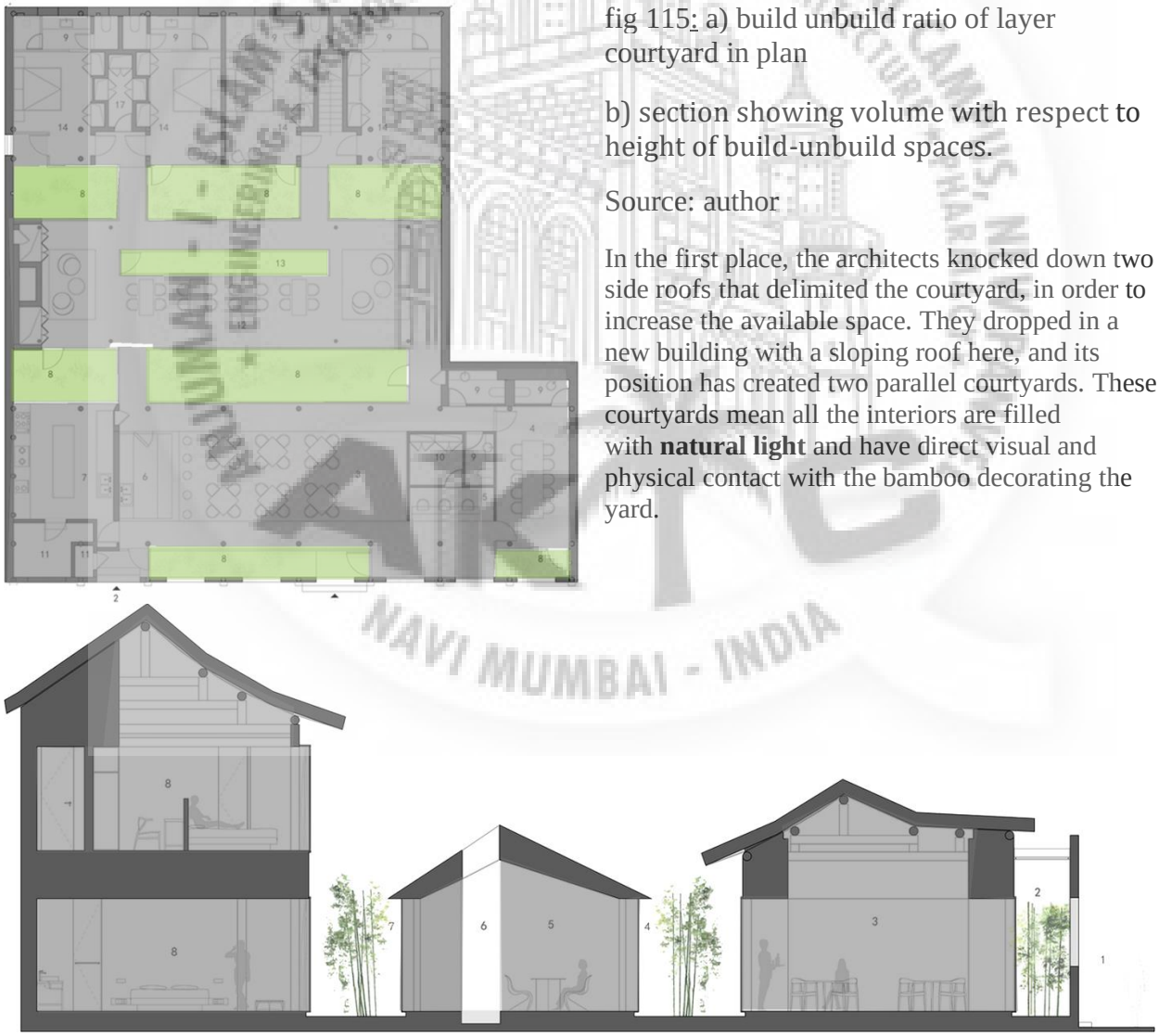


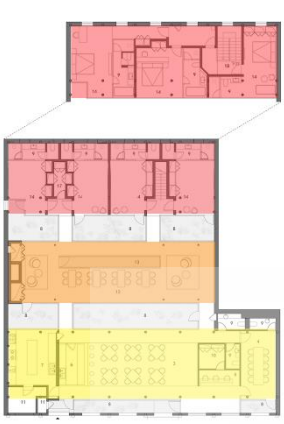
fig 115: a) build unbuild ratio of layer courtyard in plan

b) section showing volume with respect to height of build-unbuild spaces.

Source: author

In the first place, the architects knocked down two side roofs that delimited the courtyard, in order to increase the available space. They dropped in a new building with a sloping roof here, and its position has created two parallel courtyards. These courtyards mean all the interiors are filled with **natural light** and have direct visual and physical contact with the bamboo decorating the yard.

SPATIAL PLANNING OF LAYERING COURTYARD



A prominent feature of traditional architecture is the layering courtyard. In a quadrangle courtyard with three layers, a house's function changes as people entering each yard, the privacy gradually increases from outside to inside, giving people an impression of "deep courtyard".

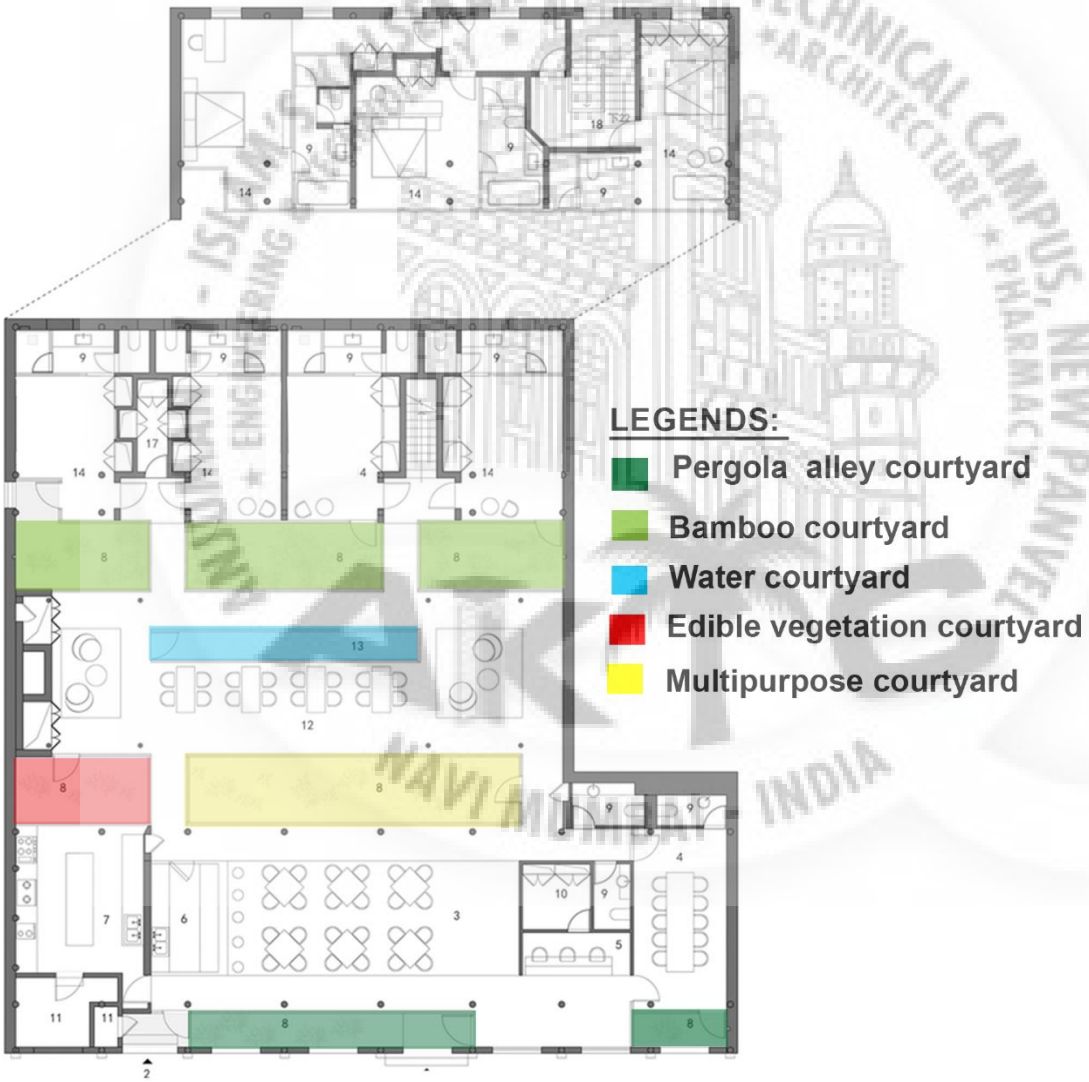


Fig 116: plan of layering courtyard source: author

Enclosure ratio of courtyards

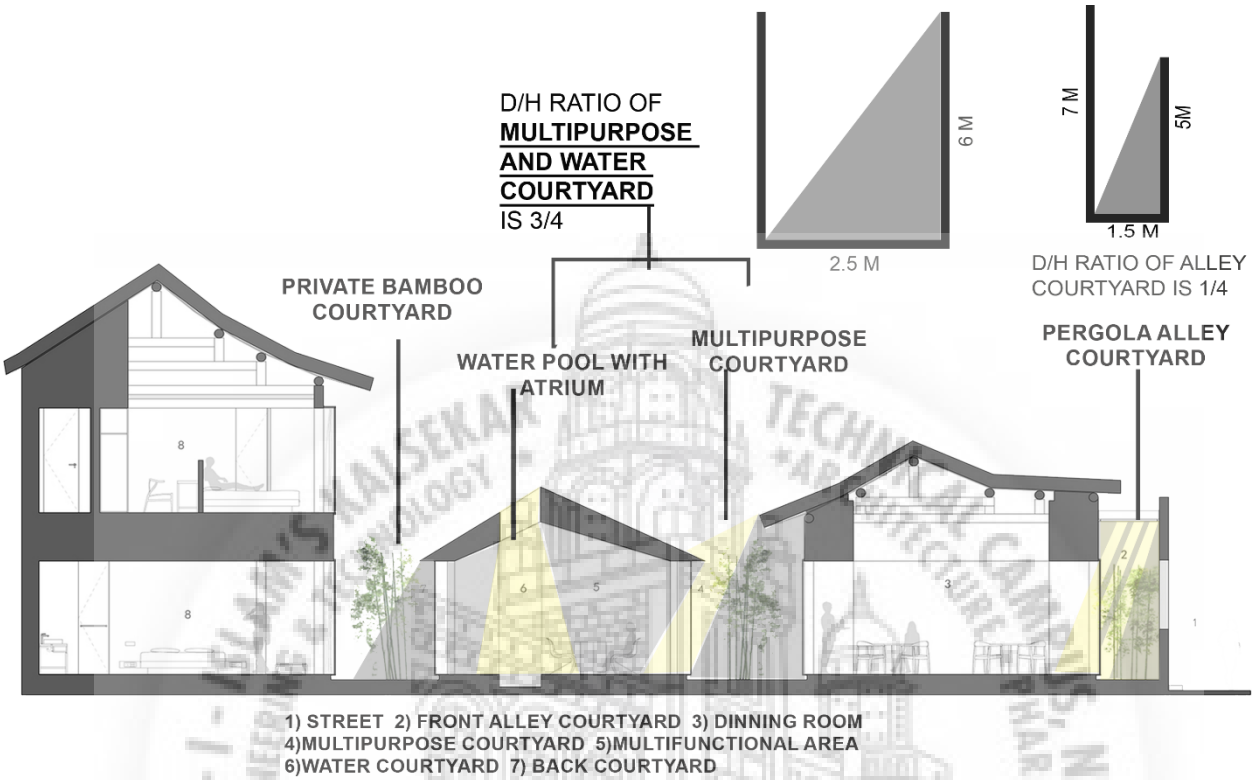


Fig 117: enclosure ratio of all three-layering courtyard

Source: author

Adaptation of courtyards

fig 118: section through courtyards showing adaption of courtyard space

Source: author

6.2.7KIENTRUCT O OFFICE

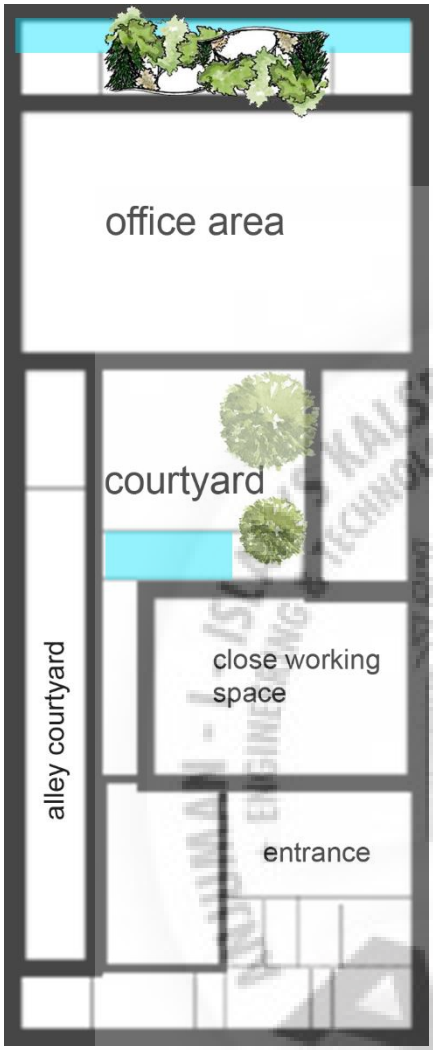
LOCATION : VIETANAM
AREA :221 SQ.M
ARCHITECT :KIENTRUC O
YEAR :2018
TYPOLOGY :OFFICE BUILDING

Intermediate zones continually wrap around KIENTRUC O office's two main areas, the void and the working area. The walls function as the unbound partition follow the binary principle of Open and Close, split the office into smaller spaces, and allow movement to flow freely across the floor. The spatial arrangement polarizes the character of spaces to Stillness and Movement, yielding out diverse spatial quality that fluctuates along the spectrum.

Fig119: kientruct o office view, Vietnam

Source: https://www.designboom.com/architecture/kientruc-o-office-vietnam-ho-chi-minh-city-03-14-2020/

SPATIAL PLANNING OF KIENTRUCT O OFFICE, VIETNAM



kientruc o designs its breezy, light-filled office space, encircled by continuous open-air courtyards integrated with lush plant life. the Vietnam-based architecture studio divides the office into two main areas the void and the work space which are freely connected to the exterior with little separation, and which are surrounded by smaller scale 'buffer zones.' this element of wide openness contrasted with smaller zones yields a diverse spatial quality that fluctuates along the spectrum. the organization further polarizes the character of space quickly from movement to stillness.

Vietnamese studio kientruc o curates its office space in ho chi minh city as a composition of 'floating walls' and interstitial zones. the studio space seems to transform as it receives natural sunlight and gives way to shadow, its depth shifting with the floating walls, successively generating intimate spaces and introducing an atmosphere of silence and serenity.

Fig 120: schematic planning of kientruct o office

Source: author

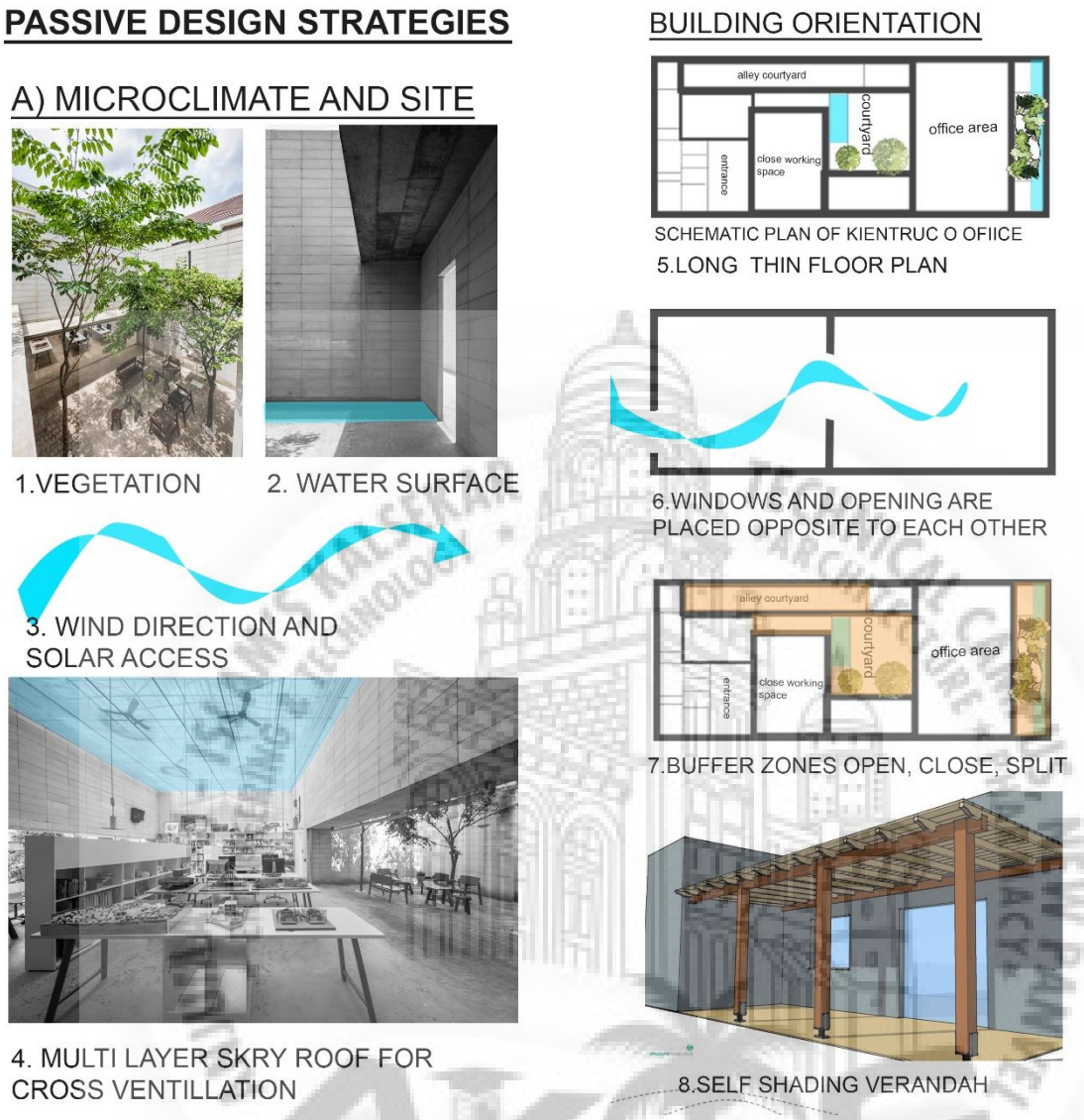


Fig 120: different passive design techniques used in office structure

Source: author

Spaces recollect its form and shape by receiving light, giving way to shadow, and delineates its depth through the floating walls, successively create intimate spaces and render the atmospheres into silence and serene. Employs three criteria in passive cooling methods to cope with tropical weather in Vietnam: heat preventing, heat modulation and heat dissipation. The office design is focused on protecting the indoor micro-climate from sunlight and choosing building orientation. Vegetation helps to reduce the impact of the sun on the exterior fabric.

ENCLOSURE RATIO COURTYARD OF OFFICE

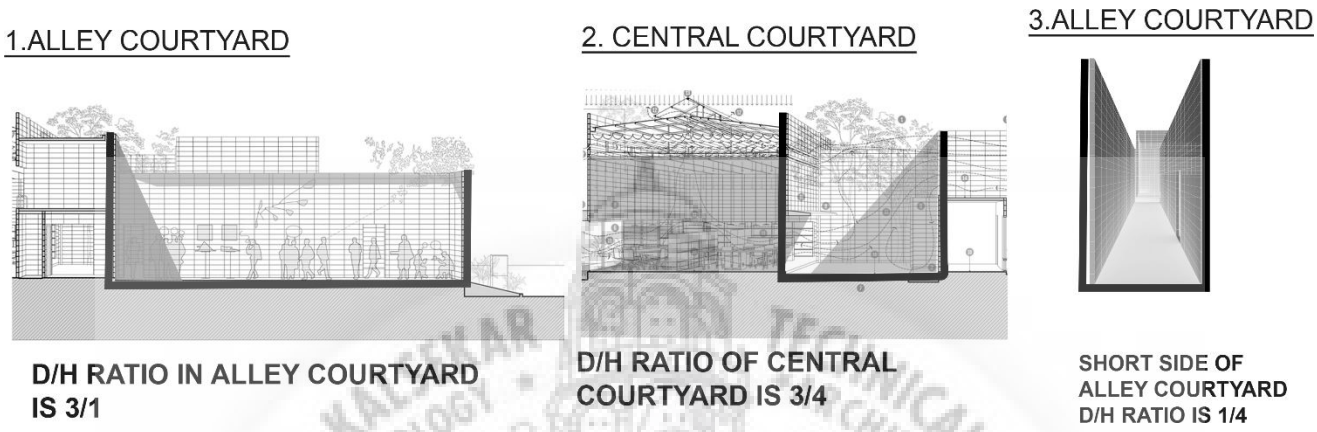
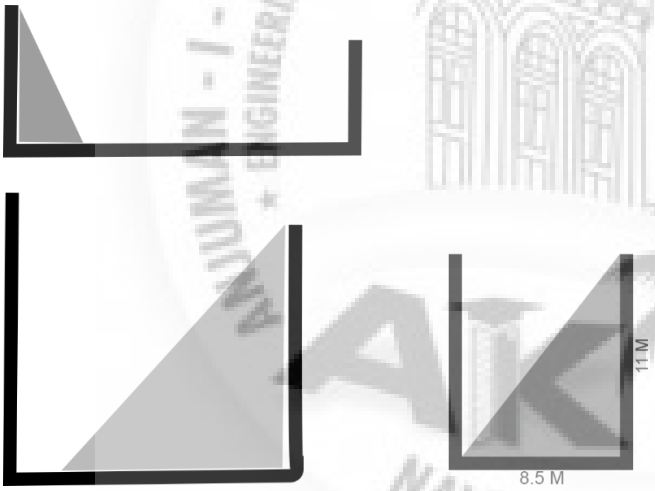


Fig 121: different types of courtyard enclosure ratio

Source: author



BUILD-UNBUILD RATIO

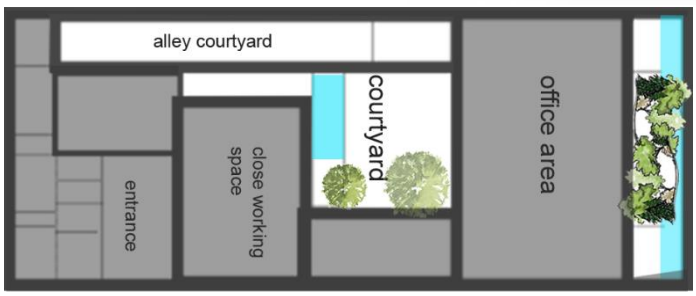


Fig 122: plan of different types of courtyard

Source: author

ADAPTATION OF COURTYARD AND TRANSITION SPACE

Fig 122:user activities inside the courtyard space Source: author

Monochromatic manipulation of material renders the architecture in a patio-temporal state, acting as a background to highlight the natural phenomenon happening among the spaces. The autoclaved aerated concrete (AAC) block has low thermal conductivity and is non-absorbent in nature, which is very suitable for both interior and exterior use and contributes significantly to heat modulation. Its monochromatic finishes blur the perception of the inside and outside, delegating space as a myriad subject, constantly adapting its spatial characteristic according to its purpose of use and the activity taking place.

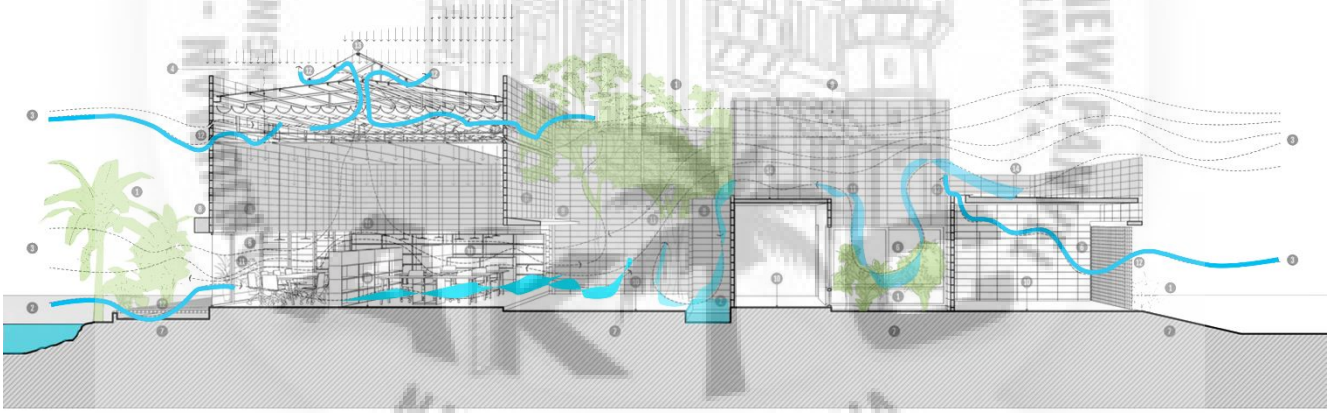


Fig 123: section showing passive design strategies source: author

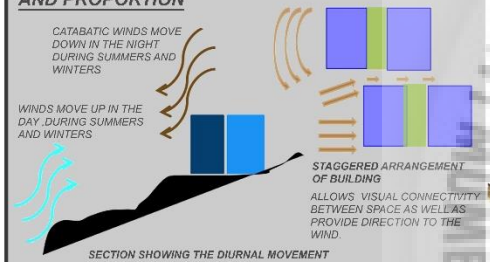
The ventilation strategy for the office is a counter approach to the common scheme found in modern tropical buildings. It is entirely naturally ventilated. Both traditional and mechanical methods are used to quickly release the indoor heat and maximize air circulation. Controlling entrance of wind and solar access contributes to creating a comfortable indoor environment. Multi-layered roof system helps air to ventilate while protecting the main workspace from being overheated. The long and thin floor plan introduces multiple buffer zones shaded by a suitable wall and veranda ratio. Air flows freely through the openings on walls and roof to facilitate a natural form of comfort. Phenomenally, it draws up a multitude state of perception, provoking a humanistic sense of space, and gives shape to the spiritual locality of place.

CENTER FOR DEVELOPMENTAL STUDIES

LOCATION : Pune
AREA : 14 Acres
ARCHITECT:Ar. Christofer beninger
TYPOLOGY: institutional
YEAR : 1994
CLIMATE : hot semi-arid climate (type BSh) bordering with tropical wet and dry

The Centre for Development Studies and Activities (CDSA) is a place of exploration, reflection and analysis on the great laboratory that is India.

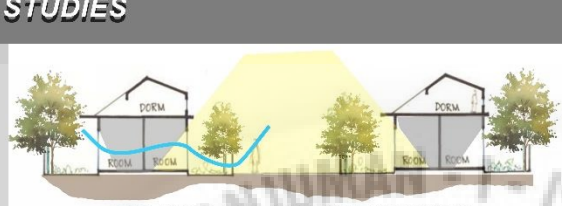
SITE SECTIONS WITH RESPECT TO SCALE AND PROPORTION



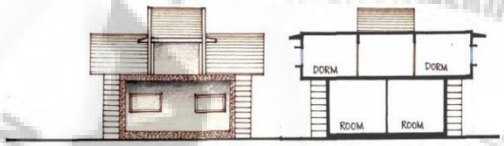
SECTION SHOWING THE DIURNAL MOVEMENT OF AIR FOR CONTOURED LAND

An interesting play of spaces has been created with the studios opening out into their own intimate landscaped courtyards, which again visually connect to the main central podium through square apertures. One can see what activities are taking place, yet one can claim authority over one's own privacy. This openness reveals the deep-rooted meaning of the Institute, in which the liberated mind searches for the resolution of specific problems, often through teamwork, or through the exchange of opposing ideas.

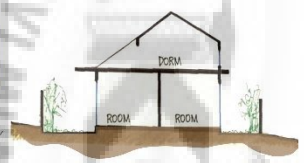
Staggered steps, with sitting blocks, and lotus ponds all reflect local forms of space making, common in the village squares, mosque courtyards, and temples of this mountainous region. The silhouette of a sculptured bust by the famous artist Piraji Sagara greets ones approach into the raised podium courtyard. Falling on two levels, the stone paved podium is planted with great restraint, while giant earthen pottery provides storage of rainwater. Traditional seating platforms known as ottas are used for rising up statues, or as a base for an antique bird feeder.

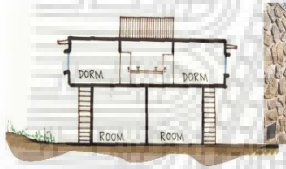


SECTION OF THE INTERACTION SPACES



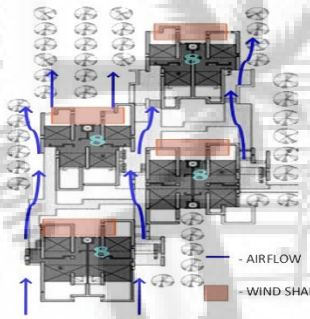
INDIVIDUAL MODEL SITE ELEVATION





EAST- WEST ELEAVTION

NORTH SOUTH ELEAVTION

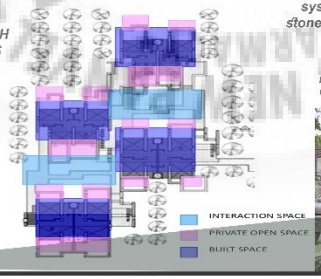


AIRFLOW AND WIND SHADOW PATTERN

wind shadows are taken into consideration thus the orientation of the units is staggered in plan as shown in the fig. which is known as the checker board layout.

The three elements are held together by a system of courtyards, stone walls, stone stairs and paved pathways.

RELATIONSHIP OF OPEN SPACES WITH THE BUILT SPACES



MULTI LEVEL COURTYARD OPEN SPACES

RESPONSE TO CLIMATE

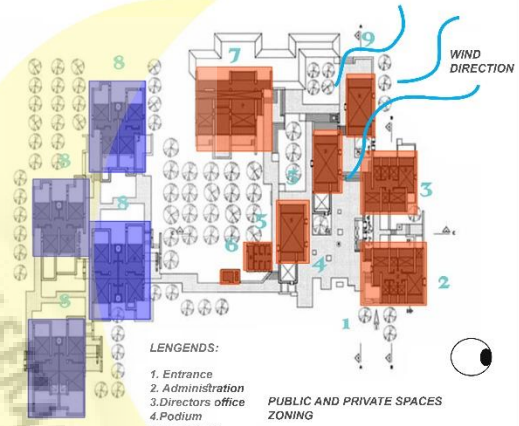
A)MATERIALS:
1. WALLS - 450MM THK BASALT STONE
2. FLOORING- KOYA STONE, SHAHABAD STONE

B)OPENINGS
WINDOWS- LARGE WINDOWS ON THE WESTERN FACADE
DOORS-TYPICAL TIMBER DOORS, PVC DOORS IN PLACES

C)ROOFS
INSULATED GLASS BLOCKS IN ROOF CUT OUTS
SOLAR PANELS INSTALLED ON THE ROOF TOPS

D) DAY LIGHT PENETRATION
90% IN WINTER
LESS IN SUMMER

E) OVER HANGS
500MM ON THE WESTERN SIDE
1200MM ON EASTERN SIDE



LENGENDS:

1. Entrance
2. Administration
3.Directors office
4.Podium
5.Classroom
6.Wet core
7.Club house
8.Guest house
9.Library

PUBLIC AND PRIVATE SPACES ZONING

INSTITUTIONAL

RESIDENTIAL

PROJECT ANALYSIS	CDSA	CONCLUSION
SITE		Well connected to the major city roads.
ACTIVITIES		Residential areas with interaction spaces Educational campus with residential facilities for students as well as staff with interesting interacting spaces
PLANNING		Compact planning with adequate buffer zones
MAGNET	Rectangle	Open court in the admin area, small courts in the residential area
FORM		Rectangle as the basic form for the open spaces and the built spaces around it.
VISUAL	MATERIAL: Stone masonry, R.C.C., Shahabad Flooring, Polished kota (interior), Glass — COLOUR: Black and Grey, Grey, Light grey, Black, Blue	Front and back courts to the residential units, Projecting R.C.C gutters, Box windows on the north and south directions

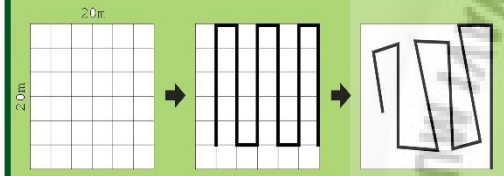
PROJECT ANALYSIS	CDSA
SITE PLANNING	• Sloping site with residential units oriented towards north-south and open courts on east-west.
ENVIRONMENTAL ARCHITECTURE	• Vehicle-free zone • Rain water harvesting • Trees preserved
ENERGY EFFICIENT LIGHTING	• Glass facades permitting light in the interiors. • 450 thick stone masonry acts as a heat insulator creating cool interiors.
SOLAR WATER HEATERS	• All the residential units are provided with solar water heating systems.
EFFICIENT BUILDING MATERIALS	Few materials like : • Basalt stone which is locally available. • Shahabad stone used in the exteriors. • Polished quota used in the interiors.
WATER CONSERVATION	• Rainwater harvesting system widely used.
SOLID WASTE MANAGEMENT	• Eco friendly sustainable garbage disposal systems.

BE FRIENDLY SPACE , H & P ARCHITECTS

LOCATION :VIETNAM
AREA :220 SQ.M
YEAR : 2016
TYPOLOGY : COMMUNITY CENTER
CILMATE :TROPICAL CLIMATE
ARCHITECT: H& P ARCHITECT

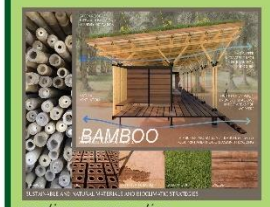
PROJECT INTENT

projects to create "a friendly space in suffocating urban areas", BE (Bamboo & Earth) friendly space presents an open space for the community, with importance being attached to aspects of culture and art (exchanges, exhibitions, cuisines, ..). BE friendly space is, thereby,expected to undertake the mission to improve the stormy relationship between man and nature in modern times.



GRID | REPETITIVENESS & MONOTONOUSNESS | A SPACE / ZONE OF COMFORT & FRIENDLINESS

MATERIALS USED IN PROJECT



section perspective

1. Rammed earth wall 40cm thick
2.Rammed earth wall
3. exposed brick wall 22cm thick
5. Multifunctional space
6. service space
7. garret
8. water system to wash and cool the roof

The entire project is made of earth-rammed walls (thickness 40cm) adjacent to each other in a zigzag pattern that spares valuable green spaces for common use.

relation between open and close space .

visual connectivity between spaces.

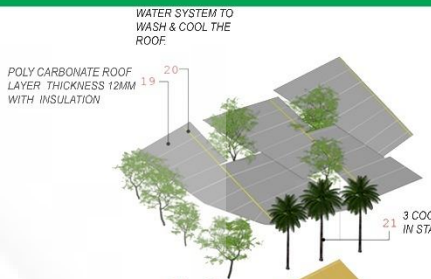
internally, the building contains four large multi-functional spaces, a kitchen and service area, and washroom facilities. set against the dense backdrop of mao khe — one of vietnam's most populous towns — the design team hopes that the venue will help raise awareness concerning the need for more friendly public spaces amid the country's mass urbanization.

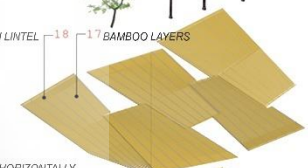
Located in the centre of Mao Khe town, BE friendly space is made of locally available friendly materials, in simple building operations and with the participation of local builders.

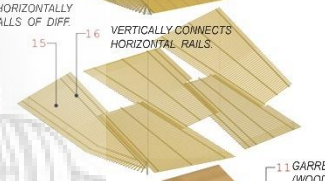
INSTALLING THE 1 ST LAYER OF BAMBOO

a series of interstitial open-air spaces are created

DETAILS OF BAMBOO ROOF CONNECTOR







RAÍCES EDUCATIONAL CENTER

LOCATION : GUATAPÉ, COLOMBIA
AREA :653 M²
YEAR : 2015
TYPOLOGY :INSTITUTIONAL
ARCHITECT:Taller piloto arquitectos

The architectural fact as a tool for the construction of the memory and identity of a community is the fundamental principle on which the project is based, having as elements of creation the collective imagination of culture, traditions and history, shaped and shaped by the Same landscape and territory in which they are.

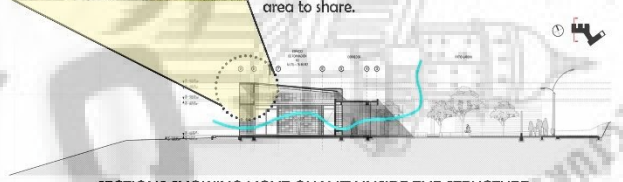
The location of the project is in the urban perimeter that makes it a visual icon of the municipality, strengthening the values and traditions supported in an open and collective public space, a scenario of integration, for the creation of an identity and appropriation of it.

Landscape as primary material is an integral part of spatial construction, taking light and shadow, air, vegetation and the landscape itself which is intrinsic part of the site, these primary elements in themselves require the absence of the built, the Empty, to be able to inhabit it, gardens, yards and squares in them can be evidenced that passage of the time that marks the rhythms and moments, full and empty. The project is in a natural context of transition between urban and rural, this is built from materials and finishes in sight, where the same structure is the final face, propose textures and finishes honest and austere, which Give the maximum protagonism to the natural atmosphere, it becomes a canvas that receives the exuberance of the vegetation and the colors of the culture.

Constructive clarity and simplicity through the use of concrete walls in varied and concrete blocks reflect a modular and practical system without losing the variety from its free areas that improve the construction quality, reduce execution times and work budgets. The Educational Park becomes a space that recognizes its own landscape, showing it with the capacity and the kindness to receive the activities and experiences, which will allow to create and to consolidate the Memoria and fragmented identity

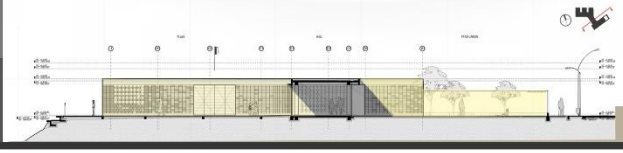
The Project receives the visitor from a square, a lookout space that becomes a witness of the new landscape in which the community lives. Within the project the pedagogical and cultural spaces are their most important value in the vacuum that complements them, free and flexible spaces suitable for the meeting, formed from yards and gardens allowing to extend their activities to the common space, the space of all, Is understood as a tradition learned and that has been lost the use of the patio and hall of the traditional housing of Peñol and this is taken as an articulating space in the project, an area to share.

PROJECTIONS AT TO CUT DOWN DIRECT HEAT GAIN INSIDE THE STRUCTURE



SECTIONS SHOWING LIGHT QUALITY INSIDE THE STRUCTURE

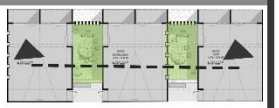
PATHWAY AROUND OPEN SPACE

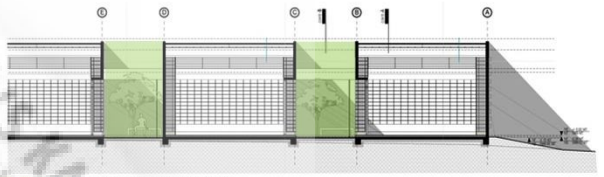


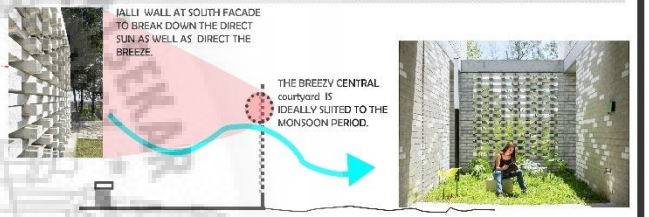
TYPES OF COURYARD IN CENTER

A) CLOSED FROM 4 SIDES

In this center the architect design types of courtyard open spaces with different functions for public and private activities.

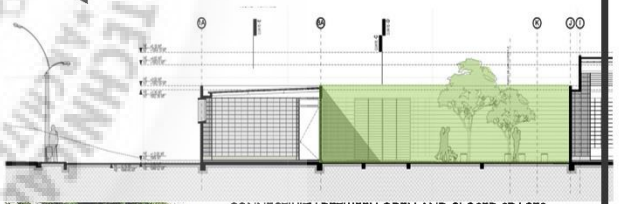






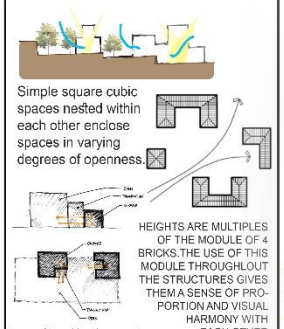
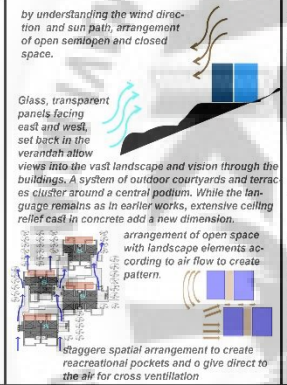
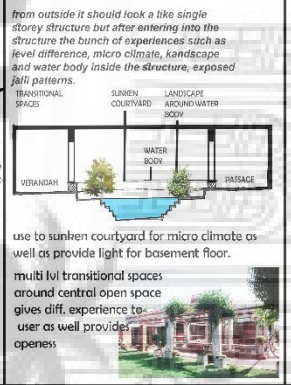
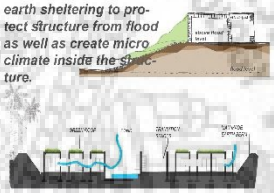
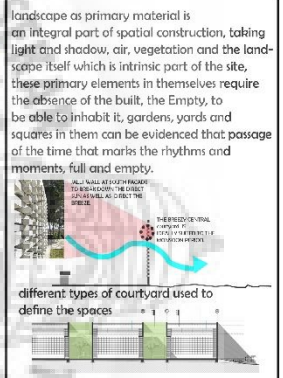
B) COURTYARD ADJACENT TO TRANSITIONAL SPACES LIKE CORRIDOR & PASSAGES CLOSED FROM 2 SIDES

ARCHITECT TRIES TO SHOW RELATIONSHIP BETWEEN COURTYARD AND THEIR ADJACENT BUILD FORM SUCH AS PATHAWAYS , ALLEY , VERANDAH ETC.



CONNECTIVITY BETWEEN OPEN AND CLOSED SPACES THROUGH :ADSCAE ELEMENT.

LANDSCAPE AS PRIMARY MATERIAL TO CREATE THERMAL COMFORT.

	CENTER FOR ENVIRONMENTAL EDUCATION	CENTER FOR DEVELOPMENT STUDIES	AMERICAN INSTITUTE OF INDIAN STUDIES	FRIENDSHIP CENTER	RAICES EDUCATIONAL CENTER	BE FRIENDLY
LOCATION	AHEMDABAD , GUJRAT	PUNE MAHARASHTRA	GURGOAN,	BANGLADESH	COLOMBIA	VIETNAM
AREA	14 ACRES	14 ACRES	1500 SQ.M	2897 SQ.M	653 SQ.M	220 SQ.M
CLIMATE	a hot, semi-arid climate	HOT SEMI-ARID CLIMATE WITH TROPICAL WET AND DRY	A HOT, SEMI-ARID CLIMATE	TROPICAL WITH HIGH TEMP.& HUMIDITY	TROPICAL AND ISOTHERMAL	TROPICAL CLIMATE
TYPOLOGY	INSTITUTION	INSTITUTION	INSTITUTION	NGO ORGANISATION	INSTITUTIONAL	COMMUNITY CENTER
DESIGN INTENTION	Cee is nation wide organistaion which works to spread awareness about the environment among the masses of this country.To achieve the vision CEE's mission is to enhance understanding of sustainable development in formal, non-formal and informal education through its architectural structure as well as design programme.	The Centre for Development Studies and Activities (CDSA) is a place of exploration, reflection and analysis on the great laboratory that is India. It was built by the architect for his own trust activities whose focal concerns are the study of development processes and the role of planned interventions in social changes and transformations.	THE AIIS (AMERICAN INSTITUTE OF INDIAN STUDIES) IS A CONSORTIUM OF AMERICAN UNIVERSITIES THAT PROVIDES SCHOLARS WITH FACILITIES FOR RESEARCH IN INDIAN ART, ARCHITECTURE AND MUSIC. FUSION OF TRADITIONAL SUSTAINABLE INDIAN ARCHITETCURE WITH MODERNISM.	*for an NGO which works with some of the poorest in the country and who live mainly in rivering islands (chars) with very limited access and opportunities. Friendship uses the facility for its own training programs and will also rent out for meetings, training, conferences etc. as income generation.* *LESS USE OF ELECTRICITY AND ENERGY CONSUMPTION.*	*The architectural fact as a tool for the construction of the memory and identity of a community is the fundamental principle on which the project is based, having as elements of creation the collective imagination of culture, traditions and history, shaped and shaped by the Same landscape and territory in which they are.* *THROUGH SUSTAINABLE APPROACH OF DESIGN.*	*projects to create "a friendly space in suffocating urban areas", BE (Bamboo & Earth) friendly space presents an open space for the community, with importance being attached to aspects of culture and art (exchanges, exhibitions, cuisines, ..). BE friendly space is, thereby,expected to undertake the mission to improve the stormy relationship between man and nature in modern times.*
DESIGN STRATEGIES						
SUSTAINABLE ASPECTS	COURTYARDS LETS IN ALOT OF NATURAL LIGHT INTO THE BUILDING. USE OF CHINA MOSAIC TILES USED ON THE ROOF TO REFLECT HEAT THE DOUBLE HEIGHT IS ORIENTED NORTH-SOUTH TO LET IN LIGHT FROM THOSE DIRECTIONS.	TILE ROOFS, WHICH SLOPE MORE STEEPLY TOWARDS THE WEST, FROM WHENCE STRONG WINDS BLOW, BEARING THE HEAVY MONSOON RAINS. STAGGERED CLUTER OF SPACES LEADS TO ROSS VENTILLATION. OVERHANG PROJECTS HELPS T CUT DOWN THE DIRECT HEAT .	ORIENTATION OF BUILIDNG PROVIDE SELF SHADE TO STRUCTURE. EAST - WEST FACADE HAVING GLASS SLITS WHICH ALLOW DIFFUSED LIGHT INSIDE THE STRUCTURE. USE OF SUSTAINABLE MATERIAL SUCH AS BRICKS, EXPOSED CONCRETE , SANDSTONES.	The project uses sustainable design approaches. From the architects, "Rainwater and surface run-off are collected in internal pools and the excess is pumped to an excavated pond which also reates icro climate	major use of stone jalli pattern for breezy central area , corridoor spaces. controlable natural lighting , the self structured overhangs depth of the roof wasoptimized to reduce direct heat gains.	made of locally available friendly materials,earth-rammed walls (thickness 40cm) adjacent to each other in a zigzag pattern that spares valuable green spaces for common use. water systemused to wash as well as cool the roof to maintaint lower lvl temperature.
INFERENCE	Responding appropriately to the climate, the building offers enough release spaces into its heavily landscaped outdoor, which is never too warm under the thick canopy of trees. The multiple terraces under the tree cover are seemingly more habitable than the inside. They give different degrees of privacy and proximity with people. **Three strategic sections give rise to distinct experiences:** 1. Building fully / partially under the ground 2. Building leveled with the ground 3. Terracing the ground.	*The materials, finishes, detailing and spatial design, attempt to consolidate wisdom of the past while attempting to articulate original spatial experiences.* *The three elements are held together by a system of courtyards, stone walls, stone stairs and paved pathways. Transparent sliding glass panels form the second element; shaded by verandahs, they act as screens that can be adjusted in individual spaces to regulate the breeze, avoiding the need for electric fans.*	*Brick walls with ornamental geometric patterns make the structures a treat to the eye, letting in light and enabling good ventilation. The sloping concrete roofs and red-oxide floors complement the walls in keeping the place interiors cool and comfortable.* *use of sunken for light and ventillate to create micro climate inside the structure.* *transitionas spaces around the courtyard connect spaces with nature.*	*The design relies on natural ventilation and cooling, being facilitated by courtyards and pools and the earth covering on roofs. An extensive network of septic tanks and soak wells ensure the sewage does not mix with flood water.* *relation between transitional spaces such as pathways , verada, adajacent rooms and courtyard , pond area*	*types of courtyard can be build withh the help of adjacent space.* *type 1- open from 2 sides and close from 2 sides* *type 2- closed by 3 sides and open from one side* *type3- closed from all the sides* *types 4- one side with buidling and another side is closed by landscape element* *use of stone with jalli pattern to cool down the temperature* *use of apprpriate ladscape inside the courtyard.*	*by re arranging the the angle of encloure can convert private and public courtyard spaces* *use of sustainable material for construction such as bamboo , rammed earth wall, exposed brick work.*

PROJECT NAME	PROJECT DETAILS	TYPES OF COURTYARDS	ORIENTATION	SHAPE	ENCLOSURE RATIO	TRANSITION SPACE AROUND COURTYARD	ADAPTATION OF COURTYRD	LANDSCAPE ELEMENT INSIDE THE COURTYARD	
								LANDSCAPE	SPATIAL DESIGN
CENTRE FOR ENVIRONMENTAL EDUCATION	LOCATION: Ahmedabad AREA : 14 Acres ARCHITECT:Ar. Neelkanth Chhaya(Dean of CEPT) YEAR : 1984 TYPOLOGY: **INSTITUTION**	STEPPED COURTYARD CENTRAL COURTYARD MULYIPURPOSE COURTYARD LANDSCAPE COURTYARD	NORTH-SOUTH DIRECTION FOR CROSS VENTILLATION	SQUARE RECTANGLE	D/H =3/4 AND D/H =1/1	PAVILLION PASSAGE ALLEY VERANDAH RAMPS	INFORMAL STUDY AREA TEA POINT RECREATIONAL POINT GATHERING AREA WORKSHOP AREA	DENSE VEGETATION LAWN PATHWAYS SCULPTURES PERGOLA	CROSS VENTILATION CHINA MOSAIC DOUBLE HEIGHT SPACES
AMERICAN INSTITUTE OF INDIAN STUDIES	LOCATION : Gurgaon AREA : 1500SQ.M ARCHITECT: YEAR : 1998 TYPOLOGY: **INSTITUTION**	SUNKEN COURTYARD CENTRAL COURTYARD WATER COURTYARD	NORTH-SOUTH ORIENTATION FOR SELF SHADE	SQUARE	ENCLO-SURE RATIO, D/H =1/3	CORRIDOOR STAIRCASE INTERNAL LANDSCAPE VERANDAH	INFORMAL MEETING SPACE WORKING SPACE GATHERING AREA STUDY AREA	POND VEGETATION LAWN PATHWAYS PEROLAS	SUNKEN COURTYARD TERRACE GARDEN SOLAR PANELS MICRO CLIMATE
FRIENDSHIP CENTER	LOCATION : Bangladesh AREA :2897 SQ.M ARCHITECT:Kashef Mahboob Chowdhury YEAR :2011 TYPOLOGY: **NGO (Training center)**	WATER COURTYARD STEPPED COURTYARD CENTRAL COURTYARD ALLEY COURTYARD	NORTH EAST DIRECTION FOR CROSS VENTILATION TO CREATE MICRO CLIMATE	SQUARE RECTANGLE POLYGONAL	ALL TYPES OF ENCLOSURE	PATHWAYS ALLEY VERANDAH PASSAGE SEMIOPEN SPACES PATHWASY	LEARNING AREA, INFORMAL MEETING AREA, RECREATIONAL AREA	VEGETAION PATHWAYS POND PERGOLAS	EARTH BERM SPACES GREEN ROOF MICRO CLIMATE LOCAL MATERIAL
KHAMIR CRAFT CENTRE	LOCATION:GUJARAT AREA :2200 SQ. M ARCHITECT:NEELKANTH CHAYA YEAR :2017 TYPOLOGY: **ART AND CRAFT CENTER**	CENTRAL COURTYARD STEPPED COURTYARD ALLEY COURTYARD	EAST -WEST DIRECTION FOR SUNLIGHT AND VENTILATION	SQUARE RECTANGLE	D/H=1/1 D/H=3/1 D/H=1/4	OTLA PATHWAYS LANDSCAPE STAIRCASE ALLEY CHAWK	GATHERING KAJU COTTON LEATHER CRAFT KACHHA WEAVING	TYPES OF VEGETATION LAWN PAVING PATHWAYS	CONNECTING STAIRCASE CROSS VENTILATION SCULPTED WALLS EARTH WALLS SPRING ROOF
SUP ATILIERS	LOCATION :Chengmai, Hainan AREA :10980 SQ.M ARCHITECT : Xiaojuan Chen,Yehao Song YEAR :2019 TYPOLOGY : **MULTIPURPOSE**	TREE COURTYARD POOL COURTYARD MULTIPURPOSE COURTYARD CIRCULAR COURTYARD	NORTH-SOUTH DIRECTION FOR SUN SHADE AND FOR MICRO CLIMATE	SQUARE RECTABGLE CIRCULAR POLYGONAL	D/H =3/4 D/H=3/1 D/H=1/2 1.5 M	CORRIDOOR INFORMAL SITTING LANDSCAPE PASSAGE LOBBY ATRIUM	EXHIBITION AREA RECREATIONAL AREA WORKSHOP AREA GATHERING AREA VEGETAION	POND VEGETATION STEPPED LANDSCAPE FEATURES PATHWAYS	CONNECTING PASSAGE SOLAR PANELS JALLI PATTERNS MICRO CLIMATE
LAYERING COURTYARD	LOCATION :CHINA AREA :530 SQ.M ARCHITECT :ARCHSTUDIO YEAR :2018 TYPOLOGY : **COMMERCIAL**	MULTIPURPOSE COURTYARD ALLEY COURTYARD EDIBLE VEGETATION COURTYARD	EAST -WEST DIRECTION FOR SUNLIGHT	RECTANGLE	D/H =3/4 AND D/H 1/3 1.5 M	SEMIOPEN MULTIPURPOSE SPACE PATHWAY VERANDAH PERGOLA	VEGETATION SPACE, MULTIPURPOSE SPACE, LANDSCAPE, RECREATIONAL SPACE	BAMBOO VEGETATION EDIBLE PLANTATION CLIMBERS POND PERGOLAS	CIRCULATION MICRO CLIMATE LOCAL MATERIAL WITH MODERN TOUCH
KIENTRUC O OFFICE	LOCATION : VIETANAM AREA :221 SQ.M ARCHITECT :KIENTRUC O YEAR :2018 TYPOLOGY : **OFFICE BUILDING**	LANDSCAPE COURTYARD CENTRAL CO-WORKING COURTYARD MULTIPURPOSE ALLEY COURTYARD	NORTH-SOUTH DIRECTION FOR CROSS VENTILATION AND SUN SHADE	SQUARE RECTANGLE	ALL TYPES OF ENCLOSURE	GALLERY PATIO LANDSACPE	CO-WORKING SPACE, MULTIPURPOSE AREA, GATHERING AREA, LANDSCAPE,OUTDOOR MEETING SPACE	TYPES OF VEGETATION LAWN POND CRIPPERS CLIMBERS PAVING	MULTILAYER SKY ROOF SPRING ROOF AUTOCLAVED WALLS

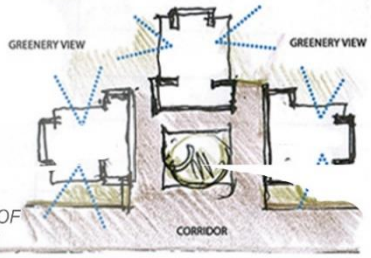
SPACE PROGRAM AND DESIGN CLUES

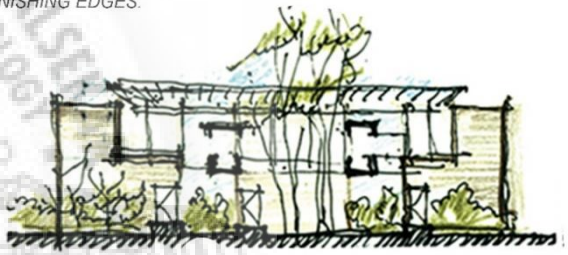
ENTRANCE
TRANSITIONAL AREA
ADMINISTRATION
DIRECTORS OFFICE
WORKSHOP SPACES
INDOOR OUTDOOR MEETING AREA
SEMINAR ROOMS
LIBRARY
RESEARCH CENTER
EXHIBITION AND CONSERVATION AREA
AUDITORIUM
VISITORS CENTER
AMPHITHEATER
SERVICE ROOM
RAINWATER HARVESTING SYSTEMS SPACE
PANCHMAHABHUTA (COURTYARD WITH DIFFERNT FUNCTIONS AS WELL AS MATERIAL)
CLASSROOMS
DORMITORIES
CULTURAL HUB
CANTEEN
TOILETS
PARKING

The composition is divided into three main zones; a controlled public space, open public areas, and private zone
1. Controlled public zones support visitors and researchers via: -A Research laboratory with its own library -A two floor exhibition space where researchers can showcase their work and share their results with the audience. -A fully equipped auditorium capable of hosting relevant to the area events (ie lectures, presentations, seminars etc)
2. Open public areas give visitors and passers-by access to: -A Cafeteria where visitors can rest with differen courtyard views.
3.private zones will specially design for the research where they can reaserach and store their data and stay in dormitorie with private courtyard facility.

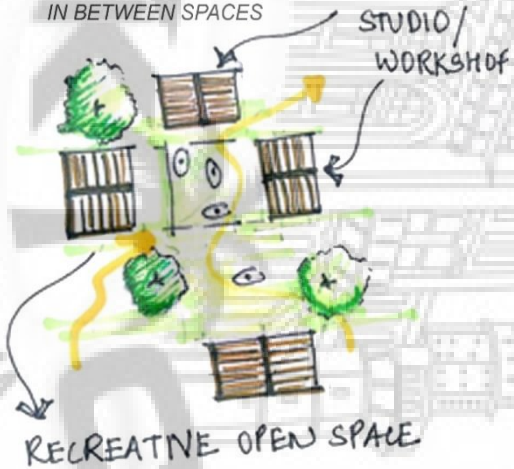
THE SPACES WLL DESIGN AS ELEMENTS PLACED IN LANDSCAPE FACING THE GREEN POCKET ON ONE SIDE AND LANDSCAPED OPEN COURTYARD ON THE OTHER.

THE SIDE FACING THE MAIN GREEN POCKETS ARE GIVEN GLAZING TILL THE SILL LEVEL OF THE UPPER LEVEL RESULITNG ICREATING VANISHING EDGES.

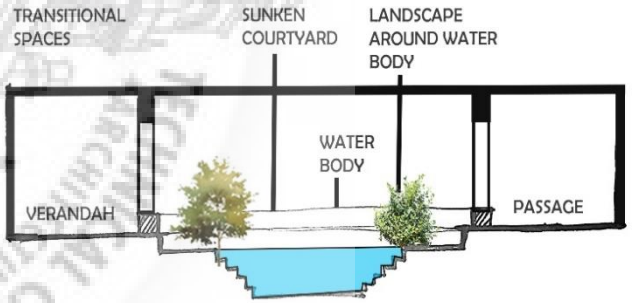




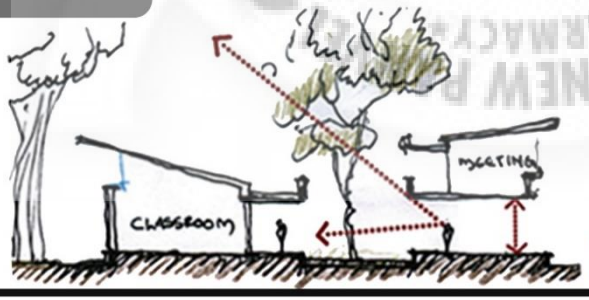
THE EXPERIENCE OF BEING WITHIN A LANDSCAPE IS ENHANCED IN THE INSIDE THE STRUCTURE.



VISUAL CONNECTIVITY BETWEEN SPACE.



CROSS VENTILLATION



MULTI LEVEL STRUCTURES GIVES A SENSE OF PROPORTION AND VISUAL HARMONY WITH EACH OTHER.
USE OF WATER BODY AND LANDSCAPE FOR CLIMATE CONTRAOL AS WELL AS ENHANCE THE VIEW.

9.DESIGN BRIEF

Total site area : 4 acres

NUMBER OF USERS

Estimated students at a time :70

Total non teaching staff : No of people

Admin area and reception : ……5

Librarian : ……3

Computer lab : …… 2

Laboratory : ……..2

Research and development……2

Cleaners/technicians/security……21

TOTAL : 35

PARKING

Car parkingtotal no of car park

Visitors……..6

Faculty and students ……..20

Bike parking total no of bikes

Visitors…….6

Working staff/faculty/students……50

AREA STATEMENT

Admin/reception: 60 sq.

Lobby/waiting area: 100 sq.m

Directors office: 36 sq.

Co-directors office: 15 sq.m

Panchmahabhoota courtyards:120 sq.m (min) areas may vary

Library: closed space 200 sq.m, semi open library space :80 sq.m

Laboratory: 150 sq.m

Research and Development: 150sq.mComputer lab :200 sq.m

Conference room : 40 sq.m

Meeting room : 16 sq.m

Workshop area : 400 sq.m

Exhibition area : 600 sq.m

Audio video room : 300 sq.m

Auditorium : approx.. 500 capacity

Store room :

Canteen for dormitory :

Canteen :

Design studio : 400 sq.m

Multipurpose courtyards:150 sq.m each

Co working space :100 sq.m

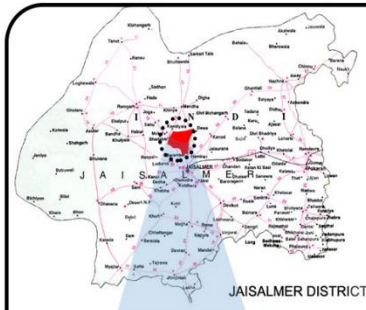
Courtyard market place: 120sq.m

Dormitories (staff) : 120 sq.m

Dormitories (researcher): 80sq.m

Community interactive space:200sq.m

SITE SELECTION
JETHWAI VILLAGE, RAJASTHAN



WHY JETHWAI VILLAGE

JETHWAI VILLAGE LOCATED IN 10 KM FROM JAISALMER.
TO SHOW THE NEED OF COUT-YARD SPACE TO SOLVE MANY ARCHITECTURAL PROBLEMS AND OFFERS THE SOCIO-INTER-ACTIVE SPACE FOR ALL

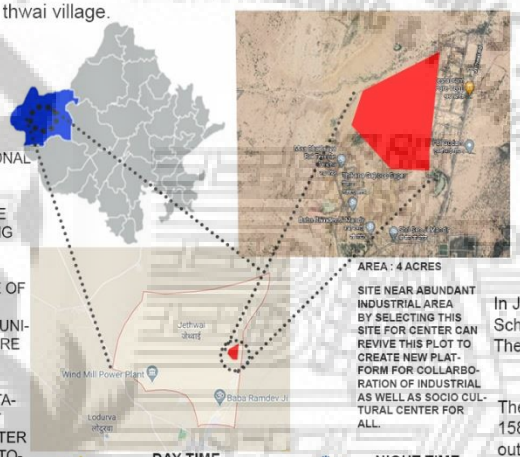
NEAR BY TOURIST AREA OF JETHWAI VILLAGE

WINDMILL TURBINES
LODHRUVA HISTORIC VILLAGE
JAISALMER FORT
AMAR SAGAR
BADA BAG
MALA KI DHANI VILLAGE

BY BUILDING THE MULTIFUNCTIONAL CENTER THAT PROVIDING JOB OPPORTUNITIES TO THE BHILL COMMUNITY AS WELL AS CREATE NEW PLATFORM OF CO -WORKING SPACE IN THAT REGION

IMPROVE THE INFRASTRUCTRE OF NEAR BY AREA.
PROVIDE PLATFORM FOR COMMUNI-TY TO SHOWACSE THEIR CULTURE OF BHILL COMMUNITY
ALSO JETHWAI VILLAGE IS SUR-ROUNDED BY MANY TRANSPORTA-TION FACILITY AS WELL TOURIST POINTS WHICH HELPS THIS CENTER TO GRAB TOURIST ATTRACTION TO-WARDS THE MULTIFUNCTIONAL CENTER.

Jethwai is a medium size village located in Jaisalmer Tehsil of Jaisalmer district, Rajasthan with total 229 families residing.
It is situated **10km away from Jaisalmer,** which is both district & sub-district headquarter of Jethwai village.
The total geographical area of village is **4021 hectares**. Jethwai has a total population of 1,266 peoples. There are about **229 houses** in Je-thwai village.

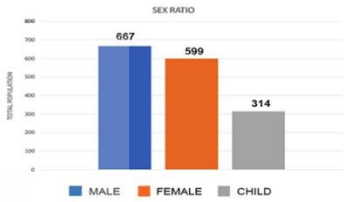


AREA : 4 ACRES

SITE NEAR ABUNDANT INDUSTRIAL AREA BY SELECTING THIS SITE FOR CENTER CAN REVIVE THIS PLOT TO CREATE NEW PLAT-FORM FOR COLLARBO-RATION OF INDUSTRIAL AS WELL AS SOCIO CUL-TURAL CENTER FOR ALL.

DAY TIME TEMPERATURE
40.3 °C

NIGHT TIME TEMPERATURE
29. 5°C



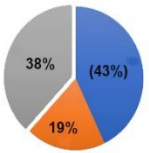
LITERACY RATE AND POPULATION RATIO

the main problem in this village is lack of education here. MLPC are telling goverment of jaisalmer that they will give land to government but please gives us the decent school to educate our childrens.

OCCUPATION OF JETHWAI VILLAGE

In Jethwai village, most of the village population is from Schedule Tribe (ST). Schedule Tribe (ST) constitutes 85.70 % of total population in Jethwai village. There is no population of Schedule Caste (SC) in Jethwai village of Jaisalmer.

The count of main workers in jethwai village is 390 whereas 158 are marginal worker who get work on minning sites . and out of 360 main workers 14 are cultivator ,9 area agricultural labourers and household industris are 18.
remaining 319 population of village are employed.

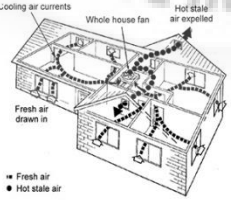


FLAURA AND FAUNA OF JETHWAI VILLAGE

Khezada, Bavla, Lora, Rohida, Van, Phog, Kumbhar, Jal, Neem, Babul and many other trees are to be found among sparse vegetation.

DWELLING UNIT OF JETHWAI VILLAGE

DWELLING UNITS OF JETHWAI WERE BUILT WITH TRADITION-AL JAISALMER ARCHITECTURE, MADE OUT OF MUD AD STONE TO PROTECT FROM HARSH SUN AND SAND STORMS.



OUTER LAYER OF STONE HELP TO MAINTAIN THE TEMPERATURE IN INNER AREA.
SMALL WINDOWS WITH JALLI PATTERNS ARE PROTECT FROM SAND STORM.

MAJOR PROBLEMS FACE BY JETHWAI VIALLGERS ARE AS FOLLOWS:

HARSH CLIMATC ISSUE:

EDUCTION FACILITY:

THEIR ARE FEW SCHOOL IN NEAR BY AREA BUT ONLY UPTO THE VII STAN-DARDS .

JOB OPPORTUNITY

IN JETHWAI VILLGE MORE THAN 300 VILLGERS WERE UNEMPLOYED. MANY OF THE VILLAGERS ARE WORK AT MINNING SITE .

INADEQUATE HEALTH FACILITIES

THEIR IS NO DOCTOR'S POST AND THE NURSESWAS SAID TO BE ABSENT MOST OF THE TIME.
AS MANY VILAGERS ARE WORK AT MINNING SITE MANY OF THEM HAVE BRAETHING PROBLEMS.
STAGNENT WATER IN MINNING AREA DEVELOPED MANY DISEASES LIKE MALARIA .

CULTURE OF JETHWAI VILLAGE , JAISALMER

Jethwai village has become world famous for its beautiful **'yellow marble'** which is not marble but fine quality sandstone, and is in great demand.
The magnificent Sonar Kila in Jaisalmer is in fact made of the same stone.
Jethwaigaon is predominated by families from the **Bhil community**. Bhils weretraditionally the hunter community.

11.Conclusion

In today's world, a general conflict between land therefore there is no footprint left horizontally as the population is going to prefer verticle growth. growing verticle is not only one solution for all problems. horizontal spaces function better than verticle. The need for the multifunctional structure will sustain the space for a longer period due to its multipurpose nature. for an architecture space when spaces having multifunction, it lives more. The courtyard is one of the elements of architecture that allows users to adapt the space according to user need, so applying these parameters of courtyards to build sustainable socio-interactive community as well as space that lives for a longer period.

The climate aspects of the courtyard were always very significant throughout centuries and the primary aim of courtyard design was to create a comfortable condition in a harsh climate. In the present context also this factor should be given top priority to achieve sustainability and the proportion as well sizes may be worked out by using simulation tools for light, shadow, and ventilation. The socio-cultural aspect has been given importance through centuries and in the present context this factor has been ignored so there is a need to consider this aspect in light of the changed lifestyle of people.

Inference from the past, the courtyard is formed because of the adjacent build form so the responsibility of designing the built form becomes more as compare to designing the courtyard space. There is so much life in courtyard space just because of human and their activities.in architecture , when a space having multifunctions, it will sustain for long period of time. By applying all this analytical study I will apply to propose a multifunctional center all of which showcase the highly celebrated architecture space that is COURTYARDS.

12. BIBLIOGRAPHY

- Amadouni Zareh S., Courtyard Housing: A Typological Analysis, M.Arch thesis, School of Architecture McGill University Montreal November 1994.
- Edwards, B. (2006). *Courtyard Housing: Past, Present and Future.* Oxon: Taylor & Francis
- Myeneni, K. K. (2013). Courtyard as a building Component. *International Journal of Chemical, Environmental and Biological Sciences*, 633-639.
- Ar. gaurav gangwar and prabhjot kaur(2016) Towards Sustainable Future: Typologies and Parameters of Courtyard Design.
- BAGNEID, A. (2006). The creation of a courtyard microclimatic thermal model for the analysis of courtyard houses (Ph.D. Dissertation). U.S.A.: Texas A&M University.
- Upendra Rajapaksha , et al., "Sustainable By Passive Architecture, Using Courtyards In Non-Domestic Buildings In Southeast Queensland" The 2005 World Sustainable Building Conference, Tokyo, pp 979 -986, 27-29 September 2005