

IMPACT OF COURTYARD IN BUILDING WITH RESPECT TO CLIMATE AND BUILDING FUNCTION

Vaishnavi Gangade *, Ar Sharda Shirsat **

*(P.R.Patil College Of Architecture Amravati, Maharashtra, India
Email: vaishnavigangade@gmail.com)

** (P.R.Patil College Of Architecture Amravati, Maharashtra, India
Email: sharda.shirsat93@gmail.com)

Abstract:

Openings Play A Major Role In Any Structure. Utmost Of The Structures Designed In Ultramodern Day Lack Openings Grounded On Factors Like Ventilation, Thermal Comfort, Wind Flow Etc. A Courtyard Is A Major Part Of Maintaining Comfort In A Residence Through Lighting, Ventilation, And Thermal Comfort.This Study Analyses Of Impact Of Courtyard In Building With Respect To Climate And Structure Function. Analysing The Part Of Courtyard And Its Influence In Inner Thermal Conditions With Specific Reference To Inner Air Temperature.

Keywords —Courtyards, Opening, Lighting, Ventilation, Climatic Zone, Shape, And Building Function.

I. INTRODUCTION

The substance of good architectural design is to achieve not only the visual aesthetics and functional fulfillment but more importantly people comfort in the structures. In addition to being a good architectural space, auricular standard, acceptable position of lighting, thermal conditions and inner air quality are all veritably important criteria for a successful design. A court or yard is an enclosed area, frequently a space enclosed within a structure open to the sky. In hot dry zones, air temperature drops vastly after evening from re-radiation to the night sky. To enhance thermal comfort, this miracle has been used in the architectural design of houses by employing the yard conception.

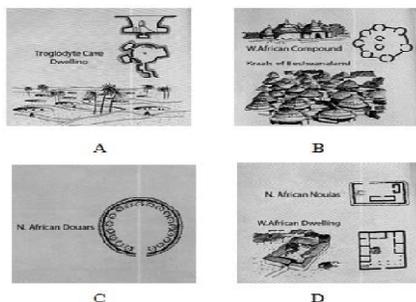
II. HISTORIC EVALUATION OF COURTYARD FORM

courtyard evolution in ancient civilization from shoveled at kahun in egypt, to courtyard form a cross the world.which back to 5000 years old to the chaldean city of ur before 2000b.c. in italy at 700b. c, a new courtyard design which relate as atrium house, developed from the old form, the purpose of this type is to give private outdoor space, atrium house met up with the greekpre-style which has a different design, the design showed small courtyard enclosed by columns. in the middle east courtyard houses an architecture tool, hat are common in hot and dry climatic and endure in numerous ancient metropolises and attempts to induce private area for introversion.

A. Ancient Civilizations

A caveman vill in Matmatas of Southern Tunisia the most ancient and homogeneous society to make

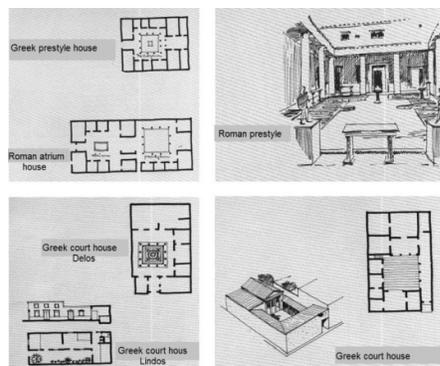
yard houses, according to Schoenauer and Seeman “ Each lodging-unit is erected around a wagon open to the sky with pitch wall and flat bottom” (Schoenauer & Seeman, 1962). Douars in North Africa, hutment of vagrant lines in West Africa, the Runs of Bechunaland in South of Africa and the first blockish residences in Morocco introduced the first prototype of yard (Das, 2006).



Different types of courtyard form in Africa

B. Classical Civilizations

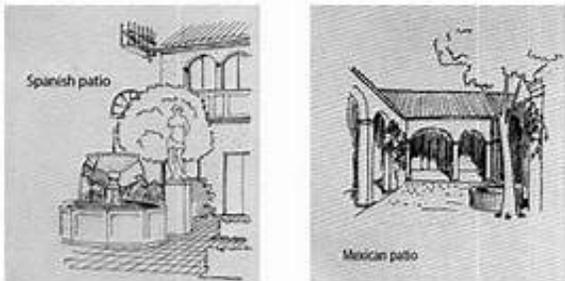
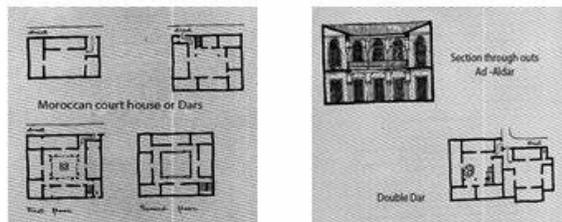
The inventor of yard takes another kind of design at 700b.c, in Italy the atrium house design has had a small yard enclosed by cells, with a holder in the center of the yard to gathering the rainwater to drink. the main purpose of this design, which is an open to the sky is to give a private out-of-door space. around 275b.c., roman structure came blend features inherited from the etruscans and the greek, after enthralled of southern Italy by romans (al-dawoud, 2006). the patio house met up with greekpre-style (court enclosed to columns), when people started to make a big house contained two styles (patiopre-style), any one of these styles has had their position in design, patio near to road andpre-style in the reverse of the house (blaser, 1985) figure-5 shows both classical period of court and atrium.



Typical courtyard dwellings prevalent during Classical Civilization

C. Middle Ages and Renaissance Civilization

After surrender of the Roman Empire of the bulletin board 476, the apartment of the yard type recurrence and the Italian code and the priority plants of the monastery were suffered. During the Christian anchor period, the terrace came from the early Christian church as a major entrance. It was used as a venue in the middle of the suppressed open coat, and was used by washing their hands before he enters the church (Blaser, 1985 North Africa and the Middle East and farms, as a result, follow the Gospel's "Minimum Social Status of Outfit Residents" (Schoenauer & Seschein, 1962). Courtyard with protected yard, pool, and out-of-the-doors cabinet for relaxing. Another factor in the Court (Serdab) design appears in the Mesopotamian region, which is used as a cool air to the house to indicate Moroccan yard house design during this period (it is 2006). According to it, the Mediterranean Sea, especially in the Mediterranean Sea of the Mediterranean Sea, Rome terrace, northern yard design, south solder, and yacht, the court was also used for Outofdoor Contationing. Preparation of Yard Domin Type Garden design system recently introduced by the Spanish pioneers of Latin America Figure 7 shows a house in Spain and a house in Mexico.



Courtyard houses in Morocco, typical during middle ages
Comparison between Spanish and Mexican courtyard

D. Modern Civilization

In the ultramodern period, the yard first entered to the West Coast of North America, and revealed in the Southern California due to the influence of Spanish colonizer. Whereas another opinion mentioned that, the reason of the different structure's style of Los Angeles influence by the movie set and film assiduity. Stefanos etal. (1996), observed the recaptured of excursionists to settle down in California between 1880 and 1930 created need to high accommodation that, changed the form of yard houses in that region (Stefanos etal. 1996) Recently, the yard type transferred across the United State to the East Coast when the idea of use yard to separate between the sleeping area from living area spread by Marcel Breuer (Das, 2006), Duncan, 1973, cited that in 1956 the binuclear yard had converted to the long, narrow sundeck house in the country. Figure-10 shows a sample of sundeck house in Los Angeles designed in 1956 by the mastermind Richard.J.Neutra



Terrace house in Los Angles designed in 1956

III. TYPES OF COURTYARDS :

A. Based On Levels:

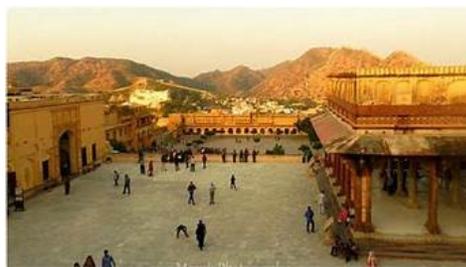
In The Vertical Plane, There Are Three Types Of Courtyards: Ground Level, Sunken Courtyard And Elevated Courtyard.It Will Depend On The Site, Climate And Other Factors To Determine The Type Of Courtyard To Be Chosen And Accordingly Their Size And Proportion Should Be Worked Out.



Sunken courtyard in American Institute of Indian studies at Gurgaon.

B. Based On Functions Of Buildings:

The courtyard shape is initially used in residential buildings, but later when THEY realized the merit of it, different civilizations also used this concept in public buildings. The courtyards of public buildings are always on a monumental scale while residential buildings are always on a human scale. Residential courtyards are very functional with regards to climate while the courtyard of public buildings also aims to have other utilities such as public meeting spaces etc.



Use of courtyard in public building: Amer fort, Rajasthan

C. Based On Shapes Of Courtyard:

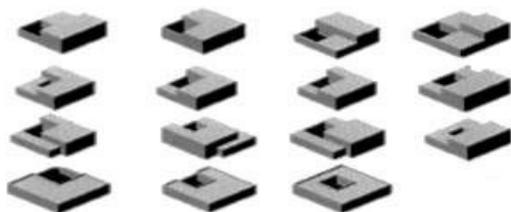
Circular, polygonal, rectangular, square and organic shapes have been used throughout the historical evolution of courts. The most popular among the masses were rectangular or square in shape due to the functionality of the building, the limitation of

structural innovation and the lower plasticity of the material, due to the economical nature. In China, Tulou buildings had a circular courtyard, and these buildings were constructed of mud. Colonial architecture also has many examples of circular courtyard in their palaces and public buildings for aesthetic reasons. Technological advancements and material innovations They have ended the limitation of the structure and all kinds of forms are possible in the 21st century according to the needs.



Circular courtyard of palace of Charles V

The courtyard does not have a precise plan, the first design of the courtyard houses is generally rectangular, square and circular. These shapes were converted to obtain ecological aspects such as site limitation, topography, orientation and function of the building to produce new shapes [U-shape, L-shape, T-shape, V-shape, H-Shape or Y-Shape] Figure 11 shows several possible shapes for a one- or two-story single-family yard. The scale and size of the yard can be adjusted very closely to expand the space. Based on bibliographic research, it can be said that the courtyard project can be completely or semicircular or delivered by only two walls.

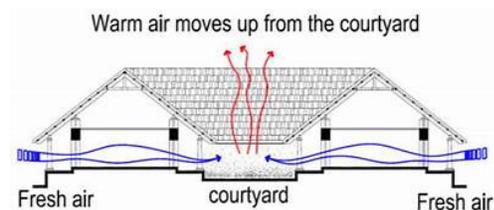


Different possible forms for a single family courtyard of one or two storeys (Edwards, 2006).

IV. VENTILATION:

In hot and arid regions where the temperature difference between day and night is significant, courtyards are a very effective solution for creating comfortable conditions. During the day, due to the

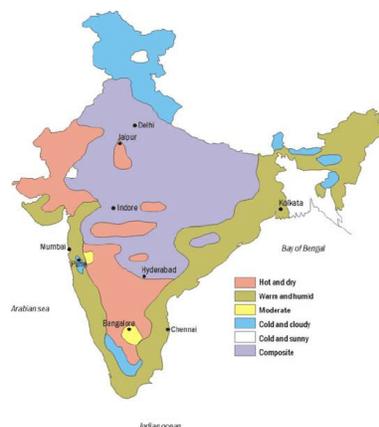
high outside temperature, the air warms up and becomes lighter, but the temperature inside the yard remains lower, so the air becomes denser and cooler than the outdoor air. This cooler air enters the rooms through the yard and the warm air exits through the rooms. At night, the air outside becomes cool due to the lower temperature and dense, the building is still warm, so the air in the yard becomes lighter. Outside air enters through the rooms and is exhausted from the yard, so this air movement creates comfortable conditions.



Air movement in hot humid climate.

V. CLIMATE OF INDIA

Indian climates range from tropical in the south to temperate and alpine in the north of the Himalayas. The high areas receive sustained snowfall during the winters. The Himalayas and the Thar Desert strongly influence the climate of the country. The Himalayas act as a barrier against the freezing katabatic winds, which blow from Central Asia. The tropical country is famous for its different climatic characteristics.



Climate MAP Of India

Climate Zone

Courtyards Are Generally Favourable In The Following Climatic Zones

A. Hot And Dry Zone

Hot Dry Desert And Semi Desert Climate Are Characterized By Very Hot, Dry Air And Dry Ground. Day Time Air Temperature May Range Between 27 And 49 Deg C.[Normally Higher Than The 31 To 34 Deg C] But At Night It May Fall As Much As 22 Deg C.

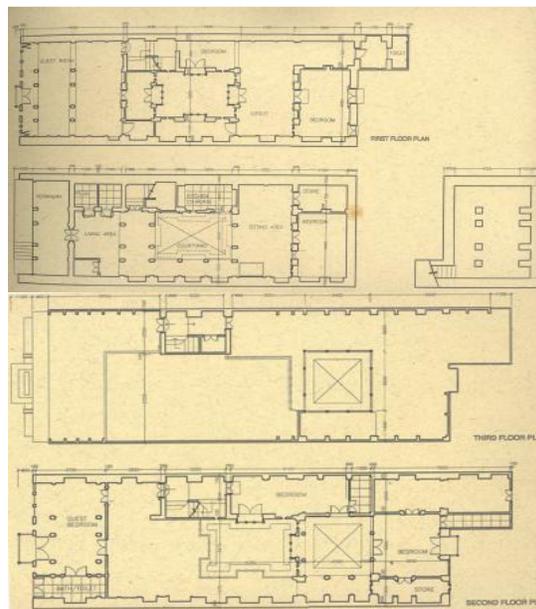
Layout And Form Of Courtyard –Compact Planning With Mutual Shading And Minimum Exposure. Compact Planning And Inward Looking Building Are Suitable Patios And Courtyard Advisable.

Very high daytime temperatures, low rainfall and a short, mild winter season characterize this climate. Another important characteristic is a strong diurnal temperature variation. It can be hot during the day and cold at night. This is due to rapid radiant heat from ground or building to clear night sky.

The desert city of Jaisalmer copes with this by building houses that line up against each other, with the interior rooms opening onto small courtyards and the front rooms opening through screened openings onto narrow streets and shaded. This scheme minimizes the exposure of building surfaces to the exterior.

The buildings are of heavy mass and the windows are small, so the interior temperature changes very little during the day and night, remaining close to a more comfortable average daily temperature.

In summer, although the day is hot, the nights are cool and people spend time on the roof terrace. Since humidity is low, if water were available, evaporative cooling of water would be a simple and effective way to achieve thermal comfort. jaisalmer haveli plans



B. Composite Zone

Composite Or Monsoon Climate Are Neither Consistently Hot And Dry, Nor Warm And Humid. Their Characteristics Change From Season To Season, Alternating Between Long Hot, Dry Periods To Shorter Periods Of Concentrated Rainfall And High Humidity .

Layout And Form Of Courtyard –Moderately Compact To Provide Mutual Shading And Shelter From Wind In Cold Seasons But Allows Advantages To Be Taken Of Prevailing Breezes In Humid Period. Courtyard Building Are Suitable, Terraced Building Facing North And South May Also Be Appropriate.

C. Sub- Tropical Zone

The Climate Is In Many Ways Similar To The Composite Or Monsoon Climate, With Its Distinct Rainy Seasons. It Is Dominated By Strong Solar Radiation, Often With Moderate To Cool Air Temperature. Even In The Warmest Part The Year Air Temperature Rarely Reaches 30 Degree C But The Diurnal Variation Can Be As Much As 20 Degree C.

Layout And Form Of Courtyard-Spacing Need Not Be Quite So Compact To Allow From Sun And Light In Winter .In Marine Areas Building With Adequate Spacing To Allow For Breeze Penetrated

Appropriate. Technical Use Of The Courtyard Is For Creating A Pleasing Internal Environment.

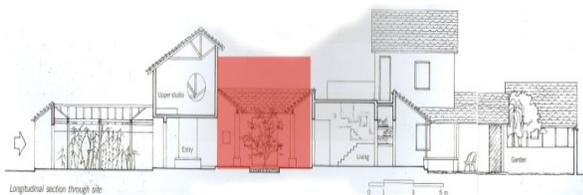
D. Warm And Humid

The Most Prominent Characteristics Of This Climate Are The Hot, Sticky Conditions And The Continual Presence D Of Dampness. Air Temperature Remains Moderately High, Between 21 And 31 Degree C, With Little Variation Between Day And Night. It Seldom Exceeds Normal Skin Temperature. Humidity Is High During All The Seasons.

Layout And Form Of Courtyard –Winter Conditions Would Permit An Elongated Building Design. The Heat Stress In Summer Would Permit A Compact Inward Looking Building.

Case Study – 1970's Modern Residence

House in Koramangala, Bengaluru designed by Charles Correa



The adaptation of the traditional South Indian house to modern times is demonstrated in the Koramangala Bengaluru house designed by Charles Correa; the house was built in mid-1987 as an office/studio/home for his children. Although the layout of the site is similar to the British bungalow (with front garden and backyard), the one-storey house is conceptually very different. asymmetrical and designed with an off-center entry and a yinyang concept. The courtyard serves as the center with the studio and home aligned diagonally.

The circulation path goes from the front door to the main facade, then moves along a changing axis to arrive at the courtyard from which the other rooms open. The interior is flooded with the light, cool breeze from the courtyard which sits at the symbolic and geometric center of the house and contains an ornamental Champa tree. It is a thing of the past and a statement of the location of the house in India. In such houses, the traditional courtyard, if used, fulfills an aesthetic and symbolic function if not climatic or activity. Correa was critical of British colonial-style one-storey houses and stereotypical "vernacular" Indian architecture to create this more modern interpretation of post-independence Indian architecture. He managed to achieve cultural identity by taking the premise of local or regional architecture, in this case the traditional courtyard houses of South India and transforming it into something more symbolic and modern.

Conclusions

The research has provided a background to support further research and analysis on the history evolution of courtyards. and impact of courtyard elements of its performance.

The paper is a first level of understand the effectiveness of courtyard on the building environments as climatic moderator and passive techniques that is help to reduce the energy conserve and provide thermal comfort to building occupants.

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