VERNACULAR

Journal of MIDAS Architecture College

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MIDAS Architecture College is a standalone college located near to Chennai in Cheyyur Taluk, Kancheepuram District, Tamilnadu. Located inside Swarnabhoomi township with state of art infrastructure facilities including indoor-stadium and swimming pool, is known for its excellence in design education continuously ranking in top-10 in the country. In 2015, the B.Arch. students secured two gold medals respectively in architecture and interior-design degree, including seven more ranks in Tamilnadu.

MARG Institute of Design and Architecture, Swarnabhoomi (MIDAS) is part of Swarnabhoomi Academic Institutions (SAI) located inside Smart City covering an area more than 600 acres.

Director: Mrs. Rajini Reddy

Principal: Ar. Sudhakar. J, Professor

HoD: Ar. Dhushyanth L, Assoc. Professor

Coordinator: Ar. Xavier Benedict, Professor

MIDAS Architecture College

Swarnabhoomi, Cheyyur Taluk, Kancheepuram 603305

Tel: 087544 12325

Email: principal@midas.ac.in

Editorial Comment

VERNACULAR – A journal for publication of papers on "Vernacular" theme. We are happy to release the first volume of this journal during MIDAS SHOW-CASE 2017. The journal is non-peer reviewed papers with diverse subject based around architecture, and urban design.

Vernacular means native – it defines the soul of any environment, culture, architecture, language, cuisine, and life-style. It is a common identity of the place which will be sustainable and energy efficient. In this data-revolution packed century, the world has become a global village, and traditions and cultures have lost their local distinctiveness. Vernacular traditions in any field are a creative process developed by the interpretation of local knowledge, geographic opportunities, challenges, past-experiences, which are negotiated and adapted by generations to the meet the needs of the time. This journal will bring good number of research articles written by architecture students, academicians, and professionals from architecture and allied fields.

We look forward to more number of contributions from all over the country which would be published in this annual journal. We wish this starting point would map a great intellectual journey forward.

Bioclimatic Design in Contemporary Vernacular Architecture Vernacular Style in Contemporary Architecture

Aarthi M
Sathyabama University
aarthimohan28@gmail.com
9840849988

Abstract: In a rapidly developing economy faced with globalization, energy crisis, mass migration, climate change is leading to mass consumption of energy. Built environment today is highly dependent on energy consuming technologies to achieve comfort conditions. This is clearly evident in the tropics where the sun is intense almost all round the year. However, our traditional settlements with less technology have skilfully mastered the art of taming the sun, remain comfortable without active means.

Vernacular - is architecture of the place that, respects nature, climate friendly, sustainable and design precise to the need. Constant research is conducted on vernacular architecture since 1964. And the result of which proved the traditional construction techniques consume less energy, further leading to new technological developments.

Many contemporary architects practicing sustainability are now using these vernacular techniques in their design either in original form or modified form. Assessment of these techniques will give us an idea of the appropriateness to the current circumstances.

Sustainability is actually well spoken when the basic needs of comfort like thermal and visual comfort is achieved by passive means, depending less on mechanical modes. Thus vernacular style is adopted in the contemporary construction to acquire comfort. With very less active means is becoming the need of the hour.

This paper will access such contemporary structures built using passive techniques in the hot humid region. The methodology followed is conducting case studies and analyzing the effectiveness by using tools to measure the same. The above empirical study will help to conclude efficient strategies for the climate. Arrive at inventory of strategies used in hot humid climate from case studies and conclude them on the bio climatic basis. The paper will further try to bring in a relation between traditional strategies and bioclimatic principles to prove the climate efficiency.

INTRODUCTION

Traditional architectural principles always respected nature, and was climate conscious, user-friendly, reflected the culture and tradition of the community at large and most important was contextual. Various parameters such as geographical climatic conditions, occupation, culture and tradition of the society/community decide these principles in a specific set up and make the structures sustainable in all respect *(P Jayasudha, 2014)* the conclusion of the research states that vernacular techniques used in the traditional dwellings, - a desirable comfort conditions is achieved in the houses with no or minimal use of mechanical devices. Some researchers have also concluded that vernacular techniques reduce the consumption of energy and provide thermal comfort.

Examination of vernacular strategies used in today's construction to adopt to the climatic conditions either in their original or modified form. This examination will be bases to prove their effectiveness and improvement of the same to bring in high levels of comfort in the hot humid climate.

Bioclimatic design is one of the concepts in architecture that takes climate as the basis of study. For the base on climate responsiveness in architecture one should be aware of the vernacular structures and the strategies used by them as they have always proven sustainable.

The paper will focus only on analysis and learning of the climatic features and the mitigation strategies used in the hot humid climate (near Chennai) and how it can be related to bio climatic design in the current context.

LITERATURE REVIEW

There are three different variables that have to be understood before going into the study. Vernacular architecture, contemporary vernacular architecture and bioclimatic design are the three variables all of which have a common base that is climate. It will be more relevant to study the climate (hot humid climate).

Climatic Features – Hot Humid Climate

- Intense solar radiation (west and horizontal surfaces)
- High average temperature
- High humidity
- Precipitation (monsoonal months)
- Wind movement is reasonably high (strong tropical wind)

Mitigation Features For The Climate

- Solar shading – walls and openings
- Cooling (ventilation)
- Dehumidification

Bioclimatic Design

Bioclimatic design refers to the design of buildings and spaces based on local climate, aimed at providing thermal and visual comfort. An evolving field in sustainable architecture, that helps in satisfying the human needs by the use of climate as a supportive tool. A chart (Fig.1.) relating temperature and relative humidity was create by Victor Olgay showing comfort zones

The bioclimatic design approach implies an application of a logical sequence of analysis, the detection of appropriate strategies and the conscious environmental control in response to external impacts and rational use of resources. With this objective, the bioclimatic design strategies aim to take advantage of the favorable environmental aspects, (Goulart and Pitta, 1994; erg et al., 1999).
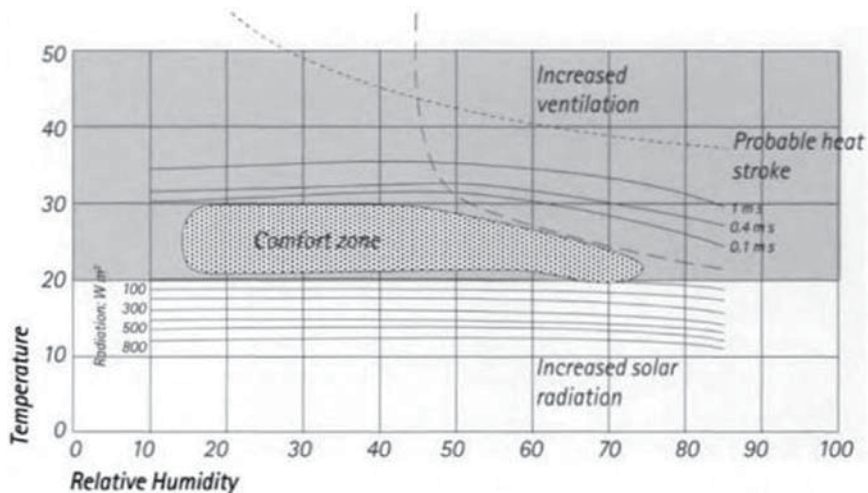

Fig. 1. Bioclimatic chart (Climate responsive design)

Based on different views of literature, the common components of the principles include the following: (relevant to hot humid climate)

- Passive solar heat protection
- Passive cooling
- Natural day-lighting

Vernacular Architecture

The growing awareness of sustainable building's potential to positively impact environmental issues pushes vernacular architecture to the forefront. Vernacular architecture presents basic and simple solutions for the sustainable issues because it is eco friendly.

Vernacular - 'domestic, native' dwellings, meeting the needs, values, economies and ways of life. Related to their environmental contexts and available resources they are customarily, owner - or community-built, utilizing traditional technologies.

Vernacular traditions are creative processes that have been developed by past knowledge and experiences, which has been adapted for generations to meet the need of the time. The study of vernacular architecture has been of architect's interest for the past 50 years since it was started by Bernard Rudosfky in 1964.

Vernacular solutions show a variety of designs related to the conditions that surround it, responding to the nature, culture, symbolic interpretations and definition of comfort in that area *(Rapoport 1969).*

Contemporary Vernacular Architecture

Contemporary - 'together with' + 'time'. Define it as something that supposes to belong or occur in the present. The time dimension plays a big role at the definition

It's the form of the attempt to revoking traditions and vernacular into the modern era.

The application is not like moving/making the same ancient vernacular architecture, but the concept of locality & use of advanced technology. Change in economy and social patterns has allowed the availability of manufactured materials throughout the country has caused a profound change in the vernacular architecture of many regions.

Table 1. Climatic strategies (hot humid climate), techniques and their effect in design.

Climatic strategies	Techniques	Effect
Orientation	• Oriented in the mostly on the north south axis • Common wall technique	- Enhances air movement - Reduction in intense solar radiation on the walls
Shape and Layout	• Compact and linear plans • Simple low rise structures • As a settlement the layouts are clustered	- Minimal heat gains due to compactness - Protection of the longer axis from radiation
Solar shading	• Deep overhangs (thinnai) • Eaves in the courtyard • Narrow side passage ways	- Protection of the east and west walls from sun - Shades verandahs in the courtyard were the windows open to - Mutual building shades
Thermal insulation	• Attic spaces with vents • Clay roof tiles with air cavity • Thick walls	- Acts as insulation layer between the main space and the exterior reducing the heat gain by gable ventilation - The tiles with air cavity reduces the transfer of heat - Reduces heat gain
Light weight construction	• Thatch for roofing • Wood	- Thatch acts as breathing layer and promotes dissipation of heat at the roof level (porous) - Use of wood helps in maintaining the temperature constant
Vegetation	• Garden in the backyard	- Helps in fresh air movement and shades the walls

Table 2. Bio climatic principle in relation to the climate features (hot humid climate)		
Bio climatic principle	**Climatic features**	**Climate strategies**
Solar heat protection	Intense solar radiation	Orientation
		Shape and layout
		Solar shading
	High temperature	Thermal insulation
		Light weight construction
		Vegetation
Passive cooling	High wind movement	Moisture & condensation
	High humidity	
	Precipitation high	Natural ventilation
		Materials
Natural lighting	Intense glare and light	Natural lighting

PROBLEM STATEMENT

In a rapidly developing economy faced with globalization there is a higher dependence on energy-consuming technology in cooling and ventilation systems, to achieve thermal comfort in buildings. The increase in the consumption of energy has led to higher levels of pollution which in turn depletes the ozone layer increasing global warming. This is clearly evident in the tropics where the sun is intense almost all round the year. Achieving sustainability in every core of development: environmental, physical and socio cultural, aspects of built environment is the need of the hour. Reaching sustainability has been one of the prominent cores of study and research for the past two decades in the field of architecture. This has led to the development of new technologies in the field to mitigate the energy crises, as result of which the use of irrelevant design principles and materials in the construction- ultimately leading to environmental degradation.

RESEARCH METHODOLOGY

An analysis and study is carried on contemporary buildings having used vernacular techniques in their design either in original form or modified form. Assessment of these techniques will give us an idea of the appropriateness to the current circumstances.

- Case study of contemporary vernacular structures that use cost effective, locally available and sustainable features that reduce the energy consumption by passive means.
- Analysis of the above case study through field measurements and observations made in the site.
- Arrive at inventory of strategies used in hot humid climate by the case studies and conclude them on the bio climatic basis.

CASE STUDY

Method of Study

Climate responsive principles are used by architects in the present day context - knowledge gained from the vernacular architecture of the region. They have successfully designed and implemented some of them into today's scenario.

Many architects are practicing such vernacular methods and energy efficient methods like Satprem mani, Anupamma kundoo, Chitra Vishwanath, Benny Kuriakose, Sathyaprakash Varanasi, Dharmesh Jadeja, etc.,

The implementation of these strategies and their effectiveness can be better assessed by empirical analysis of the sites.

Empirical and observational analysis has been carried out in the hot humid climate near Chennai of the same climatic zone.

The study was done with the equipments
- Thermo hygro meter (temperature and humidity)
- Anemometer (wind speed)

Case study chosen in the hot humid region (live study)
    a. Arulville, farm house, Cheyur (20.10.2016) the measurements are taken at an interval of two hours (8.00 am, 10.00 am, 12.00 pm, 2.00 pm, 4.00 pm)

Farm House, Arulville

Arulville is a farm house which is located on the ECR, (Fig.2) on the road way to pondycherry from chennai. The small village located in the island surrounded by back waters on three sides.

The location by itself is bestowed with richness of nature this inturn enhances the micro climate of the place.

Fig. 2. location of Arulville (Google maps)

Project: Arulville
Location: Mudaliarkuppam-ECR, Tamilnadu, India.
Architect: Dharmesh Jadeja, Auroville
Area: 2229.67 Sq. m land app.,
         500 Sq. m built space.

About the Campus

The site encloses a cottage, a bungalow, kitchen block, an amphitheatre and a water tank tower. (Fig.3) (Fig.7)

The cottage is used by the owners; the bungalow serves as a guest space with rooms in the ground and a gathering space at the first floor level. The kitchen is common space for the campus which is double storey with a thatched roof for the first floor level used by the rural community.

Each of these structures is distinctively built with unique construction techniques and artificial water bodies created for aesthetics.

Use of climate responsive strategies, (Fig.4) local materials and techniques, social and economical parameters that makes this place a sustainable one. In

Fig. 3. Site Layout of Arulville

1. EAST ENTRANCE
2. CAR PARK
3. COTTAGE
4. LOTUS & LILY POND
5. AMPHITHEATRE
6. DINING & STUDY HALL
7. LILY POND
8. VILLA
9. WATER BODY
10. NORTH GATE
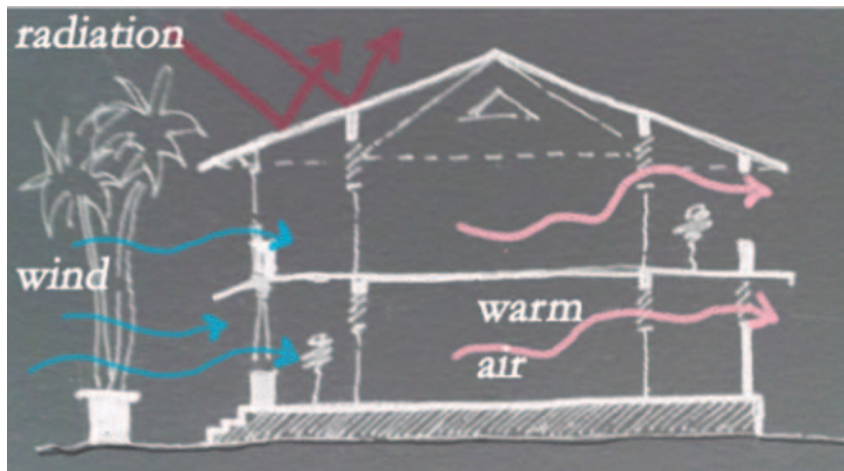
Fig. 4. Action of climate on the building

addition to this the water purification in the site is a unique feature both water for drinking and the grey water is treated by natural process.

The Spatial Planning

Site has two accesses (Fig.3) one from the North East (Fig.6.) and the other from the South East(Fig.5.) both of them give the visitor an experience of approaching a native village set up with nature surrounding the place. The north eastern gate gives a traditional temple look and the South East gate built with some innovative techniques with vernacular thinnai concept. Built space is oriented towards the South East - the predominant wind direction of the place. Three main structures – cottage, bungalow and the kitchen are zoned perfectly in the site having not disturbed the existing trees.

Primary zone has the cottage near the gate where the family stays and could have a clear watch of the whole campus. The bungalow is for the visitors to use, who could encounter a lively walkway leading from the south east gate to the block. A row of palm trees (a native plantation) create a sense of visual guard

Fig. 5. South east entrance

to the bungalow. The right side of the pathway has the kitchenette with dinning above with its vasthu position of South East in site. An open air theatre located on the South West- a small gathering space for the visitors designed with the concept of the traditional Kunds of Gujarat (Fig.7) The North West corner has the recycling plant- which takes the concept of root zonal treatment a natural process for purification of grey water.

Fig. 6. North east entrance

Fig. 7. Open air theatre (kund)

Fig. 8. Tank

Fig. 9. Verandah

Materials

baked bricks   rammed earth   flat bricks   conventional bricks

terracotta tiles   kota stone   red oxide floor   Materials for walls and floor

Fig. 10a. Materials used for walls and floor.

Fig. 10b. Materials used for roof, openings and ground

Choice of materials and textures are one of the best ways in which the built form encounters the surroundings. Thus Arulville is one of such examples that express the local architecture and the materials used make it belong to the earth itself.

The materials used are mostly rustic in their finish and in their natural from. Some of the notable materials are the bricks of various classes and types used for the floors roofs and the walls and the rammed earth, earth sourced from the site for the construction of load bearing walls (Fig.10a)

Most of the materials used are of baked clay that is a good insulating material, clay having the porous property and the transmittance value is less (Fig.10b)

Giving a warm feeling and physical comfort to the residents, Arulville is a perfect gel with the site and its surroundings.

a. Bungalow Plan - Arulville

The comfort conditions are analysed in 7 different points both ground and first floor by review of temperature, humidity and air movement.
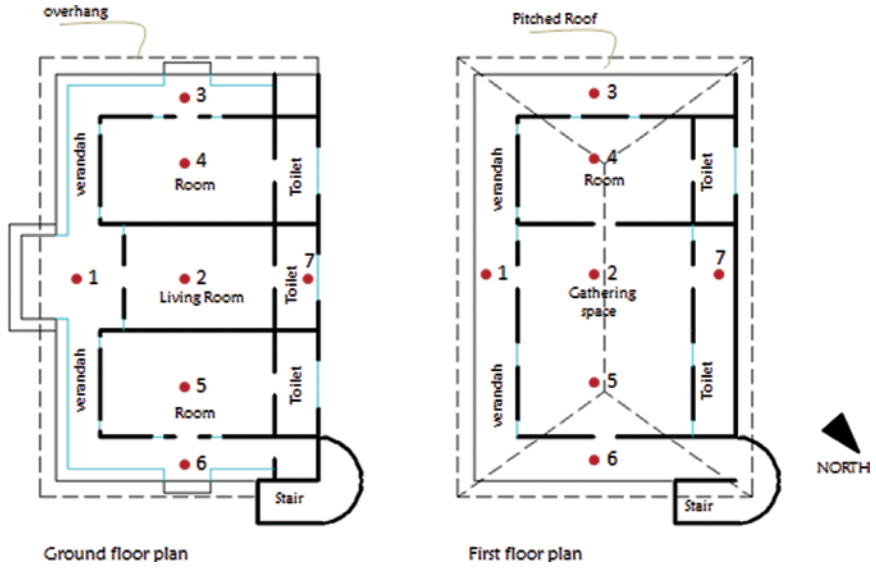
Fig. 11. Plan of the Bungalow (with points – of field measurements)

Fig. 12. Bungalow
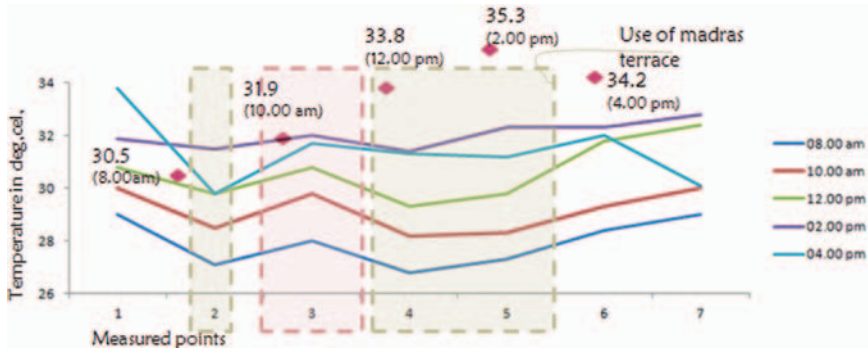
Fig. 13. Temperature analysis (ground floor)

a.1.Temperature (ground floor)

- The living that is centrally located is comfortable due to the buffer spaces on all the sides. (Fig.9)
- The rooms (pts 4,5) are less in temperature, living conditions are good without mechanical means of ventilation.
- The temperature variation is nearly 3-4 deg from the external temperature -the effect of the madras terrace (Fig.14 & 15) and also the roof above.
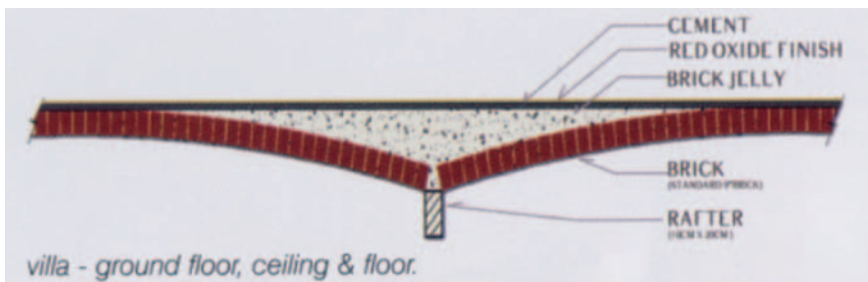
Fig. 14. Madras terrace detail

Fig. 15. Madras terrace (ground floor)
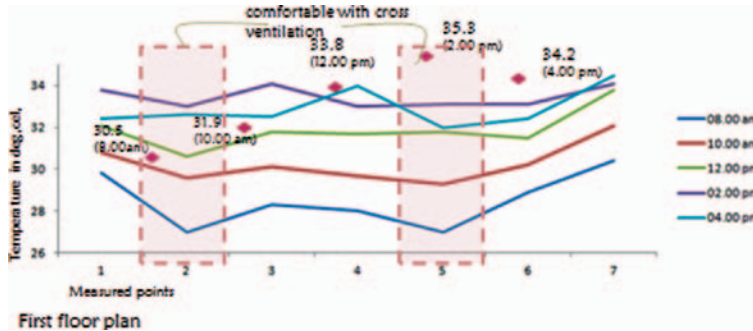
Fig. 16. Temperature analysis (first floor)

a.2.Temperature (first floor)

- Gathering space (Fig.18.) is well cross ventilated hence the temperature is maintained constant (2 & 5 points)

- The air before entering the inner spaces get cooled in the shaded verandahs.

- Shaded spaces i.e., the verandahs (Fig.17) on all the sides are less in temperature by at least by 2- degrees (deep eaves that protect the main walls from direct radiation)

- The thermal mass is less helping in quick transfer of heat by convection.

- The exposed brick work helps in maintaining the temperature via ventilation which has porous properties.

Fig. 17. Side verandahs

Fig. 18. Gathering space(first floor)

a.3.Humidity
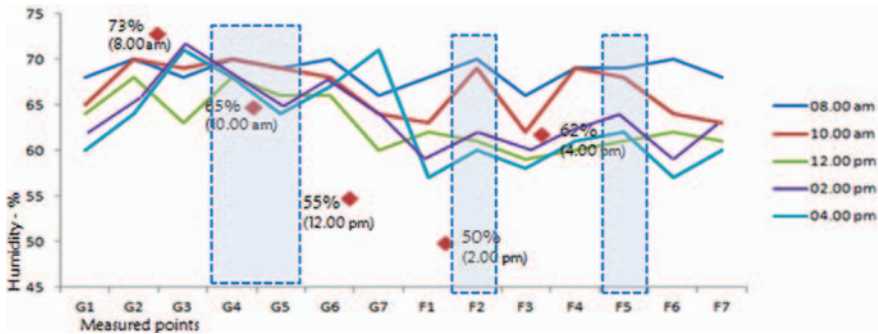
Fig. 19. Humidity analysis

Fig. 20. Louvered door   **Fig. 21.** Parapet wall

- The highlighted parts are of high humidity (Fig.19.) wherein the air move-ment is not good, the humidity remains in the place
- The humidity is reduced due to the presence of louvers (Fig.20) that filters the air and cools it.
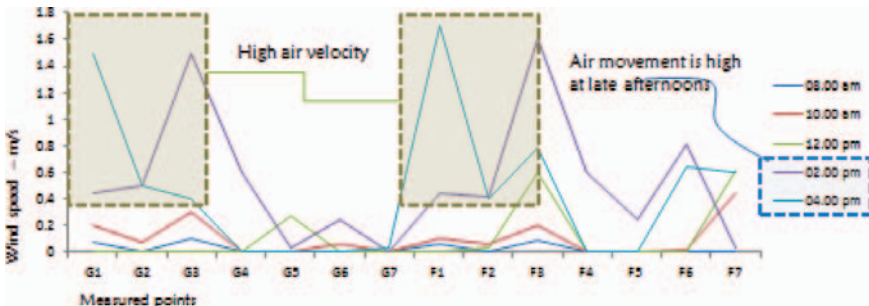
Fig. 22. Wind speed analysis

a.4.Wind velocity

- The air movement (Fig.22) is more from the south east and south thus the parts in the SE are well ventilated.
- The strip windows (Fig.23) in the corners promote more ventilation.
- At the first floor level the wind movement is enhanced by the use of porous parapet wall allowing air movement at the floor level (Fig.21)
- The bathrooms have openings on the wall creating venturi effect. (Fig.24)

Fig. 23 Strip window

Fig. 24 Wall (bath room)

b. *Cottage plan - Arulville*
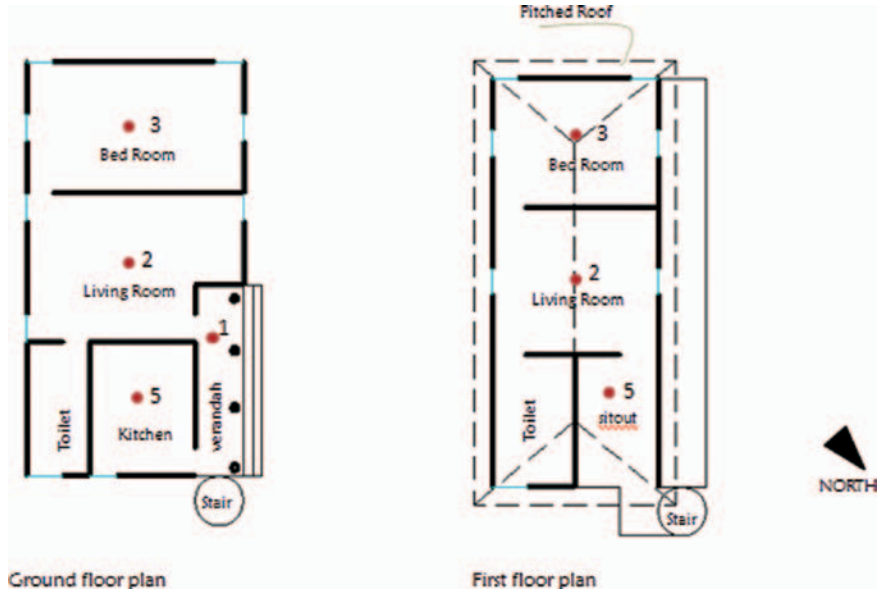
Fig. 25 Plan of cottage (with points – of field measurements)

Fig. 26 View of cottage

The comfort conditions are analyses in 7 different points (Fig.25) both ground and first floor by review of temperature, humidity and air movement

b.1.Temperature

Fig. 27 Temperature analysis

Fig. 28 Verandah (ground floor)

Fig. 29 Sit out (first floor)

Temperature inside the cottage (Fig.26) is high throughout the day remains high nearing the outdoor temp.

- Inference from the above, spaces in the cottage - living low temperature due to the verandah (Fig.28 & 29) on the south western side acting as buffers (Fig.27)

b.2. Wind velocity

- Late afternoon winds carry in hot air that increases the temperature as there are no buffer zones except the front porch(verandah)

- The wind movement is restricted by the use of glass doors (Fig.30 & 31)

Fig. 30 Living (ground floor)
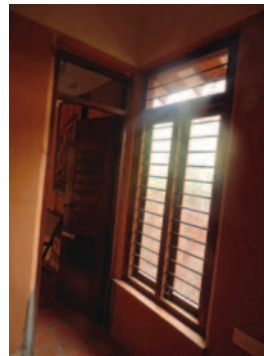
Fig. 31 Glass window
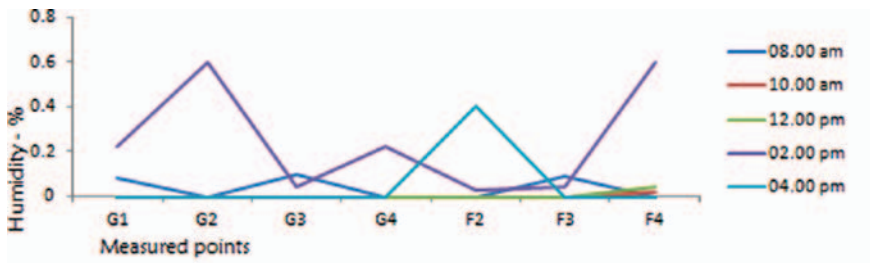
Fig. 32 Wind speed analysis

b.3. Humidity
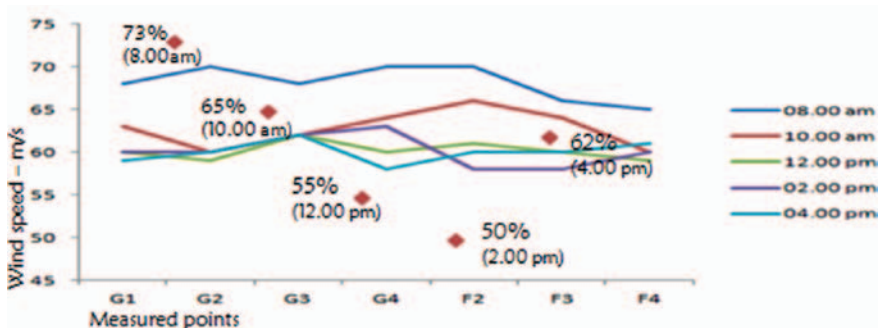
Fig. 32 Humidity analysis

- The humidity inside does not have any variations except for the 8.00 am reading.
- Ground floor has glazed windows with vents above (Fig.31)
- No presence of vegetation on the south east & south west which in turn increases the conduction and convection of heat. (Fig.26 & 33)

Fig. 33 No vegetation (SE)

Bioclimatic Design in Contemporary Vernacular Architecture

c. *Kitchen plan - Arulville*
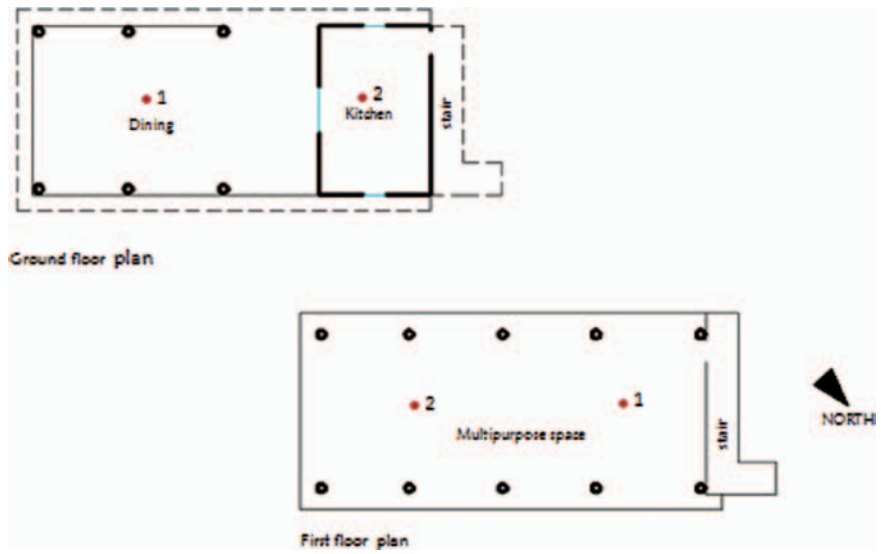
Fig. 34 Plan of the kitchen & dining (with points – of field measurements)

Fig. 35. View of kitchen & dining

The comfort conditions are analyses in 4 different points both ground and first floor by review of temperature, humidity and air movement.
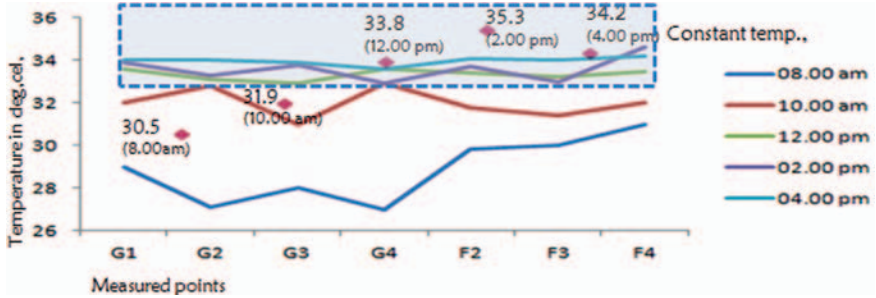
c.1.Temperature
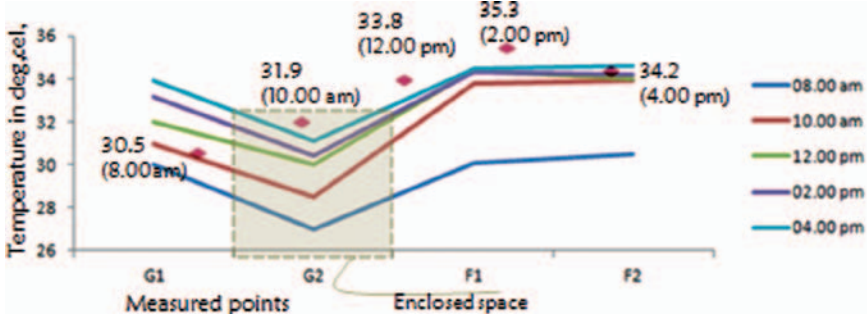
Fig. 36. Temperature analysis

Fig. 37. Ground floor dining area

- Temperature at the enclosed space is lower when compared to the semi open space. (Fig.37.)
- The use of a composite roof system (Fig.38.) precast slab, Mangalore tile with coconut coir infill and kota stone above.
- The temperature is manageable as there is vegetation on the south east side keeping the place cool

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Fig. 38. Section of the roof of kitchen

c.1.Wind velocity
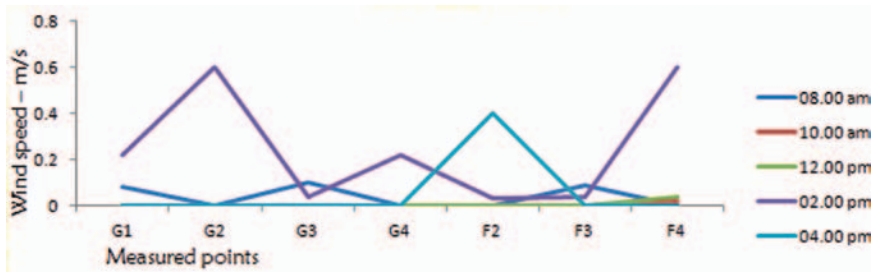
Fig. 39. Wind speed analysis

- Ventilation on good as the space is open on all the sides with no wall pro-vision. (Fig.37)
- Helps in the carrying away the heat produced in the kitchen

c.1.Humidity
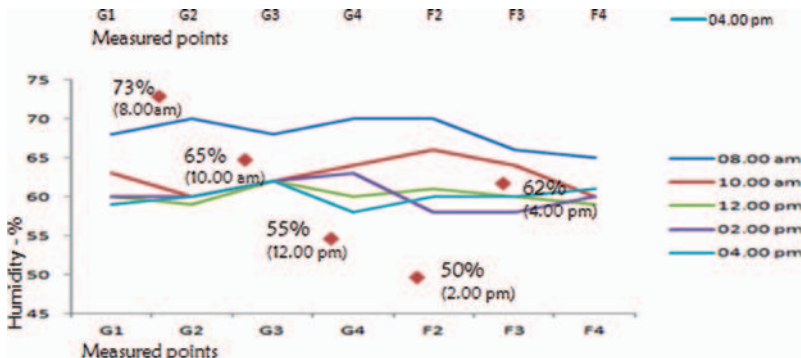
Fig. 40. Humidity analysis

Fig. 41. First floor with thatch roof (tree to right)

- This is an uncontrollable space that does not impact on the humidity being constant
- Increase due to the presence of a huge mango tree to the side of the dining. (Fig.41)

Findings

Sustainability is actually well spoken when the basic needs of comfort like thermal and visual comfort is achieved by passive means, depending less on mechanical modes. Thus vernacular style is adopted in the contemporary construction to acquire comfort. With very less active means is becoming the need of the hour.

Bioclimatic chart in with the measured points

Thermal comfort of the interiors determines the energy consumption by the environmental systems of a building and they play a vital role in building sustainability. Thermal comfort has been defined as the condition of mind which expresses satisfaction with the environment related to air temperature, humidity and wind speed (Y. Ryu, S. Kim, D. Lee, 2009)

The graph shows almost all the points in comfort zone when the wind velocity is between 0-3.5 m/s

- The ground floor 4, 5 points show discomfort as there stagnation of humidity and less air movement.
- The first floor only the points on the west show discomfort (bathrooms & the verandah on the North West)

Table 3. Case Study Analysis – Passive Strategies			
Climatic strategies	**Arulville bungalow**	**Arulville cottage**	**Arulville kitchen**
Orientation	- Longitudinal axis to the north west and south east axis	- Longitudinal axis to the north west and south east axis	- Longitudinal axis to east west axis
Shape and Layout	- Elongated single bunked plans - Spread out in the site	- Elongated single bunked plans - A linear arrangement	- Simple rectangular plan
Solar shading	- Verandahs on all the sides - Use of angled planes as solar shades - Deep eaves protecting the walls	- Verandahs on north west - Use of angled planes as solar shades - Deep eaves protecting the walls	- Use of flat planes as solar shades (sun shade)
Thermal insulation	- Thick walls of exposed brickwork - The walls of rammed earth - Thermocole in between Mangalore tiles - Composite material madras terrace	- Thick walls of exposed brickwork - Thermocole in between Mangalore tiles - Composite material madras terrace	- The walls of rammed earth - Use of coconut coir in the roof for insulation
Light weight material	- Wood used for fenestrations	- Wood used for fenestrations	- Thatch roof used in the dining space
Vegetation	- Palm trees in front of the bungalow to provide shade and uninterrupted wind flow. - The south west sides have vegetation (cashew trees)	- East side of the cottage has vegetation - The west south are exposed to solar radiation	- Mango tree in the passage shades the kitchen and dining space from the south west

Moisture and con-densation	- Controlled by louvered windows and doors - Pitched roof (tile) for quick run off	- Controlled by louvered windows and doors - Pitched roof (tile) for quick run off	- Controlled by louvered openings - Pitched roof Thatch helps in run off
Natural ventilation	- Position of doors and windows (cross ventilation) - Vents in the gable and above openings (stack ventilation)	- Position of doors and windows (cross ventilation) - Vents in the gable and above doors (stack ventilation)	The whole space is semi open thus well ventilated
Materials	- Bricks, mud, lime, wood, concrete	- Bricks, mud, wood, concrete	- Mud, wood, concrete, thatch
Natural lighting	- Glare control by louvered windows and doors - Long windows with mesh (wood)	- Glare control by louvered windows and doors - Strip windows (glass)	- Glare control by louvered window (kitchen)
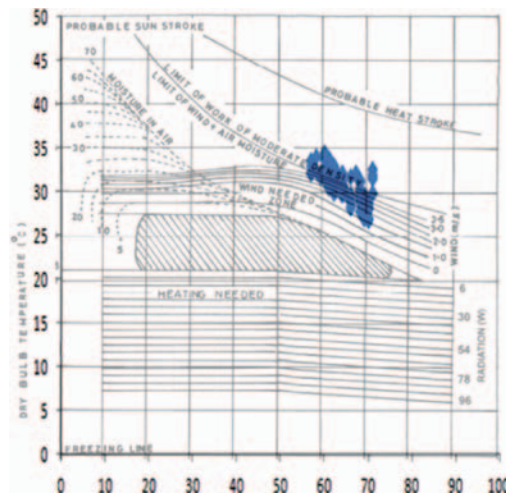
a. **Fig. 42.** *Bio climatic chart - Bungalow*
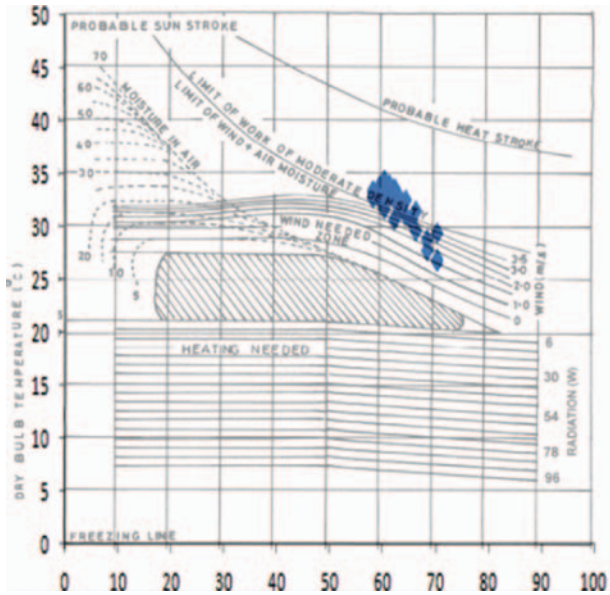
b. **Fig. 43**. *Bio climatic chart - Cottage*
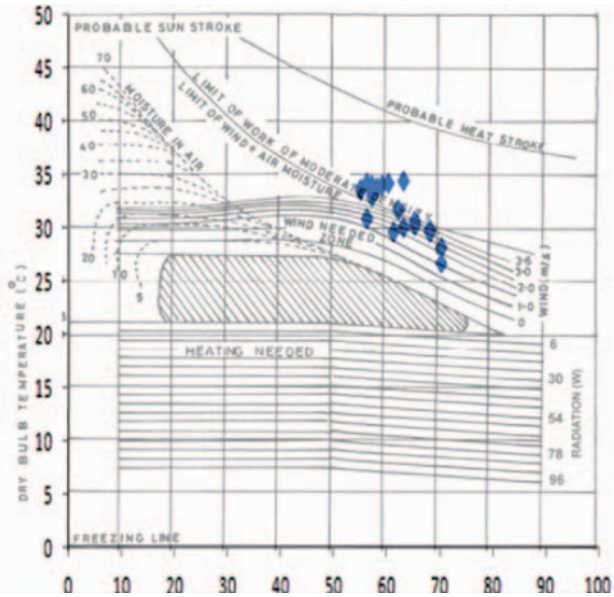
c. **Fig. 44.** *Bio climatic chart - kitchen*

The spaces are in discomfort zone the west (verandah, bed rooms)

Air movement is only pronounced when the windows are opened in the ground floor.

- The graph shows the points in comfort zone with the discomfort of the dining space below NE

Discussion

The study and examination at the site by doing empirical analysis and observations help the conclusion on the strategies that work for the hot humid climate. These have also been in operation without mechanical means of ventilation and lighting. Thus the inference from the above design will help in the introduction of the strategies in the design phase.

From the above findings some strategies are very clear that can be taken as a base for the designing of buildings in the hot humid climate consuming less amounts of energy.

- Solar heat protection
  - It is clear from the analysis that the use of verandahs and buffer spaces on all the sides helps in reduction of temperature (Fig.13) by atleast degrees at the peak hours.
  - The main walls surrounding the living or the activity spaces protected from direct heat gain also reduces the temperature.
  - The use of vegetation at appropriate sides (South West, East, North West and South East) around the building helps in less heat gain.
  - Wall material (exposed brick walls and rammed earth) acts as porous conductors that help in dissipation of heat.
- Passive cooling
  - Cross ventilation is found to be the most important strategy in this climate.
  - The use of wooden louvered windows and doors helps in the ventilation even though they are kept closed.
  - Use of openings at a higher level above the door and windows helps in the movement of hot air from the interior spaces at the roof level.(reducing the internal heat gain).
  - The humidity is also kept under control by the louvered openings.

- Use of gable vents helps in the dissipation of heat by induced air movement (stack effect).
- The small conical openings in the bathroom a wall help in air movement via venturi effect.
  - Natural lighting
    - The use of louvered doors and windows helps in manual adjustment of lighting according to the task.
    - The single bunked design helps in the light to reach more depths.

Hence the method and techniques used in this contemporary vernacular design can be effectively used in the current scenario to reduce the energy consumption.

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An inherent correlation, the similar experience they
give and the impact they have on their audience

N. Srishti Prabakar

RV College of Architecture, Bengaluru

srishti.prabakar.1rw15at@rvca.in

INTRODUCTION

On the difference between the ideals of architecture and mere construction, the renowned 20th-century architect Le Corbusier wrote: "You employ stone, wood, and concrete, and with these materials you build houses and palaces: that is construction. Ingenuity is at work. But suddenly you touch my heart, you do me good. I am happy and I say: This is beautiful. That is Architecture"[1]

The same holds good for music as well. Employing the use of musically instruments or voices gives rise to sound, or at the most a tune. Music is created by skillful articulation of notes that reverberate in your soul and make you feel something in your heart.

As abstract art forms based on rhythm, proportion and harmony, architecture and music share a clear cultural lineage. While the relationship between the two is mostly seen as one that is direct, there exists a deep more-than-just-a-surface relationship to the two.

The consideration of music and architecture as sister arts has a long history, in spite of the fact that they occupy opposite ends of the spectrum between the immaterial and the material. The intuition that allows us to even consider architecture as 'frozen music' or music as 'molten architecture' comes from a deep and ancient understanding that, in its very essence, architecture exceeds building, as music exceeds sound.

PART I : ANALYSIS

Defining Architecture and Music

The term 'architecture' is not limited to the description of buildings. By 'architecture' we refer to the more common meaning: a physical or virtual environment designed for complex human inhabitation. By 'architectonic thought' we refer to a second meaning: complex organization and coordination of a heterogeneous composite. In either case, architecture is always an excess over simple need, a surpassing of mere building or organization. It means offering or rendering professional services in connection with the design and construction of buildings, or built environments.[2]

If architecture is not limited to building, if it has always aspired to exceed the pull of matter, music, in turn, is not limited to sound. One can speak of 'music' and 'musical thought,' thereby drawing similar conclusions: 'musical thought' extends far beyond 'music' itself, and constitutes a coherent and developed outlook upon the world. The world of music is one that is as vast as architecture is. While certain basic attributes remain common to all kinds of both architecture and music, there exists multiple styles of architecture and genres of music, each comprising of their own set of rules and written grammar.

The Existing Correlation

In their most basic and simple sense, architecture and music are descriptions and representations of thoughts, imagination and occurrences, most often abstractions.

Ekphrasis[3] or ecphrasis, a word from the Greek, for the description of a work of art produced as a rhetorical exercise, is a graphic, often dramatic and verbal description of a visual work of art, either real or imagined.

The words reminds us of the modern mythological figure: Iannis Xenakis, the Greek genius who was equally accomplished in music and architecture. The clear parallels — geometric, aesthetic, philosophical — between his work in both fields evidence the extent to which ideas move back and forth between them. To look at Xenakis' scores and at his buildings is to observe forms take similar shape Figure 1 shows Xenakis' score "Metastasis" from 1954, and a photo of the Philips Pavilion from 1958, which Xenakis designed while working for Le Corbusier.[4]

Music and architecture have many things in common such as rhythm, texture, harmony, proportion, and dynamics.
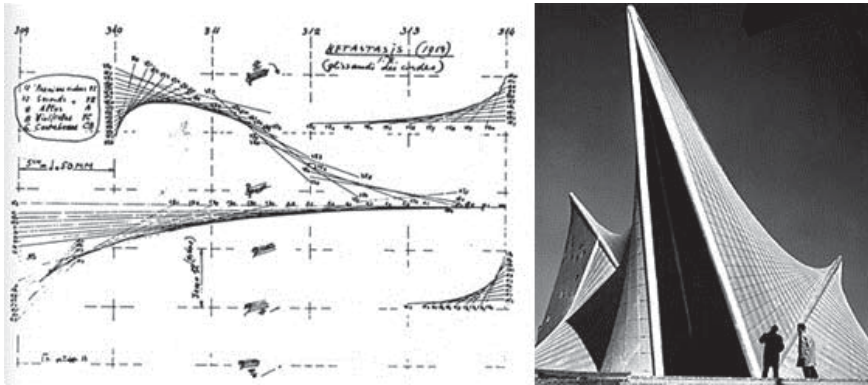
Figure 1

Rhythm has much to do with pattern. Patterns can be found in both music, through beat and repetition, but can also be found in shapes or structural elements in architecture.

Texture is also a key concept of architecture and music. Texture in music has to do with the layering of different sounds and rhythms by different instruments. Materials in architecture can also display texture. The combination of different materials can show a wide variety of different textures and how they can interact with each other.

Harmony can be from balance in a musical work or it can also be through a balance of a part to a whole. Architecture can show harmony through the successful use of different materials or designs in a space together to become one unified space.

Proportion relates to harmony in many ways. The right proportions in music in intervals and notes can help create a harmony throughout the work. Proportions with materials in architecture also create a balance. The correct balance can harmonize an architectural setting.

Dynamics deals with quality. Music and architecture need certain qualities and standards to make the works worthwhile and meaningful.

Of Musical Compositions and Architectural Principles

Although there are stylistic differences, the basic elements of śruti (the relative musical pitch), swara (the musical sound of a single note), rāga (the mode or melodic formulæ), and tala (the rhythmic cycles) form the foundation of improvisation

and composition in both Carnatic and Hindustani music. Although improvisation plays an important role, Carnatic music is mainly sung through compositions, especially the kriti (or kirtanam)

Carnatic music is usually performed by a small ensemble of musicians, consisting of a principal performer (usually a vocalist), a melodic accompaniment (usually a violin), a rhythm accompaniment (usually a mridangam), and a tambura, which acts as a drone throughout the performance.

A Carnatic composition really has two elements, one being the musical element, the other being what is conveyed in the composition. It is probably because of this fact that most Carnatic music compositions are composed for singing. In addition to the rich musical experience, each composition brings out the knowledge and personality of the composer, and hence the words are as important as the musical element itself. This poses a special challenge for the musicians because rendering this music does not involve just playing or singing the correct musical notes; the musicians are expected to understand what was conveyed by the composer in various languages, and sing musical phrases that act to create the effect that was intended by the composer in his/her composition.

A measurement scalar factor is seen in the notations[5] of these compositions which does not use semicolons and capitalization, but rather indicates all extensions of notes using a corresponding number of commas. Thus, Sā quadrupled in length would be denoted as "S,,,". The notation is divided into columns, depending on the structure of the tāḷaṃ. The division between a laghu and a dhrutam is indicated by a ı, called a ḍaṇḍā, and so is the division between two dhrutams or a dhrutam and an anudhrutam. The end of a cycle is marked by a ıı, called a double ḍaṇḍā.

The most important elements of a musical composition are as follows

Śruti[6] commonly refers to musical pitch, it is the note from which all the others are derived. While sruti is determined by auditory perception, it is also an expression in the listener's mind.

- Swara[7] refers to a type of musical sound that is a single note, which defines a relative (higher or lower) position of a note, rather than a defined frequency. Swaras also refer to the solfege of Carnatic music, which consist of seven notes, "sa-ri-ga-ma-pa-da-ni" (compare with the Hindustani sargam: sa-re-ga-ma-pa-dha-ni or Western do-re-mi-fa-so-la-ti). In certain ragas, for artistic effect, there may be two sets of these swaras, one ascending (in the arohanam) and another descending (in the avarohanam).

- A raga[8] in Carnatic music prescribes a set of rules for building a melody. It specifies rules for movements up (aarohanam) and down (avarohanam), the scale of which notes should figure more and which notes should be used more sparingly, which notes may be sung with gamaka (ornamentation), which phrases should be used or avoided, and so on.

- Tala refers to a fixed time cycle or metre, set for a particular composition, which is built from groupings of beats. Talas have cycles of a defined number of beats and rarely change within a song [9].

Architectural Principles help in the composition or unification of parts to form a single coherent whole. These compositions may be symmetrical or asymmetrical, as in Figures 2, 3 and 4.
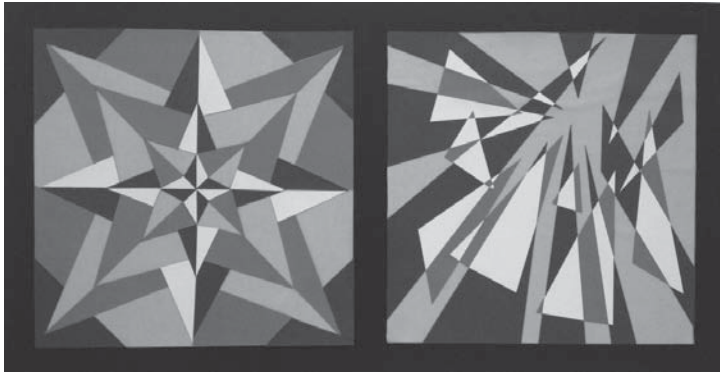
Figure 2

Figure 3 *(left)*   **Figure 4** *(right)*

Architectural compositions come together on basis of harmony, balance and unity. Along with these principles, ideas of an axis, a datum, rhythm & repetition, hierarchy and transformation may also be applied.[10]

- Axis: A line established by two points in space, about which forms and spaces can be arranged in a symmetrical or balanced manner.

- Symmetry: The balanced distribution and arrangement of equivalent forms and spaces on opposite sides of a dividing line or plane, or about a center or axis.

- Hierarchy: The articulation of the importance or significance of a form or space by its size, shape or placement relative to the other forms and spaces of the organization.

- Rhythm: A unifying movement characterized by a patterned repetition or alternation of formal elements or motifs in the same or a modified form.

- Datum: A line, plane, or volume that, by its continuity and regularity, serves to gather, measure and organize a pattern of forms and spaces.

- Transformation: The principle that an architectural concept, structure, or organization can be altered through a series of discrete manipulations and permutations in response to a specific context or set of conditions without a loss of identity or concept.

How are these Elements Architecturally Related?

In music, sound ratios lead to beauty; these are harmonic ratios that lead us to symmetry. Symmetry which is sometimes visual and sometimes in the form of an audio.

The origin of these ratios dates back to Pythagoras (6th century BC) who observed that when the blacksmith struck his anvil, different notes were produced according to the weight of the hammer. Number (in this case amount of weight) seemed to govern musical tone. He also discovered that if the length of the two strings are in relation to each other 2:3, the difference in pitch is called a fifth. If the length of the strings are in relation to each other 3:4, then the difference is called a fourth.

Later, similarities were seen in the works of Architectural theorists such as Vitruvius, Alberti who looked as Proportions and mathematics to be the deciding factor of aesthetics and the concept of beauty. An example being the golden ratio seen in nature and used in Classical Architecture, as seen in figure 6.

Figure 5

On comparision of attributes,

Sruti is compared foundational organizing principles such as the axis or a datum against which all others are compared. It acts as a reference to tell us what is right or wrong in a music, when one is in and out of sync with the other elements of the song such as the violin and the mridangam in a Carnatic concert. Similarly, an axis or datum acts as a reference from which all other components or elements may be measured, compared to. They may also be that on/using which the spatial entity has been founded

Swaras are the basic units of any music. They are akin to basic building units or modules that make up the substance of the structure. These could be as simple as the blocks used for building or a basic unit module that has been used with generative grammar to obtain the entire physical composition

Ragas are seen analogous to principles of Rhythm and transformation which decide the final outcome of the song or project. They give fundamental rules which have to be followed compulsorily in order to achieve the final compos- ition. Different ragas would mean a different set of swaras and thereby a new tune altogether. Similarly, alteration in the rules of repetition or transformation change their representation in the physical sense. For example, the articulation

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of a facade by a rule of ABC, ABC changes when the rule changes to AB, ABC, AB, ABC .... and so on.

Notation and Tala of Music can be looked as Architectural scales be it small, large or monumental. Just as a tala fixes the cycle of time, a fixed dimension may be altered to fit a micro or macro scale with the help of a reference object such as a human in order to determine scale. This would also alter the spatial experience accordingly.

PART II: INTERPRETATION OF SPATIAL EXPERIENCE

The Spaces of Sound

We come now to the most ethereal of issues. When asked about how they visualize sounds, people will readily envision shapes, colors, textures, undulating surfaces, slow or fast motion of hard or soft forms. More than this, they will respond to sound as if it were an infinitely variable chamber. The sound closes in on the listener at one moment, then expands, becoming cavernous. The enclosure fades to openness, is replaced with a soft layered veiling, with some sounds nearby and some far in the distance; the dry rustle of the veiling is periodically challenged by a tearing abrasion, pierced by rapid thunder, fractured into a cloud of uneasy splinters, settling into warm, humid, viscous, comfort. Music not only creates places, but concerns itself with the precise, highly resolved, balance of their attributes at every instant. Composers, even if they have no formal architectural training, create spaces with a sophistication of concerns that architects often forget.

Part III: CHANGE IN PERSPECTIVE

An Interpretation of Music as Architecture

The easiest way to interpret music as architecture would be to assign each attribute of music in a song, a defining form. For example, consider three architectural forms of a tall unit or peak, a base solid unit or volume enclosure and some other form/facade defining curvature. Each of these is assigned to the swaram/sahithyam, the percussion (such as the tabla or mridangam) and the string component (such as the violin) of a Carnatic classical song.

As the song progresses, each corresponding architectural attribute is procured, its dimensions based on the amplitude of the note. These are then unified into a single composition thereby resulting in a physical environment and actual spatial experience, and at that one which is unique and very music-specific.
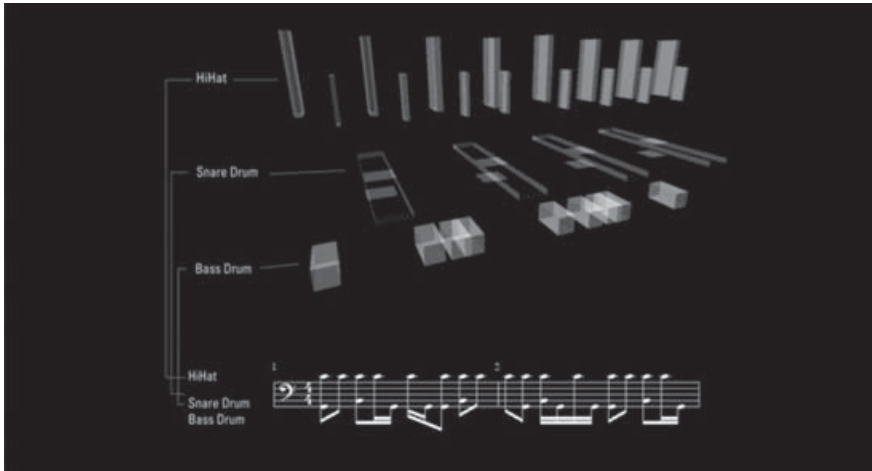
Figure 6

Figure 7

Something very similar has been done by Jan Henrik Hansen whose work strives to transform parameters of musical notes and rhythms into forms and volumes in physical space. In order to achieve that, he developed with interaction designer Armin Seltz a software tool to visualize midi data in 3D space creatively and in real-time. As seen in Figure 6, they show the use of objective and subjective data as a way to approach music and sculpture as we do in architecture resulting in the creation of unique forms such as the one seen in Figure 7.

Architecture seen as a song

You can see, feel and touch architecture, but what if you could hear it too? As seen above, architecture can be perceived as "frozen music", as compositions that have come together with underlying grammar. Architecture as music could also be the kind that has been inspired by music. Architecture that is not necessarily the kind that shows clear and obvious representations of rhythm such as the Sydney Opera House (Figure x) but presents itself as an abstraction of the art of sound, Music.

Innovative architects and designers across the globe are finding inspiration in music to create sound-producing structures that aim to heighten our senses and open our minds to the finer details that make up the world around us. From a cargo container that mimics the experience of being inside a guitar, to a multi-faceted building facade that produces an aqueous resonance on rainy days, to a towering hands-on pavilion that visitors can touch and play like a keyboard.

Here are a few examples that illustrate the notion of music in architecture.

1. Dithyrambalina's Music Box – A Village Built for Music

Figure 8

New Orleans is known for their impeccable jazz music and plethora of unique architectural styles. The artist has taken the two to another level by creating houses that double as music boxes. The Music Box was made up of little houses built from salvaged materials, reclaimed windows and instruments all of which were locally sourced. Each of these houses, which have been designed by sound artists, are equipped with custom musical instruments such as the Water-Organ, a keyboard that played music through water, and Noise Floor, floorboards that amplified creaks.

2. Coca-cola's Beatbox Pavilion

Figure 9

The pavilion combines music, architecture, technology and sports into one amazing interactive structure. Visitors to the pavilion can remix their own Olympic sounds by touching any number of the 200 translucent air pillows that blast samples of "Anywhere In The World," Coca-Cola's London 2012 song. The structure also has a ramp used to reach its top from where one can view the entire Olympic Park.

3. The Court of Water Wall

Designed by Annette Paul, Christopher Rossner, and Andre Temple, the Court of Water wall funnels rainwater through downspouts to create a unique musical sound that can be heard throughout Kunsthof Passage Dresden, a small recreational and shopping area in Germany. This examples shows how the music produced by the wall has been integral in shaping the essence of the neighbourhood thus having a lasting impact on the architecture of the place as well as the minds of the people.

CONCLUSION

> *Music and architecture blossom on the same stem: sublimated mathematics. Mathematics as presented by geometry.*[14]

Music and architecture can be paralleled in many more ways than one. Rhythm, texture, harmony, proportion, and dynamics all are tied into the arts in some way; whether it is through buildings, or songs. Either way, the overall qualities shared between music and architecture can help inspire each other. The more qualities in common, the more influence music and architecture can have on each other through emotions and the overall meanings of works.

Music and architecture reach for a common asymptote. Throughout time, we witness in music the need to surpass its own limits, to develop unlikely virtuosity at incredible cost; music, like architecture, strives not only to excel, but in the end to transcend its very own material and intellectual basis.

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Interpreting Ritualistic Landscape as a Construct of the Vernacular. . .

Ar. Devakumar Thenchery

MES College of Architecture

Kozhikode

architect.tdk@gmail.com

Ritual arts all around the world is a result of continuous thought process of our ancestors. It has close relationship with the culture of the region. Vernacular architecture is another entity which evolved from the basic need and culture of the people. This paper talks about the relationship between unique art forms and vernacular architecture of regions.

Different art forms of Kerala, a state of India, have been considered and *Kalamezhuth paatt* is taken as a case example. It is a powder drawing ritual, performed as a part of annual festival in temples, *kavu* (sacred groves) and homesteads of some cast groups. This unique art form is a type of worship, where people draw the form of particular deity in floor using powders from natural materials, sing song praising the deity and erase the drawing through some ritualistic dance. It happens in permanent or temporary venue completely made up of locally available resources. These spaces have some strong characters and it is meant to meet the needs, here the need is to perform the ritual. Main study area is Malabar region, which is the northern part of the state. Site studies conducted in different parts of the region shows that these vernacular ritual spaces are repeating as a module throughout the region. It concludes with the opinion that these repeated pattern forms an interpretative cultural landscape or to be more specific, ritualistic landscape.

Key words: Ritual, ritual art, ritualistic, vernacular.

1. Introduction

Culture of any region is shaped by lot of factors like language, communication, rituals, customs, practices, values etc. Vernacular Architecture also has close relationship with the culture of the people. Amos Rapoport (1969) points out that building a house is a cultural phenomenon and its form and organization are highly influenced by the cultural setting to which belongs. Religious ceremonies including rituals and festivals have great role in the life of common people and they transfer the influence to architecture too. So the vernacular buildings and settlements are the physical expression of cultural, spiritual, material and socio-cultural forces (Amos Rapoport, 1969).

The context of study is in Kerala, one of the states of India. The culture of Kerala is shaped by different cultures both indigenous and foreign. The land of Kerala is known as God's own country and the cultural map of the state is enriched by a number of art forms. The relationship of these art forms and the spaces has been discussed here. The above mentioned theories are closely examined using the case example of *Kalamezhuth paatt,* a unique art form of Kerala.

Powder drawing, a type of floor painting, has existed as a part of ritualistic life of Hindu families in India. Different kind of powder drawings can be seen in different parts of India, for example, *rangoli3* in north and central India, *Kolam4* in Tamilnadu and Andhra Pradesh. All these are performed by women in the family. A different kind of powder drawing seen in all part of Kerala, *Kalamezhuth Paatt* is a unique art form and ritual which happens mainly in sacred groves, temples, Brahmin houses and even in some Nair (a caste group) houses. This is a method of worship where they draw the form the deity on the floor, sing song praising the deity and perform some ritualistic dance form to erase the figure. So this can be called as a rare combination of performing arts, aesthetics and oral tradition. It aims to establish the existence of the ritualistic landscape shaped by *Kalamezhuth paatt* and interpret this to be a construct of the vernacular.

2. Methodology

As a part of the project, observed a number of rituals. Literature review was based on the folklore and ritual traditions of Kerala. Documented intangible and tangible aspects of *Kalamezhuth paatt*, transferred the data to map to interpret the results.

2.1 Findings of Literature Review

Folklore and Traditional Culture of Kerala

The land of spices attracted lots of foreigners like Arabs, Romans, Greek, Chinese, etc. for trading. Before the invasion of Aryans, Kerala people also followed Dravidian way of life and religious practices. They worshiped a lot of local deities and offered food for them. Nature worship also was there. There were no caste systems at that time. Jainism and Buddhism also played their role in the synthesis of present culture of Kerala. But three or four centuries before the starting of Christian era, the Brahmanical Aryan culture came to India. The influence of Aryans started spreading in the land of Kerala and by 5th century AD, it became a strong influence the society. Caste system had developed and upper castes got benefits. By the time, Kerala saw the decline of Jainism and Buddhism. This stage of history is important considering the origin of lots of art forms, folklore and ritual arts which are closely associated with the caste system. Evolution of caste systems became the main reason of origin of a folk tradition. Upper caste groups became the patrons of art forms, at the same time, most of the communities ensured their role in each art forms and rituals. A rich tradition of folklore can be seen in Kerala. It is synthesized by the continuous thought process of the ancestors and became inescapable element in the region.

According to vocabulary.com, folklore can be called as stories, customs, and beliefs that are passed from one generation to the next and it is a combination of the words folk and lore which dates from 1846. The former refers to a community of people, and the latter comes from the old English lar, meaning learning or knowledge. Folk, in this sense, is also used in terms like folk music, folk dance, and folktale. In Kerala, the culture and lore or the knowledge was mostly a part of agriculture. There are rituals associated with agriculture during the time of sowing, sidling, harvesting etc. Performing arts and songs can be seen during these occasions.

Different art forms can be seen in different parts of Kerala. Each one has its own characters. The entire area can be divided into four cultural areas namely

- Travancore- Cochin: southern part
- Central Kerala
- South Malabar
- North Malabar

Some of the ritual folklore of this area are Theyyam, Thira, Kanyar Kali, Padayani, Mudiyettu, Malavayiyattam, , Kothamooriyattam, Niraputhari, Padayani etc.

Purpose of these rituals are mostly associated either with fertility, harvesting, hero worship, serpent worship etc. According Balakrishnan Koyyal (2016), in the wake of socio economic transformation from tribal life to an agrarian settlement representing an admixture of various cultural traits, the religious ideologies themselves underwent major changes along with the cultural traditions. As discussed earlier, KP lies somewhere between these folklore and classical art forms. Social set up of Kerala was very much in favour of these art forms to cherish.

3.2 Origin of *Kalamezhuth*

The origin of *kalamezhuth*, the floor-art is uncertain, though it gives a linkage with *shakthi* form of worship. This form of worship existed with *thantric* mode in Kashmir, Bengal and Kerala. Of these as a floral drawing – *dhooli chithra* in Sankrit , existed in early times in Vanga (which extended over Bengal and some parts of Orissa) and in south India. But in course of time it became extinct in all areas except Kerala (Jayashanker, 1997).

During pre historic era, man worshiped the nature, the form less. Men, who were hunters, began to live in settlements. They began to use walls, floors, household articles like pots as canvas for painting and drawing. Fear of the natural forces controlled all activities of these primitive men. Thus thunder, rain, lightning, wind and fire were awe inspiring elements or mysteries of nature. This led to the nature worship. Gradually he started worshipping some forces which had some forms. The worship of animals, trees and serpents might have evolved in this time period. Divinity is given to ancestors and thus worship of own ancestors also started.

Mother goddesses and fertility goddesses included in this domain (Babu Mundekkad,). People gave some definite forms for these gods. Ritualistic practices to please them fixed some strong believes. Super natural form has been given to these gods and goddesses with arms and ammunitions, ornaments and fantastic dressings according to respective *dhyana slokas* (meditational chants). In the different phases of social evolution, people used different medium to depict these forms as follows.

Rasa chithram – painting using colours extracted from plants on walls and planks

Pushpa chithram – using flowers and leaves on floor

Dhooli chithram – using powders on floor

Kalamezhuth Paatt, the ritual tradition of Kerala

Table 1: Materials required for *kalamezhuth paatt*

Sl. No	Materials		Purpose
	Local name	**Common name**	
1	*Arippodi*	Rice powder	To draw *kalam* and to make *nivedyam*.
2	*Manjalpodi*	Turmeric powder	To draw *kalam*
3	*Pachapodi*	Powder of wind dried leaves of cassia	
4	*Krshnapodi*	Burned husk of paddy	
5	*Chunnamb*	Lime	To make red powder
6	*Muram*	A flat basket made up of bamboo	To mix turmeric powder and lime to prepare red powder
7	*Vazhayila*	Banana leaf	To put *vellari* and to make *kumbil*
8	*Nellu*	Paddy	For *Uchhappatt* and to place *nira* near *peedham*
9	*Thenga*	Coconut	To put *vellari* and for coconut breaking ritual
10	*Unangalari*	Rice	To put *vellari*
11	*Vettila*	Beatle leaves	To put *vellari* and to decorate *paattumandapam*
12	*Adakka*	Areca nut	
13	*Kuruthola*	Palm leaves of tender coconut tree	To decorate *paattu-mandapam*
15	*Elaneer*	Tender coconut	To decorate *paattu-mandapam*
16	*Kavungin pookkula*	Tender flowers of areca nut	For *thiri uzhichil*
17	*Manithoon*	Areca nut / teak poles	For *paattu mandapam*
18	*Choodi*	Rope of coconut fiber	For *paattumandapam*

Kalamezhuth paatt is a daylong festival. First step involved is the preparation of venue. Usually its performed in *paattupura*, a building typology meant exclusively to conduct *paatt*, in temporary venue or southern block (*thekkini*) of traditional houses. It has a series of rituals. After evoking the presence of deity in the venue, Kurup, starts drawing the figure of particular deity in the floor using natural materials. Once the *Kalam* is completed in the *paattumandapam*, the priest takes the sword outside the temple symbolically as it is the god itself, to the pre-assigned area for outdoor procedures called as *mullakkal paatt*. Usually it happens in an open space near the boundary of the property or near a water body. Priest gives the sanctified sword to Komaram, who is considered as the representative of god.

The entire team come back to the venue with grand orchestra (*melam*) and accompaniment of devotees. This is called as *thirichezhunnallath*. From here the entire realm changes to something like theatrical. After performance of ritualistic dance of *eedum koorum* and *kalapradakshinam* by Komaram, priest pay offerings to the deity. Then Kurup sing *thottam*, Komaram erase the *kalam* and Marar plays *chenda* (figure-3). The possessed Komaram gives predictions to the devotees and distributes the powder as a *prasadam12*. Final ritual is the removal of *koora* from the roof of *paattumandapam.*

Lots of communities are involved in this ritual, each of them having their own roles. At present, it is mostly cast based, because it may be inevitable during the evolution of the ritual. Anyway, it could be better, if it is skill based.

Most of the materials used for *Kalamezhuth paatt* can be procured from the same locality itself. Coconut tree, which is abundant in Kerala is maximum utilized here. Different parts of coconut tree like coconut, fibrous shell of coconut, tender coconut, tender coconut leaves, coir etc. are used for different purposes.

Discussion – Formation of the Ritualistic Landscape

There is a unique pattern of cultural spaces in macro level, which include paattupura, temple, open spaces, water bodies etc. Apart from the cultural spaces, there are some other factors like the settlement or small groups of communities. Three main skill based communities involved in the KP are Komaram, Kurup and Marar. In each cluster, there will be one Komaram, one or two families or Kurup and a number of families of Marar. In the study area, around four clusters were identified. So the repeated pattern in the micro level creates an interpretative landscape, where the soul of the landscape is the ritual of KP. It can be both ways that the ritual started first and the spaces evolved according to it or vice versa (Devakumar, 2016).

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PASSIVE DESIGN STRATEGIES IN VERNACULAR ARCHITECTURE

K. BHARATH,
Sathyabama University

ABSTRACT: This paper aims to investigate the passive design strategies in Vernacular Architecture. The strategies of passive design by the use of natural characteristics like the sun wind and the natural law of physics to produce a low energy cost, reduced maintenance, and superior comfort. The identification of different factors that contribute to a pleasant environment and thermal comfort with in vernacular buildings. Vernacular architecture is the simplest form of addressing human needs they use efficient local resources, available energy and material. Passive design strategies in vernacular buildings has develop in response to prevailing climate of the past, there are numerous of passive design strategies for reduce energy consumption in vernacular buildings. Due to rapid urbanization in India today building are design with complete different to the climate and the material. Now days buildings consume more energy finally it degrade our environment, ecology, renewable resources due to emission of CO_2 and eco foot print. The main objectives of this paper to establish the passive strategies to resist the growth of international styles and produce an environmentally, culturally, socially at the same time to retain the architectural identify of particular area. In this study passive design strategies will be examined in vernacular buildings to identify the passive design strategies in warm humid climate and hot dry climate. This passive design strategies include layout, orientation, built form, building envelop, thermal zoning, openings, natural ventilation, passive cooling, The undertaken review in this paper identify the passive design strategies in chettinadu houses and havelis, which seeks a better understanding and application of passive design strategies in vernacular architecture features in present architecture. This paper concludes consideration of passive design strategies suitably adopted from vernacular buildings in warm humid climate to integrate them in a present situation in a more comfortable and energy efficient ways.

INTRODUCTION
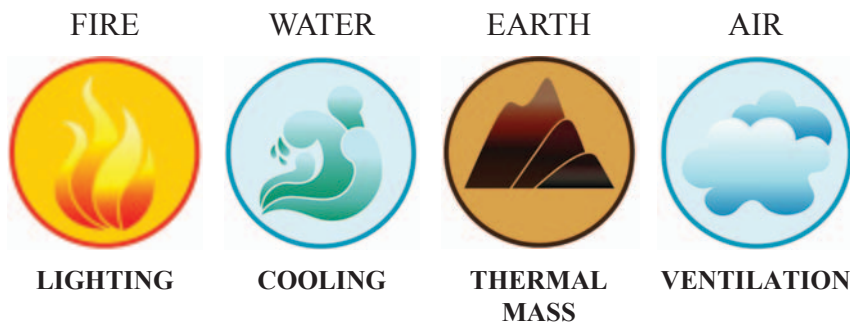
The term vernacular architecture is derived from the Latin word vernacular meaning native, domestic it tends to evolve over times it reflect the cultural environmental and historical context. Vernacular Architecture characters are widely varies from region to region due to the changes in climate pattern and different location. This paper discuss about passive design strategies to have been
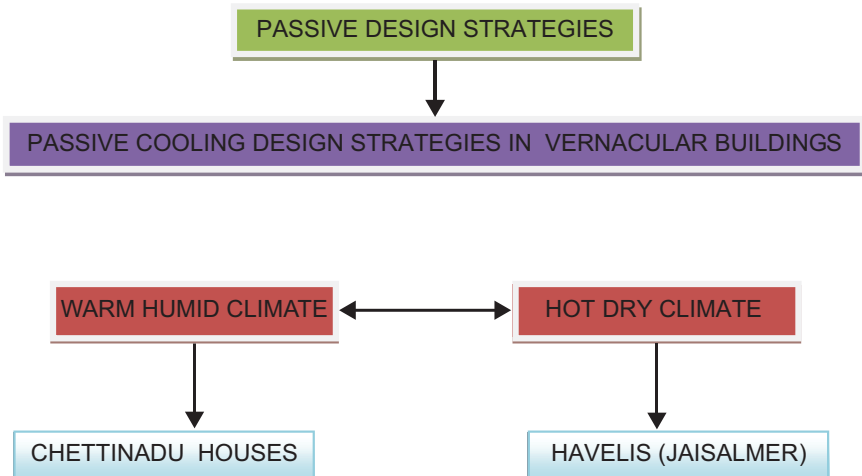
used in vernacular buildings in order to achieve more comfortable in during summer and winter Passive design strategies has been used by human beings since in the earlier settlement period the people built their home to respond their climate through techniques is called passive design. The passive design strategies are defined by the use of natural characters, like the sun wind and the natural law of physics to produce low energy buildings, and its maintains a thermal comfort for users. using passive design building forms and thermal performance of a building elements including (architecture, structural, envelop) are carefully considered and optimized for interaction with microclimate The vernacular buildings provides various passive strategies including natural cooling and heating system and are more comfortable in compared to the contemporary buildings in today context.

PASSIVE DESIGN

Passive design is concept to minimize the energy consumption in buildings and improve the human thermal comfort in buildings. The passive design elements are carefully design and optimized for interaction with local micro climate. The focus of the passive design fully eliminate the mechanical energy consumption in buildings and providing thermal comfort in all times (summer and winter) periods. Building shape, orientation, and composition can improve occupant comfort. Through properly applying a passive design principle in building we can greatly reduce the energy consumption in buildings.

The four element concept in passive design strategies FIRE (Sunlight), EARTH (soil), AIR (wind or), WATER (rain or sea) These essential elements are used in vernacular buildings.

FIRE	WATER	EARTH	AIR
LIGHTING	COOLING	THERMAL MASS	VENTILATION

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│   PASSIVE DESIGN STRATEGIES     │
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┌─────────────────────────────────────────────────────────┐
│ PASSIVE COOLING DESIGN STRATEGIES IN VERNACULAR BUILDINGS│
└─────────────────────────────────────────────────────────┘


┌──────────────────────┐        ┌──────────────────────┐
│  WARM HUMID CLIMATE   │◄─────►│    HOT DRY CLIMATE    │
└──────────────────────┘        └──────────────────────┘
           │                               │
           ▼                               ▼
┌──────────────────────┐        ┌──────────────────────┐
│  CHETTINADU  HOUSES   │        │  HAVELIS (JAISALMER)  │
└──────────────────────┘        └──────────────────────┘
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┌──────────────────────────────────────┐
│   QUALITATIVE STUDY   │
│   │
│   PASSIVE COOLING DESIGN   │
│   STRATEGIES   │
│   │
│   1. THE STREET AND   │
│   ORIENTATION OF   │
│   BUILDINGS   │
│   2. SPACE PLANNING   │
│   3. THERMAL MASS   │
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│   WALLS   │
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│   7. SHADING DEVICES   │
│   8. PASSIVE COOLING   │
│   TECNIQUES   │
└──────────────────────────────────────┘

METHODOLOGY

The research methodology of this study is based on the case study using deductive approach and qualitative analysis of passive design strategies in vernacular buildings. This paper focus case study in vernacular buildings at warm humid climate and hot dry climate. to relate the use of certain passive design strategies to specific local climate condition, examples of different passive strategies were chosen and mapped in vernacular buildings.


HAVELIS   CHETTINAD HOUSES

DESIGN FOR WARM HUMID CLIMATE

Reference; Climate Responsive Building - Appropriate Building Construction in Tropical and Subtropical Regions

- Provide maximum ventilation and free air movement by large openings.

- Provide maximum shading of direct and diffuse solar radiation.

- Avoid heat storage.

- Use reflective outer surfaces.

- Use ventilated double roofs.

- Use vegetation to moderate the solar impact
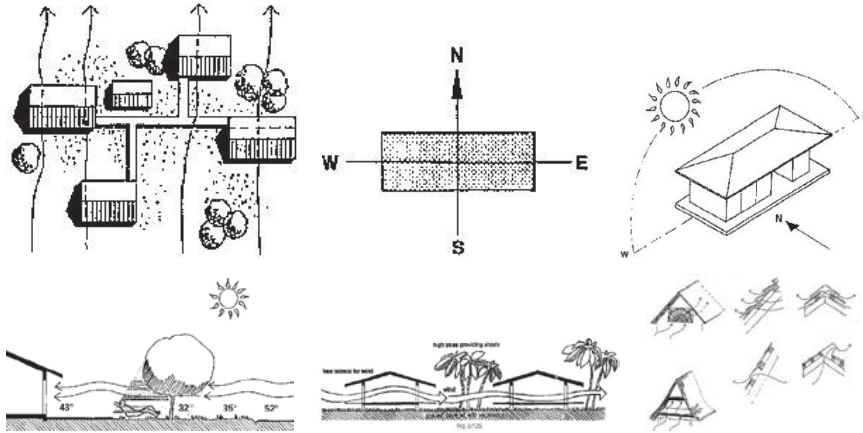
DESIGN FOR HOT DRY CLIMATE

- Provide maximum shading of direct and reflected sun radiation in the hot season.

- Balance the extremes of summer and winter by movable parts.

- Provide ventilation by regulated air movement and small openings.

- Avoid large exposed exterior surfaces.

- Use reflective outer surfaces.

- Balance the extremes of day and night temperatures by adequate thermal storage mass.

- Reduce internal heat production and conduction gain in hot seasons.

- Increase air circulation in humid maritime regions.
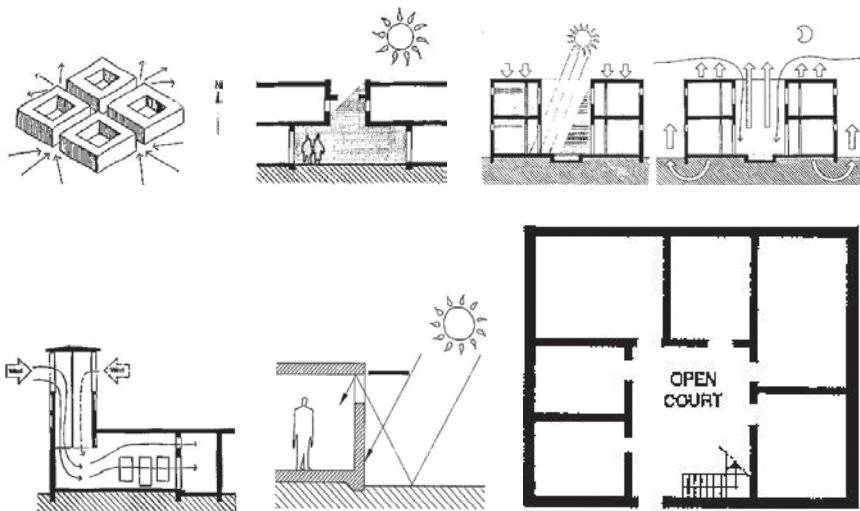
CHETTINADU ARCHITECTURE

Chettinadu is a warm humid climate located in the heart of the Tamilnadu (southindia) Karaikudi is the known capital of chettinadu. The chettinadu is a homeland of chettiars (nattu kottai chettairs) belong to a generation of wealthy traders and financiers. The chettinadu region is a well known for 18th century mansions. The most important part of chettinadu their mansions (houses), which are rich in cultural heritage art and architecture. The house was constructed following the cardinal direction rules of *Vast Shastra*, the traditional science of the architecture. Chettinadu architecture is characteristic of using large space hall and courtyard. The locally available materials and decorative elements are imported from Asian countries used for construction in chettinadu houses.

HAVELIS, JAISALMER (RAJASTHAN)

Haveli term is used for traditional houses and mansion houses, a havelis of jailsalmer date more than 300 years back. These traditional courtyard homes (havelis) is built on the ancient principles of vastu shastra. In jailsalmer havelis the residence used for rich business man, land lords and zamindhars etc. These havelis a architecture in the combination of Muslims and Rajasthan architecture, richly carved and decorate it says about rich cultural and heritage importance of jailsalmer. The courtyards are the common feature in havelis consist of two court-yard the outer courtyard for men where inner courtyard was occupied by women's.

STREET AND BUILDING ORIENTATION WARM HUMID CILMATE (CHETTINAD HOUSES)

Orientation of the building with long axis in the east west direction buildings. Long wall surfaces in the north and south direction buildings and shorter wall facing in the east and west axis on the southern side of the building the highest sun angle its easy to limit using horizontal shading devices for windows The tra-ditional vernacular houses are planned in a such away that they stretch from one street to another street for examples chettinadu houses (palatial houses) were con-structed during 1740 to 1935 the special features of this chettinadu houses, court-yards, verandas, reception halls etc.
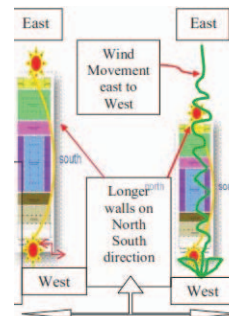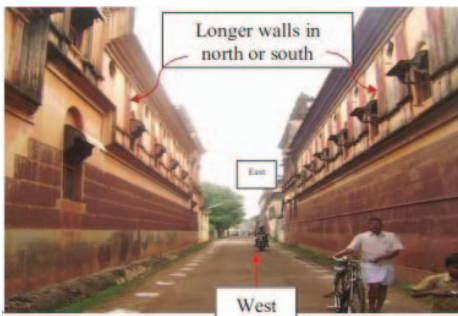
In chettinadu houses the rooms are placed along a longitudinal axis. Chettinadu houses it consist of two or more court yards. The houses are oriented in east - west axis the entrance of the houses from the east or west direction the longer side of the building faces the north and south direction less exposed to the direct sunlight to avoid the direct solar radiation from the buildings.

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HOT DRY CLIMATE, JAISALMER

Jaisalmar City Layout   Street Section
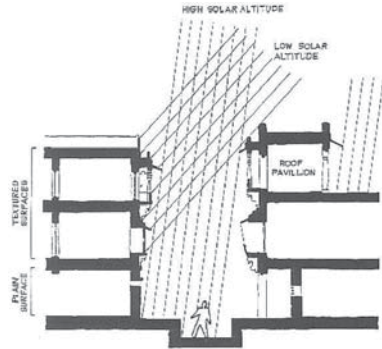
In city of jailsalmer (Rajasthan, Indian) irregular pattern the layout of city is planned against the harsh climate. In jailsalmar streets are design in narrow pattern and shaded from the direct sunlight. The general street orientation is south east to north west axis. Most of the havelis buildings are orientated toward east and west axis longer walls are facing towards north and south direction and shorter walls facing towards east and west direct to avoid the direct solar radiation for examples Nathmalji's havelis.

SPACE PLANNING

CHETTINADU HOUSES
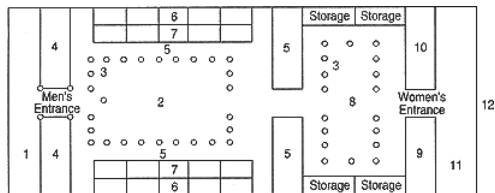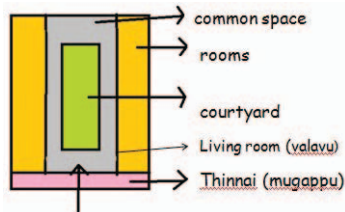
FRONT (MALE) SECTION OF HOUSE

- 1. VERANDA.

- CENTRAL, CEREMONIAL SECTION OF HOUSE

- 2. HAL VITU OR VITU: FIRST COURTYARD; LITERALLY, "HALL HOUSE."

- 3. TONTU: COLUMNS.

- 4. MELPATI, TINNAI: A RAISED PLATFORM ON WHICH PEOPLE SIT, USUALLY UNDER THE VERANDA OR ON EITHER SIDE OF THE DOOR OF THE HOUSE.

- 5. VALAVU: AISLE OR CORRIDOR SURROUNDING CENTRAL COURTYARD; CENTRAL SECTION OF HOUSE INCLUDING CENTRAL COURTYARD, AISLE, AND INNER AND OUTER ROOMS; ENTIRE HOUSE.

- 6. ULL ARAI: PULLI'S INNER ROOM FOR PUJA AND STORAGE OF DOWRY ITEMS.

- 7. VELI ARAI: PULLI'S OUTER, "CONJUGAL" ROOM.

- KIRPATI: RAISED SITTING PLATFORMS IN FRONT OF EACH ARAI (NOT SHOWN).

BACK (FEMALE) SECTION OF HOUSE

- 8. KATTU: SECOND COURTYARD, WOMEN'S COURTYARD; WHERE GRAINS ARE DRIED, FOODS ARE PREPARED, AND WATER IS STORED.

- 9. SAMAYAL ARAI: KITCHEN.

- 10. KUTCHIN: A SMALL ROOM FOR WOMEN DURING THEIR MENSES AND FOR GIRLS DURING THEIR COMING-OF-AGE CEREMONY.

- 11. VERANDA.

- 12. PIN KATTU: OPEN GARDEN SPACE WITH OR WITHOUT WELL

Passive Design Strategies In Vernacular Architecture
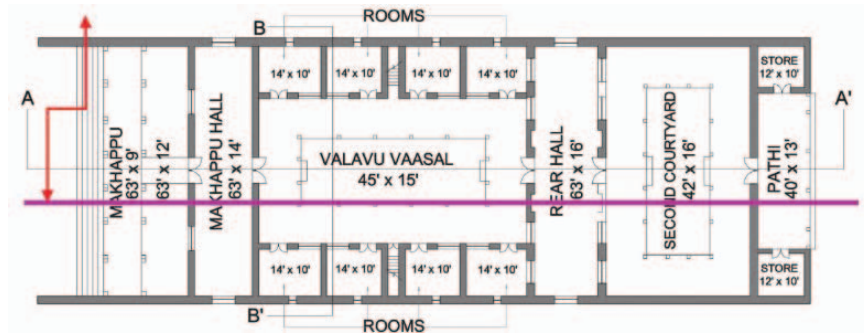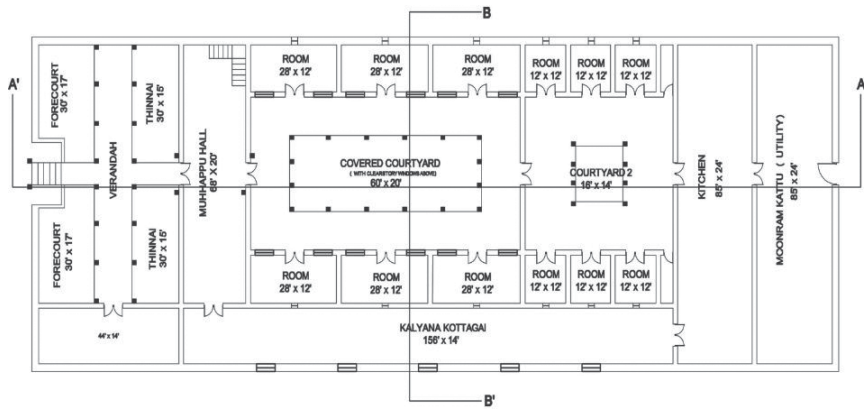
Chettinadu Houses Plan

The chettinadu houses accommodates up to four generation space planning are segregated for both men and women, the men occupy the outer verandas and front room and the women occupy the outer kitchen, courtyard and the work around the main courtyard. The most important character of chettinadu houses is that it has a such visual axis which visually connects the all the spaces of the houses.

In chettinadu houses comprised of public reception area in front of the street. The houses were built around the central courtyard. The entry of the houses consists of outside verandah thinnai for guest. The houses starting with a welcoming spaces called MUHAPPU (living hall). The rooms are planned around the central main courtyard used for marriage ceremonies and religious ritual activities. The small courtyard behind for cooking for the women's to socialize.

JAISALMER HOUSES, (RAJASTHAN)

SPACE PLANNING

In jailsalmer houses are planned according to the economic and social status there are three types of housing in jailsalmer city. Most important architecture buildings in jailsalmer havelis (Nath malji havelis)

Small and middle income houses planning in jailsalmer

Nathmalji havelis is planned around two courtyards the large courtyard are placed near to the entrance of the havelis the another one small courtyard located on the rare side of the buildings. The front portion of the havelis is three-storey height and rare portion of the havelis is two-storey height. In havelis consist of vertical ducts (courtyard) different sizes it provide light and ventilation through all rooms these openings ensure removal of heat by ventilation. In havelis walls are shaded with projection and balconies to avoid the direct solar heat gain.

THERMAL MASS

Vernacular building have thick walls these thick wall are design to provide a thermal insulation also theses thick walls of low thermal conductivity material have low transmittance value and it has a longer time lag The rate of heat flow through the surface it depends on the temperature between inner and outer surfaces. Large thermal capacity of the building material its absorbs most of heat during the day time and the internal surfaces remains cool. To reduce the heat transmission through the buildings the temperature of the outer surfaces are controlled by using shading devices.

BUILDING ENVELOP: The building envelop plays a major role in thermal mass of the building Envelop is a physical separator of interior and exterior spaces it encompasses the walls roofs, floors, fenestrations etc.

CHETTINADU HOUSES

The walls had chettinadu plaster **Muthuvellai-** traditional mix of roots, Yolk, *chunnam* jaggery, adukka *that* leaves the surface silken smooth and washable and mirror finished.

External wall plastering

In chettinadu houses are built with thick external walls. The material used to construct the walls are stone and bricks the external wall thickness in chettinadu houses are construct with 2ft (600mm) thickness and the internal wall thickness is 1'6". The external walls are plastered with lime mortar.

In chettinadu houses the internal wall plaster it gives more thermal comfort inside the house.

Lime – binding material

Sanghu powder – fitness

Egg white -smoothness

Karupatti - friction

Kadukkai- bonding

FLOOR

The flooring in chettinadu houses flooring with special types of tiles (athangudi tiles). these tiles are manufacture near locally in athangudi village this tiles are handmade tile it consist of raw material like (local mud, sand, white cement, colour pigment). The thermal property of athangudi tiles are highly conductive its gives the cooling effect inside to the interior spaces.
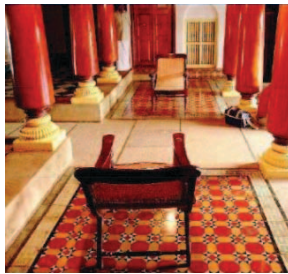
Athangudi tiles

ROOF

Chettinadu houses are design with three types of roof systems

Sloped roof

Sloped roof with a flat roof below (machu)

Passive Design Strategies In Vernacular Architecture

The madras terrace roof

Expansion of sloped roof surrounded the last courtyard near to kitchen spaces.

The sloped roof is made up of terracotta tiles are laid in three courses over the wooden batten. This terracotta tiles in roof it consist of three layers are thermally design laid over one above to another with a minute air gap to allow a hot air to escape.

WOOD THE THERMAL INSULATIVE MATERIAL

The flat roof in this houses made up of timber. It being a high thermal resistive material.

The furniture, cupboards, doors, windows, columns roofs, false ceiling and other artifacts in the traditional houses are all made of wood (teak wood) – the climate responsive material having a good thermal resistive property.
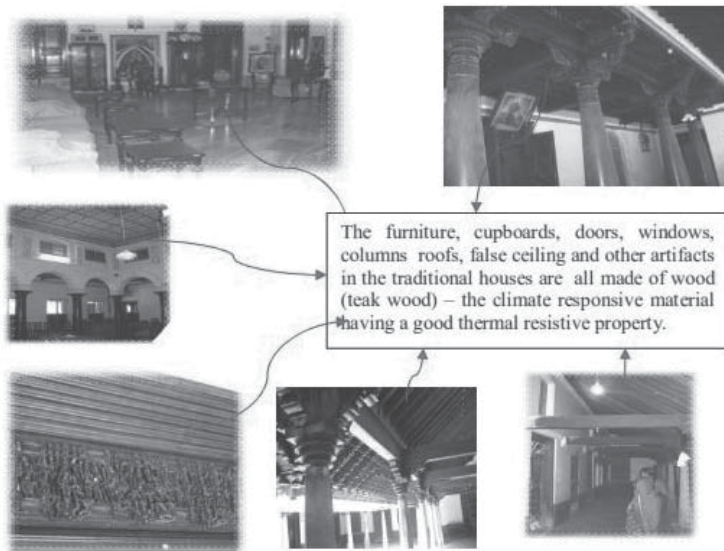
JAISALMER, HAVELIS
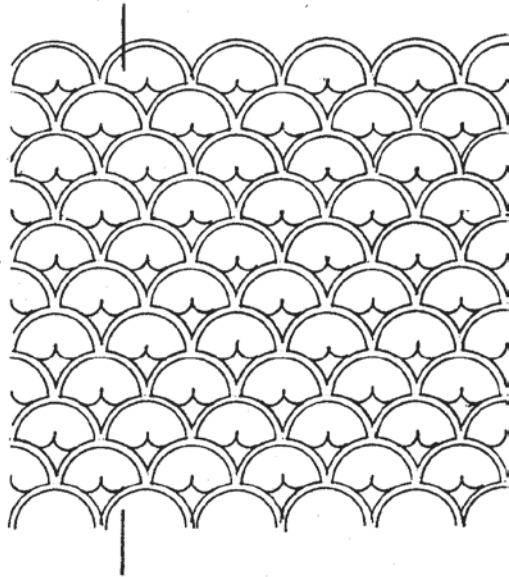
WALLS

Light yellowish sandstone wall is used for construction in havelis the external wall thickness is 0.45 m In havelis the walls with texture are only 500 mm thickness. The massive wall thickness is 450 mm to 600 mm The wall surfaces are richly decorated with projecting balconies, sun shades and jalli, and each of these building elements is in turn intricately carved. Flat surface of stone walls are also richly decorated with deep carvings. That resulting overall building surface is designed to stay cool even when it is exposed to the sun.
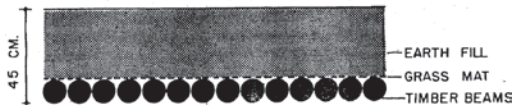

SECTION   ELEVATION
TYPICAL WALL PANEL IN STONE

ROOF SECTION

45 CM.

— EARTH FILL
— GRASS MAT
— TIMBER BEAMS

ROOF

In havelis traditional method of roof is laid closely spaced with timber beams are covered with layer of reeds or grass matting with a thick layer of 0.45 to 0.60m earth layer on the top of the roof. The roofs are finished with mud plaster. In recent construction the timber beams are replaced with stone slabs but according to popular belief the wooden ceilings with grass mats stay cooler than stone ceilings.

COURTYARDS
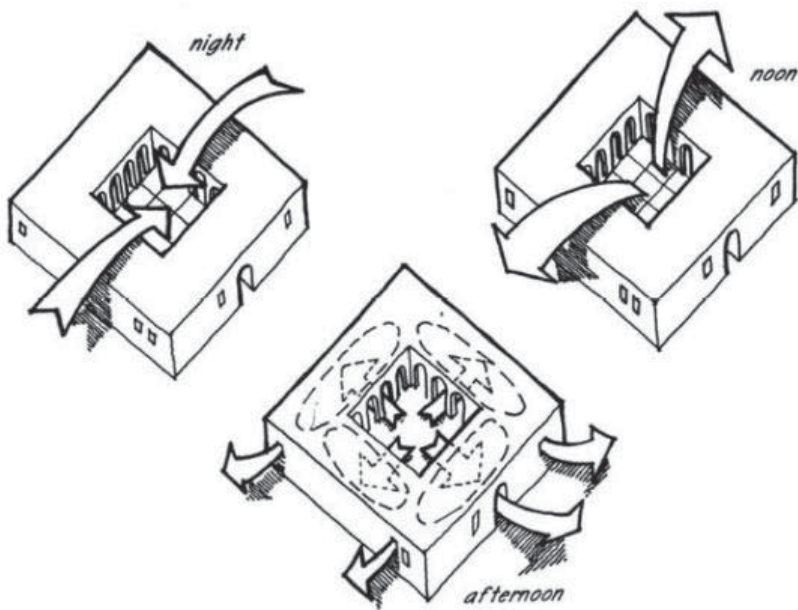
COURTYARD

In hot dry and warm humid climate courtyards located at the centre of the building and it provides a comfortable place for living. The courtyard prevents the internal rooms from the direct solar radiation and hot dusty winds. The courtyard shaded throughout the day. Due to the solar radiation in the courtyard, the air in the courtyard warmer and rises up. To replace the cool air from the ground level.

Courtyard functions

Night: The cool air comes down in the courtyard and it passes through the inside rooms in building.

Afternoon: The sun directly heated the walls that faces to the courtyard the air heats up and goes providing the natural ventilation. The courtyard works as a chimney. The huge massive wall and floors protect from direct soar radiation.

Evening: The air is so hot in evening and the courtyard floor heats creating a natural air flow from the inside rooms that faces to it through the courtyard. The last cool air goes out from the rooms in the evening, but also the shadows are longer and quickly the court is protecting from the solar radiation.

Chettinadu houses

Courtyards: cathrumukham (kattu) in Tamilnadu houses

In chettinadu houses, living hall mugappu leads to the first main courtyard used for the purpose of marriage ceremonies, religious ritual activities. The Second courtyard opens out immediate after the first courtyard this spaces is used for dinning purpose the second courtyard serves as rest room for the women's who works in the kitchen spaces. In second courtyard roof surfaces are sloped towards an internal courtyard, the cooled airflows through the courtyard and enters the living spaces through the low level openings and leaves through the high level of openings in the chettinadu houses chettinadu houses.

The hot air tends to move up through the courtyard or through the clearstorey windows.
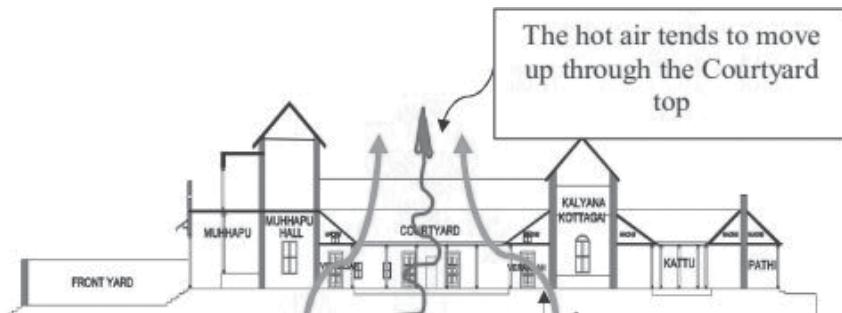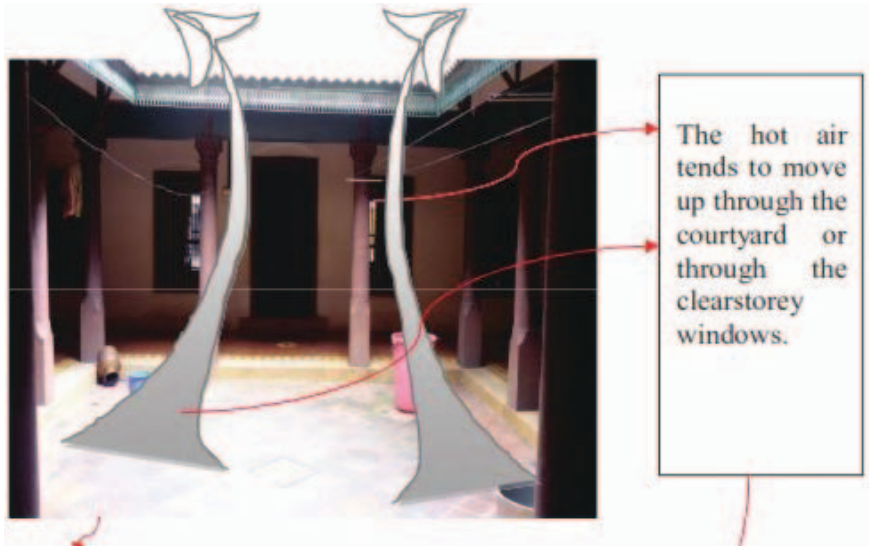
Courtyards: Havelis in Rajasthan

In Nathmalji's havelis consist of two courtyard and vertical ducts provides alight and ventilation for all the rooms. While the front courtyards receives sunlight during the summer seasons. The rear courtyard is completely exposed from the direct solar radiation.
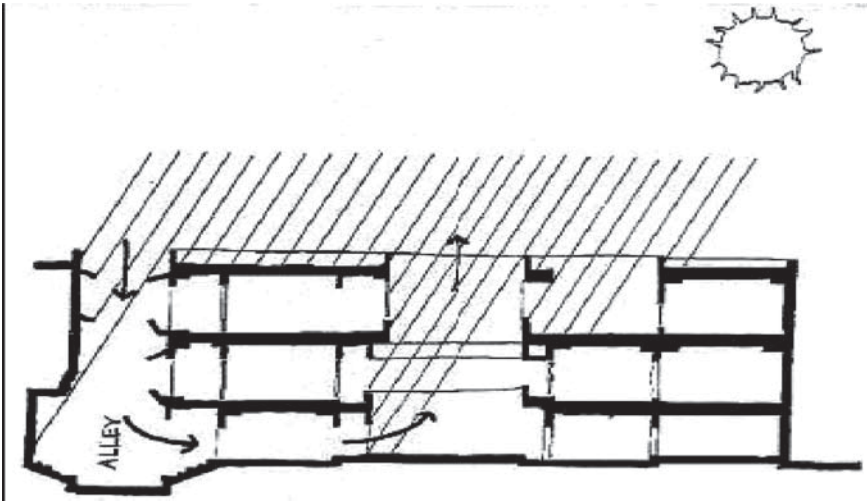
Courtyard effect (Nathmalji havelis)

NATURAL VENTILATION

Natural ventilation plays an important role in vernacular buildings to create a thermally comfortable environment. Natural ventilation is the key factor for the Passive design strategies. The natural ventilation through vernacular building is occurred by wind or the temperature difference between inside and outside. There are several factors which affects the wind flow in the building such as micro-climate, size and proportion of windows orientation of building with respect to wind direction. The natural ventilation systems providing a thermal comfort in vernacular dwellings.

Chettinadu houses

In chettinadu houses the openings such as doors and windows in a such a way it induces the cross ventilation. The positioning of doors and windows plays an important role in enhancing the passive ventilation in the buildings. The sill level of windows are kept 1'6" height from floor level to gain the maximum air circulation to the living areas.

Cross ventilation

ventilators above the door

clear storey windows

The doors, windows, clearstorey windows all serves as passive cooling elements by providing excellent cross ventilation.

The window sill kept at low level (1'6" from the floor level) so as to induce better air circulation inside the building
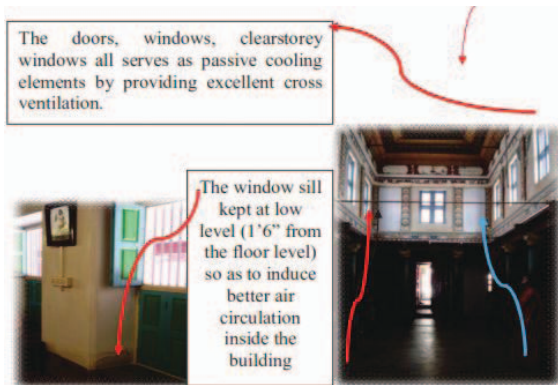
HAVELIS

Vertical Shafts

In jailsalmer havelis are tightly clustered together it is generally difficult to let wind enters into the houses. In jailsalmer houses it consist of number of interconnected vertical shafts it regulate the air flow through the houses. The courtyard effect is well known and used in almost all hot dry climate. In havelis consist of simple courtyard, narrow vertical shafts are used to regulate wind blows in to the houses.
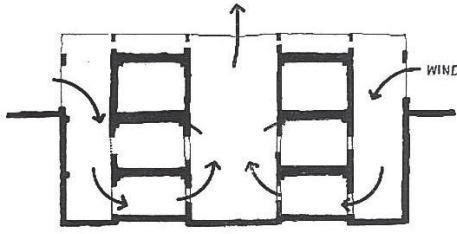
Shading devices   Vertical air shafts

JAALI WORKS

The "jaali works in havelis it provide a privacy and it controls the air flow in the buildings and it lower the temperature of the internal spaces. when there is strong solar radiation (sun shine) outside of the building. The internal spaces are not visible from the outside of the buildings by using the jail works diffused sunlight is spread through the interior in havelis. It consists of placing a double skin as the outer layer of the havelis. The outer skin layer can be promoting to let in natural light This double skin acts as a thermal screen of sorts; letting in light, but not heat, In jail works is provided a eye level for viewers sitting on the floor.
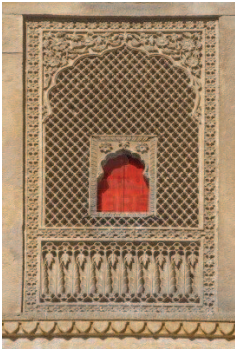
Jaali   Projected balconies

CHETTINADU HOUSES

HORIZONTAL SHADING DEVICES; In chettinadu houses horizontal shading devices can be used in north and south side it cuts the direct solar radiation to achieve a minimum heat gain in buildings. In direct day lighting has a benefit of day light access to interior spaces while avoiding a heat gain in buildings

VERANDAH

The traditional chettinadu houses and havelis have a open courtyards is covered with Verandha running around them. The courtyard is the most elaborate space in chettinadu and havelis houses covered with verandah. It cuts the direct solar radiation, and it gives minimum amount of heat gain through the interior spaces of the buildings.

VEGETATION

Vegetation plays an important role in vernacular buildings, it reduce solar heat gain and also it cuts the direct solar radiation in buildings. In chettinadu houses PINN KATTU (OPEN GARDEN SPACES) is faces on the west side of building it reduce the air temperature and brings a fresh through the buildings (longitudinal axis)

K. Bharath

MACHU

These Machu are constructed below the sloped roof. The wooden beam that runs though horizontally supports it connected to the rafters and tie member. This reduces the heat transfer through the roofs acts as an barrier below the sloped roof surface and act as a air trap, this construction technique is considered as a good passive cooling construction technique.
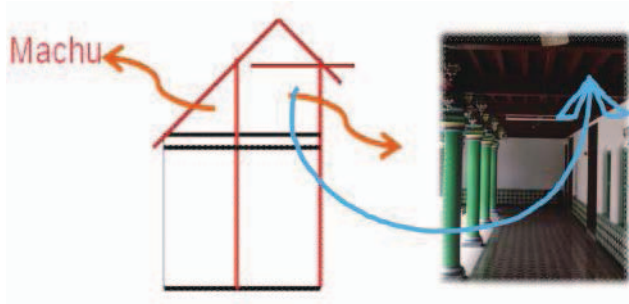
Passive cooling techniques in vernacular building

HOT DRY CLIMATE

HAVELIS

- Dense clustering of buildings.

- Sun control through orientation and structural projections.

- Cooling of sunlit surfaces by use of fins.

- Massive construction for roofs and walls.

- Courtyards

- Vertical air duct for Ventilation

- Wind scoop

- Shading devices

WARM HUMID CLIMATE

CHEETINADU HOUSES

- Sun control through orientation

- Massive construction for roofs and walls

- Courtyard

- Cross ventilation through longitudinal axis

- Clear storey windows

- Machu below the roof it reduced heat transfer

- Shading devices

CONCLUSION

Fathy said, "The principles that produced the traditional solutions must be respected. This is the only way modern architecture can surpass, in human and ecological quality, the achievement of vernacular architecture in the hot arid regions of the world"(Fathy, 1986).

The purpose of the study was to determine the main passive design strategies in the field of vernacular architecture and make a comprehensive definition of passive strategies (elements) in the field of vernacular architecture. As a conclusion the model of passive design strategies is summarized.

By adopting the passive design principles that reduce energy consumption in buildings. Incorporate the passive techniques in a building design to minimize the load on (heating, cooling, ventilation and lighting). The vernacular passive techniques and principles has been developed and clubbed with Morden buildings to promote the harmony between the human and nature.

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Reviving the Placefulness of Royal Precinct of Bhopal

*. . .. .Being from somewhere is always preferable to
being from nowhere. - Keith Basso (1996, 148)*

*Simranpreet Kaur
Amrita Rastogi*

*School of Architecture & Planning, Bhopal ar.rastogi.
amrita@gmail.com, ar.simranpreet@gmail.com*

Abstract: *"Place-making relates to planning endeavors focused on spatial development, urban design and city-form, public realm, streetscapes and related infrastructure, and the general imaging and re-imaging of places. (Szold, 2000)"*

The primary elements that combine to create a sense of place are the history of region, the physical environment of the place, and the community. Relationships between space and people are attached with their spirits, existence, meaningful location, sense of place and rootedness. There are few principles of place making that can be helpful in evolving "public spaces" into "community places". Although perceived alike, "spaces" and "places" have very different meanings. A space is a physical description of a piece of land, whereas a "place" connotes an emotional attachment to that space. It is a ground-breaking idea about designing cities for people, not just cars and shopping centers, focusing on the socio-cultural importance of lively neighbourhoods and welcoming public place which forms the support function.

Through this paper we are trying to establish the need of place making in historical precincts and their socio-cultural interactions, which are lost somewhere in the process of being modern. This study will be carried forward by analyzing the case of Royal Precinct of Bhopal, which includes Asia's third largest mosque, Taj-ul-Masajid. Our aim is to add the meaning and value to the public realm through the experiential quality of the Royal precinct of Bhopal in Shahjahanabad which is flourished by rich ecological, historical and cultural values. The area consists of old palaces, Taj-ul-masajid, three cascading lakes and the big open space, Badabagh.

This will help to regenerate the Connectivity, Drama and Dignity, Variety and Whimsy, Reflection of Local Values and Sociable Settings of this place; Hence, rejuvenating the worn-out essence of the place.

Keywords: *Public spaces v/s Community places, Place making, Historical Values, Rejuvenation.*

INTRODUCTION:

"The art of making better places for people" (Carmona et al., 2003:3) is called place making according to John Punter *"The bigger challenges remains to convert the increasingly vacuous mantra of place-making into substantive corporate practices linking development management with housing ,transport and community services provision"*(Punter,2010).These considerations indicate a degree of convergence between two major disciplinary traditions that have for long remained separate and are often in competition. Here required is a great mutual cooperation between planning and design (Punter 1997, Wyatt 2004, Vale 2008). The most popular conception of place-making seem to move in different direction like issues of great civic and social interest. Place-making has the potential to be of the most transformative ideas of this century (MPC Chicago, 2008).It is original way of philosophy about urban issues and their possible important solutions. Through the various case example observations we found that place-making scale is not only local, unfortunately it indicates the influential experience of history or culture also. In terms of spatial planning some institutional, social and disciplinary difficulties, values are still unresolved, which affect the public spaces and similarly image of the city. (Fleminc, 2007)

Formulation of good place **"participatory design of public spaces"** is certainly not an unusual term in urban design or planning. Every place should link with key attributes in orange, then intangibles of attributes in green and further measured by the indicators are in blue. In below figure we show the relationship of all three keys. (Kjartansdóttir, NordPlus2014)

Figure 1 Place-making key attributes

Reviving the Placefulness of Royal Precinct of Bhopal

PRINCIPALS OF PLACE MAKING:

The community is the expert. The people living and working in a place are the folks who know what needs to be done and how best to do it. ***You are creating a place, not a design.*** The drafts for a neighborhood enhancement effort are much less serious to its success than other factors, such as a management plan and the involvement of local citizens. ***You can't do it without help.*** Finding the right followers will bring more resources, innovative thoughts, and new sources of energy for your efforts. ***They'll always say, "It can't be done."*** When government officials, trade people and even some of your personal neighbors say it won't work, what they really mean is "We've never done it like this before." It's a sign you're on the correct track. ***You can see a lot by just perceiving.*** The smartest way to turn a area around is to first take a local appearance at what goes on there, watching out for what works and what doesn't in that particular place. (Charles C. Bohl, 2014) ***Develop a vision.*** For a community vision to make sense and to make a difference, it needs to come from the people who live there, not from consultants or other external specialists. ***Form backings function.*** If you don't gross into account how persons use a particular place in the beginning, you will have to deal with the values later. ***Make the influences.*** A great place in a neighborhood offers many things to do, all of which develop each other and improve up to more than the sum of the parts. ***Start with petunias.*** Tiny things can set the period for big changes, especially by showing to local skeptics that change is indeed imaginable. ***Money is not the issue.*** If you have a spirited community working with you, you'll find creative ways around financial obstacles. ***You are never finished.*** Eighty percent of the success of any good place is due to how well it is managed after the project is done. (Walljasper, 2015)

Case example of literature ***"Making a City: Urbanity, Vitality and Urban Design"*** (John Montgomery). Building a different city is now the biggest question in this decade. Following the decades of both planned and market driven decentralization of cities and city-regions, urban policy makers are now extolling the virtues of compact city. Traditional European city model is considered much sustainable over the sprawl or edge city model often planned around the automobile. If we want to have better and active cities, we need to know how to best manage, develop and design them extended over the period of time to become **successful urban place**. This paper argues about structured complexities of a city and their place making. The author thinks that the judgment to know when to design and when to leave the space for organic growth and development is the task to bring sense of place in any city or region. It is very simple to observe which place is more successful but to know and understand the reason for its success, its structure and setting the right conditions for future is something mind boggling.

Over the years, various theorists have defined the sense of place or urban quality. Some like Cullen lay great emphasis on physicality, whereas others like Alexander and Lynch rely on psychology of place, the subjectivity. But actually it is much wider aspect bridging the divide of physical attributes of the buildings, spaces and street patterns with the dynamics of the place to produce urban quality in terms of form, scale and built environment. Peter Buchanan comments, "Urban design is essentially about place making where places are not just specific space, but all the activities and events which made it possible." Hence, the successful urban places combine quality in three essential elements: physical space, sensory experience and activity.

NO ACTIVITY = NO URBANITY

ACTIVITY + PHYSICAL SETTING + MEANING = SENSE OF PLACE

The cocktail of elements which produce good places are:-

Activity: The concept of vitality and diversity distinguishes successful urban areas from others in terms of number of people on street, facilities, events, and extent of liveliness. Every place has its own rhythm of life, but this can change over the course of time. So, to sustain longer, muggling up with the pace, time and the era is important to retain its vitality. The key to successful urban place is the combination of activities, and no separate uses, which caters to different tastes of people along with easy travelling distance. Having achieved this, public realm, i.e. the streets, squares and spaces acts as terrain for social interaction. This will encourage activity, transactions, eyes on the street and therefore natural surveillance.

Image: Every place has an identity (objective) and an image (perception). This image is based on the individual beliefs, ideas and cultural personalities; influenced by the city's legibility. Also this image varies depending upon the users, i.e. the new residents, long term residents and the visitors; all of them will have varied mental maps. This imageability is further linked to "memory". Some places represent memory and connected associations with it. Hence, public realm is a space system with varying sizes, levels and meanings allowing space for people to perform both public and private roles.

Form: A vital city fulfills the safety factor for inhabitants; a sensible city perceives the legibility factor; an accessible city allows all age groups to be a part of the city; but a city with good control will have managed spaces for its people. Activity and image interrelate with form to generate sense of place. A good urban place is characterized by complexity, diversity, legibility, imageability, knowedgeability, presence of attractors, economy grains, and patterns of movement.

Hence, a good urban place can just 'fit in'; for it must allow flexibility for city to grow organically, and must not be over sanitized. Chaos, uncertainty and disorder defines the cities' manages complexities.

PHYSICAL CONDITIONS FOR MAKING A CITY:

- ✓ *Development Intensity:* Diversified high densities are essential for achieving urbanity. Mixed use urban districts in the residential neighbourhoods with clearly delineated edge and separate identities.
- ✓ *Mixed Use:* Vital urban areas always have primary and secondary activities which magnetize the people across different times of day. Absence of self-generating secondary diversity is like the mixture of oil and water.
- ✓ *Fine Grain:* The larger an urban place, the greater will tend to be both number and proportion of small business. Whereas large businesses have greater self-sufficiency. Development grain would become closer and fine within areas of higher development intensity.
- ✓ *Adaptability:* Areas offering in built adaptability rather than obsolescence are more successful because of types and intensity of activities.
- ✓ *Human Scale:* The street life, have a certain spatial efficiency, and the overall shape it attains owe to its proportions; hence, imparts the urbanity to the space.
- ✓ *Permeability:* Increasing the permeability increases the footfall and finishes off its stagnant entity.
- ✓ Active street life, transparency, eye contact, movement pattern and architectural style of a place defines it's publicly and public realm.
- ✓ All the factors discussed above provide a rationale for good city design. Cities are complex entities with many layers which unveil its identity as a whole. It is an experiential process, not a destination to finish off. (Montgomery, 2007)

CASE OF BHOPAL:

The city of lakes, Bhopal is the capital city of Madhya Pradesh, rich in its heritage and culture. Founded by Paramara king Bhoja, and carried to the princely position by its Begums, with the help of Dost Mohammad Khan and the British suzerainty; Qudsia begum being the first ruler, followed by Sikander begum, Shahjehan begum and Sultan Jehan begum; gave the city its waterworks, railways, postal system and municipality. Bhopal was the second largest muslim-ruled princely state after Hyderabad. (Robinson)
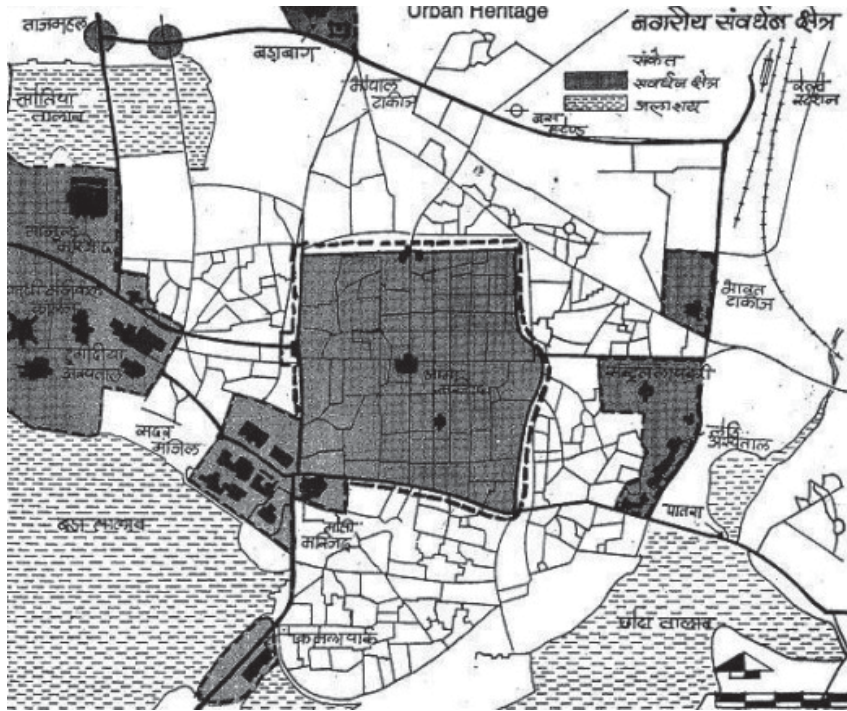
Fig. 1: the royal precinct of Old Bhopal (Source-Bhopal masterplan)

INTRODUCTION TO THE SITE PRECINCT

The site precinct lies in the Shahjehanabad area of old Bhopal. It was part of palatial complex that includes the royal market square, Taj-ul-masajid, Benazeer Palace, Taj mahal Palace, the three cascading lakes, the royal tombs within Badabagh among other historic stepwells and the putlighar minaret. An Id-gah (Hindi for mosque) was located at the highest point in the landscape and Shahjehanabad was enveloped by a city wall. Three terraced lakes were created in this area with water from one cascading into the next which finally nutured the Badabagh via graveyard of the commoners. These formed the central area of Shahjehanabad. The palaces and residences of the elite were located along these lakes. The building of this whole complex was the beginning of the creation of a new urban centre. The individual buildings were a part of the overall image, the assertion of a statement displaying power and authority. The area has currently been encroached upon by residential areas, garages and hospitals causing degradation of the ecology of the area.

**Fig. 2:** The royal precinct route and landmarks

Fig. 3: Vantage points along the precinct

Of the whole royal precinct of old Bhopal, we have considered small part for the detailed analysis of placelessness and making a space "Place". We have marked Badabagh(the graveyard for the royals), the graveyard for commoners and the putlighar minar area. If we analyze the chronological development of this area, we infer that the large chunks of baghs and open spaces have been now converted to dense built up area. Majorly residential with commercial mainly on the major connecting roads, this area has developed dense fabric around this big open parcel of land. It seems as a relief space in such density when we observe the figure ground map. Even in this high density the grains of development seem to be varying in its own haphazard manner. There is no sequential development seen in the course. Refer the maps below for this.

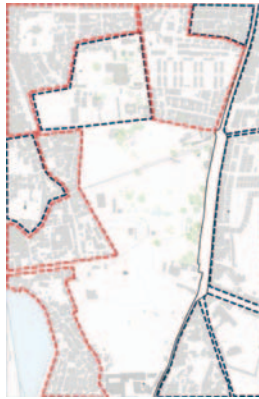**Fig. 4:** Royal precinct around the Badabagh
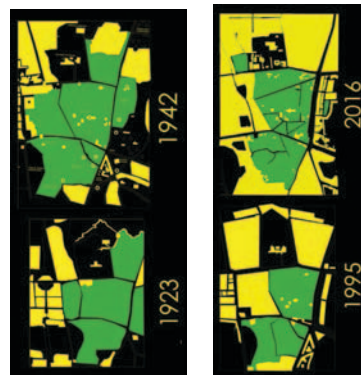
Fig. 5: Chronological development of Badabagh

Fig. 6: Existing figure ground of the area   **Fig. 7:** Grain analysis   **Fig. 8:** Land use map

INTERPRETATION OF PHYSICAL CONDITION

The Bagh is right now not put to any specific usage, except being the relief space, that too not well managed and designed. This bagh is an asset to the city and the royal family of Nawabs (currently owned by Saif Ali Khan). Such a heritage precinct, and is not imaged as a public place. Though it is visually accessed, but physically not permeable. No activities happen as such except the Goat bazaar during the Eid festival in the city. If well formulated and legitimized, this urban place can just 'fit' in the city as an asset (as discussed above in the literature section).

Reviving the Placefulness of Royal Precinct of Bhopal
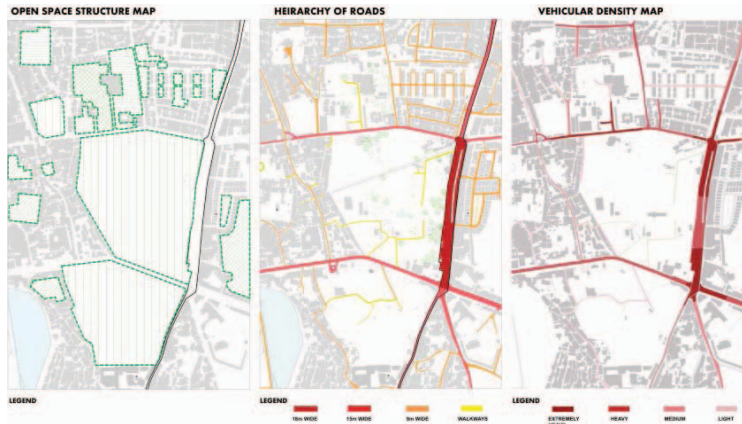
PEDESTRIAN DENSITY MAP   DEAD AND ACTIVE SPACES
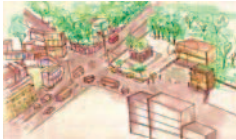
The precinct has lost the identity of being royal at once, owing to the haphazard development along the Shahjehanabad area, which has been occupied by economically weaker section of the society, rendering the space jam-packed of the high enclosure, open drains, least infrastructure maintenance and most importantly treating Badabagh as the backyard to their colony. Hence, the dark spots or what we call dead spots in urban spaces, where people avoid going or even interacting. This darkness is also shared by the automobile workshops along the periphery of Shahjehanabad, who treat Badabagh as spillover for keeping the unused vehicles and repair materials. You can also see in the figure below, how these garages and workshops are tool to culminate the tomb's historic entity. The overall imageability which existed as we head from Taj-ul-masajid towards Badabagh via Hamidia road has completely turned over with such surroundings. This disrespect of "The place" has converted it to a "dead space".

Fig: Present condition and negligence of tombs and its surroundings

Secondly, the office buildings, commercials and the street market on the Berasia road, overcrowd the area with intense traffic but in a fatalist manner to the bagh. The edge conditions along both the sides of the road treat bagh as the backyard, with temporary structures, garbage dumpyards, street vendors and on-road parking. The same can be clearly referred in the pictures below. As already discussed in literature section, activities, vitality and diversity of crowd is important for magnetizing a place. But what kind of activity should be where and to what extent it should be allowed is also to be thought of. Here, we find the vitality and diversity of crowd and activities along the edge, but this edge condition does not amalgamate inside the bagh. So, achieving permeability towards bagh and creating the activity magnets inside the boundary to induce the footfall inside the bagh is something that can fetch the eyes of the citizens.
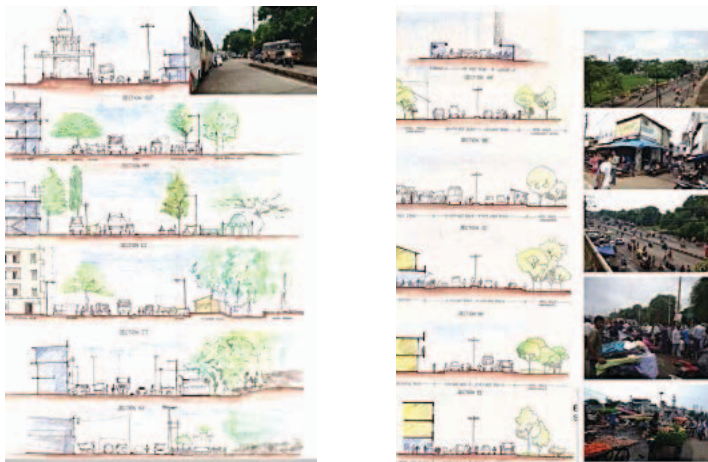
Fig. 9: Site sections and images showing the edge
conditions along the Bada-bagh

Fig: edge condition along Berasia road   Fig: Minaret and its surrounding area

Thirdly, the new kabaadkhana road coming from islamia gate, cutting the divide between the bagh and the minaret 15 m wide roads, that has a varied edge condition along its stretch. Crossing the Islamia gate, we have the Berasia bus stand which caters the local routes and the surrounding villages with approx. footfall of 140 buses per day. Labourers, patients from nearby remote areas, daily commuters follow this transit mode. Hence, there is a labour shed at Durga temple square also. This road is chaotic in its own sense of transit modes (buses, tempos, majic, auto, rickshaws). Also, the minaret ground is backyard of the Berasia bus stand, which creates dead and socially inactive space. The surrounding houses also have their back edge facing the minaret. Hence, neglecting the historical minaret, which is one of its kind in the state.

CONCLUSION:

The above stated site conditions are a stark contrast to the place making principles discussed in literature section. Although it has activities, diversity and vitality, but that has not been controlled and designed at urban scale. The connections and networks need to be thought at city level, to organize the space at area level. But, at the same time we need to know when and where to stop the design. Some places develop their character with time on their own pace. Badabagh and the minaret area has a lot of potential to orient a placeful character.
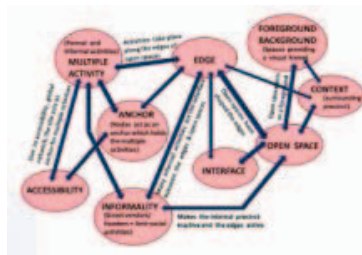
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AUTHORS:

Simranpreet Kaur, Student, Masters of Urban Design, School of Planning and Architecture, Bhopal

Amrita Rastogi, Student, Masters of Urban Planning, School of Planning and Architecture, Bhopal

Note: All the hand drawn sections with sketches, and the maps of the precinct have been made by the author, with the help of primary survey.

High-Rise as a Solution to Overpopulated Indian Cities – Is this a Boon or Bane?

Hemant Chauhan
Assistant Professor
MIDAS

Abstract: This paper discusses the high-rise scenario in over-populated Indian cities. Due to urbanization and increasing job opportunities in cities, people from distinct background & culture move towards cities making them overpopulated. This, in turn, leads us to opt high-rise as a solution for easy access to facilities and resources. However, over the years, people's perception towards high-rise is changing for many reasons. This paper throws light at the importance of high-rise development by taking into account the workability and impact of these buildings on land use. The problems associated with the high-rise residential buildings and the reasons for the changing perception of people towards these buildings are discussed here. Conclusions suggest that there are some possible solutions that, if appropriately dealt with, can make high-rise buildings a successful solution to the problems associated with overpopulated cities.

1. Introduction

"A house is not a home unless it contains food and fire for the mind as well as for the body" – a popular aphorism said by Benjamin Franklin. Everyone needs a house that can response towards their lifestyle and culture. However, over the years, it has been seen that people find it quite hard to get a house which satisfies their needs. Because of city based job opportunities, globalization and urbanization, the number of people migrating from distinct cultural backgrounds & traditions from villages to cities, are surprisingly growing. This scenario is very typical these days in India. Census of India shows that the migration to capital city of India Delhi itself has increased by about 9% since 2001 to 2011, whereas the overall urban population growth in Delhi per decade is 21% (Census of India, 2011 and MPD-2021). It has also been seen that this pattern is more or less same in other Indian metropolitan cities too. Further, It is then followed by planned or unplanned growth and results in scarcity of land due to over-population and it in

turn, forces us to go more vertical. High-rise buildings are a typical solution for over-populated cities in India. Due to resource availability and better location, only option for the people coming to these cities for employment, is to live in public apartments which encourages dealers and engineers to construct more of these buildings in order to make more and easy money ignoring the actual needs of a living space.

High-rise residences mostly being very expensive, a larger percentage of urban population prefer to live in the high-density low-rise buildings which are better affordable by the low and middle class families. Most of the migrants from different regions and states are living in these buildings and it sometimes creates a sense of crowding. According to the psychologist Jonathan Freedman (1975), it is not density that determines the degenerative behavior of populations, but crowding. "Sensation of being crowded" is a distinct feeling from that of having very little space. In Indian context, high-density housing generally results in over-crowding, pollution and sanity problems. The primary purpose of this paper is to draw attention of all participants related to housing design and practice including clients, architects and builders as well as global audiences towards the problems associated with high-rise residential buildings. It will try to find out the reasons that are causing those particular problems and then it will be suggesting some possible solutions.

2. Literature Review

People are in connection with the space surrounding them all the time and it affects their health, family growth and lifestyle. According to A.Baum and S.Valins (1977, Architecture and Social Behavior), "our behavior can be conceptualized as a dynamic sequence of adjustments and readjustments to our physical and social environment". Architecture plays a vital role in making a space worth living, deciding the satisfaction and dissatisfaction of people living in it. In 21st century, housing has been playing a vital role in generating the economy of a country. Given this demand, while high-rise residential structures have become a solution in the metropolitan cities, they remain eluded in tier II cities in India. Low-rise or mid-rise high-density dwelling types have developed more in these cities. A study of Pune city's housing needs, demands, market, and type of structures being built, reveal that tall buildings of 11 floors are being developed on the city's urban fringe. Most of the high-rise projects remain as proposals. An investigation in this case study reveal that high rise structures are not preferred due to user perception of insecurity in case of fire or earthquake and high cost of the building. (Kavilkar & Patil, 2014).

High-Rise as a Solution to Overpopulated

Consumer's perception is one of the most important things to be considered while proposing and designing a high-rise. According to a survey conducted in Kolkata city among high-rise and non high-rise dwellers, considering four age groups (Below 35, 35-50, 51-60, Above 60) , it was found that the non-high-rise males and females, both have more positive & favorable perceptions of their housing environments compared to their high-rise counterparts. The studies reveal that the high-rise dwellers have perceived their housing environments to be unhygienic, substantially warm and uncomfortable, sometimes quite suffocating and thereby making it an inappropriate place for living. In case of Attractiveness and Planning of residences, non-high-rise residents expressed more dissatisfaction than high-rise dwellers. The high-rise dwellers also opined that their residences are inconvenient, less comfortable and less secure than their counterparts. Whereas the non-high-rise has found their residences to be somewhat noisy with poor level of incoming light and a little too undisciplined making them not quite congenial for studies. Though, the study shows that high-rise dwellers were pretty satisfied with the quietness, air quality and views from their buildings. (Chatterjee, 2009).

People who stay in high rise buildings do so because of the view, the breeze and the privacy that they can get. For instance, it has been seen that people stay in tall buildings in Mumbai and those in Pune do not prefer to. The reason for that is possibly due to the fact that in Pune most people are service class and they prefer security, whereas in Mumbai relatively more people are entrepreneurs who like to experiment with new things (Sundrani, 2012). On the study basis, people have many reasons for not preferring high-rise residences. Some of them are insecurity regarding fire & earthquake safety, problems in case of lift-failure, fear of structure failure and high maintenance cost.

Child safety and their development in high-rise is another issue. Most of the high-rise housings are built without considering kids living in it. For instance, new residential towers in Melbourne were constructed keeping in mind that they would be family-free zone and all the occupants would be single working people but around 20% families living there were having kids. According to a study conducted in Australia, children living in public high-rise housing experienced relatively high levels of independent mobility. The geographies of children in public housing were dominated by local, designated play spaces that were perceived as unsatisfactory by the children. Children in privately owned housing not only explored throughout a greater territorial range but used a wider variety of spaces (Whitzman, 2010).

Health is a very important factor in determining the satisfaction of people towards their habitat. Health issues in housing are not merely related to the avoidance

of diseases, but they also encompass the needs to provide adequate spaces for the occupants to conduct their everyday activities in a comfortable and pleasant setting (Ranson, 1991). That is why the absence of desirable and comfortable living environment in high-density apartments with regard to their own daily activities, traditions and cultures somehow makes most of the families unsatisfied when it comes to the matter of health, adaptability and overall wellbeing. It is confirmed that failure of achieving desired spatial adaptability or customizability in needs or choices in house is one of the major reasons that impact on an occupant's mind and mood (Ineichen, 1993). However, physical quality of a living environment is one of the factors that predict occupants' satisfaction towards their housing (Bell et al, 2001). But, the physical condition of housings should not become the only consideration for determining the quality of housing. In fact, "the housing process cannot be associated exclusively with the physical unit alone, as it requires an integral analysis of the relation between the inhabitant and their habitat" (Jiron & Fadda, 2003, 7).

By revisiting the past, we can get to know that assuring the security in high-rise residential buildings has always been a challenging task for architects and designers. Pruitt-Igoe was a live example of security and design failure in high-rise. It was a public housing project in St. Louis, US which ended in the demolition of 2,800 housing units. Thomas P. Costello, the former director of the St Louis Housing Authority, said in an interview "The entire public housing program was always geared to production, not to providing decent housing for poor people". Costello believed that badly designed high-rise buildings, like those at Pruitt-Igoe, "virtually guaranteed failure". The situation is no different today. Government of different countries like Srilanka, are repeating the same process to get rid of the slums (Samaratunga & O'Hare, 2012).

3. Need for Study

There is no denial in the fact that today high-rise residential buildings need a lot of alterations to make them an adequate place for living, but at the same time we cannot overlook the need of these building today. Where it gives us a better land-use in congested and over-populated cities, it also provides better view to the dwellers living on upper floors. These buildings can also proved to be more environment friendly, reducing air and noise pollution, providing better outdoor air quality and a peaceful atmosphere. Although, there are many factors which make people insecure about adopting a apartment in a high-rise building such as Child safety and their development, Security towards crimes, lack of social interaction spaces, high maintenance cost etc.

High-Rise as a Solution to Overpopulated

Its high time to introduce all participants related to housing design and practice including Clients, architects, builders as well as the government with all the problems associated with high- rise residential buildings and sort them out by finding possible solutions. It will later contribute in the development of a country providing better land-use, leaving more area for open & social interaction spaces and better skylines to the cities. It can also be a medium to bring people with different religion, tradition and places all together and create a safe & healthy multicultural society.

4. Analysis & Discussion

There can be several reasons why the government and people of different countries and regions need high-rise residential buildings and there is no denial in the fact that these buildings serve their purpose well too. Where, on one hand, these buildings can provide better land-use and skyline for a city, they also provide great views, better outdoor air quality and less noise pollution to its residents. But despite of more construction of these buildings by builders and promoters, people's perception towards high-rise is changing. Due to a lot of news about fire and earthquake devastation in high-rise lately, people generally develop a fear for these buildings and do not want to invest in such projects. On other side, there are projects like Pruitt-Igoe which gives a bad historical glance and make people have a negative attitude towards these buildings. The present perception of people towards these buildings needs to be changed as these buildings are a vital need of overpopulated cities.

Several initiative can be taken to make these buildings comfortable and satisfactory. For the issue of high buying and maintenance cost, if proper cost-effective material is used, these buildings' maintenance and overall cost can be reduced and they can offer good deal on prices for their consumers. There are several other issues that need to be taken care of while designing a high-rise building. Easy access to green space , availability of active transport, Services & resources, Sufficient natural lightning, avoiding indoor air and noise pollution, housing affordability, Safety and security (prevention of crimes), Provision of socially active spaces, healthy atmosphere, child safety and their adequate development, Sense of belonging are some major issues that need to be resolved to make high-rise residential buildings an adequate place for living.

To make these type of housings more safe, a defensible space can be created which will also help in creating a sense of belonging. A Defensible Space program restructure the physical layout of communities to allow residents to control the areas around their homes. This includes the streets and grounds outside their

buildings and the lobbies and corridors within them. The programs help people preserve those areas in which they can realize their commonly held values and lifestyles. (Newman, 1996). It can also help in child safety and their movement through the space more frequently.

For social interaction and green space, a common sky garden with every 4-5 floors can be introduced in the building. Also, a few of multi-purpose spaces can be introduced in between the building blocks for easy availability of services and resources.

It's an appeal to the builders and promoters that they should realize that the looks and profit from a building shouldn't be the only thing to be taken into consideration while constructing a high-rise building. No urban planner should put urban poor in stacked, unhealthy and unnatural conditioned buildings with poor maintenance and non-responsive design just to make government projects more productive. Government of different countries need to make sure that housing projects under different urban development authorities shouldn't be handed over to contractors completely. These projects should be invigilated carefully to make the best out of it.

5. Conclusion

High-rise buildings are quite a successful solution for overpopulated cities in India. These buildings need to be made worth living in and as comfortable & satisfactory as any other private residential building.

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'BRICK' AS A HISTORIC BUILDING MATERIAL

Ar. Apoorva Bhargava

Conservation Architect

apoorvabharagava59@gmail.com

INTRODUCTION

Historical buildings and heritage are our cultural properties. They have priceless value and should be preserved. And for preserving, it is important to know about all its characters, properties, materials etc.

What is a brick?

A brick is that construction material without which construction is incomplete. It is used as a filler material in framework structures and as a main material in masonry structures. Its first tracing has been dated back to Indus Valley Civilization [9]. It is a block made up of clay. Over the time, bricks have appeared, gained importance, lost importance and then come back again with various styles of architecture. Burnt bricks were used in ancient Indian, Babylonian, Egyptian and Roman civilizations [2]. The process of making a brick has not changed much over the centuries or through various types of topographies. Because of its simplicity, it is in use.

Evolution of Bricks:

At early Stone Age or Paleolithic Age, people were nomads. They took shelters in cave, rock shelters and temporary structures (huts) of plants and animal materials such as wooden poles, grasses, leaves and animals skin. These temporary structures were round. By the end of the Paleolithic age, construction was of mud. In the Mesolithic age, structures found were a bit more durable, made of clay and stones but in a wild and natural state. In Neolithic age, people started settling down and so came the need for their settlement. Because of this people started farming and producing various other things for their living. They started exchanging things for their living. And because of this, came the need for permanent settlement which brought in the use of mud in larger extent. So the bricks came into existence. Their early and popular mode of construction was mud, mud bricks and stone. In Indus/Harappan civilization, both kiln and sun-baked bricks were

used for construction. Most of the villages or towns of Indus civilization are built from stones and mud bricks. Mud bricks have been used since 7000B.C.[10] at Mehrgarh whereas baked bricks at Jalilpur from around 2800B.C.[10] which was a mature Harappan phase. The prominent role was of baked bricks between early and beginning of late Harappan phase. Clay brick masonry continued to be in use during medieval and modern times.

Classification of bricks:

Bricks in modern times are made in the same way as they were made in earlier times but because of various technologies available today, they can be classified in different types. But in earlier times, bricks were made simply and according to their needs were used. They were not classified separately under some heads as they are done today. So, they can be classified according to quality, usage, colour, sizes, materials, mineral content and also the shapes.

1. **Classification according to quality –** Burnt bricks are divided into three classes namely, (a) first (best quality bricks); (b) second (some imperfection due to shape or colour or both); (c) third, remaining bricks in the kiln (suitable for interior work).
2. **Classification according to usage –** Division according to the suitability for their usage like (a) interior purpose (common bricks are used for this); (b) exterior purpose (requirement is durability and freedom from defects and in case of exposed work, colour and texture); (c) pressure-resisting purpose (strength is the chief requirement to resist large stresses) and (d) fire-resisting purpose (suitable to resist high temperatures).
3. **Classification according to colour –** Colour is influenced by (a) chemical composition of clay, (b) temperature during burning, (c) atmospheric condition of kiln (depends on the smoke in kiln), (d) sand-moulding (includes the bricks which are hand moulded and sand sprinkled on it defines its colour) and (e) staining (done with sprinkling various metallic oxides before burning).
4. **Classification according to materials –** Bricks made of different material other than clay and sand are – (a) cement and concrete bricks, (b) concrete bricks, (c) glass bricks, (d) calcium silicate bricks (sand and lime), (e) adobe bricks and (f) stone bricks.
5. **Classification according to shapes –** Bricks was moulded as per the shape required for the structure which is practiced till now. (a) arch bricks (voussoirs); (b) bullnose bricks; (c) rectangular bricks; (d) splayed bricks (champhered edges); (e) circular or semi-circular bricks.
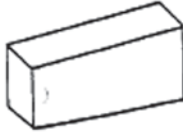
Various Specialized Shaped Bricks.
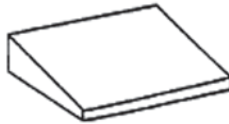
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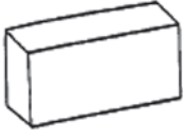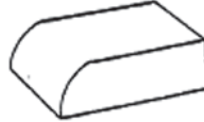
No. 1 Key
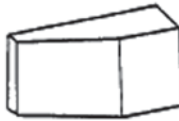
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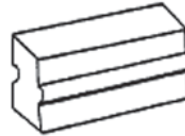
Soap

Edge Skew

Bullnose Stretcher
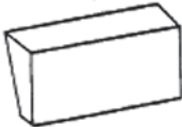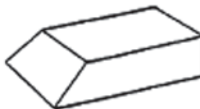
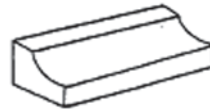Checker

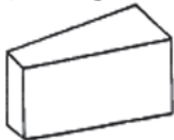Feather Edge

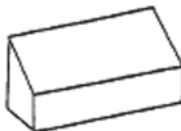Bullnose Header

Split Brick

No. 1 Neck

Tongue and Groove

No. 3 Arch

End Skew

Cove Stretcher

No. 2 Wedge

Side Skew

Ornamental

Specialized size bricks (Source: [12] p.12)

'Brick'as a Historic Building Material

Sizes of the Bricks:

The size of bricks varies significantly depending on type and date of manufacture. Size and visual appearance can help in dating bricks, particularly those made in the period before bricks were machine-made. Handmade bricks vary in dimension from one place to the other and even locally. The different dimensions of the bricks used for construction in the heritage structures of various parts of the world are:

Table 1. Comparison of Royal Size Standards to Colonial Brick Sizes (in inches)

Brick	Length	Width	Thickness
English Royal Standards (Lloyd 1925)			
1571, Elizabeth I	9	4 1/4	2 1/4
1625, Charles I	9	4 3/8	2 1/4
1725 George I (Place Bricks)	9	4 1/4	2 1/2
(Stock Bricks)	9	4 1/4	2 5/8
1729, George II (within 15 miles of London)	8 3/4	4 1/8	2 1/2
1769, George III (Sizes same as George I beyond 15 miles)	8 1/2	4	2 1/2
1776, George III (all of England)	8 1/2	4	2 1/2
English/American Colonial Bricks			
Typical 18th C Colonial Brick (Nöel Hume 1969)	8 3/4	4	2 5/8
Nöel Hume "English" Brick (small cherry red), mid 18th C	7 1/2	3 1/2	2
Brunswick Brick (small) 1725-1775 (South 1964)	7 1/2	3 1/2	1 1/2
Brunswick Brick (large) 1725-1775 (South 1964)	9	4 1/8	2 5/8
Williamsburg, Brick, 1719 (South 1964)	9	4 1/4	2 1/4
Jamestown Brick (small) (South 1964), 1650	8 1/2	4 1/8	1 7/8
Jamestown Brick (large) (South 1964), 1650	9	4 3/8	2 1/2
Fort George Brick, Pensacola (Lazarus 1965), 1765-75	9 1/4	4 1/4	2 1/2

Different Brick sizes (Source: [12] p.14)

- In Indus valley civilization as well as the Harappan civilization, ratio was 4:2:1[9] whereas the Kalibangan city has the ratio of bricks as 3:2:1 [9].
- During Egyptian civilization, the ratio used was 2:1:3/4 or 4:2:1 [4].
- Bricks used in the Scottish architecture were called Scottish brick measuring 8-9x3x21/2 (inches)[16] whereas in Irish architecture, they were called Irish brick measuring 81/2-93/4 x 4-45/8 x 13/4-25/8 inches during 17th century [6].
- In the 17th century, the heritage structures of Cheshire, U.K. had the brick size of 93/4x45/8x2 inches.
- In the Roman architecture, bricks had the size ratio of 8:4:1 and in some of the structures length and width were same and the height varied [5].
- American brick sizes

Raw Materials:

Raw materials used for the construction of bricks vary with the types of bricks. Raw materials commonly required for brick making are –clay, water, sand fuel. Clay is the naturally occurring raw material which is used to make bricks. Clay has variations in its appearance, its physical properties and minerals with the site variations. Minerals content is the key common in all clay type which are formed from the erosion and weathering of primary igneous rocks. The different types of clay are surface clays, shales and fire clays. All these three types of clay are composed of silica and alumina with some metallic oxides (which influence the color of the bricks). Clays occur in three principal forms, all of which have similar chemical compositions but different physical characteristics.

In earlier times, the clay used for making bricks were taken from the river bed or lakes in monsoon season and left for weathering for one complete year during which the mud used to gain and lose all the components required like various minerals etc. It uses to get wet and break the large mud lumps into smaller ones.
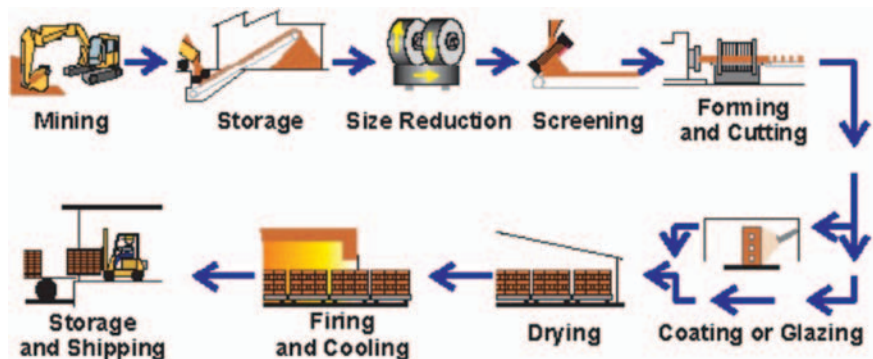
Brick Manufacturing Process:

Now if we see the traditional process of brick making, the process is like this – the traditional manufacturing of fired clay bricks can be divided into four stages. Firstly the extraction of the clay for making bricks (which in today's term is known as mining) is done and is kept at one place in open. Selection for clay depended on the availability of construction location. The mixing of clay was done by hands or feet by adding water to it in very earlier times. Later, when they learned how to tame animals, mixing was done by heavy wheels in a pit tied to the animals like – Ox,

Horse or Donkey etc. amount of water to be used was directly depended on the type of element. For eg. – as small and thin the particles of clay will be, the more water will be required to mix it.

After this, the prepared mix is put into the mould which was usually of wooden material with no base. Before keeping the brick on ground, sand is placed below the brick so that it doesn't stick to ground. The excess clay was removed with the help of wooden stick or rope etc. The still rough clay elements were removed from the mould and dried in a covered space, which was generally a shelter made of scraps of wood and with a straw thatched roof: these shelters were known as hovels [3]. Sun dried bricks were made like this and were left for longer durations to get hardened. But for fired baked bricks, they were kept for 1 week or so for drying and then were fired with the natural fuel like wood straw, etc. Bricks were sorted and which were not fit for external use, were used internally.

But in today's time, bricks are prepared in kilns and from selection of plant setup area to raw material, various factors are to be considered [7]. Clay rocks are extracted from the quarries and are further grinded into dust and then with crusher.

The crushed raw material is stored in an open area. After this, the materials which are to be used to form a brick are mixed together and grinded further. This mix is screened for proper unit size and stored at a place from where it is put into a machine for brick making where water is added in it. Now quantity of water added to the mix is according to the process adopted for making bricks. Air is removed from the mixture before it is sent for extrusion. Next, the texture and coatings are applied before it is cut into the size of an individual bricks. In case of small production, hand moulded bricks are produced. After this bricks are sent to dryer for evaporation of water and then fired in kilns. After the temperature has risen to its

Diagrammatic Representation of Manufacturing Process (Source: Internet)
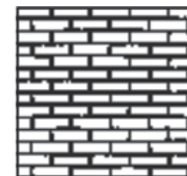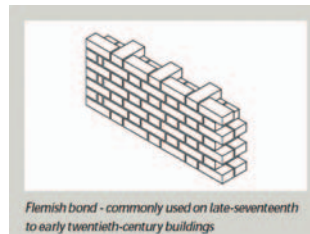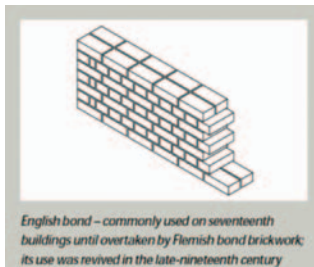
maximum to prepare bricks, cooling process begins. Cold air is drawn into the kilns to cool the bricks slowly which has direct effect on the colour of bricks. Then the bricks are unloaded from kiln and are sorted.

Techniques of Construction:

Bonding is the technique used for constructing a brick wall by laying them over each other either just below or above immediately. It has various courses to tie the units together. They have been practiced since olden times. The only difference is, that they were not given names as they are defined today. The main aim for bonding is to provide strength. Various bonds used for construction in olden times were:

English bond, Flemish bond, Running bond or Stretcher bond, Header bond Additional bonds which are used for construction today other than the common ones mentioned above are:

English cross bond; Brick on edge bond; Facing bond; Dutch bond; Raking bond; Zig zag bond; Garden wall bonds; Bonds at connections – Tee junctions, Intersection or Cross junction, Squint junction, Quoins; bonding in Piers etc.

English bond – commonly used on seventeenth buildings until overtaken by Flemish bond brickwork; its use was revived in the late-nineteenth century

Flemish bond - commonly used on late-seventeenth to early twentieth-century buildings

Running Bond

Types of bonds (Source: [6] p. 17)

Use of Bricks:

- **Traditional use –** Traditionally, bricks have been used for construction in many ways. They have been prepared in several shapes including simple rectangular one for different purposes like walls, footings, sills (Bullnose brick), copings, piers, treads, arches (Voussiors), radials (curved surface brick), lintels, roofs, floors, parapets, brick carving (examples can be seen in Tanjore), dome, buttresses, corbelling, in walkways, minars, stairs etc.

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- **Modern use –** The common structures constructed in brick work in today's time are: walls, piers, footings, buttresses, window sills, corbels, copings, jambs, chimneys arches, lintels etc.

Laurie Baker has used the bricks in new form and shape and given a new meaning to it in today's time with countless creations. He has built arches, jaalis, frameless doors and windows with bricks, which are not a new discovery as an element but are the new techniques from the old material i.e. brick. He tried to use the minimum possible quantity of materials. His objective was to generate the possible use with the common brick in building line to create beauty, cost efficiency and environmental harmony to which he succeeded.

Conclusion:

The common burnt brick is one of man's greatest discoveries. Thousands of years ago, bricks were made in several different shapes and sizes but, one by one, the less suitable ones were rejected. Now all over the world, with few exceptions, almost all bricks are roughly of the same shape and size i.e. 9 x 4.5 x 3 inches which is neither by chance nor fluke, but the result of thousands years research and change.

In today's world, the shift has been made from brick to concrete. But if ones work can be done with brick which is a cost effective material – cheaper than concrete, its dead load is lighter than concrete, it is easy for construction, it has flexibility and it has its scrap value as well. Then why the bricks are being replaced by non-friendly material.

When the bricks can be left exposed then why there is need in today's world to hide it with plaster? Laurie Baker said that it is very foolish practice to build a brick wall and then plaster it with cement and then paint it all over to make it look "beautiful". In his words - "I just think it is plain stupidity to build a brick wall, plaster it all over and then paint lines on it to make it look like a brick wall. I think it is equally untruthful to cover it all over with tiles shaped to look like bricks. Or another variation of untruthfulness is to plaster it and then paint it to look like marble!" (3).

Even the writers, whose books are being studied by the students for construction and material purposes, have clearly defined that how the bricks are made, what are the uses of them, how they bond with each other for strength, etc. Uncommon uses of bricks, like in making slabs and in concrete as aggregate, are lost now as they are not mentioned by the writers in the books. So only the people those who are working with the traditional methods and techniques, are aware of it.

With this research, conclusion came is that the things which were originated thousands years ago, are still being used but in a modified manner. Bricks were used with lime mortar to give strength to the structure but today it is used with cement mortar which sets quickly as compared to lime. Bricks are made more or less in the same manner as they were used to be prepared when there were no mechanical means. So the basic things are same, only the approach has changed.

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VERNACULAR

Date: 24 February 2018

Venue: ECR, Swarnabhoomi,

Cheyyur Taluk, Kancheepuram District, TN

Vernacular means native – it defines the soul of any environment, culture, architecture, language, cuisine, and life-style. It is a common identity of the place which will be sustainable and energy efficient. In this data-revolution packed century, the world has become a global village, and traditions and cultures have lost their local distinctiveness. Vernacular traditions in any field are a creative process developed by the interpretation of local knowledge, geographic opportunities, challenges, past-experiences, which are negotiated and adapted by generations to the meet the needs of the time. This conference will bring best resource persons from architecture and allied fields to speak on their experience and research. It will also encourage scholars, and activists to present papers, which would be published in this journal.

Sub-topics:

- Vernacular Style in Contemporary Architecture
- Vernacular Architecture
- Landscape and Gardens
- Language & Architecture
- Music & Architecture
- Art & Architecture
- Place-Making
- Construction & Materials
- Sustainable Transportation
- Natural Resource & Management
- Sustainable Technology suitable to location
- Indigenous Knowledge & Disaster Management

The conference invites research **papers** or **posters** from professionals, scholars, and students of architecture and allied fields of engineering and life-science – organised with parallel sessions with keynote speakers' presentations, with separate posters display area.

Important Dates:

- Abstract Submission   26-Nov-2017 (300 words)
- Notification of Acceptance   30-Nov-2017
- Full Paper Submission   30-Dec-2018 (3500 words)
- A1-Poster Submission   30-Dec-2018
- Presentation Dates   24-Feb-2018

Contact Details:

Email: conference@midas.ac.in

Tel: +91-7358000752

*Each selected paper presenter will be provided with accommodation, boarding, and economy class Air-ticket <u>or</u> 2nd AC train fare