1-1-2004

Traditional Indian architecture and its adaptability to Mumbai city

Saloni H Kadakia
University of Nevada, Las Vegas

TRADITIONAL INDIAN ARCHITECTURE & ITS ADAPTABILITY TO MUMBAI CITY

by

Saloni H .Kadakia

Bachelors in Architecture
Academy of Architecture, Mumbai, India
2000

Masters in Architecture
University of Nevada, Las Vegas
2003

A thesis submitted in partial fulfillment
of the requirement for the

Master of Architecture
School of Architecture
Coliege of Fine Arts

Graduate College
University of Nevada, Las Vegas
May 2003

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Thesis Approval

The Graduate College
University of Nevada, Las Vegas

April 25, 2003

The Thesis prepared by

Saloni H. Kadakia

Entitled

Traditional Indian Architecture and Its adaptability to Mumbai City

is approved in partial fulfillment of the requirements for the degree of

Master of Architecture

Examination Committee Chair

Dean of the Graduate College

Examination Committee Member

Examination Committee Member

Graduate College Faculty Representative

1017-53

ABSTRACT

Traditional Indian Architecture & Its Adaptability to Mumbai City

by

Saloni H .Kadakia

Dr. Janet White, Examination Committee Chair
Coordinator of Architecture Department
University of Nevada, Las Vegas

Mumbai 'the official name for Bombay' has adapted to various styles of architecture. 1830 - 1870 saw the Gothic Revival, followed by IndoSarcenic architecture in 1870 - 1900, followed by Edwardian and Art Deco styles (1920 - 1930) respectively. The present state of architecture in the city reflects a "failure" in of this process of adaptation. 'Keeping in mind the cosmopolitan nature of the city ', it is important that the city continues to adapt to various architectural influences but in the right spirit. Today, what serves, as image centers are pre independence buildings like the Rajabai Tower and the High Court, or urban artifacts like the Flora Fountain and Gateway of India, which were built in the late 1800's and early 1900's. The architect's of Mumbai today pair neo-classical pseudo-Corinthian columns with ultra-modern circular windows and tops the ensemble with a Florentine dome, as if they were elements from a prefabricated catalogue. Lack of imagination is leading to the production of shoebox architecture or architecture that still copies and duplicates old classical elements in an irrelevant manner. Whether this is the result of a creative bankruptcy, or the crass commercialization of architecture, it is a disheartening reality and does not bode well for the architectural scenario of the city of Mumbai. There are a few indigenous Indian architects who are trying to create architecture, which Indians can identify with; they are creating architecture that is modern in construction technology as well as having Indian spirit. Few have succeeded in this attempt to create an architectural national identity after centuries of domination by the colonizing empire. Among the successful architects are Raj Rewal,

Achyut Kandive, and Charles Correa. Analyzing the work of these masters and how they have applied traditional elements in their designs in a modern language would help to design principalsthat could be adopted within Mumbai to make the architecture more interesting and as well help the city to establish an identity and relate to buildings that are being built in the city of Mumbai.

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ACKNOWLEDGMENTS

First and foremost I would like to thank my thesis guide and Chair Dr. Janet R. White for her valuable and dedicated guidance without which the completion of this thesis would not have been possible. I would like to express my gratitude to Mr. Dave Maynard for giving me his valuable input and time to help me shape my thesis in its early stages. I would sincerely like to thank Hemal for his support else it would be impossible. Lastly I would like to thank God and parents without whose good wishes and blessing helped me to achieve my goals.

CHAPTER 1

INTRODUCTION

Bombay has adapted to various styles of architecture and overtime it is felt that keeping in mind the cosmopolitan nature of the city it is important that the city continues to adapt to various architectural influences but in the right spirit. Even today, what serves as image centers are pre independence buildings like the Rajabai Tower and the High Court, or urban artifacts like the Flora Fountain and Gateway of India which were built in the 1830's or structures built in the early 1900's. None of the buildings, except a few in the last half-a-century evoke the same kind of public identification and pride. There are a few contemporary indigenous Indian architects who are trying to create architecture that Indians can identify with; they are creating architecture that is modern in construction technology as well as has an Indian spirit. Few overall have succeeded in creating a national identity after centuries of domination by the colonizing empire. The post-Independence period saw the emergence of two schools of thought in architecture -- the Revivalist and the Modernist. The Revivalists, who advocated "continuity with the past", could not break the shackles of the colonial legacy and left no significant impact on the neo-Indian architecture. The Modernists depended too heavily on the European and American models and tried to adopt them in India without taking into consideration the regional aspirations, diversities and requirements of the people. The contemporary Indian architecture was also beset with problems like population explosion, lack of vision among the planners, lack of support from the government and a less than satisfactory standard of architecture education. The result was that, during the initial years after Independence, foreign architects continued to play a leading role in Indian architecture. Raj Rewal, Achyut Kandive and Charles Correa represent contemporary indigenous Indian architects.

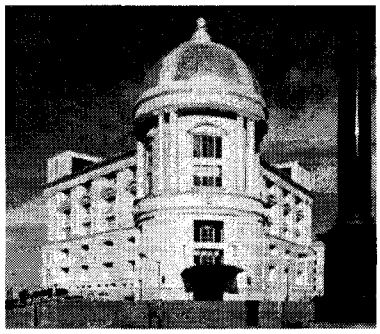

Figure 1 Out of proportion Florentine dome over the Classical façade.

Our architect's (Mumbai city) today pair up neo-classical pseudo-Corinthian columns with ultra-modern circular windows and top the ensemble with a Florentine dome (fig 1). It seems like picking elements from prefabricated catalogue. Lack of imagination is leading to the production shoebox architecture or architecture that still copies and duplicates old classical elements in an irrelevant manner.

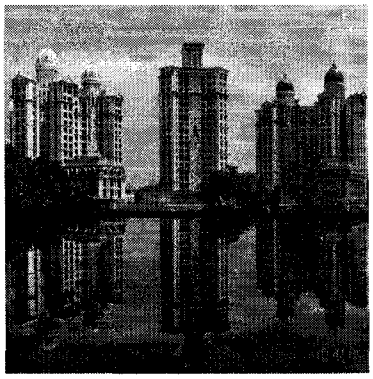

Figure 2 Hirnandani Towers, Mumbai

Whether this is the result of a creative bankruptcy or the crass commercialization of architecture, it is a disheartening reality and does not bode well for the architectural scenario of the city of Bombay.

One simple question that gets Bombazines thinking is they still recognize their city with landmarks built during the early periods. It is very difficult to associate this same city with factory designed monotonous buildings. Bombay city evolved like a canvas, which got enriched with

various Architectural expressions, but it is felt it is loosing its nature to adapt and produce buildings we can cherish for always. Also it makes one think if it's stagnation and if it is what it could leads to.

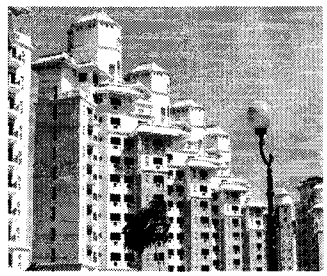

Figure 3 Lake Castle Mumbai city.

Figure 4 Peregrine, Mumbai

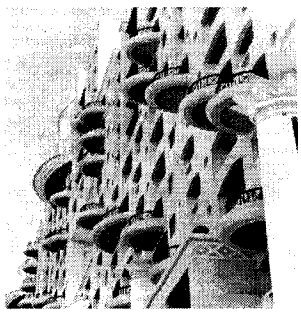

Figure 5 Lake Castle, Mumbai

CHAPTER 2

THE ARCHITECTURE OF MUMBAI (BOMBAY) CITY

Gothic Revival (1830-1880)

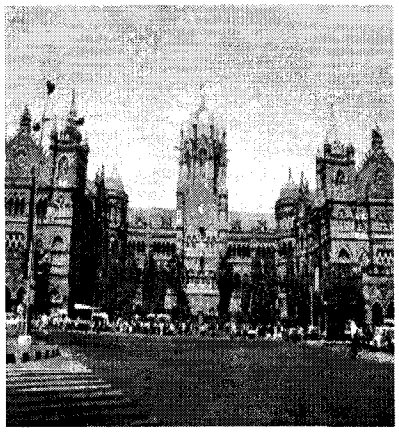

Figure 1 Victoria Terminus, Mumbai

Gothic Revival architecture dominated the city of Mumbai from 1830-1880.Landmarks such as Victoria Terminus (Fig 5), Rajabai tower and Afghan Church was built during this period. The British wanted to establish their presence and so introduced Gothic revival through architects such as Fredrick Stevens. Establishment of the Central Indian railways helps to propagate the style. Bombay resembles Victorian London not just in its civic architecture but also in its exuberant color and sheer dynamism. This can we justified by comparing structures such as Victoria Terminus to St.Pancras station, The Rajabai tower to the Tower in London or Afghan Church to the Christ Church in London. The Reason for Gothic Revival was political as the British wanted to establish supremacy of power.

Indo Sarcenic Architecture (1860-1900)

Figure 7 Prince of Wales Museums, Mumbai

The Jeypore Portfolio in which Jacob presented 600 detailed drawings of elements picked from various buildings initiated evolution of IndoSarcenic architecture. It was a direct result of the British looking for a style that would be more adaptive to the Indian subcontinent and it manifested as a hybrid style. Arches and domes were very economical to span large spans in design of huge public buildings such as the General post office, The Prince of Wales museum (Fig 7), and The Gate way of India remain landmarks the with which the city is still identified with. IndoSarcenic architecture. IndoSarcenic architecture was inspired from Islamic architecture including features such as jails, domes, sqiunch and arches to name a few. It also adapted various features from European architecture around the world. It was inspired from Gujarati architecture, as well as there is an influence of Rajasthan architecture.

Edwardian Architecture (1900-1920)

Figure 8 Ballard Estates in Mumbai

Change in architectural style was observed with construction of the Ballard estate (Fig 8). It was adapted from Edwardian architecture in London and Bath and Cheltenham. It was a more simplified style having simple rectangular opening with a prominent keystone. Buildings had sloping roofs not visible from the road f. There was less of ornamentation and less of detailing to buildings. Buildings build all across the Ballard estate were similar with respect to height and the opening decreased in size on each upper story. The Ballard estate established it self to a commercial office precinct where major business are conducted till present day. Introduction of Edwardian style of architecture was felt to meet the growing need of building public buildings, which were less ornate and so would take less labor.

Pre Independence Architecture (1920-1930)

Bombay maintained its dynamic character both in terms of its architecture and its general growth right up to the First World War. Claude Batley designed many structures during this period. He believed that talent does not lie in copying European architecture or traditional Indian architecture but in analyzing and make operative those aspects of traditional Indian architecture that would help build a better architectural vocabulary for the future. There was a change in spirit wood and reinforced cement concrete, he tried to use a combination of modern materials and traditional elements and values replaced steel.

Art Deco Architecture (1930-1947)

Figure 9 Art deco architecture in Mumbai.

With the Paris exposition in the 1920's-1930's Art deco dominated the construction of the Marine Drive stretch (Fig 9). It's called the Queens necklace. All buildings facing the sea were constructed in Art deco style inspired by Miami Beach house. It adapted very well as both Bombay and Miami have similar climate and topographies. Structures were built 4 story tall having sunshades balconies, geometrical motifs, colorful bands. Its effect was seen on ornamentation and street furniture too. Industrial change and Cinemas were a major factor that brought in Art deco architecture.

CHAPTER 3

STUDY OF TRADITIONAL INDIAN ARCHITECTURE

3.1 Indian Temple Architecture

Indian Hindu temple architecture can be divided into three distinct styles - North Indian temples architecture, South Indian temples architecture, and Deccan temples architecture.

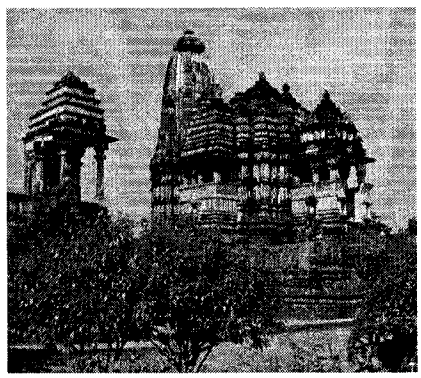

Figure 1 Jagadamba Temple - Khajuraho - Madhya Pradesh

The Northern style, (Fig 10) which developed by the fifth century, is characterized by a beehive, shaped tower (called a shikhara, in northern terminology), topped by a large round cushion-like element called an amalaka. The plan is based on a square but the walls are sometimes so broken up that the tower often gives the impression of being circular. Moreover, in later developments such as in the Chandella temples, the central shaft was surrounded by many smaller reproductions of itself, creating a spectacular visual effect resembling a fountain.

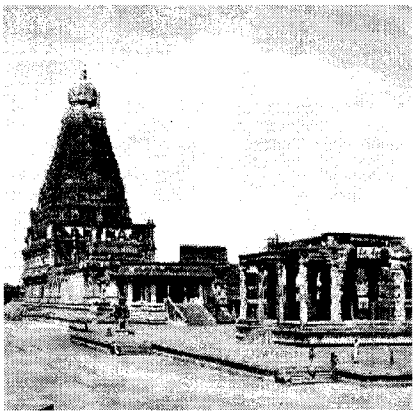

Figure 11 Brihadeswarar Temple at Thanjavur

The Southern style (Fig 11) has a pyramid shaped tower consisting of progressively smaller storey of small pavilions, a narrow throat, and a dome on the top called a shikhara (in southern terminology). The above story gives a horizontal visual thrust to the southern style. Less obvious differences between the two main temple styles include the ground plan; the selection and positioning of stone-carved deities on the outside walls and the interior, and the range of decorative elements that are sometimes so numerous as to almost obscure the underlying architecture.

The Deccan style of architecture

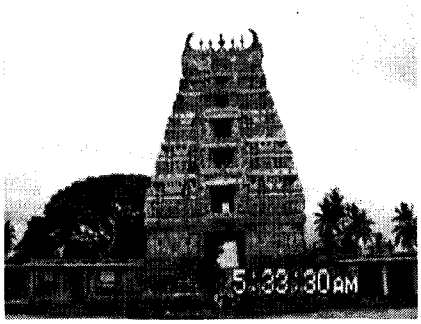

Figure 12 Chennakesava Temple at Belur

Figure 12, gopurams (gateways) led the devotees into the superstructures and, capped with a barrel-shaped roof these were in fact to become the most striking feature of the south Indian temple. They become taller and taller, dwarfing the inner sanctum and its tower and dominating the whole temple site. From the fourteenth to sixteenth century onward, these highly embellished and often brightly painted structures become extremely numerous. The width of the stories of pavilions and other architectural elements were carefully adjusted to create a concave contour, which is a distinctive characteristic of the Deccan style of Temples.

Various plan types in Indian temple architecture.

The plans of temples were basically divided in various types depending on the number of projecting elements it is composed within the plan. A plan having three projecting elements (ratha) on each side was called a three-ratha-plan. Similarly the number of projecting elements in plan increased as seen in Fig. 13 from five called the five –ratha to seven called the seven – ratha respectively.

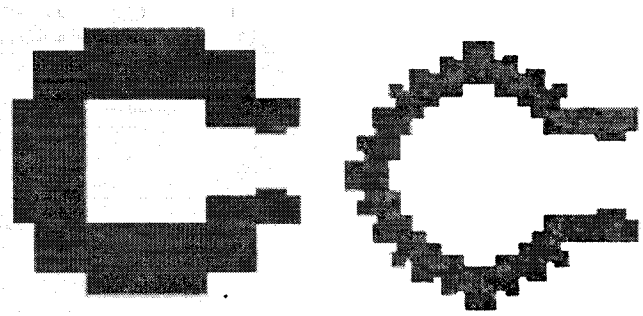

Figure 13 The three ratha and seven ratha plans.

The plan is composed of the (mandala) (Fig.14) 8 by 8-square grid, which governs the plan of the sanctum of the temple (Garbha griha). The north Indian temples were divided in a 9 by 9 square grid with a symbol representation to each deity.

Yantaras (symbolic representation of sacred forms such as lotus, triangles etc) were another important feature representing various celestial gates or openings within the temple. Its geometry formed a symbolic illusion of a triangle within a lotus.

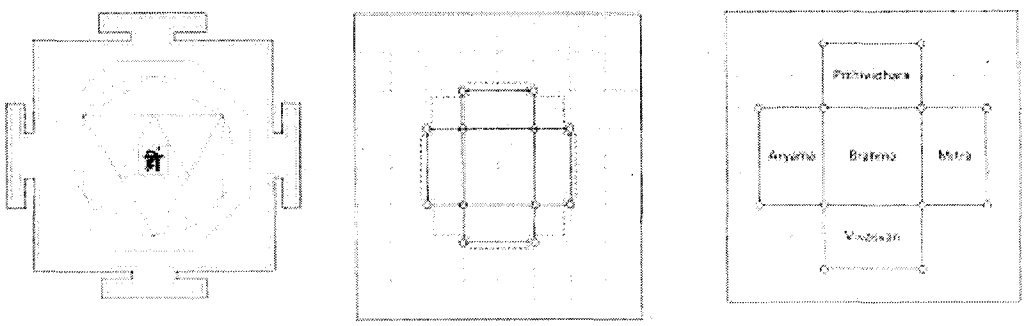

Figure 14 The various layouts for Temples.

Indian temple architecture

Example - Parashurameshvara Temple at Bhuvneswar (India)

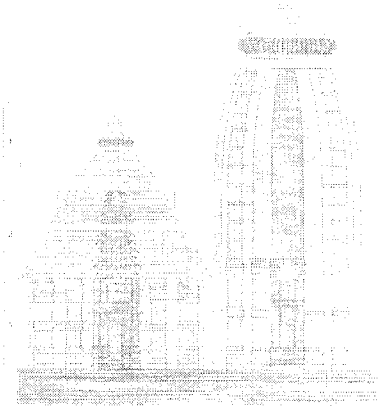

Figure 15 Elevation of the Parashurameshvara Temple at Bhuvneswar.

The Brahmeshwar temple in situated Bhuvaneshwar.It was built in the year 1075.It has a horizontal plinth with dance halls and vertically shows a solid pyramidal roof. It has four small turrets at the corner of its precinct. (Fig 15) shows the elevation.

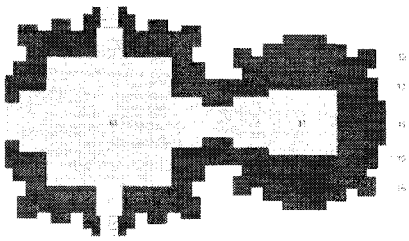

Figure 16 Plan of the Parashurameshvara Temple at Bhuvneswar.

The plan is based on a rectangular module of 2:3 ratio, fourteen square grids wide (Fig 16). The sanctum is at the center of the upper square. Four secondary towers form a group of five. The design reproduces a classic cosmological pattern. The section shows the enormous roof-structures which dwarf the confined internal spaces.

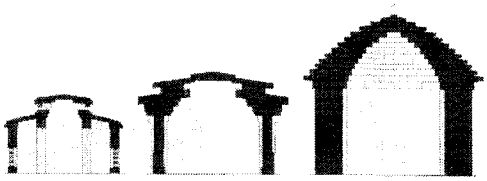

Figure 17 Various roof structures developed for temples within the similar region

3.2 Indian Temple Reservoir Architecture

Introduction - Water has played an important role in the architectural heritage of western India from the earliest times as observed in step wells and Kunds (water reservoirs). The Kunds and step-wells of Gujarat, India consist of two parts: a vertical shaft from which water is drawn and the surrounding inclined subterranean passageways, chambers and steps which provide access to the well. The galleries and chambers surrounding these wells were often carved profusely with elaborate detail and became cool, quiet retreats during the hot summers.

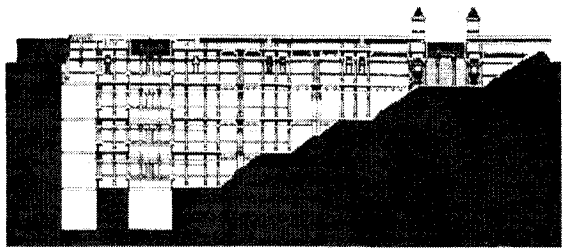

Figure 18 Section through the step wells of Adalaj

Step wells of Adalaj

Step wells at Adalaj were built around the 14th century. Local architects and builders built these. Such wells were built from the 11th century to the 16th century; some descend seven levels below the ground (fig 18). The entrance to the well is where the worship took place; a number of shrines were erected in honor of certain deities. Even on hot days the platforms and the galleries were cool and dark, a perfect refuge from the blazing heat of the sun. This would act as a meeting ground for socializing for village folks. The plan follows a linear circulation.

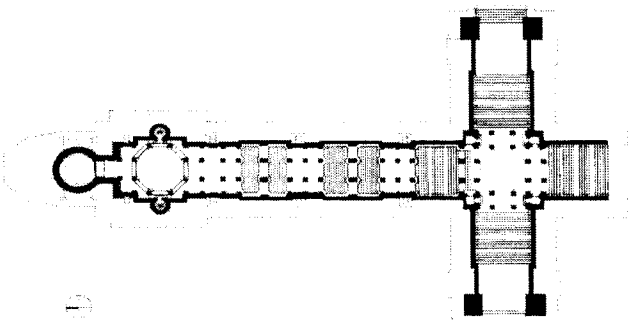

Figure 19 Plan of step wells at Adalaj

The *step –wells* at Adalaj, located 12 miles north of Ahmedabad, is octagonal. As the long flight of steps descend columns and connecting beams create open structures of increasing complexity; the receding perspectives of columns and crossbeams are particularly striking. Wall niches incorporate miniature pilasters, eaves and roof-like pediments.

Kund (water reservoir) at Kapadvanj

The kund at Kapadvanj was designed to be a temple reservoir. Kunds were designed around 1026-1027 AD. It was built in city of Ahmedabad in Gujarat originally a sanctuary set up by a sect called the Sun-Worshipers in honor of the Hindu sun god called Surya. Today these kunds are used by a certain section of Indian society called Brahmins for ablutions.

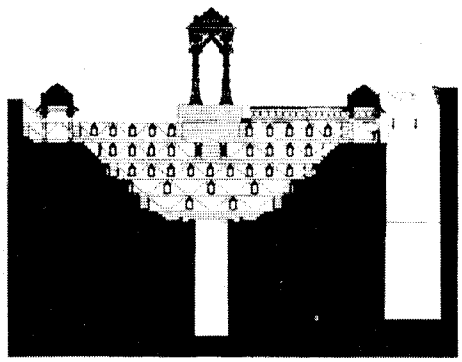

Figure 20 Section through the reservoir at Kapadvanj, Gujarat.

The notion of formal access to a source of water was deeply rooted in the religious traditions of the Hindus.

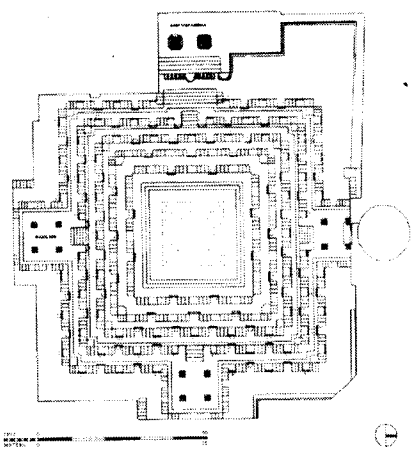

Figure 21 Plan of water reservoir at Kapadvanj, Gujarat.

The local crafts man built these. The reservoir was also built because the climate was hot and had high humidity .Day light was brilliant and nights were clear. This reservoir consists of a steep flight of steps from assembly hall leading to the direction of the morning sun. There were seven large shrines around the reservoir and sixty-four smaller shrines. All parts of the structure were built without the use of mortar.

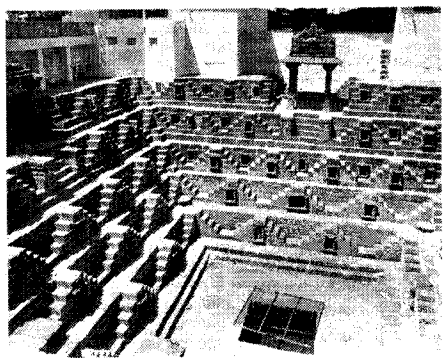

Figure 22 View of Kund as seen in Kapadvanj in Gujarat

The plan (Fig 22) reflects the effect of cosmic architecture having the mandala planning were the central core of the nine square grids had major significance as seen in the reservoir as the central square was occupied by the water body that was considered sacred.

3.3 Role of Cosmos in Traditional Indian Architecture.

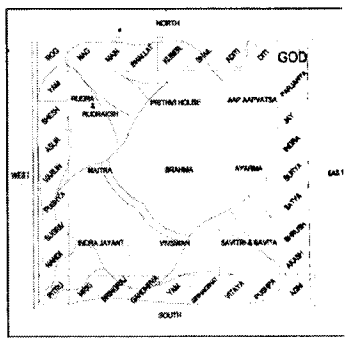

Figure 23 Vastu purush mandala

Cosmic architecture was seen in India in the 13th century AD; it was a principal factor in the design of temples, cosmic architecture has been observed in Mosque Design too. It shows the harmony that can be achieved designing structure. Cosmic architecture revolves around three basic principals as observed below.

1. Mandala-architecture revolves around the cosmos According to the Vastu Purush Mandala. Vastu means surrounding and Purusha means man. Mandala is the astrological chart that relates the layout to orientation. The principals of orientation are directly related to the Vastu purusha mandala. The plan of the layout of a temple or a residential building is technically called Vastu Purusha Mandala. It consists of a grid of 8 x 8 = 64 spaces or 9 x 9 = 81 spaces of equal dimensions addressed as an energy grid (Fig.23), in a modern architectural context. In layout they are squares two dimensionally, and cubes tri-dimensionally. Derived from the likeness of the human 32 gods figure, with head in the northeast in the mandala of 64 squares, the legs in the southwest, right hand in northwest, left hand in southeast and other parts the body in other parts of the square. 32 gods or deities are constituent of the body of Vastu purush. When these are scrupulously followed proper ventilation and good disposition to Sun and privacy is ensured.
2. Manusha (Human being)-where architecture is a measure of man with respect to scale proportion of structure that is human scale in proportion to height, massing and size of openings of the structure.
3. Manthana (absorbing ideas)-which means to absorb new ideas blend them with preexisting architectural principals to create a new statement of design in traditional roots.

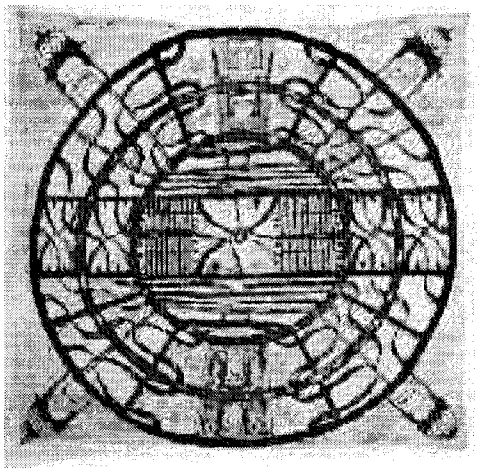

Figure 24 Cosmic charts in Buddhist and Hindu Architecture and religion.

In Cosmic architecture Mt. Meru - the mythical mountain, axis of the world, idea embedded in many of the eastern schools-Hinduism, Buddhist and Jainism. Mt.Meru is believed to stand in the center of the universe, with all the rest of the world laid around it in concentric rings. For four religions (Hinduism, Jainism, Buddhism and Bon-Po), Mt. Kailas in Tibet is believed to be the physical representation of Mt. Meru.

The planning of the entire city of Jaipur is based on the cosmic principals (Fig. 25).

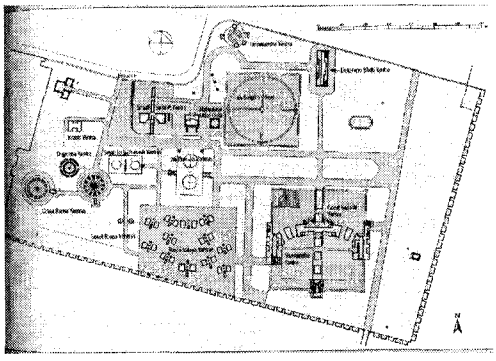

Figure 25 Plan of Jaipur city.

3.4 Palace Architecture in India

Introduction - The palaces of Jaisalmer, Bikaner, Jodhpur, Udaipur, and Kota represent the maturity of the Rajput style. All of these palaces were built predominantly in the seventeenth and

early eighteenth centuries. The huge fortified city of Jaisalmer is situated far out in the Thar Desert. The buildings are constructed with the local yellow-brown stone and they have been remarkably preserved owing to their remote location. An imposing 30 feet high sandstone wall encloses the fort. Wells within the fort provided a regular source of water.

Jaisalmer Palace architecture

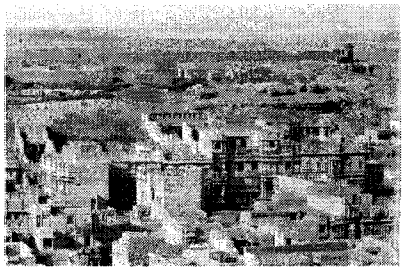

Figure 26View of Jaisalmer

Jaisalmer was one of the greatest cities in palace architecture in India. Situated in Rajasthan at the edge of the Great Indian Desert, founded in 1156 by Rao Jaisalji (Military ruler) as a military fort. The climate was hot in daytime and cool at night. Numerous mansions were developed, some larger, some smaller. The planning of these mansions showed much influence of traditional cosmic architecture and mandalas as discussed earlier.

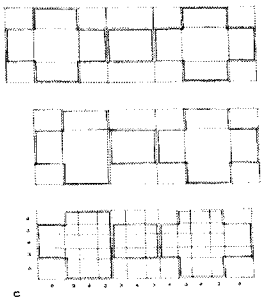

Figure 27 Plans are simple end rectangular in design show the influence of the mandala planning

In a typical house plan, (Fig 27) every space except the kitchen; the staircases and the toilet changed its purpose with the passing day. While the sun was still low, the members of the family

went about their normal business in the highest space. As the day became hotter they moved down to darker and cooler places.

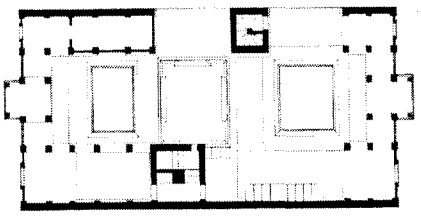

Figure 28 Typical plan of house built in Jaisalmer.

At Night the sun -warmed terraces (Fig. 29) provided good places for sleeping. If the night were particularly chilly 'the fire at the bottom of the courtyard would warm up the immediate environment. There were two vertical circulation systems, one meant for formal use and the other meant for services use.

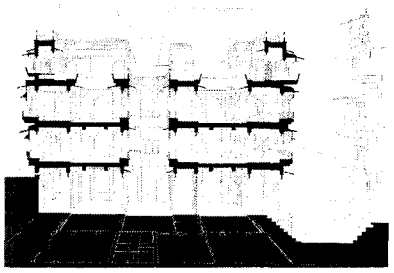

Figure 29 Section through typical palace complex at Jaisalamer.

The spatial system consisted redundant interpenetrating horizontal and vertical voids based upon a distorted double cross plan. Or, alternatively, a prism eroded from the top in such away that as to leave kind of an inverted pyramid of open space to the sky.

Figure 30 Connecting terraces and play of mass and voids.

A system of level changes reinforces the idea of the cross plan in the front and back half of the building. In plan a wide and narrow band of spaces along party wall denotes a major and secondary circulation zone. The relationship between the central court and the main and secondary vertical circulation spaces corresponds with their respective functional significance.

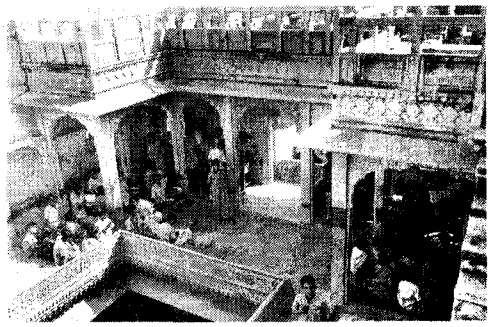

Figure 31 Internal courtyards help deal with the hot climate

3.5 Islamic Architecture in India.

Mughal (Islamic) architecture throughout its history blended local Islamic and Hindu building traditions with those of Central Asia and Iran. The Mughal emperors moved between their imperial capitals of Delhi, Lahore, and Agra, where they constructed a variety of building types including palaces, gardens, mosques, forts and whole urban schemes in addition to celebrated mausoleum like the Taj Mahal.

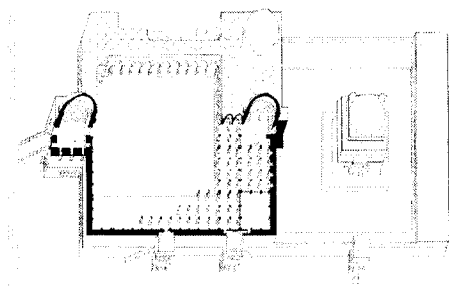

Figure 32 Plan of a typical mosque in Islamic Architecture

Mughal architecture consists of mosque tombs and palaces. In mosque design the shaded area on the south side of the courtyard could be used for prayer in the direction of Mecca. An early development of this basic plan was the provision of shade on the other three sides of the courtyard, forming a basic plan, which has become known as the Arab-plan mosque. Architecture in the Mughal Empire was formed from the Persian and Indian style of art. Mughal architecture consisted of arches, domes, towers, indentures, and carvings. To show the greatness of the Mughal architecture, the buildings tended to be tall and enormous. The best example of the Mughal architecture is the Taj Mahal, made by Shah Jahan, a Mughal ruler. There was much pride taken in their architecture because it showed the power of the Mughals.

Figure 33 Arches and squinches were essential features of Islamic architecture.

Islamic architecture is characterized by arches (Fig 33), which are employed in all types of buildings from houses to mosques. One of the most common uses is the arcade in which a series of arches span between two of columns or piers to support the roof of the gallery open on one

side (Fig 34). Arcades are used to line mosque courtyards although they are also used in courtyard houses. The earliest form of arches employed in Islamic architecture was the semi-circular round arches which were characteristic of Roman and Byzantine architecture.

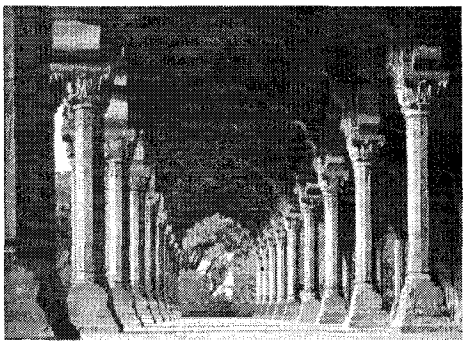

Figure 34 Colonnades in Islamic architecture.

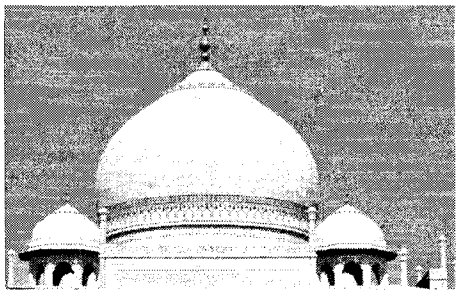

Figure 35 Domes in Islamic Architecture

During the medieval period, Islam developed a wide variety of dome types (Fig 35), which reflect dynastic, religious and social distinctions as much as different construction techniques.

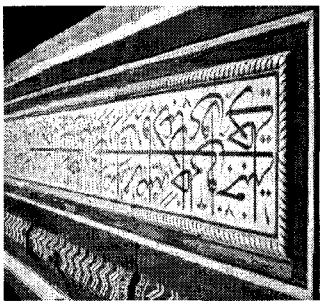

Figure 36 Calligraphy in Islamic architecture.

Calligraphy (Fig 36) was an art of writing that adorned the walls of mosque and palaces often inlaid in marble and other stones. The universal employment of geometric ornament of amazing complexity is one of the main characteristics of Islamic art.

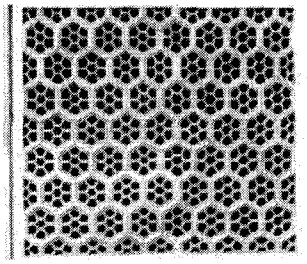

Figure 37 Jalis in Islamic architecture.

Geometric designs are patterns composed of geometrical elements like the Trigon, square, rectangle, pentagon, hexagon, octagon or other polygons, stars or motifs with straight or curved lines.

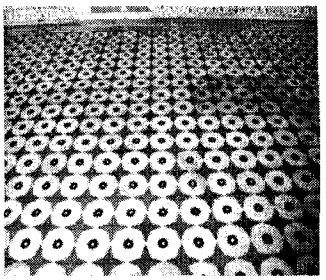

Figure 38 Decorative mosaics in Islamic architecture

Mosaic (Fig. 38) can be defined as the decoration formed of small pieces of hard substances such as glass, stone and marble, which are generally multicolored and joined in a certain order to form a particular designs. Depending on the material used, mosaic can be of different types like stone mosaic or glass mosaic.

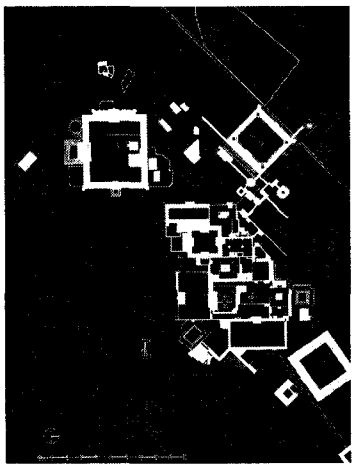

Figure 39 Plan of Fathepur Sikri based on principals of Cosmos.

The city of Fathepusikri is a classic example of structures planned with respect to cosmic architecture. This city planning has inspired many modern architects. It is planned on a grid according to the Mandala planning concept. It has many structures within the complex, each one having a unique architectural expression.

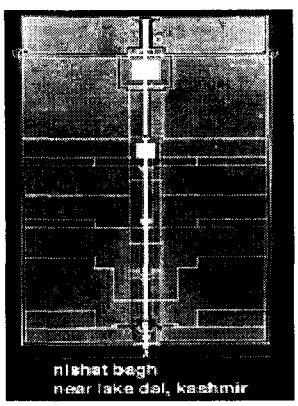

Figure 40 Plan of Nishat Bagh Gardens in Kashmir.

Islamic gardens transcended the embodiment of local tradition and Islamic ideology' becoming as close as man can come to Paradise on earth. The Charbagh (a magnificent four-quartered garden) was a garden filled with pavilions, pools and fountains, and the most beautiful, sweet-smelling flowers and trees. In Mughal gardens there is no strict distinction between garden and building, each flows seamlessly into the other, but in palace gardens in particular there are differences of space and function and areas designed for court ceremonial are increasingly separated from the restricted areas of the zenana (woman), the women's quarters and the place of the harem.

Example of Islamic architecture

Gol Gumbaz Bijapur, India

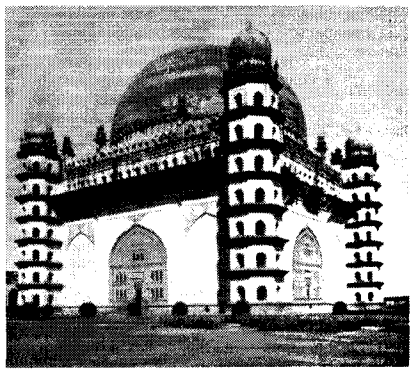

Figure 41 Gol Gumbaz at Bijapur

The Gol Gumbaz (Fig 41) built by Muhammad Adil Shah (1656), the seventh ruler of the Adil Shah dynasty, as his mausoleum set in a garden suggests Paradise. Its fantastic dome with a diameter of 125 feet covers the largest uninterrupted floor space in the world-18, 337 square feet. Islamic architecture had learned to span large openings with column free spaces. Squinches were used to support the dome.

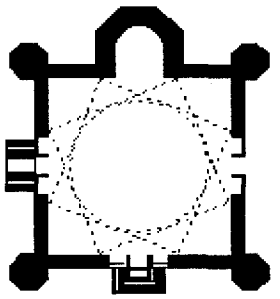

Figure 42 Plan of Gol Gumbaz

Turrets (Fig 43) were another common feature observed in Islamic architecture and seen in Gol Gumbaz too. It contained the staircases. Externally the tomb is a massive cube, with octagonal seven storied towers topped by small rounded domes, projecting at the corners. Each face has three shallow arches-large central arches, flanked by two smaller arches. In line with the sixth story of the corner towers is a projection on the tomb walls, supported by closely set brackets, above which is a band of small arched openings. The parapet has a decorative edging, beyond which rises the bulbous dome with a foliated drum which is a typical feature of Bijapur's buildings apart from a preference for the pier over the pillar and a crescent finial surmounting spires, to denote the ruler's Turkish origin.

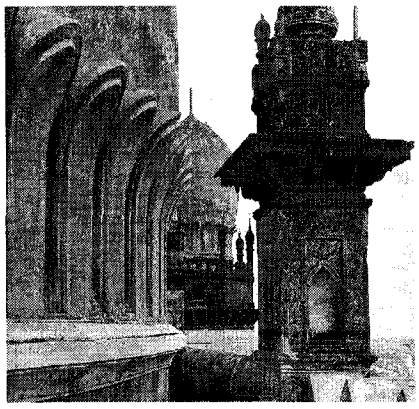

Figure 43 Turrets seen at Gol Gumbaz.

The key to the entire plan (Fig 42), of supporting the immense dome over the square room below, was solved by constructing eight pointed intersected arches which, perfectly stable and contracted any thrust from the weight of the dome. The arches support a circular platform above that encounters the base of the dome. The transition from a square chamber below to the circular base of the dome was possible by intersection above producing an octagon. The interior surface of the dome is about 12 feet from the inner edge of the circular produced by the arches, so that a proportion of its weight is transmitted directly down-wards on to the four walls, the remainder being carried on the intersecting arches.

3.6 Havelis Wooden Houses in Gujarat, India

Introduction-Havelis were an important part of Domestic or Vernacular architecture in India. They reflect a life style that was very significant in human terms having intimacy in life style that seemed to be lost in contemporary architecture. These buildings were constructed around 1820 but still, 150-200 years later, stand strong and are inhabited by people in Gujarat.

Example: Amin haveli ,Vaso ,Gujarat

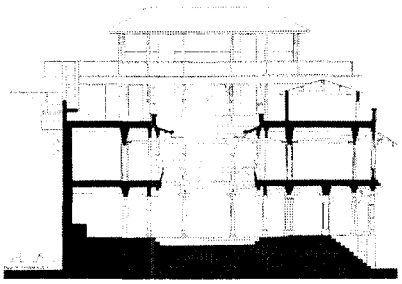

Figure 44 Section through Amin Haveli.

This building was built in the mid 19th century (Fig 44). The core consists of four outdoor seating areas called the ordos. The central courtyard is surrounded by passages and has a well in one corner .To the left in the floor plan are the storage areas on either side of the kitchen. Opposite of these rooms are chambers for bathing and washing.The area around the courtyard

shows carving that is elaborate. The first floor (Fig 45) has a huge living area called the Diwan Khanu.The rest of the floor plan is similar to the ground floor layout.

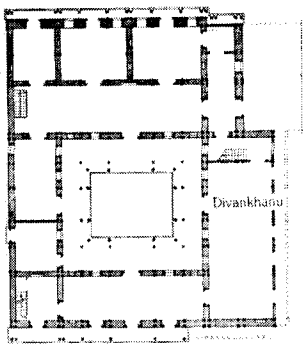

Figure 45 First floor plan of Amin Haveli

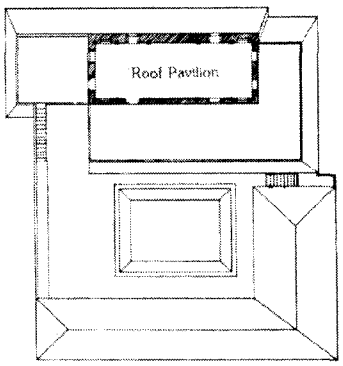

Figure 46 Terrace plan of Amin Haveli.

The second floor plan has a large terrace from which rainwater is collected and channeled to an underground cistern. It also has a room for the helpers or maids working in the house. The third floor has a pavilion for catching the evening breeze.

3.7 Buddhist Architecture in India

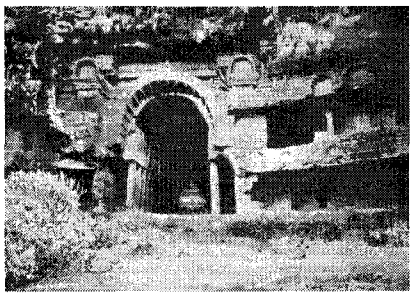

Figure 47 Cave temples at Ajanta and Ellora

The beginnings of the Buddhist school of architecture can be traced back to 255 B.C. when the Mauryan emperor Ashoka established Buddhism as the state religion .Buddhism was, as it were, a graphic creed, and correspondingly its expansion was accompanied by a distinctive style, several stupas were built in this style. Stupas, are sacred mounds of brick commemorative of the Buddha. Asoka (emperor) also constructed stone pillars symbolizing his creed. These were lofty freestanding monolithic columns erected on sacred sites. The most famous of these is at Sarnath. At about the same time that the Buddhist communities were elaborating on Asoka's chaityas (Fig 48) and stupas, an entirely different form of Buddhist architecture was developing in western India. These structures were not, however, built of stone or wood, but carved out of living rock.

Figure 48 Chaityas at Ajanta Caves.

CHAPTER 4

STUDY OF VARIOUS CONTEMPORARY INDIAN ARCHITECTS WORK

4.1 Case Study - I

Common features of Architect Raj Rewal's work

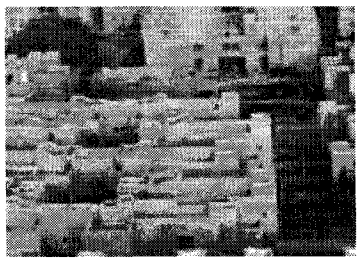

Figure 1 Creating a new urban pattern along the traditional lines- NIM, RajRewal.

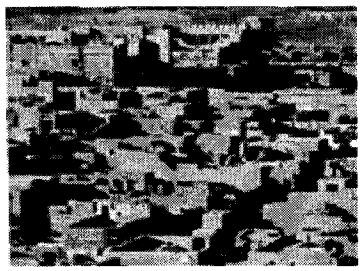

Figure 2 Cool shadows result from the built fabric of city-Jaisalmer

Raj Rewal in most of his projects has absorbed elements from India's past and given them an effective new expression. His tactic has been to investigate material, certain vernacular forms, and interpenetration of urban places with respect to India's climatic conditions. He has carefully studied places such as the FathepurSikri and the palaces of Jaisalmer and 'incorporated' in various projects. His work has a sense of history of both western & Indian cultures. Incorporating historic precedents into architectural design.

The National Immunology Institute (Fig.49) shows the interactive roof terraces as seen in houses build in Jaislamer city (Fig.50) in Rajasthan. His concern with tradition are genuine .He not only believes in use of decorative elements of the past but it also involves reconstructing of life of communities and families. Another feature is like the traditional Indian houses he uses cluster in his designs creating a link between the mass and the voids. The identity of an individual

is absorbed in a collective whole. Cluster of volumes achieve a unity through the similarity in facade treatment of Jaisalmer city.

Figure 51 NIIM by Raj Rewal

Figure 52 Façade treatment Jaisalmer

Gateways were built in the cities to define particular zones and to keep intruders out (Fig53). They act as punctuation marks in urban form and open up a new sequence of spatial experiences. Entrance gateways are used in housing schemes to mark territory. Linking overhead functional roof terraces forms gateways, or joining cantilevered rooms in adjacent apartments. Raj Rewal has beautifully used this concept of the NII. Gateways in Jaisalmer (Fig.54) define the housing zones, joining terraces, cantilevered rooms.

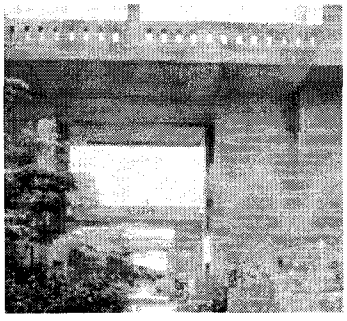

Figure 53 Gateways seen at NII.

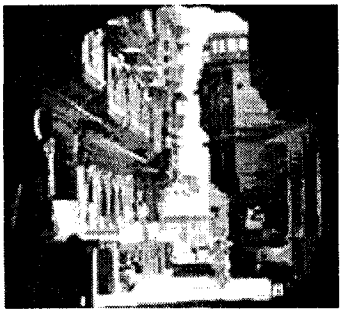

Figure 54 Gate ways used in the Jaisalmer.

Raj Rewal designed the Hall of Nations Exhibition hall in 1970 (Fig.55).He created a column free space. Fenestrations and sun breaks were incorporated in 5-mt depth of the frame. View of the interior of Hall of Nations exhibition hall has window openings that constitute a modern

interpretation of carved window openings this constitutes a modern interrelation of carved window screens, or jalis, in ancient buildings. An example of an ancient jali work. (Fig.56) Jalis were designed in order to filter in the natural light and create an interesting geometry of solid and voids.

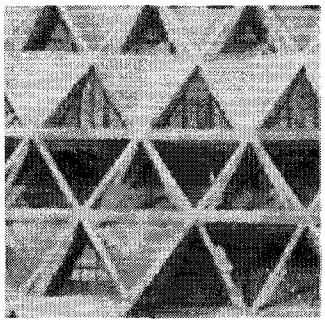

Figure 55 Façade of Hall of Nations.

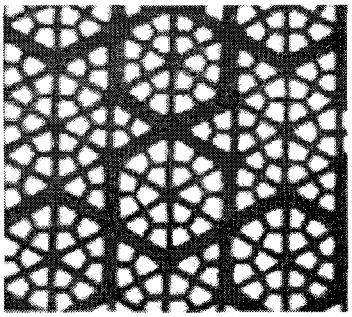

Figure 56 Jalis in Islamic buildings.

Courtyards (Fig.57) formed the basis of planning for temples, mosque, and educational institutions. They create microclimate, free from dust, heat and sand storms. Courtyards are protected by external walls and verandahs, or are defined by rooms and act as light and air wells in which cool night air is trapped. The suns rays touch the courtyard in the afternoon, causing heated air to rise, setting up convection currents, resulting in airflow ventilating the surrounding rooms. It's a place of community interaction.

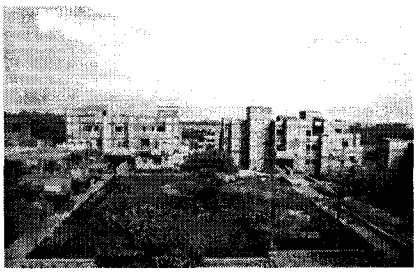

Figure 57 Court Yard at NII.

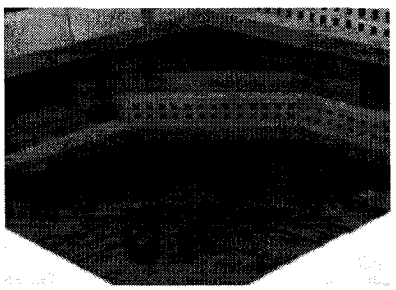

Figure 58 Internal courtyard at NII.

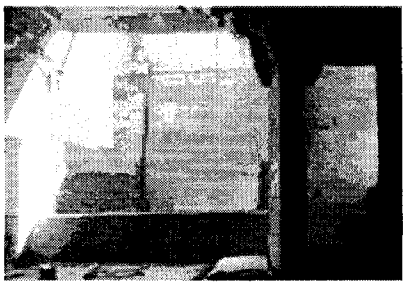

Figure 59 Internal court at Jaisalmer.

An internal courtyard is a part of an interlocking system within the complex. Adapted from the JodhaBai's palace at FathepurSikri. In Jaisalmer effects of lighting and cool breeze were achieved and created by using the small courtyards.

Example-The National institute of Immunology, New Delhi, 1983 - Raj Rewal

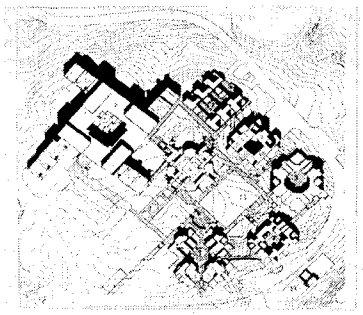

Figure 60 Plan of NII.

Research institute comprising: an institute block, senior staff housing, junior staff housing, lower staff housing, a lecture hall complex, and an animal housing facility (Fig.60). Individual buildings and clusters are arranged around courtyards .The plan is tight clustered with numerous buildings relating to contours, through architectural massing and detailing by linking different blocks.

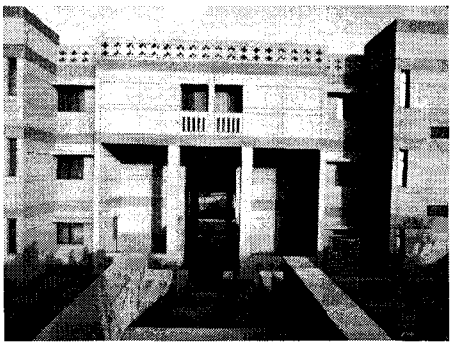

Figure 61 Internal view of building.

The complex consists of housing for the senior's scientists and their families. These units have their own terraces, are disposed around a central courtyard, which offers focus for community interaction .The upper duplex apartments are diagonally placed open stair cases along facades, contributing to a sense of individual access and social visibility.

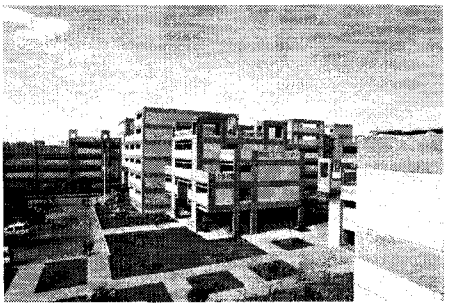

Figure 62 Courtyards play an important role in linking spaces.

The central courtyard (Fig, 62), in shadow most of the day, is also intended as a place for children to play especially supervised from the roofs. Courtyards have traditionally always been an important component on Indian architecture as seen in earlier Jaywalker Mansion. A courtyard is supposed to shade in hot summer and trap sunlight in cold winters.

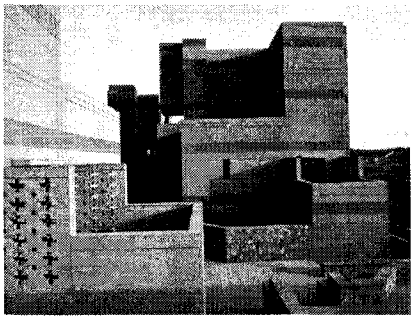

Figure 63 Connecting terraces at NIIM.

Traditionally terraces were used as a place to sleep since in summers they would absorb a lot of the heat but still prove soothing at night. Also is seen the influence of Islamic architecture as jails (perforated screens) are used in order to trap in the sunlight and filter the breeze (Fig.63).

Internal courtyards as seen in the houses in Jaisalmer help to trap in diffused lighting. They help to create a nice shaded are in hot summer months at the same time in winter they act as spaces that collect sunlight during the day, keeping it warmer during the evenings (Fig.64)

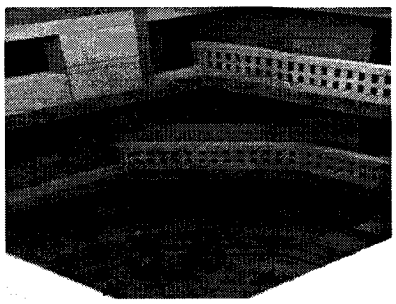

Figure 64 Internal courtyard within Building.

Interesting spaces have been created by the means of corridors, terraces, balconies etc. The architect has created diverse changing perspectives through open and closed outdoor spaces.

Fountains and plants adorn the main building's courtyard where employees and researches gather to relax. Water bodies have always been an important part of Indian architecture. Not only does water create a soothing, healing environment it is also supposed to be a climatic feature adding cooling effect.

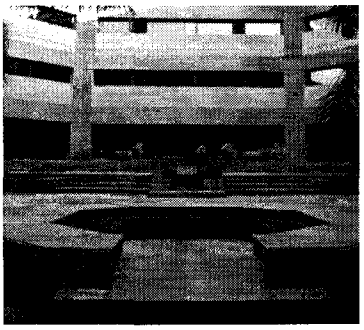

Figure 65 Water body used internally.

4.2 Case Study - II

Common features observed in Charles Correa's work.

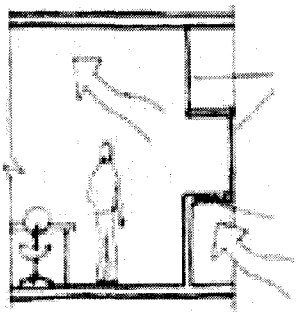

Figure 66 Air circulation features used within the L.I.C building as well as the Vivessurya building in Bangalore.

In various projects, instead of air-conditioning Charles Correa has taken advantage of the strong wind currents that swirl around the tower to provide air circulation within these office buildings. He has used this design feature at the L.I.C building as well as the Visvessurya building in Bangalore. It shows conservation of resources, making the best of what is available.

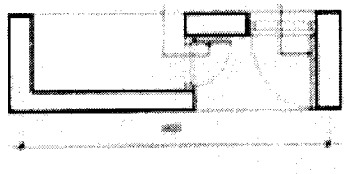

Figure 67 Detail of openings on external walls.

In the external walls the light and ventilation enter through the open glazed panels while the wooden ones are closed to keep the sun out (Fig.67).

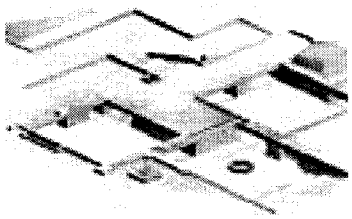

Figure 68 The Kund observed in various designs.

The kund (Fig.68) signifies an area where people can get together it is a forum for interaction. It was traditionally a stepped water tank.

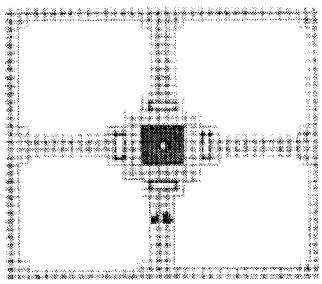

Figure 69 Charbagh Garden planning observed in various designs

The Charbagh concept (Fig.69) is a principle of garden design in which a formal path way is created (ritualistic pathway).It evolved from Islamic garden architecture. These features were observed in various projects designed by Charles Correa. These further added interest as landscape features.

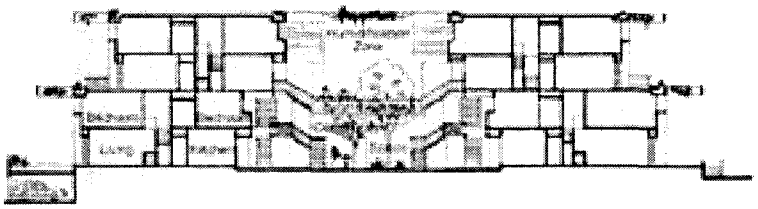

Figure 70 Section through the Tara group housing Delhi, India.

Courtyards (Fig.70) were an essential feature of building design and also water bodies. Courtyards create a central area which allows the units to shade each other in hot summers and a central community that's landscaped with trees and water bodies which would cool the winds and the entire complex. The design and structure created modern in design and method of construction but incorporates various elementary design principles observed in traditional Indian architecture.

Figure 71 Dome at IUCCA, Pune, India.

Use of iconology in cosmic architecture is observed in Correa's work. Iconology expresses a strong sense of iconography derived from cosmic architecture that is related to astronomy. Sometimes it's relevant to the use of the building as observed at IUCCA, Pune, India.

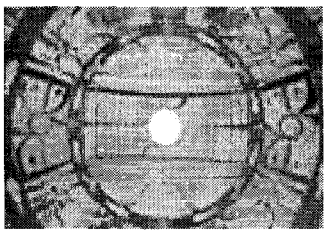

Figure 72 Dome seen at the Jawaharkala Kendra showing Buddhist

The dome in the administrative section signifying power, based on the Jain cosmology, (Fig.72) depicts rivers, mountains, animal's vegetation and world.

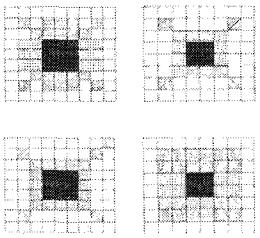

Figure 73 Vastu purush mandalas

Cosmic architecture has always been part and parcel of traditional Indian architecture. Charles Correa's designs are influenced by the archaic notion of the cosmos. His work represents a lot of symbols such as the nine planets, sun and the moon. The traditional symbol of each planet is expressed in marble and stone in the stone inlay walls around. Interiors are painted in auspicious colors. His work shows various symbolic elements, which are ayurvedic (Indian science of medicine) in origin, and they link different seasons with different 'Rashis' (constellation). Various buildings are based on principle of the cosmos eg:IUCCA-Pune, Jawahar Kala kendra-Jaipur, Surya kund -Delhi, National crafts museum -Delhi. The cube is the strongest form and plays an important role in architecture. Firstly it is made up of lines and planes that are visually clear. Secondly it is portray of the basic order, which with respect to astronomy is considered a spatial law. All of his designs have an influence of the vastu purush mandalas. Vastu-Purush-Mandal symbolically represents this amalgamation of good and bad in life and charts the path that can avoid vices and reinforce the virtuous qualities. In Vastu-Purush-Mandal,

deities are identified with the positive or negative confluence of these fluxes in relation to changing position of the sun.

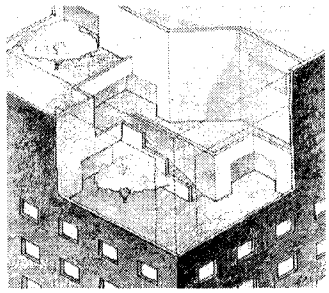

Figure 74 Use of color as seen in a building in Mexico

All of Correa's designs have a lot of color used inside as well as on the exterior facade of the building. He used colors in terms of material used for construction as well as colors used in painting the interiors; there are various examples such as the Citadel Goa, India, Alameda park-Mexico (Fig.74), Kanchenjunga apartment, Mumbai-India.

Example- British Council Delhi-Charles Correa.

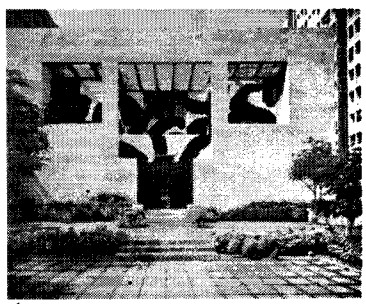

Figure 75 Front view of The British council in Delhi.

The British Council at Delhi (Fig.75), India was built in 1987-92.The building comprised of various functions such as the library, an auditorium, an art gallery and the head quarters of the British council offices in India.

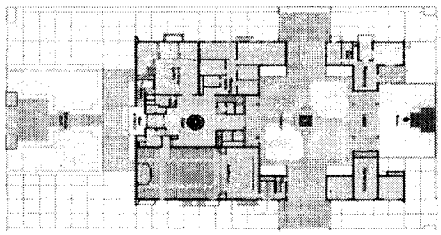

Figure 76 Plan of the British Council in Delhi.

The plan is based along an axis (Fig.76), which has three nodal points, which are structured along around three beliefs. The end nodal point opens into a spiral, which is supposed to be the cosmos or the center of all the energy. The next nodal point opens into the courtyard which is derived from the Islamic garden-planning concept called Charbagh (four gardens) or the garden of paradise. The third node opens in a European icon of tiles inlaid in marble and granite representing the British in India. In away it also represented as the age of reasoning and scientific progress.

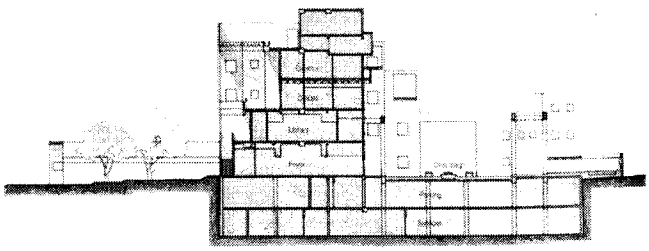

Figure 77 Section through the British Council Delhi.

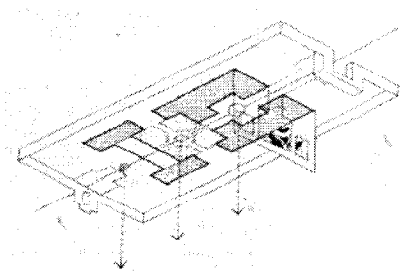

Figure 78 the three nodal axes as seen in the axonometric.

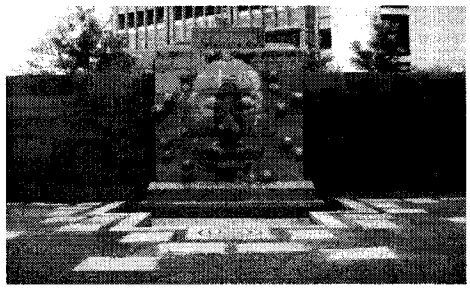

Figure 79 Idol of Lord Shiva (Hindu religion) See at the last nodal point

The Kund (Fig.80) or water body is placed along the axis as water was always an integral part of both Hindu as well as the Islamic architecture.

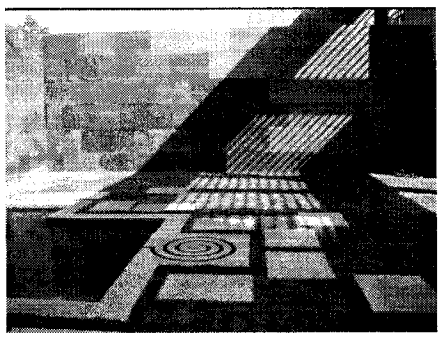

Figure 80 the spiral or Bindu (depicting Cosmos) the source of all energy.

The spiral (Fig.80) is one of the strongest forms in the cosmos it is the creator as well as the ultimate culmination. Charles Correa uses the similar feature in his work as a symbolic representation.

The entrance garden is encompassed by a Mural made by Howard Hodgkin, made out of white Makran stone and black (kaddapha) stone. It symbolizes the shadow of a tree that looks like a flat image from distance but is actually layers that create the entire tree pattern. This image represents symbolism in architecture.

4.3 Case Study - III

Common features of Bal Krishna Doshi's work.

Bal Krishna Doshi's ideally tries to combine the regional and the universal, old and new, the trying best way to modernize but at the same time trying to maintain a core of Indian cultural identity.

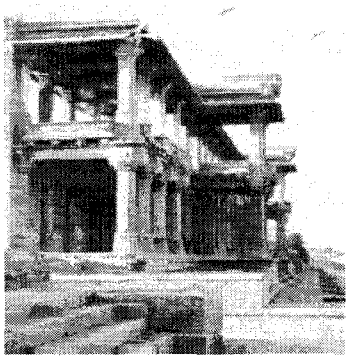

Figure 81 Sarkhej in Gujarat, India

His architecture combines modern movement as well as a strong spiritual influence. Designing with respect to climatic needs, he believes in strong relation of ground as sky as seen in Correa's work. He keeps in mind the social space, local material, traditions and human scale. For example, the Institute of Indology (Fig.82) having in inspiration from the Palace at Sarkhej (Fig.81).

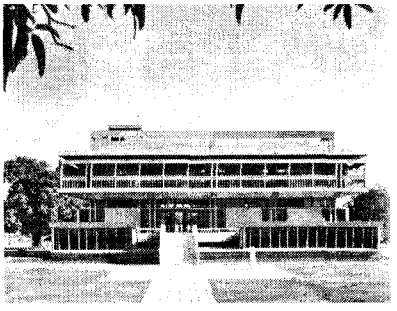

Figure 82 IIM at Ahmedabad, India

Indian palaces have always inspired contemporary Indian architects. Places at Jaislamer have inspired contemporary architects such as Raj Rewal. The solid, voids, planning of masses are designed with respect climate as an inspiration to the town ship for Gujarat state fertilizer (Fig.83).

Figure 83 Gujarat State fertilizers, Housing project

Fathepursikri has been an inspiration for many buildings built in India this is reflected in plan of IIM Bangalore,strong axes are set up and interesting spaces are created as one wanders through the various corridors.

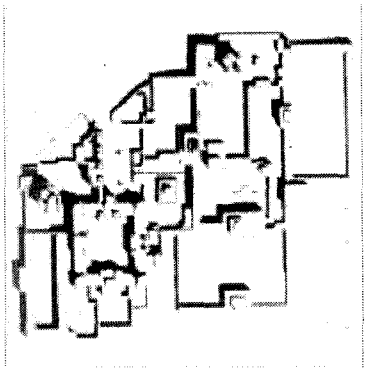

Figure 84 Indian institute of Management at Bangalore

The Indian institute of Management at Bangalore has its plan (Fig84) based of a similar concept as the layout of Fathepursikri. It has rectangular teaching courts and diagonally placed

dormitories. It uses other elements such as cascades of terraces, pillared halls, courts of various sizes and airy pavilions linked together in subtle order of shifting axes and vistas.

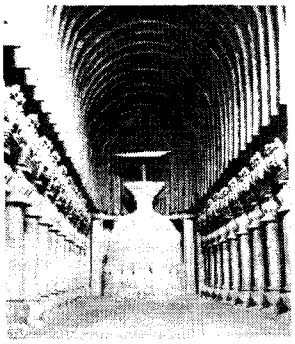

Figure 85 Stupa as seen at Ajanta & Ellora

Figure 86 Interiors of Sangath by Doshi

The ancient Buddhist gateways were designed in early the 13th century at the city of Magadha. These vaults were designed in rock cave architecture.

The interiors of the Sangath designed by B.V.Doshi are inspired from the Chaityas at the Ajanta and Ellora Caves. (Fig.85) he has used this concept with relation to the scale and proportion and also tried to get in natural light through use of this form (Fig.86).

Figure 87 Colonnades as seen at Fathepursikri.

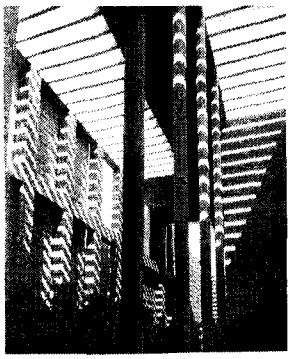

Figure 88 IIM at Bangalore.

Colonnades create a sense of fluidity and continuity of space and create climatically responsive rooms as seen at FatehpurSikri (Fig.87). B.V.Doshi has used this element at IIM creating light and shadow, defining space and framing vistas (Fig.88).

The city of Jabalpur had numerous building that had polygonal courtyards (Fig.89) Doshi tried to incorporate this similar feature in an Electricity Board building that he designed in the same area during today's times.

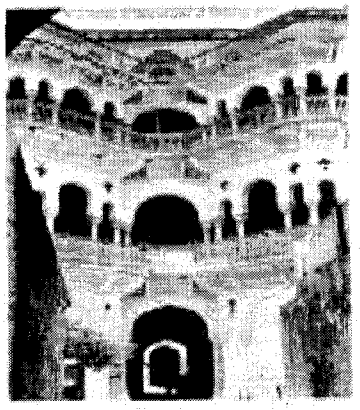

Figure 89 House at Jabalpur, India

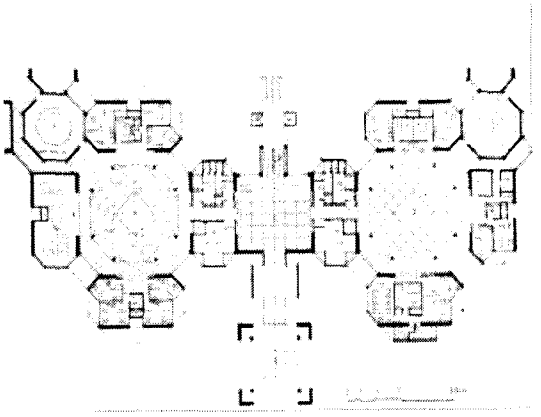

Figure 90 Plan of Madhya Pradesh Electricity Board.

Example - Sanganth – B.V Doshi

"Sangath is a fragment of Doshi's private dream: a microcosm of his intentions and obsessions. Inspired by the earth-hugging forms of the Indian vernacular, it also draws upon the vault suggestions of Le Corbusier. A warren of interiors derived from the traditional Indian city, it is also influenced by sources as diverse as [Louis I. Kahn], [Alvar Aalto] and [Antonio Gaudi]. A work of art stands on its own merits and Sangath possesses that indefinable quality of authenticity. " - William J.R. Curtis. B. V. Doshi an Archi-tecture for India. New York: Rizzoli, 1988.

Figure 91 Sangath at Ahmedabad, India

The building complex called "Sangath" (Fig.91) has a total floor space of 473 square metres and is located on a flat 2425 square meters site on the fringe of Ahmedabad in India. The complex is an ensemble of vaulted and flat roofed buildings of differing heights juxtaposed at a number of varying angles and arranged around a large, terraced entrance court. The court contains a fountain surrounded by split-level pools. A number of exterior surfaces including the vaulted roofs, which take precedence, are covered with white irregularly shaped mosaic tiles. Some of the buildings have been sunk below ground. The entire complex is contained within a walled rectangular area. The complex houses a number of activities in its component parts. The design studios are housed in a double height volume surmounted by two vaults; between them lays a flat roofed area that permits light to enter the end-walls of each vault.

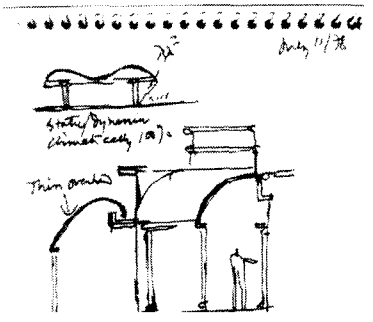

Figure 92 Sketch showing vaults.

Perpendicular to this wing is a block of four vaulted units. The two units facing the entrance court rise to a triple height and house an architect's office, conference room, lounge, and service

area on the ground floor. First and second floors house the Vastu-Shilpa Foundation and guest area.

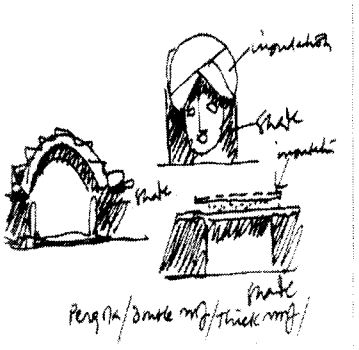

Figure 93 Adaptive use of Turban

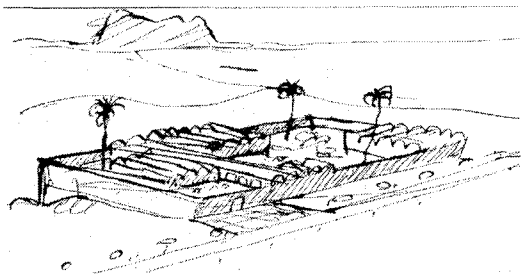

Figure 94 Relationship of Ground to sky as in cosmic architecture.

Like Charles Correa his building represents a relation ship between the ground and the sky as well as the ground and the building (Fig.94).

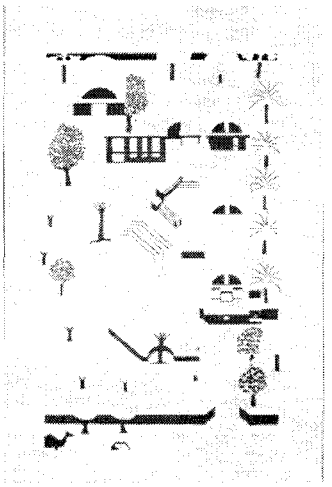

Figure 95 Miniature painting of Sangath

Movement within the structure is given a lot of importance as it can lead to a lot of interesting places. It helps to experience the building in variety of spaces and vistas. Balkrishna Doshi designed his plan like a miniature painting. Miniature paintings (Fig.95) are an integral part of Indian society. Miniature paintings were designed to give an idea of the complex art scheme. Bal Krishna Doshi in most of his projects has absorbed elements from India's past and given them an effective new expression. His tactics has been to investigate Material, certain vernacular forms and interpenetration of urban places with respect to India's climatic conditions.

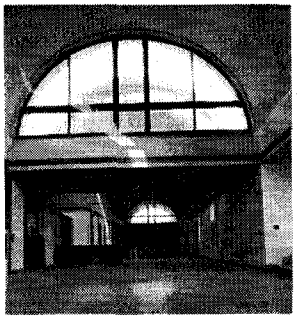

Figure 96 interior view Of Sangath

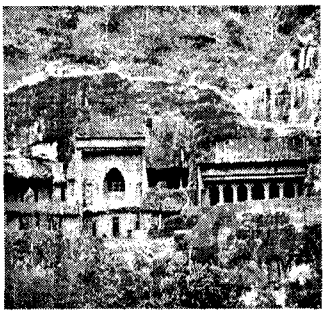

Figure 97 Buddhist caves an inspiration .

His work at Gandhi labor Institute (Fig.96) shows an impact of Buddhist architecture.The interiors of the Sangath by B.V.Doshi are inspired from the stupas at the Ajanta and Ellora Caves

(Fig.97). He has used this concept with relation to the scale and proportion and also tried to get in natural light through use of this form.

CHAPTER 5

OBSERVATIONS FROM VARIOUS CASE STUDIES

Contemporary Indian architects of India are masters such as Rajrewal, Charles Correa, Bal Krishna Doshi, Achyut Kanvinde to name a few. All of these architects have developed an architectural expression that would relate its buildings to the Indian subcontinent by the use of various principals that is common in almost each of these architects work.

All of these architects are trying to blend old and new regional and universal expressions in order to create an architecture that is relevant to India, modernizing yet maintaining cultural identity. Their aim seems to transforms, not imitate or to reproduce .Since they believe in architecture depends on aesthetic as well as ethical conviction. They believe in making maximum use of natural light that has natural air movement and a relationship of the ground with the sky in order to establish a cosmic relationship. Their buildings don't depend on frivolous superficial decoration, but they integrate and create interesting spaces by means of platforms, terraces and steps. The building functions as a body composing of water bodies, natural landscapes, gardens and foliage.

Not all movement on the building is symmetrical in nature; an element of interest is created by the means of shift in axis creating a dual expression as seen in Jawaharkala Kendra at Jaipur or at the Sanganth in Ahmedabad.

The various spaces, finishes and volumes within the building express function and the user's articulation. Various components such as open spaces, courtyards, terraces and built volumes are tied down to create an urban complex with traditional thoughts. Climatic needs are essential elements to deal with and they have been taken care in every project with respect to existing

climatic conditions. The plans and sections of each individual building show and express an additive growth concept as each individual space is designed as a complete element. Local material, method of construction is important components of building design. Importance is laid on taking in to consideration local symbols, context and their association. Interesting features created by casting of shadows, breaking of masses creation of solid and voids within the structure. Human scale is an important factor that decides on how each element in the building should be used with respect human proportion.

5.1 Factors Influencing and Justifying Application of Traditional Elements to Buildings.

There is a loss of identity which is inherent to modernization. Contemporary architects should attempt to authenticate their work with traditional ideas and typologies while relying on technology and material that is propagated by modernism. A search for regional architecture is crucial to regain strength to serve the physical and spiritual needs of the people.

In a city sometimes the form and architecture are inappropriate to the city's social, physical and cultural aspects leading to alienation and loss of identity. International models of architecture and urban planning are not suitable.

Social pattern-The lifestyle and activities of people are important in determining the architecture of a place. Traditional elements such as courtyards were places of interaction among people. Internal and external courtyards are a reflection of daily activities of the people living in the region. A traditional city allowed people to come together, to pause to interact individually or in group through a variety of spaces and elements. Today's architecture in Mumbai city has inadequate interactive spaces which is leading to social disintegration and puts a strain on energy in transportation of goods and people.

Climate and energy–The pergolas, terraces, court yards, parasols and jails were all developed in response to a climate that the Indian subcontinent faced. They are not merely an elevation feature. When these are used in response to climate they each serve a certain function. The elements were traditionally designed to satisfy more than one situation and were multifunctional. Indian architecture in the past has responded to functional requirements based on

climate and community needs and evolved a method through centuries of modulating light and space. Traditional Indian architecture evolved in response to the area's harsh climate, incorporating traditional designs into the structure which have both symbolic and pragmatic functions

Cost-Indian construction is carried out in reinforced concrete cement as labor is cheap and fast. Frame of concrete blocks can be created as Jalis that can be connected together by steel bars creating faster and efficient construction.

Materials- The material for construction is Reinforced cement concrete. The consistency of this material would help to produce numerous designs inspired from traditional ideas in a new adaptive form. The use of local materials and construction techniques ensures that the structure should fit easily within the context of the area.

CHAPTER 6

VARIOUS TRADITIONAL ELEMENTS THAT CAN BE USED FOR DESIGNING CONTEMPORARY STRUCTURES

Inspired from traditional elements of design various elements can be incorporated in modern designs in order to create buildings in Mumbai (Bombay)that are built using modern construction method and technology but incorporate basic elements and ideas from traditional Indian architecture such as courtyards ,colonnades ,pergolas, trellis (jails) , step-wells to name a few. These can be incorporated in buildings of various scales such as small scale, medium scale and large scale. The following papers deals with incorporating these features in various scale structures.

This will give more creativity to architecture and improve the architectural scenario of the city of Bombay. This will give Bombayites an opportunity to recognize the city with new landmarks rather than factory designed monotonous buildings. The nature of the city to adapt will lead it to produce buildings it can cherish for always and break the present state of stagnation in architecture.

6.1 Courtyards

Courtyards have always been an integral part of Indian architecture. Courtyard buildings were developed in a period when air-conditioning was an unknown concept. In the Indian culture, courtyards were built as an important part of the house design to combat the hot summers.

Functions of Courtyard with respect to design and climate:

1. The courtyard shades building surrounding such that the microclimate is tempered. This shading effect lowers the overall cooling load.

1. The courtyard shades building surrounding such that the microclimate is tempered. This shading effect lowers the overall cooling load.
2. Courtyard is a simple design strategy that enhances daylight availability in every room. In an indirect sense, daylight being a cool source of light, it further helps reduce the cooling load.
3. Court yards both internal as well as external. Creating a cooling effect as the shaded earth provides both coolness and can heat up due to the sun.
4. It can prove to be a natural source of humidification by adding plants and trees. It is a source of diffused light.

Various design solutions can be achieved buy means of arrangement of the structure around the courtyard .Similarly light wells were created in response to climate. Court yard design principal can be achieved to enhance design in modern residential, commercial as well as institutional structures.

The size of the courtyard would vary with the size of the structure built around it. It can be used as a design application in different buildings in different ways so that it not only serves climatically useful function but also integrates various masses to create visually pleasing aesthetic at the same time perform a specific function.

Court yards are ways of life of the people .Its a common place of interaction where people get together discuss their day to day lives and events.

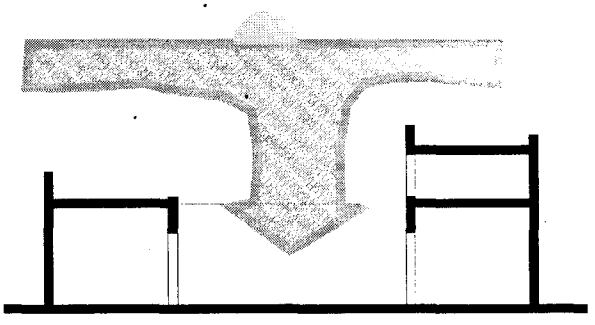

Figure 98 Courtyard in open space in morning.

In open spaces the courtyard acts as coolness generators (Fig. 98) when the cool air flows into the surrounding rooms. This keeps the rooms surrounding the courtyard pleasant during the day time.

During the day time the courtyard gets heated up by the combination of direct, diffused and reflected solar radiation. Figure 98 shows how the heat from sun is transmitted to the courtyard and the building shadows the internal courtyard.

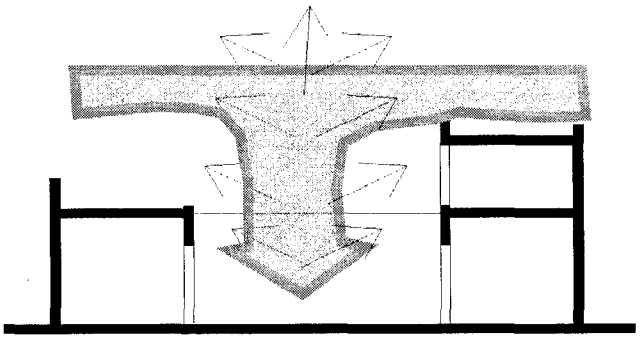

Figure 99 Courtyards in open space in evening

The courtyards in open spaces in evenings began to radiate the absorbed heat to the surrounding areas (Fig. 99). The temperature is more temperate during evening hours. During night it reflects heat it absorbs from sunlight during the day time. Thus it ideally functions at different periods of the day providing heat and shade as and when required.

6.2 Courtyards in Small Scale Structures

Courtyards in small scale buildings can perform the function of light wells when used internally within the structure. Fig. 100 shows an internal court yard that can be used for small scale residential homes or low rise apartments.

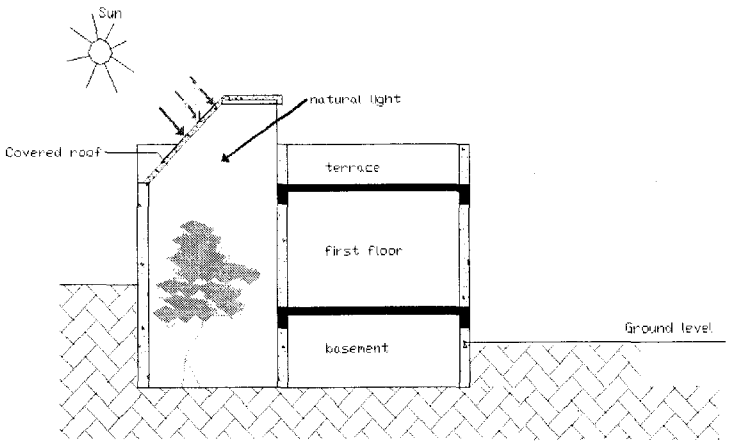

Figure 100 Section through a small scale building.

Figure 100 shows a small scale structure which is provided with a courtyard which is semi covered to block the harsh sun but at the same time allowing natural light and air to filter within.

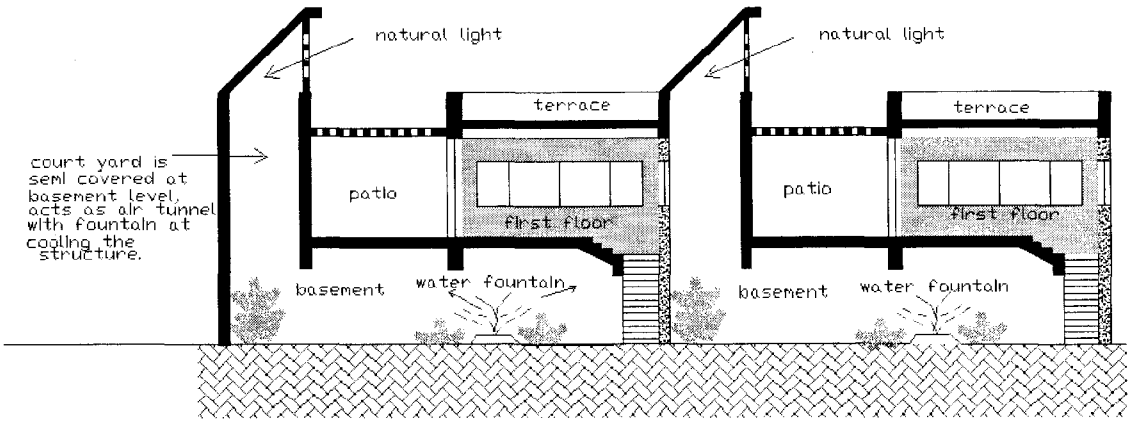

Figure 101 Section through a small scale building showing fountain in basement.

The climate and soil in Mumbai provides ideal situations of basements .A wind shaft can help to cool weather with the help of a courtyard in the basement that is provided with a water feature. This could be ideal way of beating the heat in the summers and a more sustainable architecture. The similar concept can be applied to various building types which are small scale.

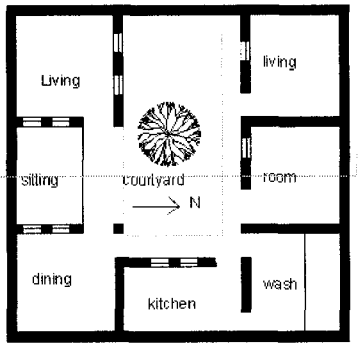

Figure 102 Ground floor plan-planning around courtyard.

Figures 102 and 103 show a small scale residential unit planned around the courtyard with respect to the north. The ground floor is planned keeping in mind the rising and setting sun. Thus morning period sees pleasant temperature. Activities are planned around the court, example and sitting area opening in the courtyard area .The above floor plan show rooms that can be used for resting /bedrooms .It has an covered patio and a terrace that further enhance the courtyard.

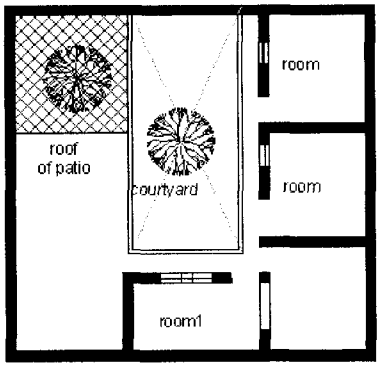

Figure 103 First floor plan-planning around courtyard.

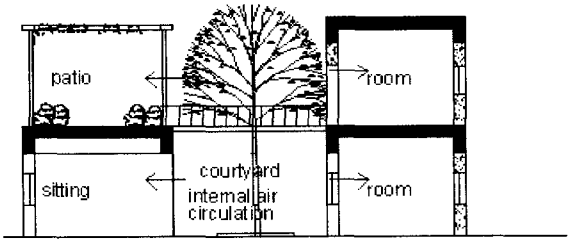

Figure 104 Section through the building shows the air circulation and the interesting spaces within the structure.

6.3 Courtyards in Medium Scale Structures

Courtyards can be used in medium scale buildings such as apartment complex, hostels and boarding schools. They become an area of public interaction; the children from the complex can play in this court under parent supervision under close proximity of home. It not only acts as aesthetic element but also function with respect to the climate. Courtyards don't only serve a climatic function but can also help to design buildings according the social patterns and life style of a particular region. The become spaces of community interaction. Courtyards traditionally were places were people gathered to discuss day to day matters.

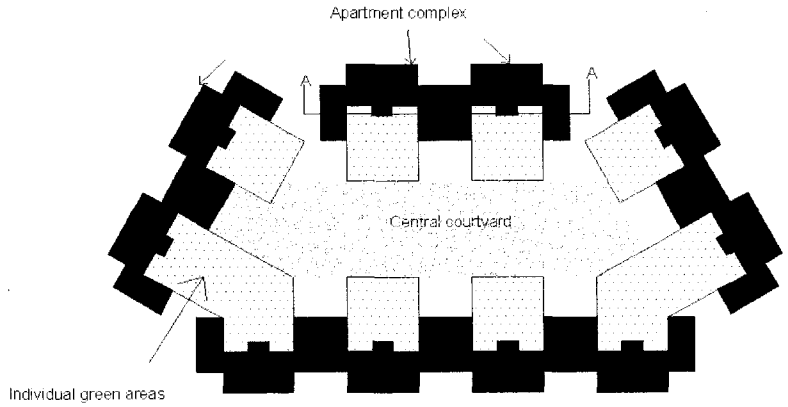

Figure 105 Plan showing arrangement of medium scale buildings around central courtyard.

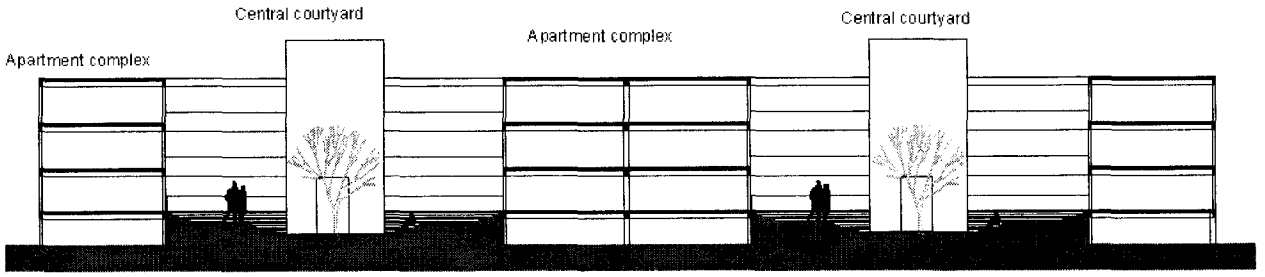

Figure 106 Section showing arrangement of apartments around central courtyard which is shows central spaces that are ideal for community interaction.

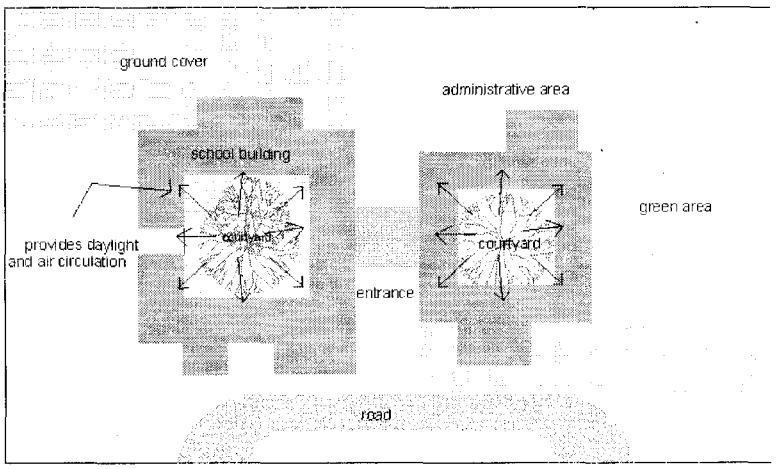

Figure 107 Plan showing a medium scale building incorporating daylight and air circulation from courtyard.

Courtyards provide day lighting which is adequate lighting to classrooms /medium scale offices maintaining the typical building configuration, even under cloudy Conditions, if the internal surfaces are light colored in each of the interior rooms. This is not only an efficient use of saving energy as done by traditional architects but recent studies have concluded that day lighting from elements such as courtyards helps to attain those results like creative thinking ,work efficiency and easy learning. Integration of interior and exterior spaces together can create not only interesting interior spaces but exterior ones too such as an exterior teaching area or meeting area /discussion area etc.

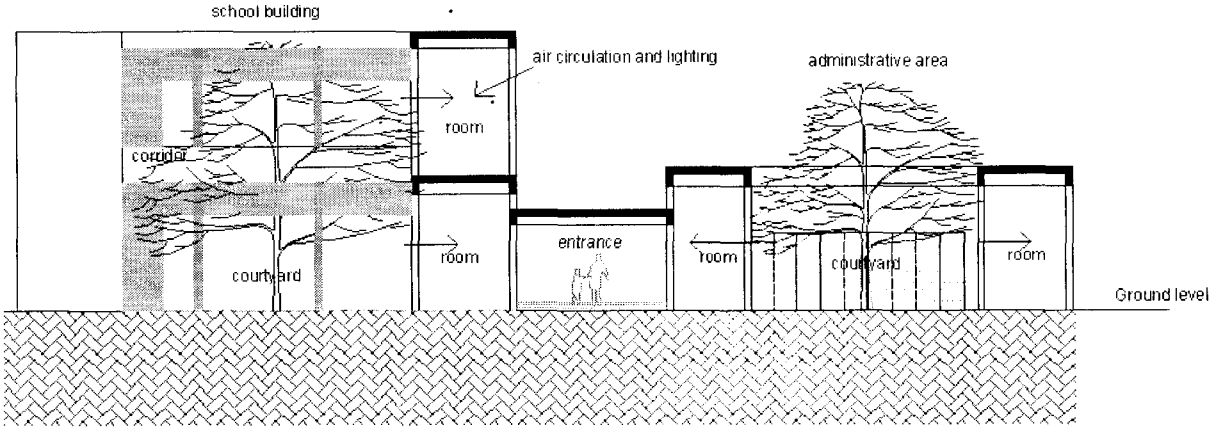

Figure 108 Section showing a medium scale building incorporating daylight and air circulation from courtyard.

6.4 Courtyards in Large Scale Structures

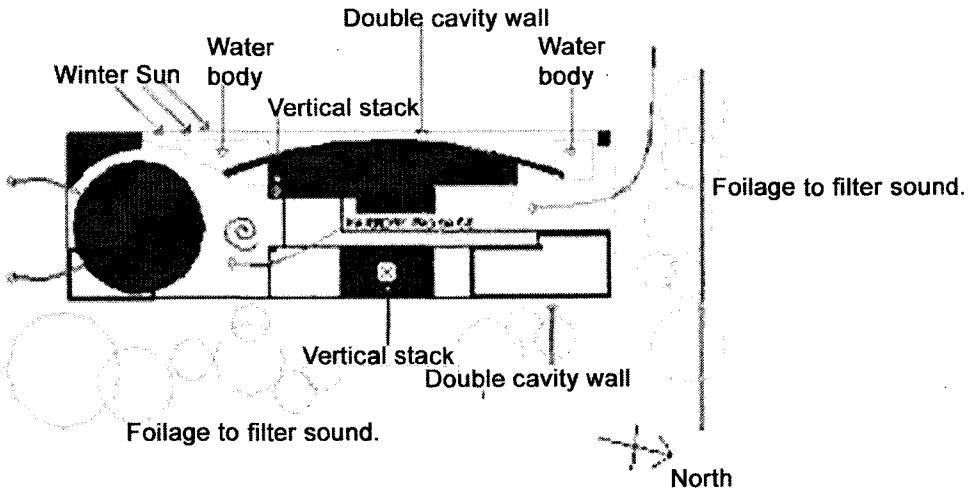

Figure 109 Plan of a large scale building showing the vertical stack.

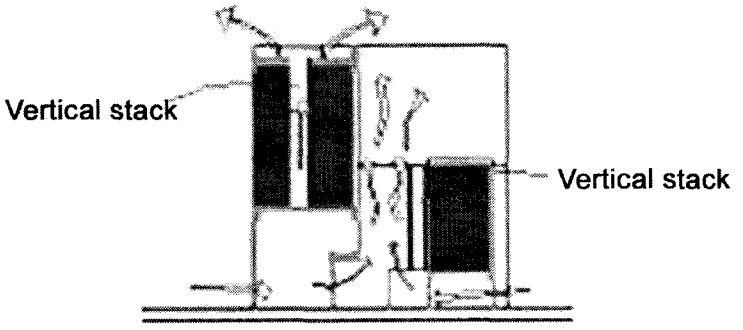

Figure 110 Section shows courtyards reduced to vertical stacks.

Court yards in large scale buildings cannot be narrow or of small spans as they create insufficient lighting .In large scale building court yards can be reduced to vertical stacks that perform the function of air circulation as well as act as light wells. Figure 110 shows how stacks can perform similarly to courtyard making the hot air rise up and creating circulation of air within the structure. Also it can also act as a light well.

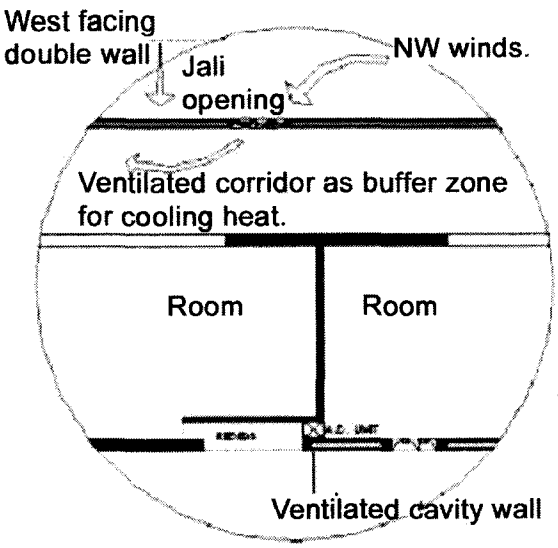

Figure 111 Detail shows the double cavity walls around the balcony.

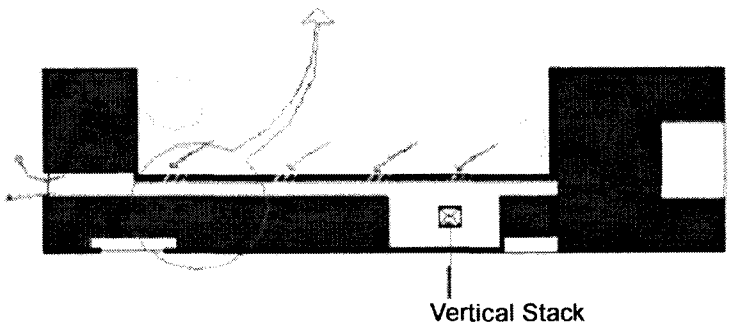

Figure 112 Plan shows the double cavity wall located in the structure.

Double cavity walls (Fig.112 &111) can be a concept evolved from the principal of courtyard design .In case of large scale structure where internal courtyards may not be practical. These walls are set around balconies or niches allowing air from niches or balconies to penetrate through the cavity in to the rooms.

6.5 Trellis / Jalis

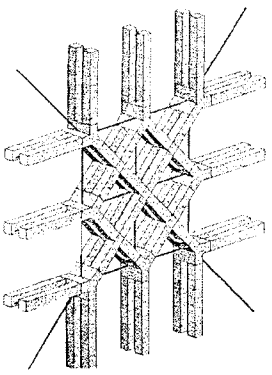

Figure 113 Typical module cast in cement concrete to help with faster and economically viable construction.

1. Jails have served various functions:
2. They ensure seclusion prevent occupants of the house from being watched by other people, at the same time it allows the occupant to look outside.
3. It helps to admit breeze within the room at the same time it filters air from the dust before it enters, the curvilinear form of the bars helping to remove the dust from the air.
4. It reduces the rate of heat transfer through the window this is achieved through restricting the solar radiation transmitting.

Function Jalis/Trellis with respect to design and climate.

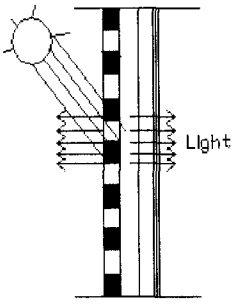

Figure 114 To diffuse rays of sun before entering the room

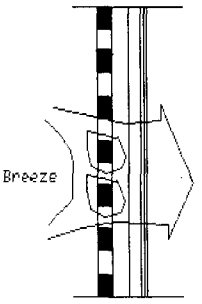

Figure 115 To admit breezes into the room

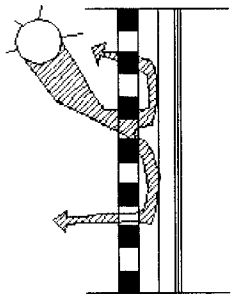

Figure 116 To reduce the rate of heat transfer through the openings.

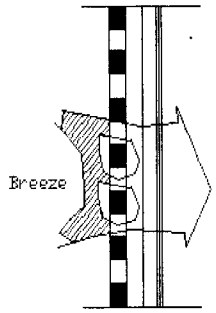

Figure 117 To filters air of dust.

Figure 114 to 117 show the Section through the jails.

1. Jalis help to diffuse in sunlight and prevent heat from entering in to the room.
2. It allows admitting breeze in to the room.
3. As the jails are laid at an angle they reduce the heat transfer through the opening.
4. They not only let in cool breeze but also filter the dust from entering in.
5. These modules are based on mathematics and geometry, creating interesting aesthetics and perform climatic functions.

6.6 Trellis / Jalis in Small Scale Structures.

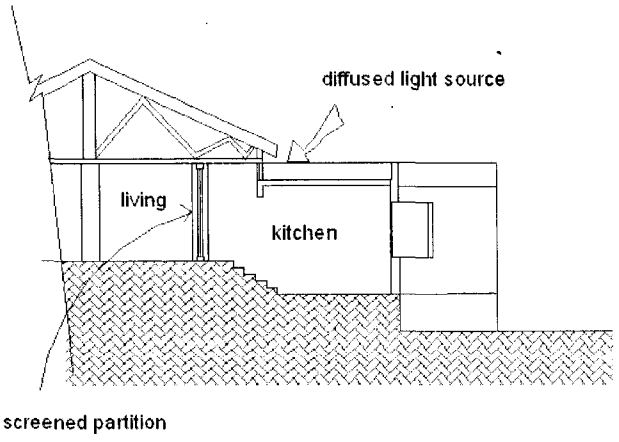

Figure 118 Jails used as partition between kitchen and living area.

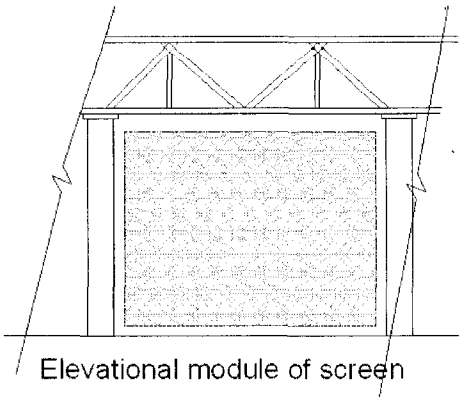

Figure 119 Elevation of screen

Jalis can be used both in small scale residential, institutional as well as commercial structures. Within each individual unit in a residential complex it can be used as partition members between the kitchen and the living area (Fig.118) providing an ideal separator between the areas. Recast concrete modules of various geometric patterns can be laid down .These can be assembled on site according to the requirements. These can further be used in balconies to create the parapet that would filter in sunlight. These similar partitions can be used as separator between various spaces .These pierced screens can be filled with glass members who would help it to be soundproof so that only light gets transmitted but not the sound. These prefabricated members can be used in order to create parapet walls of balconies and terraces rather than using solid walls .This would not only give good aesthetics but shall also help to filter the light within the structure.

6.7 Trellis / Jalis in Medium and Large Scale Structures.

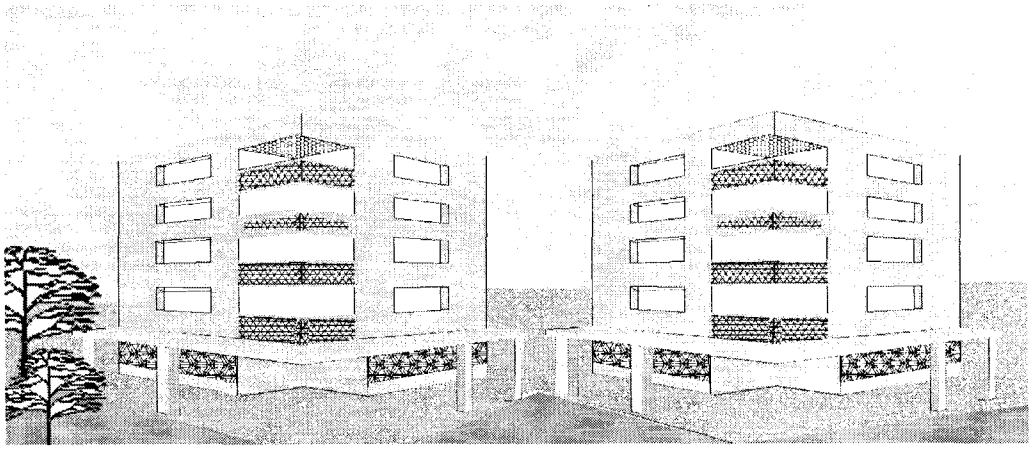

Figure 120 Jalis used as balcony parapets and dead walls as seen above.

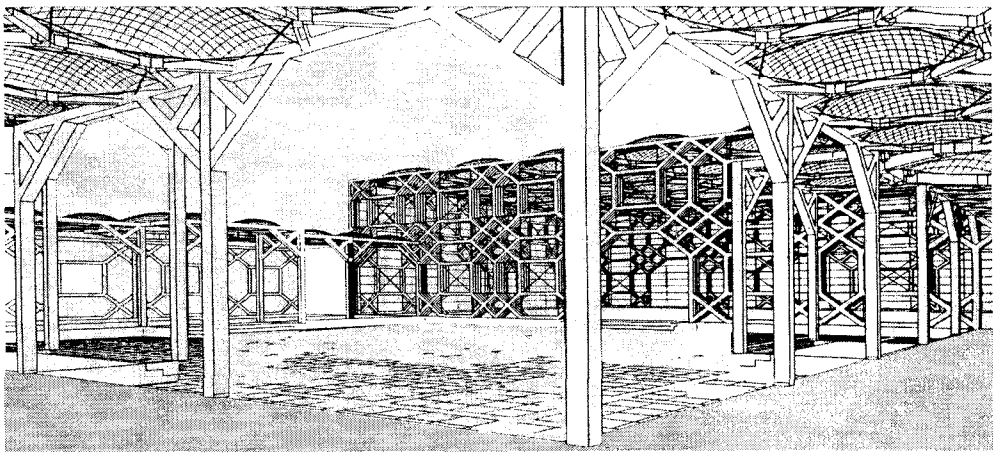

Figure 121Jalis used internally within a medium scale /large scale commercial or institutional structure

Jalis /Trellis can be used for aesthetic reasons and they contribute to the elevation of the façade of the building (Fig120 &121).They can be used for terrace and balcony parapet walls as well as dead walls in public spaces that would allow light and air to filter through. The geometry of Jalis will help to produce numerous designs; the frames can be designed to be precast concrete members that are laid together using mortar (cement and sand).The building façade can be

designed totally on an geometry pattern, designing openings within the voids of the frame work and projecting and recessing masses wherever required.

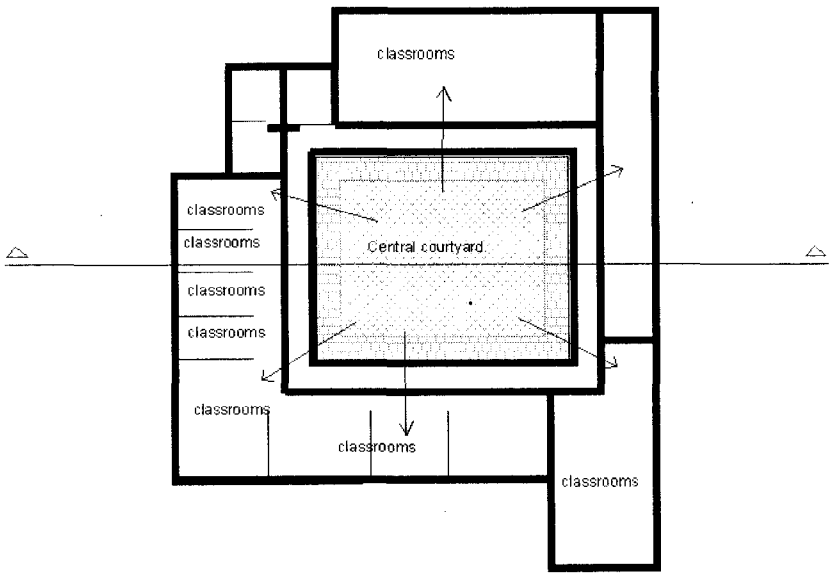

Figure 122 Plan of medium scale building where jalis used around corridor area.

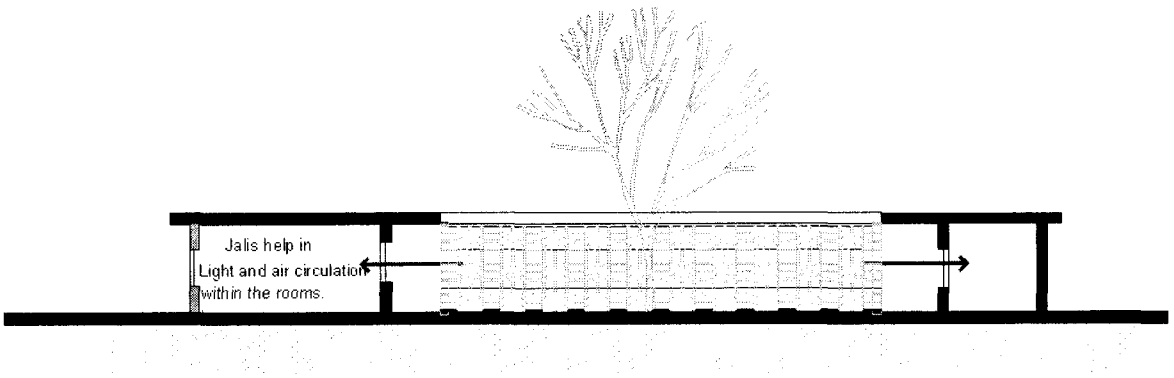

Figure 123 Section through medium scale structure showing use of jails around circulation corridors.

Jalis can be used internally around corridor walls for medium and large scale structures. They become a natural source of light and ventilation of the corridor area. They create excellent cross ventilation (Fig 123) .The following figure shows a school design in which the class rooms are

arranged along the length of the corridor. It creates interesting play of light and shadow within the corridor areas 'as well as aesthetically is pleasing'.

6.8 Pergolas

Pergolas are conceived for hot climate providing protection from heat and rains. This feature has been used traditionally in the architecture of Gujarat and Palaces of Rajasthan. Series of spaces can be created by use of pergolas that explore and challenge normative notions of spatial perception through varying degrees of opacity, transparency, overlap, adjacency, expansion and compression. The pergola frame allows openness in both plan and section, creating spaces prescribed only by one's movement through them via such connecting devices as the horizontally biased architectural. Pergolas are members used to cover internal or external spaces creating interesting spaces that helps tie spaces together and creates a rhythmic movement

Pergolas shade the building and outdoor spaces, reduce summer temperatures, improve comfort and saves energy. Deep verandahs, balconies or pergolas can be used to shade east and west elevations, but may still admit very low angle summer sun. They are used in combination with planting to filter unwanted sunlight. Pergolas can also be covered with deciduous vines, providing self adjusting seasonal shading.

6.9 Pergolas in Small Scale Structures

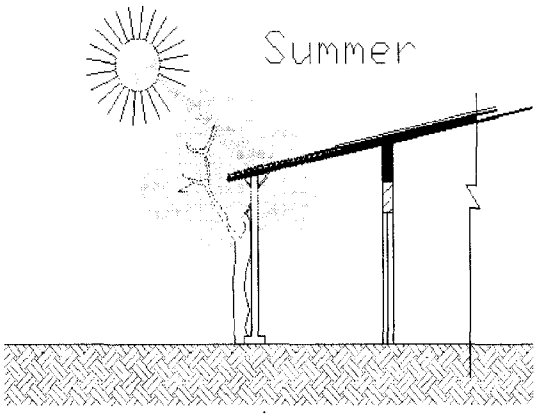

Figure 124 Perogolas designed with respect to summer sun

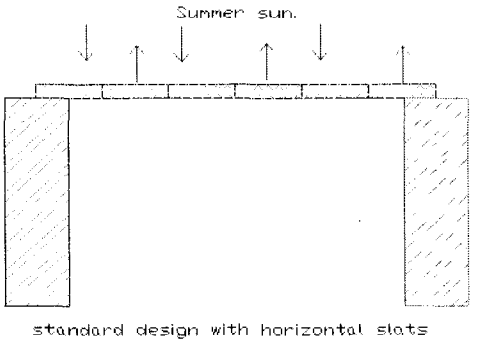

Figure 125 Detail of slats to prevent entry of sun.

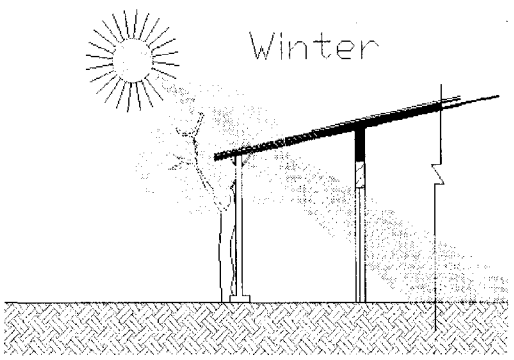

Figure 126 Perogolas designed with respect to winter sun

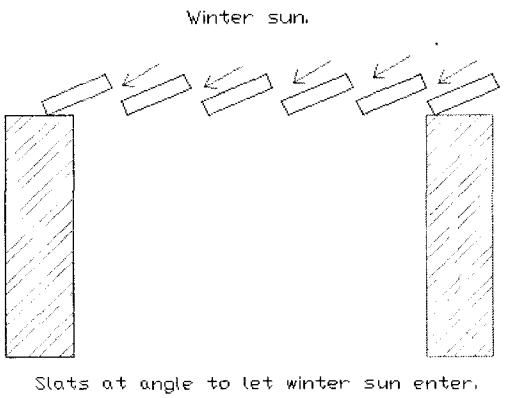

Figure 127 Detail of slats at angle to let in the winter sun

The standard pergola design, with horizontal slats, provides some shade all year round. The solar pergola has slats, which are tilted to allow access to sun in winter (Fig. 127), but provide a continuous barrier to summer sun (Fig.125). Slats can be placed closer together to block out sun during spring and autumn as well. The angle and spacing of the slats in the picture are designed to suit different places.

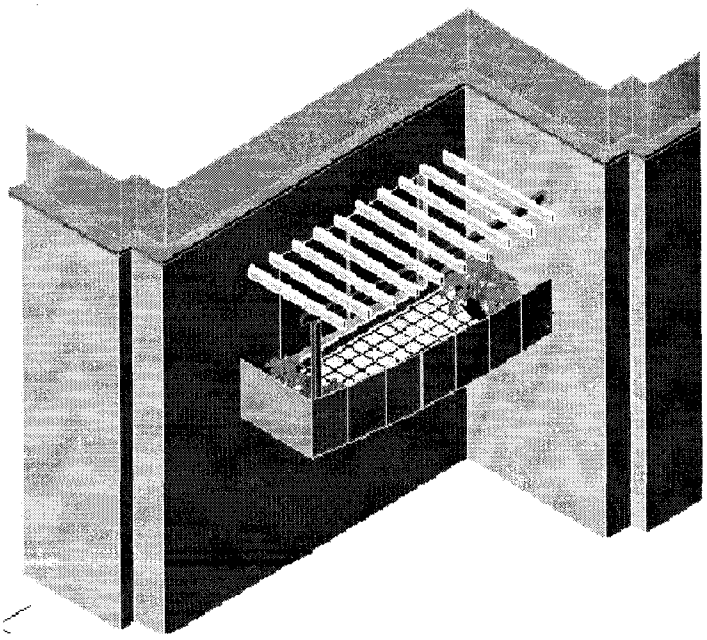

Figure 128 Pergolas over balconies and terraces in small scale structures

Pergolas can be used to shade east and west elevations, but they may still admit very low angle summer sun. Pergolas can be used in combination with planting to filter unwanted sun. These can not only be used as a climatic feature but can be used innovatively as an aesthetic feature as seen in (Fig 128)

6.10 Pergolas in Medium and Large Scale Structures

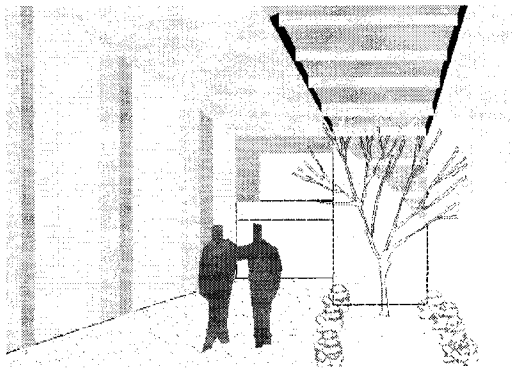

Figure 129 Entrance to an institutional building, an element of design feature

Pergolas in medium scale structures can be used to create ambiguity and duality to articulate space, creating fluidity and continuity Punctured openings as seen in the above Fig 129 are elements used to reach this goal and create climatically responsive structures.

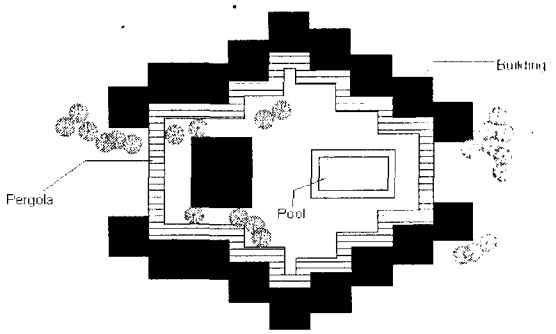

Figure 130 Plan of a housing complex showing pergola linking them together

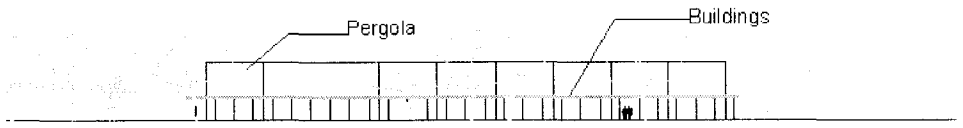

Figure 131 Section through the pergolas showing them visually connecting different houses.

In medium scale structures such as a complex of houses or Apartments can all be linked together visually with pergolas as seen in the adjoining figure. These are individual buildings by themselves only linked visually by pergolas around periphery this also creates a semi-covered corridor or walkway.

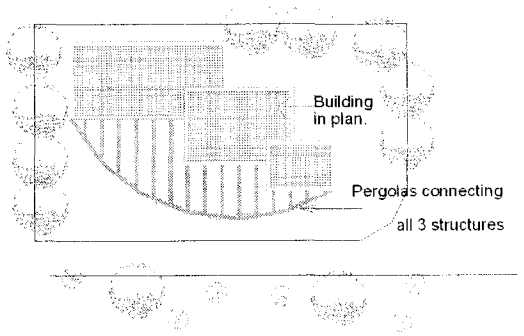

Figure 132 In a medium scale structure the pergolas can act and perform the same function of space frame as seen in plan above.

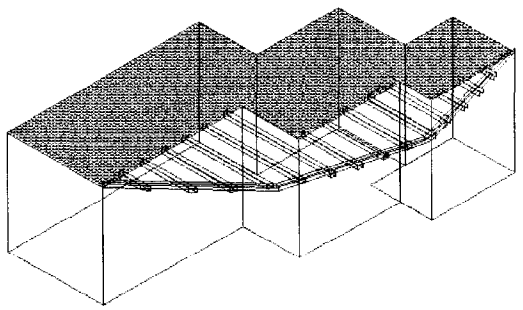

Figure 133 In a medium scale structure the pergolas can act and perform the same function of space frame as seen above.

6.11 Step Wells/Kunds

Step-wells are most certainly one of India's most unique, but little-known, contributions to architecture, and it is uncertain whether they are to be encountered anywhere outside the Indian sub-continent.

Function of Step wells/Kunds.

1. Step wells or Kunds were earlier discussion place where the learned would meet and talk about day to day issues and how can it can be resolved.
2. The actual function of well was the location of the water body that was used for the particular function of serving a particular community.
3. These wells were also of aesthetic value as they have various ornamental decorations on it, in earlier times idols of God glorified the step wells.

6.12 Step Wells in Medium and Large Scale Structure

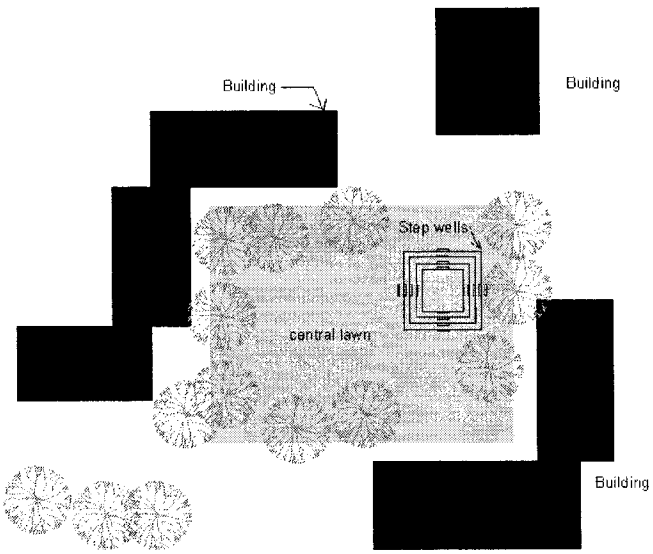

Figure 134 Plan showing location of step well in a medium/large scale structure.

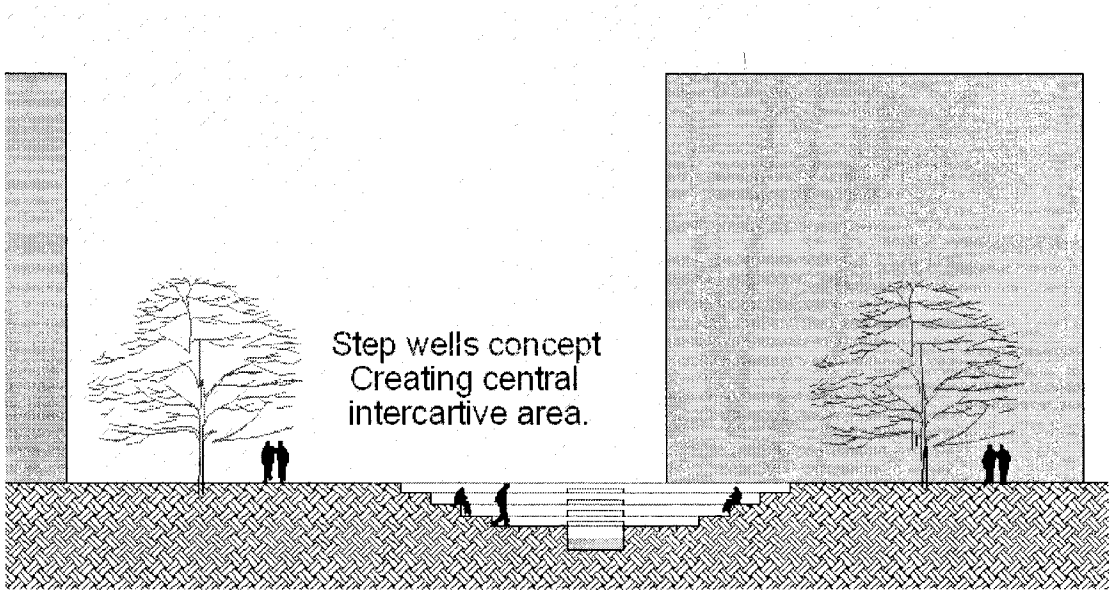

Figure 135 Section showing activity around the step well in the complex.

Step wells can be designed to fit into large an medium scale complex, not only do they act as an landscape feature that would act as interactive areas where people from the complex can gather address issues as well it would prove to be an excellent landscape feature.

6.13 Terraces

Roof terraces have always been an essential component of the architecture in north Indian cities. Terraces were also important portion of the palace architecture in Jaisalmer as discussed in Chapter 3.6.

They perform various functions as listed below.

They provide welcome outdoor space during summer nights in the dry, hot climate when the interior rooms retain the heat absorbed during the scorching day.

Terraces provide extension to living areas at an upper level during sunny winter days when interior rooms can be cold.

Traditional housing in warm places is designed on roof terraces design and functions as a climatic relief.

Terraces can have aesthetic value as well and can be a welcome place for a breeze.

6.14 Terraces in Small Scale Structure.

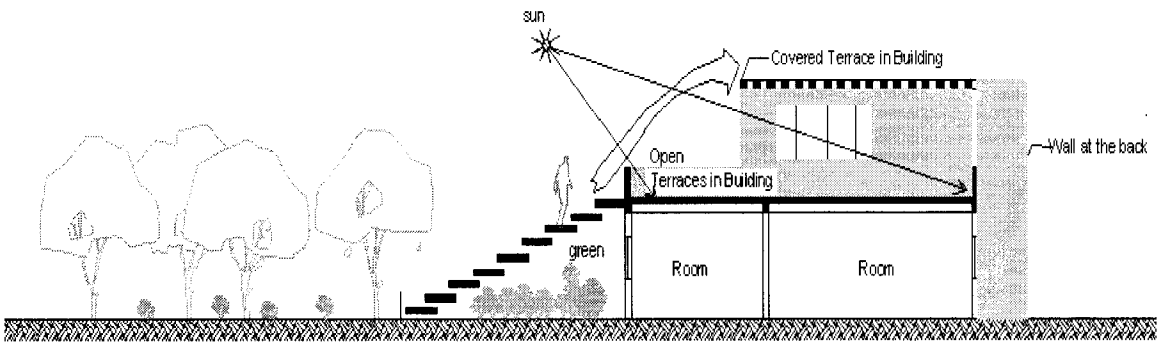

Figure 136 Roof terrace in a small scale structure.

Terraces in small scale structures provide occupants with a second form of outdoor space that functionally complements the courtyard area. The function served by a roof terrace in a small scale structure is directly affected by its location and its orientation. As seen in Fig .136 frequently the roof terraces are placed in front of winter rooms orientated towards the south or on the west side of the structure oriented towards the east. These terraces are positioned in such a way that in winter the rays of the morning sun can reach the occupants to maximum degree. A portion of the terrace is covered with grape vine trellis to enhance cooling effect. The parapet wall is so designed that it doesn't block sunlight from entering any adjoining room.

Traditionally' in an individual small scale dwelling which may be a house, terraces perform many domestic functions. In hot summers' people enjoy sleeping on terraces as they provide a cool relief. They receive ample sun light during morning and afternoon hour's .This period is most house hold to dry down stuff like dry snacks which they make at home and lay on terraces for days to dry.

6.15 Terraces in Medium Scale Structure.

Terraces in can be used in design of medium scale structures as seen below.

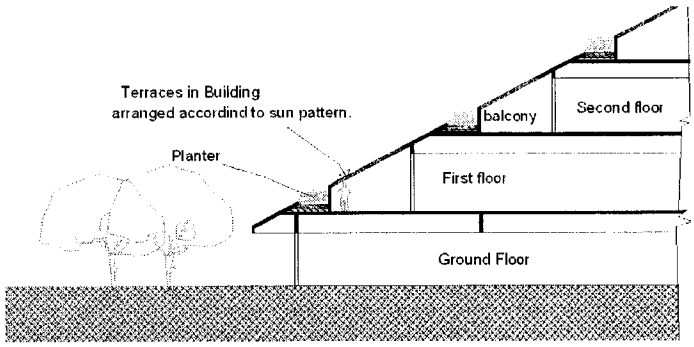

Figure 137 Terraces can be designed to recess with the angle of sun provides maximum heat protection in summer also provides adequate sunlight.

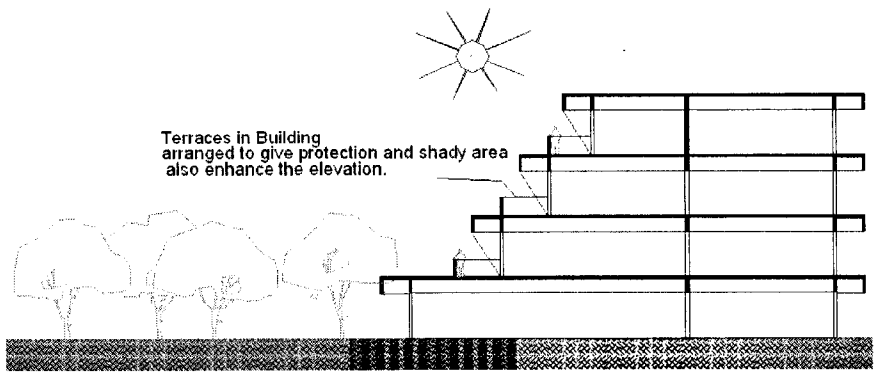

Figure 138 Terraces can provide an interesting extension to the living area so one can enjoy the sun even in an apartment complex

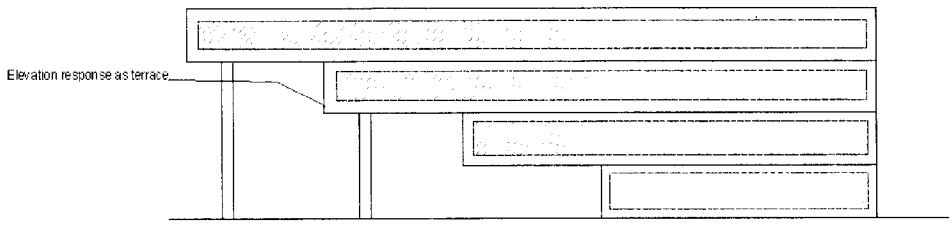

Figure 139 Terraces can act as an elevation response further providing natural shade.

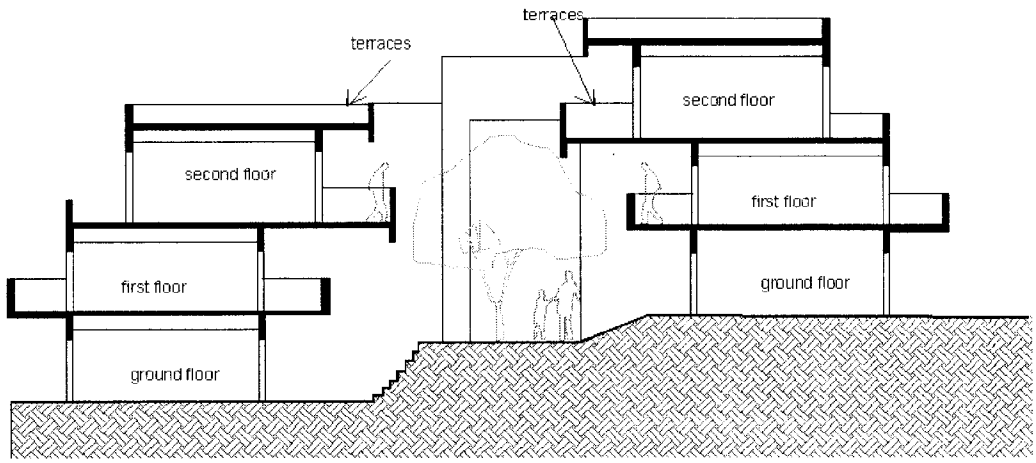

Figure 140 Terraces as area of social interaction.

Terraces in medium scale structures can be used as an element of aesthetic at the same time as they can help to create socially interactive areas (Figure 140).These terraces can be designed to recess with the angle of sun providing maximum heat protection but provide adequate sunlight and also terraces can provide interesting extension to the living areas so one can enjoy the sun even in an apartment complex.

6.16 Terraces in Large Scale Structure.

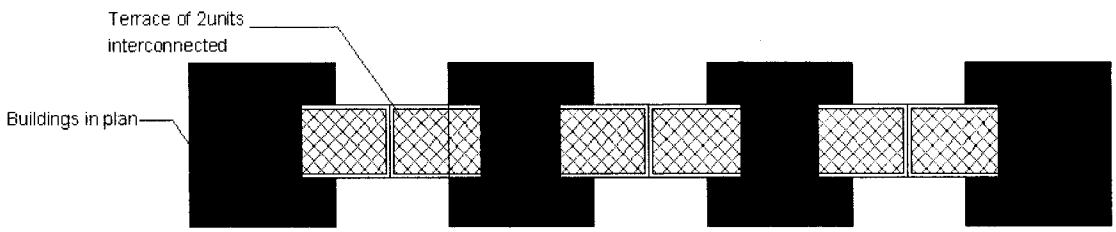

Figure 141 shows plan of buildings that are linked by terraces in a large scale complex.

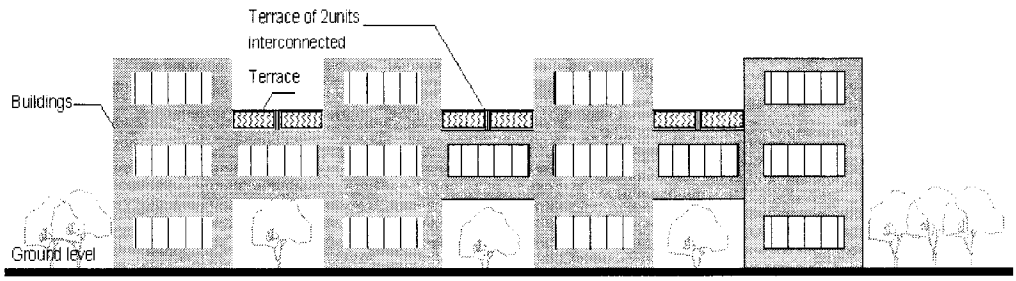

Figure 142 shows elevation of buildings that are linked by terraces in a large scale complex.

In large scale structure's terraces can used in many ways with similar function as in medium scale, in large scale building terraces can act as a links that can merge the entire complex in to one .Terraces can act as both an visual as well as an functional link between various building in an large scale complex. These terraces can be used in large scale buildings such as hostel complex to tie the entire structure.

CHAPTER 7

CONCLUSION

The goal of my thesis is to show that features from Indian traditional Indian elements such as Courtyards, Jalis, Trellis, Pergolas and Step wells can all be successfully used in a small scale and medium/large scale design of structures in Mumbai city.

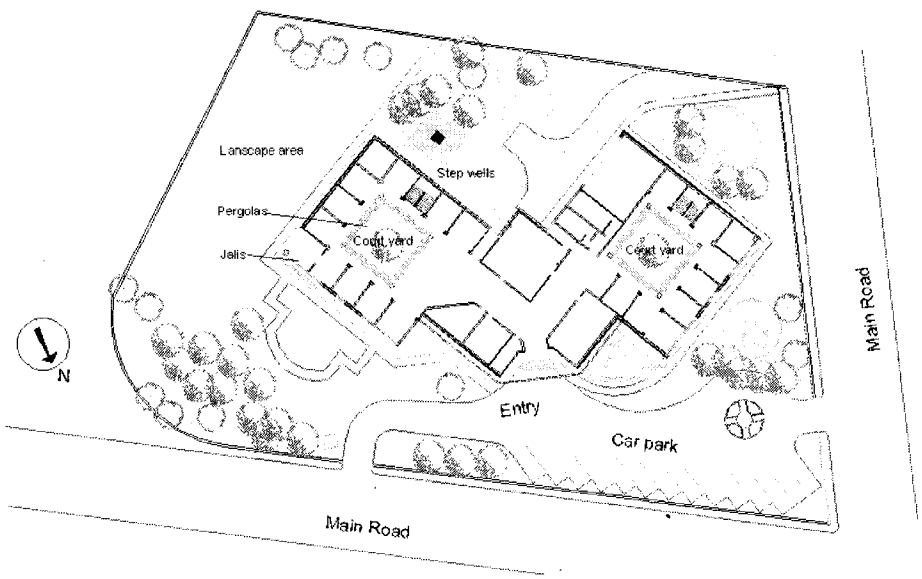

Figure 1.Site layout of a small scale building composed of various elements discussed in chapter 6, courtyards, pergolas, step wells, jalis and terraces.

Figure 134 shows a site plan of a building designed to include of traditional features which are described in chapter 6. This site layout shows how elements such as courtyards, step wells, terraces, pergolas and jails /trellises can be used in a small scale structure. The building is oriented with the four cardinal directions in mind which gives

helping in ventilation, adding aesthetics and building with traditional elements as described in Chapter 6.

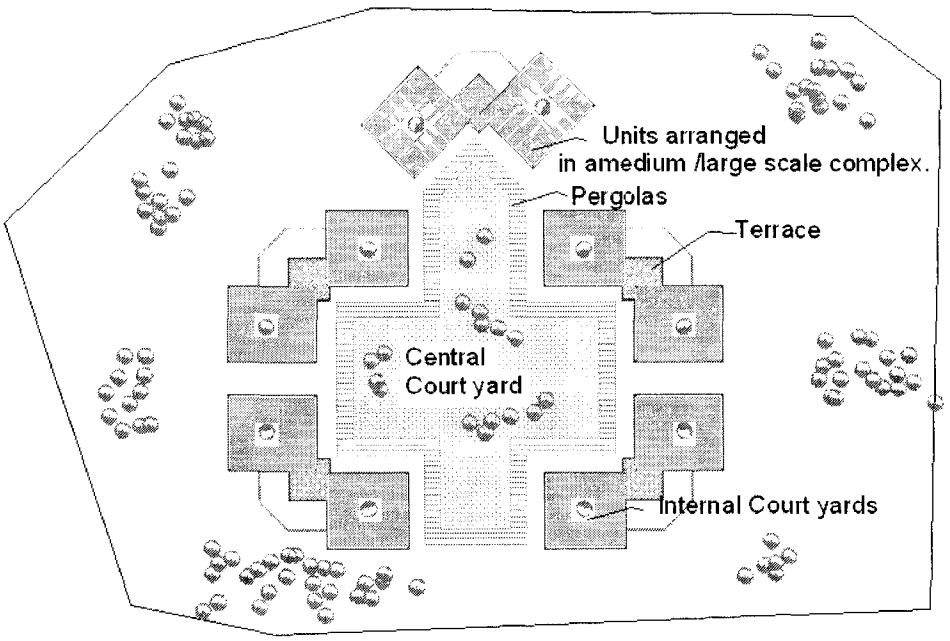

Figure 144 The similar building unit can be used in a medium and large scale design.

The plan above shows each of these units can be composed in a large scale complex where each of these units would function as an individual but at the same time a part of the whole. In the plan above all the units are composed around a central courtyard area along with its existing features such as pergolas, terraces, internal court yards, terraces and step wells.

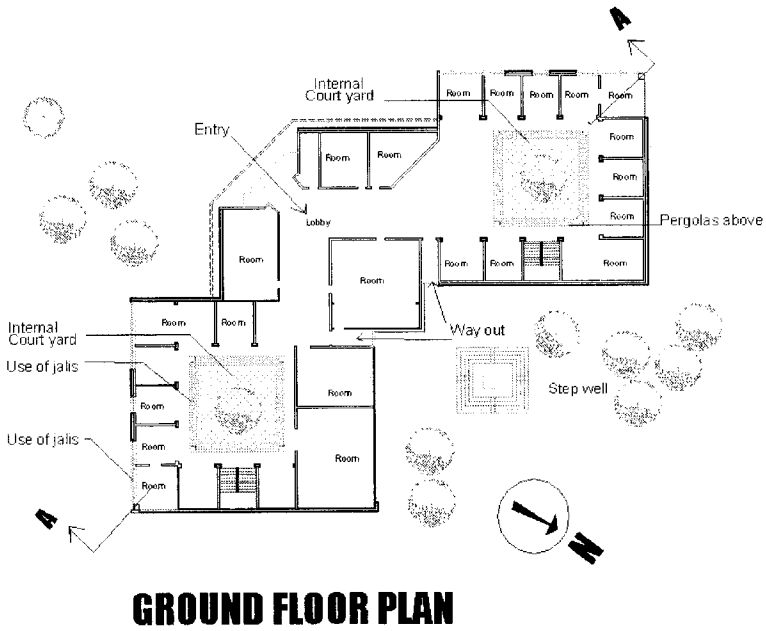

Figure 145 Ground floor plan showing use of courtyards, jalis, step wells and pergolas.

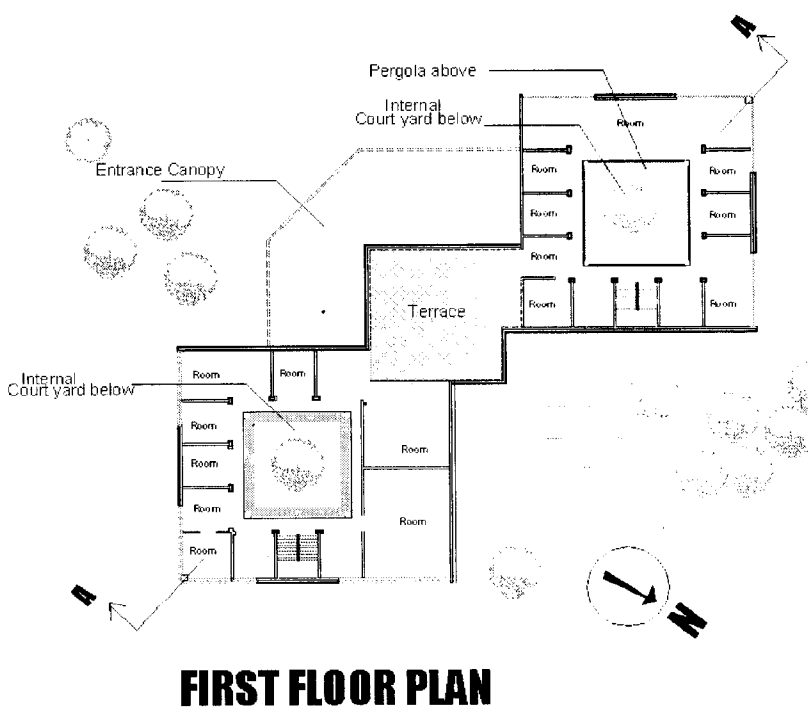

Figure 146 First floor plan showing use of internal courtyards and terrace.

Figure 145 show the ground floor plan of this building shows the composition of two internal court yards covered with pergolas along its walkway to further enhance the play of light.

The plan of floor (Fig.146) above shows the two individual units connected together by means of a common terrace. The step well is used as a landscape feature taking discussion areas or meeting areas from within the structure to outside the structure. The window openings through out are designed so that trellis /jails can be used in certain opening's not only for aesthetic reasons, but also to contribute to natural lighting and protecting against harsh sunlight. The Figure 147 shows the roof plan showing the terrace as a connection between the two units.

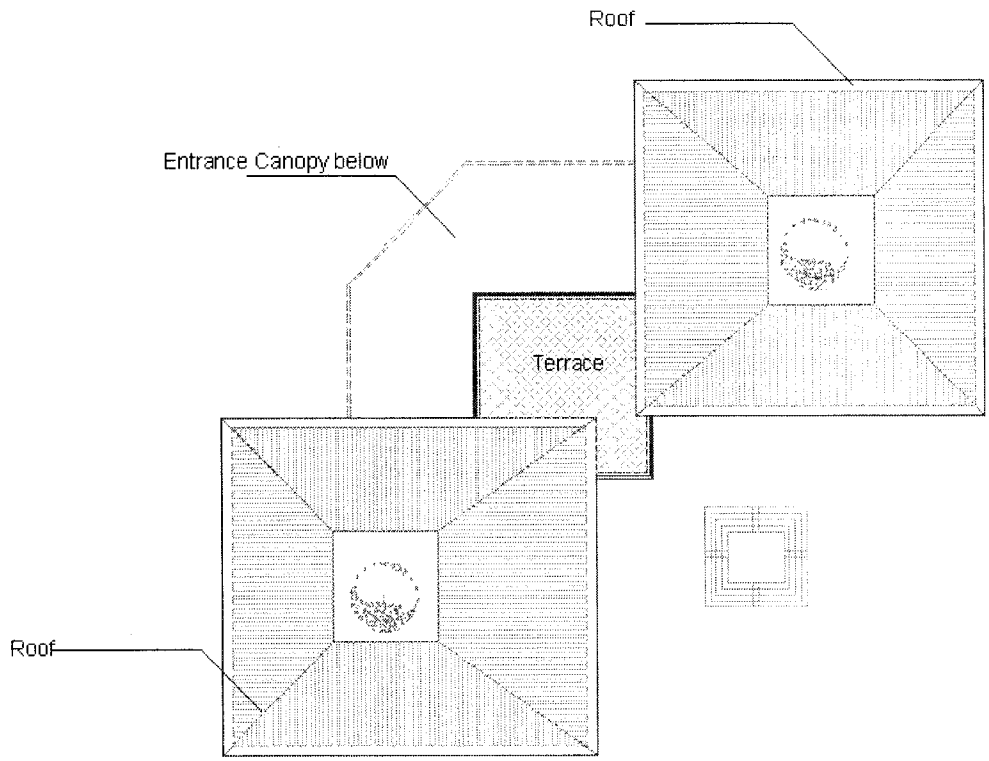

Figure 147 Roof layout showing terraces and court yard.

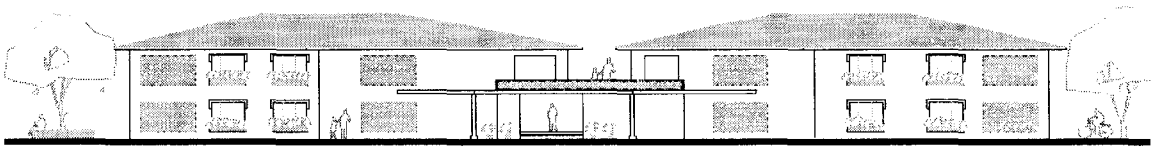

Figure 148 .Elevation showing the use of jalis, terraces and courtyards.

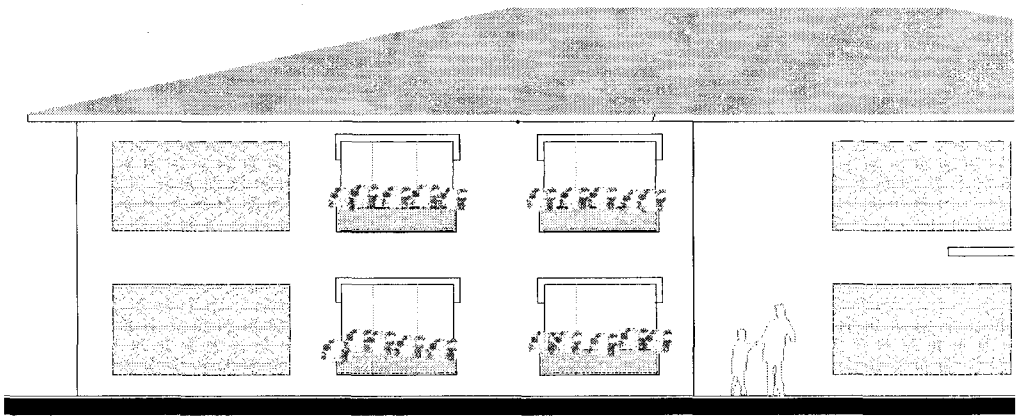

Figure 149 .Enlarged view of elevation showing jalis.

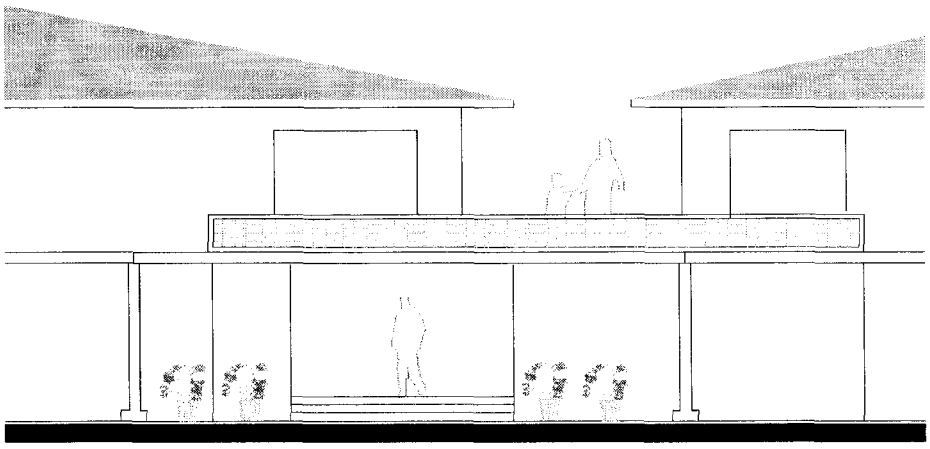

Figure 150 .Enlarged view of elevation showing terrace.

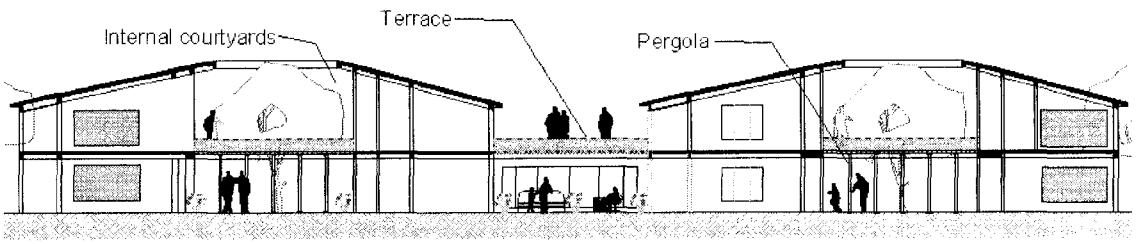

Figure 151 .Section showing internal courtyard, terraces and pergola

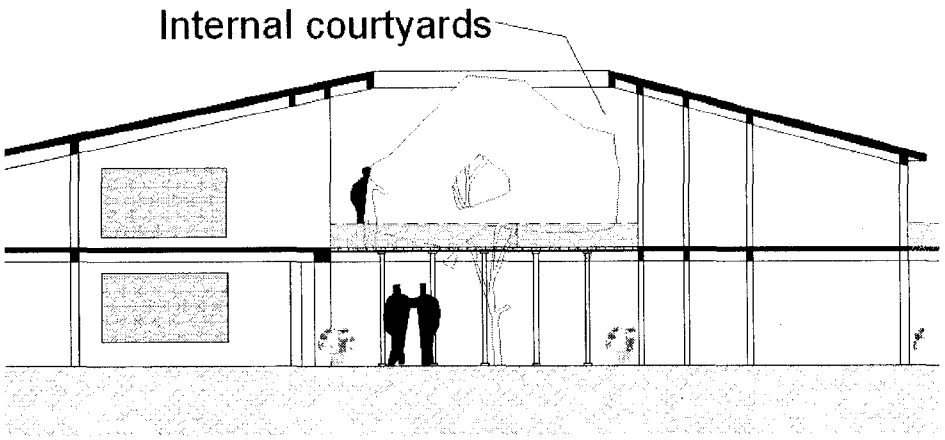

Figure 152 Detailed section showing internal court yard.

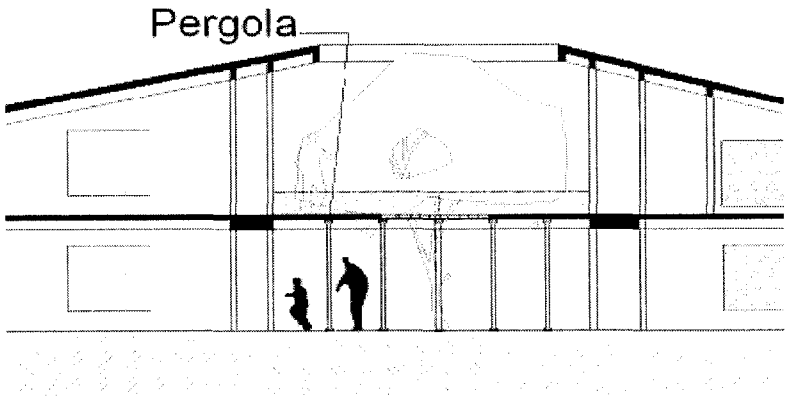

Figure 153 Detailed section showing Pergola

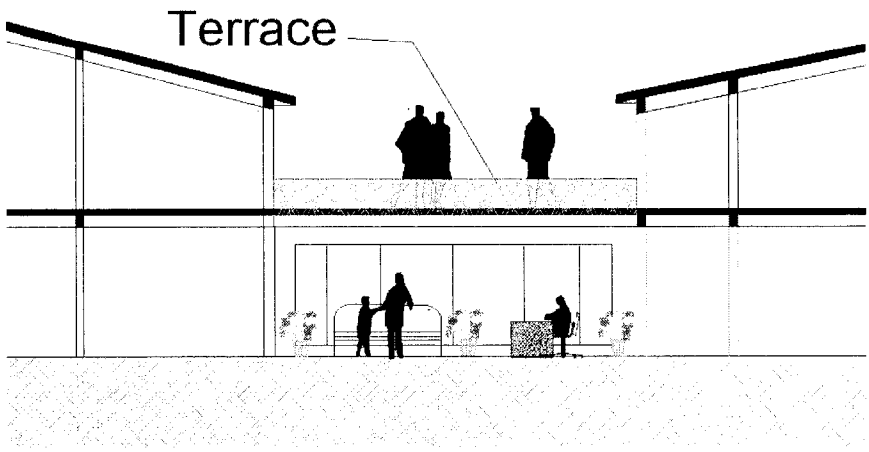

Figure 154 Detailed section showing terrace.

Thus we can see that these traditional features can successfully be applied to small, medium or large scale buildings. Integrating such traditional Indian features in design would help the city of Mumbai (Bombay) to break out of the use of the repetitive classical orders of architecture in a mindless manner and explore its own roots in a better manner. These features were created with intention to suit the climate of the region and aesthetics'.

The city of Mumbai has been adapting to various architectural influences over a period of time .Traditional Indian architecture has rich elements of design that can be adapted to architecture of Mumbai(Bombay)city .Few contemporary architects have succeeded in incorporating these traditional elements in their design. The reason behind exploring elements of past is Mumbai cities architecture is still living and building , buildings in neo-gothic and pre independence style of architecture as seen in chapter 1 .Huge domes and columns in classical orders adorn facades in an distorted manner. This creative bankruptcy can be fulfilled by means of exploring ideas from the traditional roots of Indian architecture. Studying these elements and incorporating in design will help to produce architecture that is regional in its approach and people can identify with.

Going back to the roots often leads to ideas that would help create architecture that is more viable and adaptive to that particular region. Features such as courtyards, jails/trellis, pergolas, terraces and step wells are traditional Indian elements as discussed in chapter 3.Exploring these

ideas is essential as each culture has an definite identity which is rich with respect to people , practices ,social customs ,religion and architecture. So rather than trying to adapt what western nations or other countries are doing, cities such as Mumbai can create its own identity as it has a different geographical location, social life style and economical background just like any other place in the globe. Studying the traditional elements will help build building the city and people can identify with as discussed in chapter 6.Each culture is rich in its own way an we can explore it to relative context to get best results. In my thesis I have tried to justify the use of traditional elements to build structures in Mumbai (Bombay) city and returning to roots can be a solution to establish architecture for a city.

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VITA

Graduate College
University of Nevada, LasVegas

Saloni Graduate Student

Local address:
3/7 Uphaar Building
Siri Road Chowpatty
Mumbai -40006, India

Home Address:
860, Worrell Avenue
Las Vegas, Nevada 89123

Degree:
Bachelors of Architecture, 2000
Academy of Architecture, India

Masters in Architecture, 2003
University of Nevada, Las Vegas

Special honors and Awards:

Publications:

Thesis Title: Traditional of Indian Architecture and Its Adaptability to Mumbai City.

Thesis Examination Committee:
Chairperson, Dr Janet White, Ph.D.
Committee Member, Steve Schur, Architect
Committee Member, Dave Maynard, Architect
Committee Member, Tom Holder, M.F.A