

LEARNING FROM PLANNING AND DESIGNING OF HAVELIS OF MALWA REGION OF PUNJAB AS A ROLE MODEL OF SUSTAINABLE BUILT ENVIRONMENT

Ar. Bhupinder Pal Singh Dhot¹, Ar. (Dr) Prabhjot Kaur² & Ar. Jit kumar Gupta³

¹ Research scholar, I.K.G. P.T.U, Kapurthala , bpalldhot@hotmail.com; **Corresponding author**

² Professor, Department of Built Environment, I.K.G.P.T.U Campus khunnimajra, pkaurdap@yahoo.com

³ Director, College of Architecture, IET Bhattal , Punjab (Retd.) , jit.kumar1944@gmail.com

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ABSTRACT

Traditional buildings are known for their valuable contribution to the architectural vocabulary of India and visual interest they create. These buildings are also known for their great learning and for their contribution to the knowledge and understanding of quality of built environment as they showcase their sensitivity in planning, designing and construction of the buildings. Built in harmony with nature, these buildings define the principles, based on which buildings need to be designed to achieve sustainability. Havelis are residential buildings which are known to be role model of sustainability in the built environment. Considered as treasure house of art and architecture, sustainability in Havelis is achieved by using innovative planning and design principles besides using renewable resources of energy and passive means of heating and cooling. Modern buildings are anti-thesis to the principles followed in Havelis and are accordingly dependent largely on the use of active systems and mechanical means of energy to achieve thermal comfort within buildings. Buildings are known to be large consumers of energy and resources besides being largely responsible for global warming. In search for appropriate solutions to make buildings more sustainable and to promote sustainability through built environment, this paper tries to look at the principles, approach and the elements used in the planning and designing of Havelis which have helped in making them highly energy efficient. It also tries to look at the architectural built form of Havelis, which was evolved in response to local context, climate and lifestyle.

Keywords: Courtyard, Building materials, Sustainability, Thermal comfort.

INTRODUCTION:

Climate remains the major definer and determinant of the architectural vocabulary of any place because entire set of built environment created is supposed to provide best of the living conditions and create conditions of optimum thermal comfort for the users of the buildings. Accordingly, different vocabulary of architecture found in different parts of the world has its genesis in the climate conditions prevailing therein. Humidity and temperature are the two major determinants based on which climate of any place, region and the country is defined.

Located in North Western part of the country, State of Punjab falls in the composite climate zone out of the five climatic zones of India. State accordingly experiences large variations in temperature and humidity over the year with periods of extreme hot and cold months. However, the western part of the state is worst impacted because of its close proximity to state of Rajasthan, which makes it part of Hot and Dry Climatic Zone. State has further been divided into three distinct zones based on the location, culture, rivers etc namely MAJHA, MALWA and DOABA. Among three, Malwa region located in the Western part of the state, has the largest geographical area involving 12 out of 22 districts of the state namely Bathinda, Sangrur, Patiala, Fatehgarh sahib, Ludhiana, Barnala, Ferozepur, Fazilka, Muktsar, Mansa, Moga and SAS nagar. The Western Punjab, known for its harsh terrains and composite climatic conditions, invariably poses enormous challenges of comfortable living. To meet the climatic harshness, effectively and efficiently, people of the region adopted numerous innovative planning, designing and construction technologies to promote environment friendly buildings for achieving thermal comfort and promote comfortable living. Best example of residential buildings which have emerged as the role model of sustainable planning and designing are in the shape of Havelis. These Havelis have survived for centuries because of their geometric, technical and constructive principles that have ensured their sustainability.

Haveli: Havelis are known to exist in different parts of the world as the definer of architectural vocabulary of residential buildings. They have emerged in response to prevailing harsh climate conditions of heat and cold to create ambient living conditions. They have been built generally by the rich to showcase their wealth and prosperity and accordingly are known to be massive and have large footprints. They have also been storehouse of art and architecture of the region. Accordingly, these Havelis have emerged as buildings of importance and detailed study among architectural fraternity, considering their planning, designing, construction and elements which have gone into their conceptualisation. As per the Wikipedia; Haveli is a traditional town house or mansion in India, Pakistan, Nepal and Bangladesh, usually one with historical and architectural significance. The word Haveli is derived from Arabic Hawali, meaning "partition" or

"private space" popularised under Mughal Empire and was devoid of any architectural affiliations. Later, the word Haveli came to be used as generic term for various styles of regional mansions, townhouse and temples found in India, Pakistan, Nepal and Bangladesh. As for a physical definition, it can be said that Haveli is a medieval dwelling with a courtyard or a bigger mansion within. The Havelis of Northern and North-Western India are perhaps the most popular types of courtyard houses in India and particularly in its states of Gujarat, Rajasthan and Punjab. The Havelis in Punjab reflect the psychology of the people who built them with passion and commitment, relying primarily on security for safeguarding their families from the Muslim invaders.

Paper identifies and defines critical features of Havelis which make them sustainable with focuses on Havelis of Malwa region of Punjab. Paper also makes an attempt to identify critical features of planning, designing and construction of these Havelis and analyzed them in terms of spatial planning and climatic responsiveness.



Fig.1: View of Haveli at Baghrian (Sangrur)



Fig.2: Sandhu's Haveli, Harditpura (Patiala)



Fig. 3 Haveli at Jhanduke (Bathinda)



Fig.4: Haveli at Kotakpura (Faridkot)



Fig.5:Bhanamal Haveli, Bathinda



Fig. 6 Punia Haveli, Abohar (Fazilka) Fig. 7 Jaildaran di haveli, Dhingawali (Fazilka)



Fig. 8 Views of Bansal Haveli, Batihnda

PLANNING AND DESIGNING OF HAVELIS: Malwa region of Punjab is characterised by its typical desert like climate, known for its harshness and extremes, where during the summer temperatures rises as high as 48°C and during winters dips as low as 1°C. Accordingly, the prevailing climatic conditions present the greatest challenge to human living and creation of sustainable buildings. On one hand, harsh summer season mandates buildings to be made safe from the incessant heat of the sun whereas the cold climate asks for making optimum use of the sun to create ambient living conditions. In addition, continuous threat posed by the foreign invaders called for buildings to act as promoters of safety of human life and liberty whereas prevailing social fabric wanted high degree of segregation created between men and women and between public and personal life. These factors made planning and designing of Havelis a very complex task demanding high degree of professional ingenuity. In order to counter all the factors, planning and designing of Havelis revolved around a central open space. The feature that characterised the Havelis was symmetrical planning worked out around courtyards which also delineated public and private spaces in the house. Social segregation in the Haveli was achieved by allocating the front section of Havelis to men folk called *Mardana*, which was made extrovert and made open to exterior, while the rear portion which is carefully set away from the entrance was reserved for women or *zenana*, as per Indian traditions. The number of courtyards varied depending upon the size and need of the Haveli. In most of the cases, open veranda was designed as integral part of the Haveli in front, to abut and face the street/road. Baithak (Drawing room), was also provided along the veranda for the use of males and entertaining guests. Doors and windows provided in the house were intricately ornamented. Greater emphasis was given to the Main entrance door which was usually fabricated from solid wood, divided into rectangular planes or engraved panels. Considering the role and importance of water, rainwater was valued and stored underneath the courtyard for various uses.

SAILENT FEATURES OF HAVELIS: Looking at the existing Havelis in the western part of the state, it can be said that planning and designing of the Havelis included certain typical features which include; Courtyards, Terraces, Verandahs, Large Room Sizes Thick Walls, Ventilators, Large height and Volume of rooms and Brick and lime as a material.

Courtyards and Terraces: Courtyard is the most vital and critical part of all Havelis for numerous reasons. The earliest archaeological evidence of courtyard homes in the region dates back to 3300bc. Traditional homes in South Asia are also built around a courtyard, and all family activities revolved around this courtyard. In addition to being a social space, courtyard serves the purpose of providing air, light and

ventilation in the house. It has large capacity to act as heat dump and to make the adjoining rooms well ventilated. Courtyards and Terraces on different levels are most fascinating features of these Havelis which not only define the perfect spatial organization, but are also the centre for rituals, marriages, festivals and social gatherings. Courtyards, nearly square in shape give connectivity to areas or spaces inside and outside. The vertical part encloses courtyards and defines their volume. The elements like arches, niches, fireplaces, cornices make this space lively. Well placed and proportioned courtyards at all levels also serve as micro-climate modifiers due to their ability to mitigate high temperatures, to channel breezing and thereby adjusting the degree of humidity. During summer time, throughout the day, they provide shade and in combination with the thick external walls minimise the heat gain. During night, warm air rises and exits from the courts. The cool air enters to supplant already existing air. Hence, during hot day, cool air gets circulated to the rooms and the courtyards turn into a source of fresh and cool air. These aspects make Havelis highly sustainable. In majority of buildings now being created, courtyards are still being used as integral part of the architectural design to make buildings sustainable based on using natural and passive systems of air, light and ventilation in the buildings.

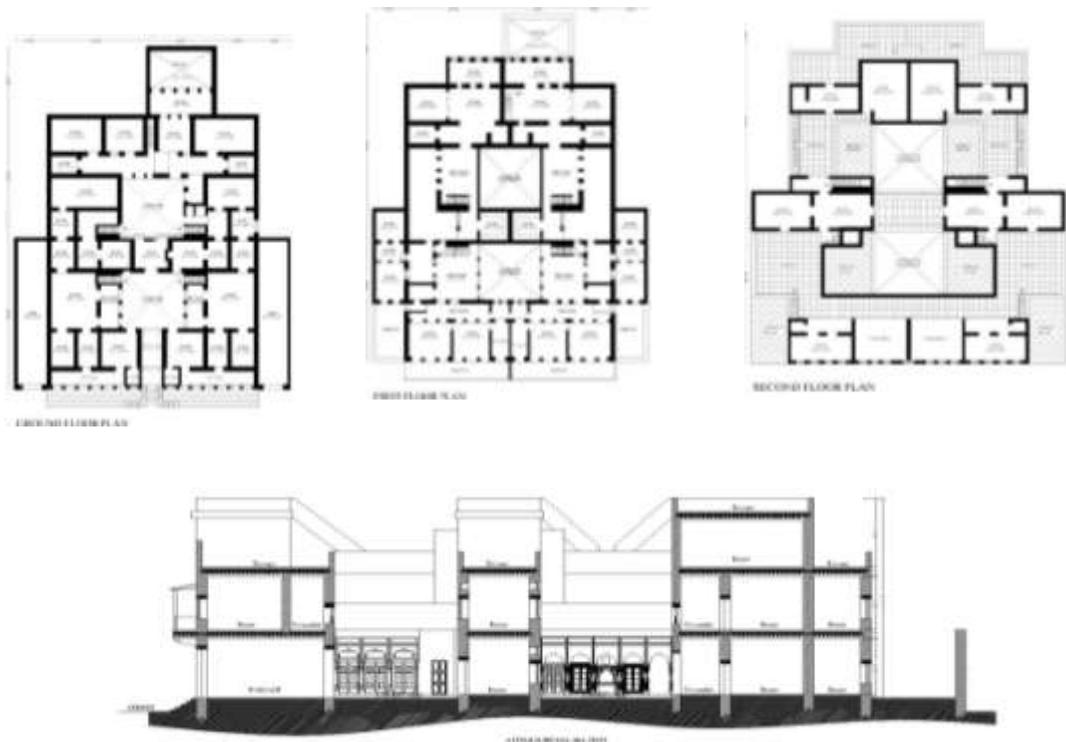


Fig.9. Typical plans and Section showing built and open space relationship

Room size and Massive walls: In Havelis, room placement has been done with care and caution in order to ensure they have adequate air, light and ventilation. Most of the inner rooms have been placed abutting on the courtyard on the ground whereas on the first floor they have been planned to face inwards on the courtyard or along the terraces for providing adequate daylight. Room sizes have been rectangular with longer sides placed along the courtyard to maximise the benefits arising of the courtyard in terms of light, air and ventilation.

The walls of Havelis are massive with thickness varying from 18" to 27" and mostly have been constructed with Nanakshahi bricks, lime and surkhi. Bricks are known to have high thermal capacity and longer life. Thick walls ensure that time lag is very large so that minimum heat is gained and lost through walls. Thermally heavy weight construction is part of the climate responsive strategy for both the cool and the warm periods. Furthermore, thick walls in addition to their insulating properties, act as heat reservoir. During hot days, the heat that flows from exterior due to solar radiation to the inside gets reduced. During the cool hours a part of the stored heat in the walls is released to the interior. This results in the minimization of temperature change inside the Haveli. On the other hand, in winter, heating requirements are reduced due to the heat stored in the walls which radiates during the night.

Heavy roofs, High ceilings: Havelis in general followed the principles of orientation in their planning and designing spaces. Buildings have been oriented to make optimum use of solar energy in the winter whereas to exclude the hot sun during the summer. Due to orientation and mutual shading, the walls stand protected from solar radiations. The thickness of roof varies from 15" to 18". The flat roof is made of timber. Timber being bad conductor of heat does not allow the horizontal surface to gain much heat throughout the day. Greater ceiling heights of 14 feet to 18 feet provide greater volume in the room and reduce the impact of solar heating. It also improves environmental conditions in summer time by permitting warm air to rise. This height increases the volume of the enclosed space, taking thus more time for the internal air to get heated up as compared to the buildings with low height ceilings. Greater room height also permits the provision of adequate ventilators for effective ventilation in the room by eliminating hot air and by promoting air circulation and ventilation in the Haveli.



Fig.10: Heavy roof supported on wooden battens



Fig.11: High ceilings increasing time gap in heating the internal air.

HAVELIS ENVELOP:

Verandahs, Overhangs and Balconies: Building envelops remains very critical in promoting sustainable buildings because it is the separator and definer of the building outer skin which separates the manmade environment from the natural environment. It is also called the first line of defence against the natural elements of weather and climate. Building envelop also assumes importance for promoting sustainability in building because majority of heat gain and heat loss occurs through this. Adequate air, light and ventilation in the building is also dictated by the building envelop. Accordingly for making building sustainable, adequate care has to be taken in designing the buildings envelop.



Fig.12:Verandahs ,overhangs and balconies as a part of Building envelop.

In the designing of the Havelis, Verandahs have been found widely used as integral part of building envelop in all the Havelis of Malwa region of Punjab. The verandahs are located at the entrance and around the courtyard, shading the peripheral rooms. They function as a transitional space between enclosed rooms and outdoor spaces and also provide shade to the walls reducing heat gain. Verandahs, on the southern side, are the most effective building elements which allow the sun to reach the interiors in winters, and prevent in summers. Projections created at different levels shield the Haveli from direct solar radiations & reduce heat gain. The depth of balconies and overhangs minimizes the solar radiations in summer and allows the winter sun to penetrate inside. Balconies have been projected in front of large openings to prevent solar radiation from entering the rooms through them whereas balconies on the first floor have

been encased with the help of wooden jaali windows to permit natural light and ventilation and achieve privacy from the street side. Balconies have also been provided to connect the buildings with outside. In addition to providing shaded spaces in front of the buildings, these balconies provide sheltered space for sitting and looking outside.

Openings and Ventilators: Providing adequate air, light and ventilation through adequate and appropriately placed openings and ventilators has been observed to be another sustainable feature of the Havelis. Studies have indicated that ensuring air movement in the built space through the adequate openings provides thermal comfort at higher temperature. These openings have been adequately shaded from the direct solar radiation. However, in winter, window apertures are opened during the day to store the thermal radiation and these are closed at night to eliminate heat loss.. Windows, in addition to providing appropriate ventilation, also permit sufficient daylight into the interior. In addition, ventilators also form



prominent features of the Haveli design. These are manually operated and generally provided just below the ceiling. The warm air rises and leaves the space. The cool air from the courtyard enters into rooms thus creating the stack effect. A typical ventilator near the ceiling increases the velocity of air entering into the Haveli and results in lowering of the pressure at the ceiling level, thereby inducing the hot air under the roof to flow out. Ventilators also function as clearstory windows to lit up the interior spaces not having any exposed surface to admit daylight through window openings.

Fig.13 windows and ventilators provide adequate cross ventilation

Surface texture and Colour: Colours and textures are known to have important role in making the building sustainable by limiting and reflecting the heat gain or heat loss. Light colours are known to large reflectors of heat and minimiser of heat gain whereas darker colours promote heat gain through walls. Accordingly, colours and textures have important role in rationalising heat gain and heat loss in the building. Accordingly, textured surfaces have been used in the exterior finish of the Haveli facades exposed to sun. The walls in Havelis are finished with lime and stucco plaster. The façades of the Havelis are treated with stucco on motifs and floral patterns made up of lime plaster. The external surface of the Haveli is painted with light colors that reflect solar radiation in order to have minimum heat absorption. Whitewashing reduces the heat absorptive property of the wall surface, minimizing the effect of solar radiation on internal climate and tends to stabilize the inside temperature, making the Havelis sustainable in the process.

CONCLUSIONS:

Going by the perspective of Climatic responsiveness, the principles of planning and designing of sustainable buildings have been found to be precisely worked out and actually followed in the design of Havelis. Study has also revealed that natural sources of energy, light and ventilation besides passive means have been adequately deployed in the Havelis for minimising dependence on active and mechanical means of energy. Thermal comfort has been achieved through design features like internal courtyards, orientation, thermal mass and solar gain. Havelis also highlights and showcase the construction methods and skills for using locally available materials. These observations would be theoretically and practically useful to the professionals working in the field of Climatic responsive Architecture.

Considering the overall ambit of planning and designing of the Havelis involving courtyards, construction with locally available materials, immunity from the harshness of summer- winter seasons, naturally regulated flow of air and openness for natural light reducing dependence upon mechanical energy constitute cogent proofs of its sustainability. Combination of these features provides comfortable indoor environment to the inhabitants. Variety of spaces like open, semi- open and enclosed, has been put into use during daytime in different seasons. If the courtyards ensure ventilation in the Haveli, verandahs on the outside facing balconies covered with wooden windows, help in reducing the heat intake from south -west side. These serve as buffer space between the interiors and the outside environment. The walls have been adequately protected from the sun with various elements which makes the building interior cool. Building components and spatial layering in the Haveli helps in the reduction of heat intake. The greater ceiling

height increases the volume of the enclosed space thus increasing time gap in heating the internal air. Thick masonry walls and heavy roof construction system increase time lag of the building envelop to rationalise and modulate the solar heat. The openings such as windows and ventilators provide adequate cross ventilation, which helps in creating stack effect. Heavy Building mass of Havelis emerging out of massive structure reduces the heat gain in summers. Harmony of Havelis with the environment both physical and social along with its solidity and intactness clearly discernible even after decades of construction, are also significant factors constituting its sustainability. Study made and analysis carried in the paper clearly indicates the effectiveness of appropriate use of materials, spatial organisation and construction techniques in creating much desired comfortable environment inside the buildings to make them sustainable and least consumers of energy and non-renewable resources,

Obviously, Havelis has significant lesson to convey to the Architects, Engineers and other stakeholders engaged in the creating built environment, regarding achieving the goals of designing energy efficient building and providing sustainable design solutions in their professional ventures. Traditional buildings are not just remnants of the past, but offer great lesson and convey meaningful message for securing the future of mankind. Need for making present day built environment sustainable may well be served by using the principles of climate responsive designs options built in the traditional architecture. Haveli beckons us to move intelligently and wisely while designing and constructing state of art sustainable and energy efficient buildings .

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