

Window as an Element of Architecture

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Abstract—Windows are the eyes of a building which relate the outside world with the inside. It arranges and governs the light and thus sets the atmosphere of the interior. It regulates the winds and thus helps to ameliorate the human comfort inside for the occupants. Further windows frame a beautiful view outside and create a moving picturesque portrait which can act as a backdrop to our daily activities. It is often framed and spanned with glass mounted to regulate light and wind. There are many different types of windows which have been evolved worldwide. The configuration of the window, composition, image making quality depends upon many factors including the climate, society, materials, construction techniques, religious beliefs e.t.c. The different attributes of windows help to give a desired character of building. The paper tries to explore window as an element of architecture by taking interesting architectural examples which are modern as well as vernacular.

1. INTRODUCTION

The Oxford dictionary meaning of window is “An opening in the wall or roof of a building or vehicle, fitted with glass in a frame to admit light or air and allow people to see out.” [1]

Apart from the basic functions of a window which include admittance of fresh air, light, view and spatial articulation there are many other connotations of a window in a building facade. The window design keeps evolving over the time. The windows of the vernacular buildings contribute to the sense of place. Depending upon the available building materials, construction techniques, local building traditions one can trace the different treatment given to the windows. The paper tries to explore the relationship of window with the space leading to interesting architectural examples.

2. EVOLUTION OF WINDOW

Windows have always been an essential element of a building. The size and shape of the opening depended highly upon the different building materials, social condition, climate and construction techniques. The early windows can be traced in the Harappan houses of the Indus civilization. For the courtyard houses, the windows had wooden shutters and reed grills which allowed light and ventilation. [2,3]



Fig. 1: Model of Harappan house with use of windows on the walls facing the streets

The caves carved out of the rocks consisted of openings. The sun windows placed in the centre of the horseshoe arch found in the Buddhist Chaitya halls at Ajanta allowed sunlight to dispel the darkness of the deep caves. Especially in the cave no 26 which is aligned to summer solstice sunrise. As the sun raises the sun window allows the beam of light to illuminate the stupa and the statue of Buddha inside. In a similar manner the sun window of cave no 19 is aligned to allow the beam of sun of winter solstice. [4,5,6]



Fig. 2, 3: Front View and interior view of Cave no. 26, Ajanta Caves, Maharashtra

To enlighten the central space below the dome, a circular opening referred as *oculus* was designed in the Roman Pantheon. [7]

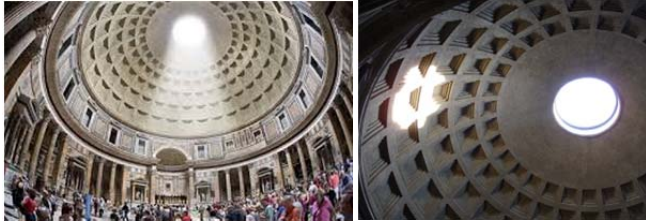


Fig. 4, 5 : Interior view of the Pantheon, Detail view of Oculus of Pantheon

Another interesting early example of use of windows can be traced in Hagia Sophia. Forty windows placed below the dome added to the visual weightlessness and to the wonderful play of light. [7,8,9].



Fig. 6: Interior view of Hagia Sophia.

A significant element of Gothic church's facade is the circular rose window. The rose window consisted of stone tracery along with the stained glass. The structural system of Gothic church with flying buttresses, ribbed vault and columns allowed lot of windows with stained glass in the walls with the narratives which created a mystical play of colorful light. All types of windows in Gothic church allowed the divine light to enter the church. [11,12]



Fig. 7: Interior view of a Gothic Church

Because of the load bearing construction, the earlier windows were of small size. But now due to the advent of frame structure, glass etc. windows help to blur the distinction between the interiors and the exteriors. The finest example for the impact of frame structure on building facade are the ribbon windows which Le Corbusier used in his buildings exemplified best in Villa Sayoye . [20]



Fig. 8: Exterior view of Villa Sayoye, Poissy, France

Thereafter new experimental types of windows were used in the buildings.



Fig. 8: Different types of windows [19]

After understanding the evolution of a window ,a wide horizon of connotations and functions for windows in architecture opens up which are briefly discussed as follows:

WINDOW IS A SIGN OF LIFE :

Pierre von Meiss says that,"A window is a sign of life .He further adds that it is a wink to the passerby. And it is equally uncomfortable to be in a house which bounds a public street with no window at all on the street. It is also an eye of the building allowing one to gaze at the outside world without been seen.' [29] The interaction between the inside and the

outside world is possible due to windows as people can visually as well as verbally interact and introspect with each other which enlivens the human mood. Without a window the street looks dull and frightening.

2) ORIENTED WINDOWS

In the traditional Indian temples the orientation of the temple is east-west. And the windows were oriented to admit the garbhagriha /Sanctum sanctorum placed towards the east direction. The significant examples being Sun Temple at Modhera, Sun Temple at Konark e.t.c. A festival of sun rays also referred as Kirnotsav is celebrated in Mahalakshmi Temple at Kolhapur when the sun rays fall directly on the idol of Mahalakshmi highlighting it at the time of sunset on specific six days in a year which is possible because of the precise calculations of the size of the opening and the distance between the source of light and the idol. [21]

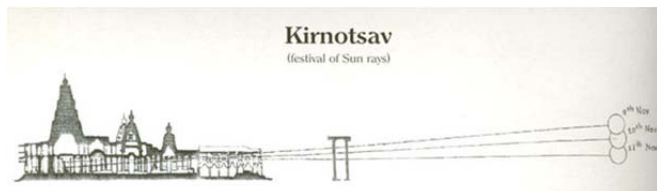


Fig.9,10-Sun beam touching the feet of the idol at Mahalakshmi Temple at Kolhapur during Kirnotsav.

In the research paper titled “The Benefits of Daylight through Windows” done by Peter Boyce, Claudia Hunter and Owen Howlett, it mentions that windows are preferred for daylight and the views they offer. It also quotes that windowless spaces are generally disliked when the spaces are small. Windows offer daylight and ventilation along with a view outside. In the results of surveys of office workers, out of all the above mentioned functions of the window the two important functions of windows are outside views and daylight (Collins, 1975; Brill, 1985). Out of these two attributes the research work of Young and Berry (1979) demonstrates that view dominates daylight admission through the window. [31]

3) WINDOWS TO CONNECT WITH THE NATURE.

Windows help to connect with the nature. One of the finest architectural project which displays the concept of windows which help to frame a vista is a resort Heritance Ahungalla designed by Ar. Geoffrey Bawa.



Fig. 11: Heritance Srilanka –Ahungalla, View from the entrance lobby to overlooking the reflecting pool, swimming pool and finally the vast sea.

It exemplifies beautifully his concept of complete synthesis of site and the context. The design breaks the distinction between the interiors and the exteriors by sensitive use of full height windows which binds the building with the sea. The reflecting water pool in front of the entrance lobby welcomes the visitor and the window opening of the reception and waiting area acquaints the visitor to the vast sea. Further the reflecting and swimming pool stretches the visual continuity from the public to private and from the exterior to interior and further to infinity. Thus the window frames a beautiful view and helps to connect the exteriors especially with nature. [32]



Fig. 12: Interior view of Fransworth House

Another excellent example which highlights window as a backdrop for the spaces inside is weekend Farnsworth House designed by Ar. Mies Van Der Rohe. The glass spans the overhead and ground plane running on the periphery the base

plane which connects the interior with the exterior surroundings to the fullest. [22].The full length window opening designed in Church on the water,Japan by Ar.Tadao Ando takes the relationship of the interiors with the exteriors to a very different level wherein the cross placed in the reflecting pool which is surrounded by trees extends the space of the church visually.This helps the user to experience and relish the change in weather.



Fig. 13: View towards the exterior from the interior, Church on the Water, Japan

5) WINDOWS REGULATE VENTILATION

The location and size of the window according to the air flow allow fresh air to come inside which ensures ample amount of fresh air inside the space.

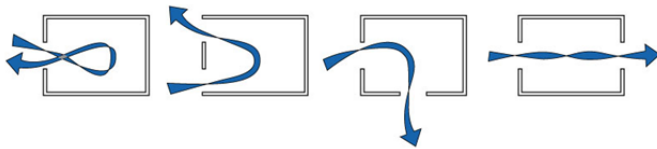


Fig. 14 Diagrams showing plans with single opening ,two openings same walls ,two openings adjacent wall and Two openings opposite walls. [23]

The effectiveness of air ventilation depends largely upon the wind velocity, size, location and placement of windows. Windows help to regulate ventilation through a space. A single window facing the windward side in a room will be less effective than two windows in a room. Further, if one places two windows on adjacent walls the ventilation will increase. Cross ventilation i.e. placing windows on opposite walls of a room is a preferred strategy in warm and humid climate to achieve effective ventilation through the space. The combination of smaller inlet and larger outlet window placed on either sides of a room increases the velocity of air. [23].The Energy Research Institute (T.E.R.I)Bangalore designed by Ar.Sanjay Mohe ,is an excellent example wherein we can see that the windows allow sufficient light and ventilation through the building while simultaneously disallowing the foul air

from the nallah towards the south of the site. The building takes up maximum glare free natural light from the northern side. A blank wall towards the south creates a negative pressure which pulls fresh air from the north. This strategy increases the convective currents of air in the building ensuring proper ventilation. [36]

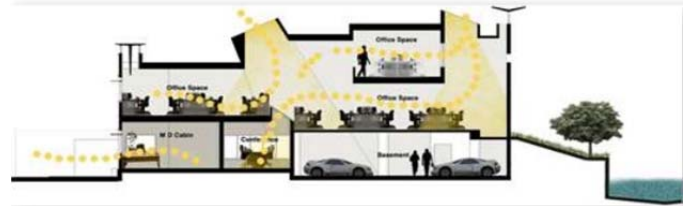


Fig. 15: Section through T.E.R.I.Bangalore showing natural light penetrating deep inside the building due to windows placed on the northern façade and due to skylights.

Another noteworthy example for effective use of windows for ventilation is the Gandhi Smarak Sanghralaya Ahmedabad. A museum dedicated designed to commemorate the life of Mahatma Gandhi, designed by Ar.Charles Correa consists of square modules placed in an asymmetric way to replicate the organic plans of Indian towns. The design was kept simple to reflect the simplicity of Gandhiji’s life .The building vocabulary consisted of tiled roofs, stone floors, exposed brick walls and louvered windows. The windows which allow cross ventilation and filtered light inside were devoid of any glass, but consisted of adjustable wooden louvers. [25,26,27]

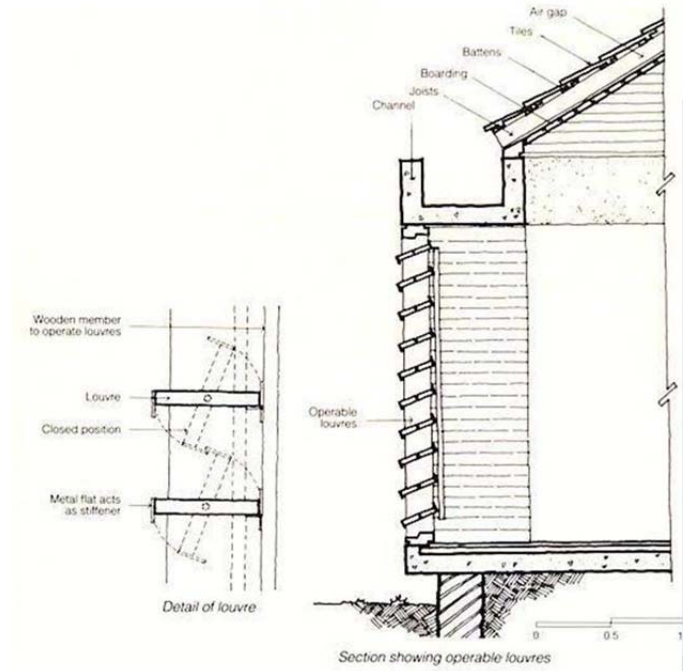


Fig. 16: Section showing the detail of louvered window at Gandhi Smarak Sanghralaya,Ahmedabad[25,26,27].

WINDOW AS A FACADE MODULATOR AND IMAGE MAKER -

Windows help to create an image of a building due to their shape, size and composition of many windows. Many times the buildings are recognized and identified because of the windows. Many architects experiment the windows to modulate the building facades. A traditional example of this is the Hawa Mahal at also known as Palace of Winds, Jaipur, India. It consists of a five-storey pyramidal facade facing the street consisting of 953 latticed bay windows also known as *jharokas*, were filled with stone jalis and colorful tinted glass which enable the royal women to observe the street festivals while being unseen from outside. The lattice windows allows cool air through their intricate pattern carved out of red sandstone due to Venturi Effect, air conditioning the interiors during the summers in the daytime. [34]



Fig. 17: Exterior view of Hawa Mahal from the street.



Fig. 18: View of the central court surrounded by walls with square windows grouped together at I.U.C.A.A, Pune[35]

Ar.Charles Correa in his building Inter-University Centre for designed the building facade with the grouping of square windows of different sizes which eventually creates an image. [Astronomy and Astrophysics, Pune had very efficiently 35] Thus the element of windows draws a user's attention to the building facade.

Another contemporary example where we can trace that



Fig. 19: Façade facing the River, Cidade De Goa, Dona Paula, whose design is inspired from Portuguese town

window creates an image is Cidade De Goa, designed by Ar.Charles Correa. Here the windows contribute to lively and an interesting façade due to uneven window projections and colours.

WINDOW ATTUNED TO CLIMATE

A vast amount of heat loss or heat gain is through windows. Thus it forms a decisive factor while designing the type location material and size of the window in a space. We find small windows in hot dry regions to disallow the hot winds from the outside on the outer facade and large windows on the wall adjacent to the inner courtyards in a typical house. In warm and humid climate windows are large and multiple in the building facade which faces the wind direction to allow cross ventilation. A building is cooled by window openings low in the building by allowing cooler air inside which carrying heat away through openings in the top of the space creating a stack effect.

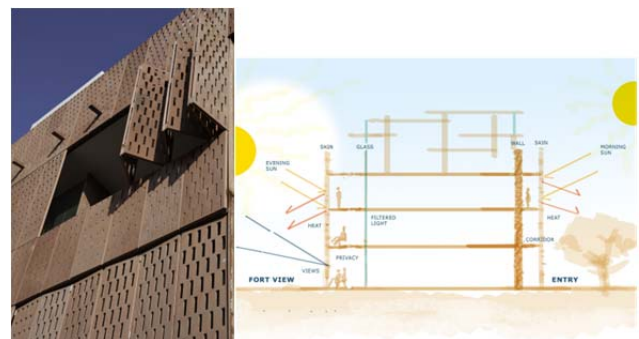




Fig. 20,21,22: View of perforated sliding and folding window, Conceptual section showing the windows and exterior view of Hotel Raas, Jodhpur. Rajasthan overlooking the Jodhpur Fort.

Raas Jodhpur is a contemporary example of windows which is inspired for the traditional windows of the region to ameliorate the climate inside a space. The windows offer passive cooling, play of light and shade and privacy to the users simultaneously. The window panels can be folded to reveal the uninterrupted views of the fort or closed to keep the harsh sun out. [24]

8)WINDOWS REFLECT BUILDING TRADITIONS

The vernacular windows are the best examples which reflect the climate,culture,building materials, building techniques, traditions of a space. They at the same time create an image on the onlooker.



Fig. 23: Images of vernacular windows from different parts of India.

3. CONCLUSION

Window is connection between two realms. The attributes of its design could be based on proper understanding of the requirements primary as well as secondary from both sides. It plays a significant role in space quality; physical as well as emotional. Windows are important apparatus of architecture which help in articulation and modulation of space as well as

form and add meaning to both. It can facilitate and control the link between inside and outside; and can be effectively used as an object of image making. The perception and experience of manmade enclosed space depends largely on how well various considerations have shaped the design of window. We have numerous examples of this kind which needs to be looked into, and approach design of windows as fulfillment of with specific criteria in given situation rather than following the rule of thumb and rhetoric.

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