



# Lattice Jaali: Study of Decorative Aesthetic Architecture

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## Abstract:

Jaali Screen is for creating light effects & partitions and for the thermal comfort in a structure. The screens also offer protection from the dust and providing fresh air through the fine carved patterns. They can be used to adorn windows, openings, as railings, grills, furniture elements too. One of the large Jaali screens adorning of the Tomb of Muhammad Ghaus at Gwalior, built in 1565, by the great emperor Akbar. The way lattice screens have been conceived across the Tomb. This study examines that the development of jaali designs and this type of construction method during the time period changed and geographical conditions and helps to the architects or designers of new era, to using these lattice Jaali work in modern architecture buildings or present era's structures and help to used to different materials for Jaali Screens.

**Keywords:** Mughal Architecture, heritage building, geometric patterns, carved stone lattice screen, materials

## I. INTRODUCTION

Jaali is described as a word- Jhilmil or jhalka in ancient era, which means a net which is not fully closed and has geometric patterns or other patterns which are carved on walls and etc, and lattice work is in geometric and floral designs to create light effects & partitions and for the thermal comfort. The screens also offer protection from the small elements which allow the passage of fresh air through the fine carved patterns. They can be used as a windows, and opening, railings.

The jaali work belongs to the 16<sup>th</sup> and 17<sup>th</sup> century stone art of India. It is an essential element of Mughal, and Indo-Islamic Architecture. In mughal architectural monuments as we see that the red sand stone and white marble is used to built the structure. Jaalis have been used on the cause ways, as railings, and also edges of the chhajjas, jharokhas and garkhs (a mughal word which is used for the balconies). Jaali was gorgeously used for the openings, windows and doors for the ventilation and the effect of light. These jaalis allows free air, and temper sunlight. It is also a excellent ventilator in rooms. These jaalis work essentially used in architectural accessory, the mughals made it as art work. Lattice jali works has consist of different patterns geometrical or floral designs and these patterns have unity, symmetry which reflects the aestheticity of structure.

## II. CASE STUDY

The mausoleum of a Sufi saint Muhammad Ghaus Tomb in Gwalior (Madhya Pradesh in India) is a great example of perforated lattice jaali work which is commissioned by the great Mughal emperor Akbar. Its construction completed in 1565, the starting of Mughal Architecture explosion. It is a traditional Mughal Architectural monument which has the domes and very delicate lattice work on the walls.

It is also a best example of Mughal Architecture of 16<sup>th</sup> century. This tomb is made up of red sand stone. Tomb of Muhammad Ghaus was built for the Saikh Sufi Saint Muhammad Ghaus who was the teacher of humanyu. Humanyu was the father of great emperor Akbar and a Tansen

tomb is placed behind the tomb for the great musician from Akbar's court and Muhammad Ghaus was also his teacher. This study examines that tomb built in the form of hexagonal towers. The corners of this tomb surmounted by the domes. The whole body of the structure is enclosed and perforated on all sides by the carved stone lattice work which is elaborate and delicate design. This tomb is whole crowned by a large dome.

### Planning:

It is a big structure as like other mughal tombs, there is a large room and has 43 sq area, and for supporting from inside a lofty dome above it. The walls of the Tomb are surmounted by a verandah with a gallery and it is twenty feet (20ft) wide, and enclosed by beautiful lattice designs of pierced stone lattice. The tomb is located at the centre of the quadrangle pattern with garden like char bagh pattern surrounding it. The structure is placed over a raised sands stone terrace measuring 149 feet square and 3 feet and 4 inches high from the ground. There is a central hall where the funeral of saikh is placed at centre of the hall and it also enclosed by the jaali work on marble and inside it a large dome is found surrounding a pavilions over the central hall. The corners of the top of the building placed four rounds towers approximately measured 40ft in height which are surmounted by sandstone kiosks.

### Jaali screens:

The mughals have mostly used geometric jaalis with curved and straight lines both and they have also used arabesque designs and floral designs for carved on the stone walls. In Muhammad Ghaus tomb geometric pattern is mostly used to adorn the facades of tomb and give the proper light effect in the building and the geometric patterns like hexagon, and inclined and straight lines are joined in the form of a delicate pattern. The geometric patterns have taken from the Ammann-Beenker tilling a non periodic tilling. Due to these jaali works the cooling can feel in the tomb and there is always a difference of 5degree between the of outer and inner temperature. The temperature of inside the tomb is always 5degree less than the temperature of outside the tomb



**Figure.1. Jaali pattern on the facades of the Muhammad Ghaus Tomb, located in Gwalior (M.P., India)**

**Glazed tiles-** Glazed tiles was well used inside the tomb as ceiling of the tomb and the design of the glazed tiles should be a subject like flowers, human, or other part of nature. In the tomb they used flower or floral design to adorn the beauty of ceiling of tomb. Mostly glazed tiles used in the facades of the mughal buildings but in this tomb it is used as a ceiling of building.

### III. CLIMATIC CONDITION

**Gwalior-** Gwalior is the most popular historical city of Madhya Pradesh in India. Gwalior is a well known place of art and associate with historic evidences like, the Gwalior fort, Gujari Mahal, Man mandir palace, Muhammad Ghaus tomb, sun temple and other historical buildings which reflects the historic beauty of Gwalior. The climate of Gwalior is mild generally warm and hot temperature. There is more rainfall in winter more than in the summer.

- Hottest month of Gwalior- May (35degreeC Avg.)
- Coldest month of Gwalior- January (15degreeC Avg.)
- Well month of Gwalior - August (166.5 mm Avg.)
- Windiest month of Gwalior - June (4km/ h Avg.)
- Annual Rainfall in Gwalior- 599.7mm (per year)

### IV. MUGHAL ARCHITECTURE

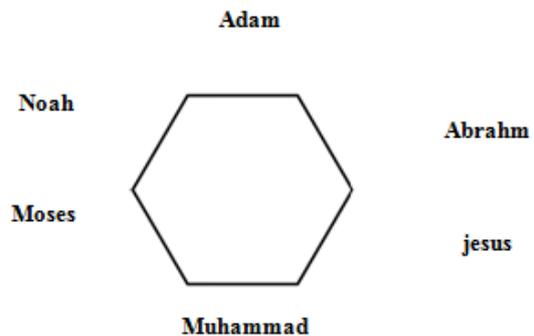
Mughal Architecture was come from the Iran and the art work of Iran in 15<sup>th</sup> century. On many levels this was a great period for all over the world where the mausoleum spreads diversity of art and culture, in which Ottoman, Saffaviid and mughal art were impacted by the aesthetic beauty established in 15<sup>th</sup> century. The great emperor Akbar also supports most to the art and he introduced the painters, sculpture artist, and other art forms from the Persian in India. The jaali work also a Persian

art and mughal introduced it well in their structures or buildings, and the large jaali works in Agra and Delhi city of India.



Two carved stone screens (jali). North India, later 16th century(left), and Agra, 1630-40(right) Mughal introduced different type of architectural ornamentations including stone mosaic, inlay works, mural paintings glazed tiles, and jaali works for the decoration of the exterior and interior surfaces of buildings. They used jaali work on the exterior walls especially to their weather durability and unique designs. Mughal laid the great reflection on the decoration of their monumental structures and used all forms of art like glazed tiling, lattice jaali works, stone mosaic, mural paintings, timurid stylizing and etc. Aesthetically appearing surfaces give a delicatated magnificent architecture.

### V. GEOMETRIC PATTERNS



The key to understand the symbol of jaali screen is the hexagon pattern which is mostly used as geometric pattern in jaali screens. In Islamic architecture symbolism the figure hexagon represents the heaven. The concept heaven related to the world of nature and the world of faith. The six sides of the hexagon have depict the particular meaning itself. In the Isma'ili sates that God has sent six Major Prophets to guide, Noah, Abraham, Moses, Jesus and Muhammad. These six words reflect the six sides of human body i.e., front, back, right, left, above, beneath. Adam came from above, Noah came them from left, Abraham came them from the back, Moses came them from beneath, Adam – opposite, Jesus came them from right , opposite to Noah, Muhammad depict the peace and upon and came them from front, opposite to Abraham. The centre part of the hexagon, the inner atrium represents the Lord of Resurrection through whom humanity can have a spiritual meaning. There are more examples of geometric pattern like Akbar's Tomb (Delhi, India), Taj Mahal (Agra, India), Hawa Mahal (a Rajputana's structure, also a great example of indoislamic architecture, Gujarat India).

**Rajasthan's Architecture-** The outstanding arrangements of the Islamic and Hindu architecture is Rajasthan's Architecture.

It is basically depend on the Rajput architectural buildings like, houses, palaces, schools and these show the Rajasthan's architecture. Architectural heritage of Rajasthan is awesome. There are main two aesthetic aspects of Rajasthan's Architecture

- **Jharokha-** Jharokha is defined as an enfolded balcony. The jharokha is basically stone window which beautify the Mansions. The overhanging balcony is the main structure of Rajasthan's architecture which follows the duty to decorate the instruments of building.

- **Jaali-** It is normally lattice carved work on stone as screen, with ornamental pattern and designs for hide the women from the public and gave the way to see the outer world without any problem. Hawa Mahal in Jaipur in Rajasthan, India is the great example Rajasthan's architecture. The facades of this building is fully carved stone jaali screens and also have a best cooling effect in the building according to the climate of the Jaipur.

### CLIMATIC ASPECTS OF GEOMETRIC PATTERNS

The carved small holes increases the velocity of air and as it passed through the small holes. Similarly, the function of funnel works. The air is also cool down while coming through the small holes which function like an air conditioner. Thus thermal comfort occurs. In the hot areas and the mesh like structure filter out the dust and give the compelling strong winds in the regions. These attributes of jaali make the building breath. These cooling functions are deal with the humidification.

### VI. REGENERATION OF JAALI WORK IN PRESENT ERA

Jaali work is creating sustainability in building and environmental friendly. Gave the natural cooling effect inside the building. It is really beneficial for the dealing with the environment in the modern era of architecture. Jaali patterns are used in different materials like bricks, and a well example of it is Laurie Baker's building. He used well jaali pattern in the brick walls. It says that Laurie Baker loves environment most and due to this they used environmental friendly techniques in building to adorn the architecture for environment. He takes unique design for the jaali pattern inspired from the abstraction of Indian historic jaali wall which carved of stone.



**Figure.1. Computer Centre at the Centre for Development Studies**

Located in Ullor, Trivandrum, Completed in 1990 Similarly, Frank loyed wright's also used jaali paaterns in his buildings inspired from the history. This is the new construction system in his design.



**Figure.1. Textile House designed by Frank Loyed Wright**

### VII. CONCLUSION

In the world of technology and inventions, we found the comfort in the technology or gadgets and depend on these electronic objects like air conditioner. But we forget about the use of our traditional architecture. Our traditional architectural buildings have such a excellent natural cooling techniques in which the jaali is one of the most common used as a cooling effect in the historical buildings. Jaali screens show as a decorative ornamental of the building, but this delicate works give the passive cooling in the building due to the fine carve patterns on the jaali screens. It is not only a aesthetic architecture, it provides us thermal comfort, security, privacy, cooling effects in a building. It would be used more and more in the present era of architecture for secure the environment. There are many materials will founded in which the lattice carving possible like bricks, mixture of alloy, steels, alluminium and etc.

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