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Study of New Materials Used in a Heritage Structure

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Abstract: *Heritage buildings and designs contribute to the richness of a country's history and culture, with "heritage" referring to archaic structures and artifacts associated with historic, cultural, and architectural designs. These structures and monuments serve as powerful reminders of the region's past while also compromising the regional culture's foundation. India has a long and illustrious history, as evidenced by diverse structures, forts, temples, landscapes, and ancient artifacts. Many of them were built during the Golden Age of Indian Civilization, many hundred years ago. India is characterized as a place with a great legacy, rich in traditional practices, culture, and historical landmarks, all of which have been blended to make a "unified nation." To preserve this cultural property restoration of heritage structure is necessary. New innovations, upgraded systems, improved technologies, advances in the construction industry are constantly evolving. It is very important that properties of the old materials and new materials should match each other. In this study, some special materials are used for restoration of heritage buildings are discussed. Use of materials like FRP, CFRP, Wood preservatives are attempted in this particular study.*

Keywords: Heritage buildings, Historical Monumental Structures, Restoration.

I. INTRODUCTION

Major heritages like as Qutub Minar, Red Fort complex, Humayun Tomb, and others may be found in northern states such as Delhi. TAJ MAHAL of Agra, FATEHPUR SIKRI, IMAMBARA RUMI GATE, and other heritage monuments in Uttar Pradesh are more popular than those in Rajasthan and Bihar. Every year, it attracts a large number of tourists to the country, which helps to boost the economy. From generation to generation, they mirror the majesty of history. These structures have survived hundreds of years, whereas most modern structures require maintenance after only a few years of use.

Historic structures are national symbols with cultural and historical significance, it is important to protect/ restore them. A study of the structure should be carried out prior to the restoration being carried out. The material and techniques to be used should be compatible with the original. It is essential to bring a systematic approach to deteriorating structures.

II. NEED OF THE RESEARCH

Most historical cities feature monuments that reflect former religious, military, political, or economic forces. The state of such structures is largely determined by their current purpose and use. Structures that are no longer in use degrade quickly, but structures that are currently in use have a greater chance of being preserved. The extent of maintenance varies from structure to structure, resulting in structural degradation. Restoration improves the structure's overall expected life by strengthening it to sustain all imposed stresses. If the structure is not restored promptly, its structure may deteriorate to the point that restoration becomes extremely difficult. It is required to adhere to a specific methodology, the key steps of which are survey, diagnosis, and safety evaluation, selection of criteria, appropriate materials, intervention techniques, and ultimately controls.

III. LITERATURE REVIEW

Bahira A. Abdul-Rahman (2006) Author concluded that FRP is an excellent choice for strengthening masonry historical structures, providing them with extra strength and ductility to withstand static and dynamic forces that are frequently the cause of historic building damage and collapse. Previous research revealed that FRP is a structural material that may be employed in a variety of novel ways to reinforce historic structures. This might be accomplished by manufacturing very

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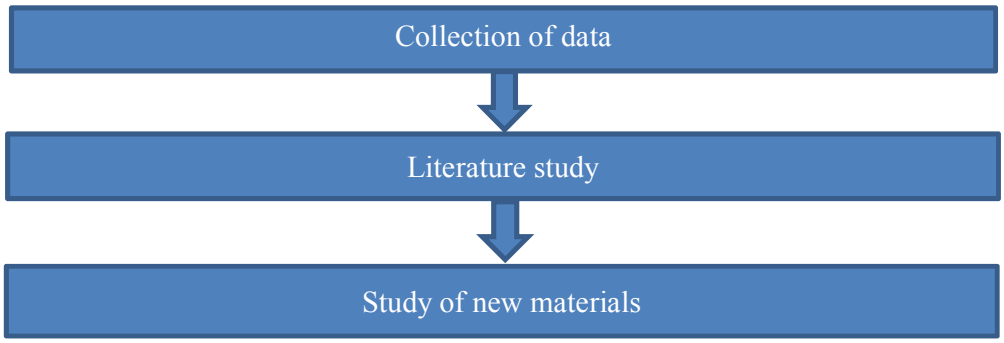
strong structural parts with small dimensions and low weight. To enhance the binding between FRP and masonry, FRP anchors might be made and placed on the body of the bricks. For ancient masonry walls and domes, FRP bonded or unbounded sheets and FRP tendons provided a suitable, reversible, and non-invasive reinforcement option.

S. Saileysh Sivarajaa (2013) in their assessment of 'Preservation of Historical Monumental Structures Using Fibre Reinforced Polymer,' stated that FRP had significant benefits over traditional materials for strengthening and retrofitting. Because of its thinness, its application does not add weight to existing buildings. It contributes to the preservation of monumental monuments' cultural heritage. It does not corrode

IV. RESEARCH METHODOLOGY

For achieving the Research objective there is a need for a detailed plan that keeps the researcher on track and for the effective completion of work. The research methodology allows understanding of different approaches and methods used to conclude. The following methodology will be adopted for data collecting and analysis



V. STUDY OF NEW MATERIALS

5.1 FRP

Polymers with Fiber Reinforcement FRP are frequently utilized to reinforce reinforced concrete and masonry constructions. Because of its appealing features, FRP is employed for retrofitting heritage structures to resist seismic events, despite the lack of lateral load design. Some of their distinguishing characteristics include a very high tensile strength to weight ratio. The low weight of FRP contributes to the structure's seismic qualities. To produce an efficient adhesive between FRP and stone, epoxy resins are applied to the surface of the stone. FRP sheets, either bonded or unbounded, and FRP tendons provided an excellent, reversible, and non-invasive reinforcement alternative for old masonry walls and domes.

5.2 GFRP

Glass Fibre Reinforced Polymer (GFRP) bars have been developed as a steel reinforcing option for a variety of structural concrete applications. They are ideal for tough settings where steel reinforcement is prone to rust because to their non-corrosive nature. Composite materials are being developed for use in a wide range of structural applications, with the primary benefit of being a lightweight, corrosion-free alternative to steel reinforcement. Furthermore, GFRP rebar has a high tensile strength, stiffness-to-weight ratio, outstanding resistance to corrosive chemicals, electromagnetic neutrality, superior fatigue qualities, and thermal expansion control.

5.3 Wood Preservatives

A. Alkaline Copper Quaternary (ACQ).

ACQ (alkaline copper quaternary) is a water-based wood preservative that inhibits fungus and insect degradation (i.e., it is a fungicide and insecticide). It also poses fewer dangers due to its copper oxide and quaternary ammonium compound components. ACQ and other water-based preservatives provide a dry, paintable surface. ACQ is approved for use on the following wood products: lumber, timbers, landscaping ties, fence posts, construction and utility poles, land, freshwater and marine pilings, sea walls, decks, wood shingles, and other wood structures.

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B. Borates

Disodium octaborate tetra hydrate (DOT) is a water-based wood preservative that has been approved by the EPA and regulatory agencies in Asia, North America, and Europe. Furniture and interior construction uses include framing, sheathing, sill plates, furring strips, trusses, and joists.

C. Copper Azole

Copper azole is a fungicide and insecticide that is a water-based wood preservative that resists fungal degradation and insect assault. Water-based preservatives, such as copper azole, dry to a clean, paintable surface on the wood. Copper azole is approved for the treatment of millwork, shingles and shakes, siding, plywood, structural lumber, fence posts, building and utility poles, land and freshwater piling, composites, and other wood products used in above-ground, ground contact, and freshwater decking applications, as well as a saltwater splash (marine) sheathing.

D. Copper Naphthenate

Copper naphthenate was initially registered in 1951 and is used to brush, dip, spray, and pressure treats wood that will come into touch with the ground, water, or above ground, such as utility poles, docks, ports, piers, fences, and landscaping timbers. Copper naphthenate is good at preventing insect damage to wood.

Copper-HDO (Bis-(Ncyclohexyldiazeniumdioxy-copper)).

It is used to pressure-treat wood for decking, railings, spindles, framing, sill plates, gazebos, fences, and posts. It is prohibited from usage in aquatic regions, beehive building, or any application involving food or feed packing.

Polymeric Betaine

It is a borate ester that degrades into DDAC (didecyl dimethyl ammonium chloride) and boric acid when applied to wood. Pressure treatment is used to apply polymeric betaine to forest products.

VI. CONCLUSION

Deterioration of the heritage structures took place due to various reasons such as aging of components of the structure, natural disasters like earthquakes and floods, etc. depending upon the original materials used for construction, new techniques and materials are used for the strengthening of this structure.

As a result, it is possible to conclude that the historic structures are cultural icons. The existing fabric must be restored; the new one must be compatible and similar to the old one with little interference. Heritage has traditionally drawn visitors both nationally and internationally, bolstering the local and national economies. Regular maintenance of these structures is required to enhance the structure's durability.

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