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Applications of Glass Fibre Reinforced Polymer (GFRP) in Concrete Structures – A review

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A B S T R A C T

Fibre-reinforced plastic (FRP) composites have revolutionized the manufacturing sector. Construction sector is realizing the benefits of FRP for producing reliable parts and components.A composite consists of plastic resin or polymer matrix and a fibre. The fibre may be anything from glass to recycled carpet flooring, depending on target properties of the material.One such composite is glass fibre reinforced polymer (GFRP). Use of GFRP rebars instead of steel bars is under consideration.FRP offer better properties compare to steel. One of its best properties is corrosion resistant. It is light in weight compare to steel and has high tensile strength and long service life without expensive maintenance. Along with all of the advantages, it also has some drawbacks. As a result, it is beneficial to investigate many elements of GFRP composites, such as their mechanical properties and structural qualities, in order to properly identify their applications in civil engineering.**T**his paper focuses on the work done by various researchers inApplications of Glass Fibre Reinforced Polymer (GFRP) in Concrete Structures

Keywords: Glass Fibre Reinforced Polymer, Concrete Structures

1. Introduction

Advanced composite materials, such as fibreglass rebar, can be utilised to alleviate some of the long-standing structural issues, such as corrosion of steel reinforcement, quick concrete deterioration, and costly maintenance. GFRP rebar and other materials are already being employed as rust-free, lightweight, high-strength concrete reinforcement, despite the limits. GFRP materials are appropriate for sensitive structural applications such as research facilities, MRI units, and educational institutes due to their electromagnetic neutrality. It is critical to ensure sustainability and environmental stability while selecting construction materials for various applications. According to most of the studies, the benefits of using GFRP composites, as compared with traditional materials, include extended lifespan without expensive maintenance. The overall compositions of GFRP fiberglass rebar can be customized depending on the unique requirements of a project. The ease of installation and transportation without using heavy machines makes these materials economically viable for many waterside concrete applications. Hence, for innovative and sustainable concrete reinforcement for various construction projects it is important to consider GFRP technology which is designed to serve the future.

2. Relevance

To resolve some of the longstanding structural problems such as corrosion of steel reinforcement, rapid concrete deterioration, and costly maintenance the advanced composite materials such as fiberglass rebar can be used. Despite the constraints, GFRP rebar and other products are already being used as rust free, lightweight and high strength concrete reinforcement. The electromagnetic neutrality of GFRP materials makes them ideal for sensitive structural

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application such as research laboratories, MRI units and educational institutes. It is critical to ensure sustainability and environmental stability while selecting construction materials for various applications. According to most of the studies, the benefits of using GFRP composites, as compared with traditional materials, include extended lifespan without expensive maintenance. The overall compositions of GFRP fiberglass rebar can be customized depending on the unique requirements of a project. The ease of installation and transportation without using heavy machines makes these materials economically viable for many waterside concrete applications. Hence, for innovative and sustainable concrete reinforcement for various construction projects it is important to consider GFRP technology which is designed to serve the future.

The replacement of steel reinforcement with GFRP offer various advantages and good properties but it does come with some disadvantages which reduces it demand in construction industry and market. So, our work is to counter these disadvantages by analysing various existing work in detail and implementing innovative ideas such as introducing new material or modifying the composition of material which could possibly bring some change that can be examined further to obtain the best results and better form of material. The future for our industry remains in the development of new combinations of materials, making use of the good properties of FRP and the good properties of concrete, to produce a durable, economic and useful material that will justify the very large amounts that have been spent on research.

3. Literature review

A.A. Mufti, M. Onofrei, B. Benmokrane, N. Banthia, M. Boulfiza, J. P. Newhook, B. Bakht, G. Tadros, P. Brett. REPORT ON THE STUDIES OF GFRP DURABILITY IN CONCRETE FROM FIELD DEMONSTRATION STRUCTURES. Composites in Construction 2005 – Third International Conference, Hamelin et al (eds) © 2005 ISBN xxxxx Lyon, France, July 11 – 13, 2005

Based on the results of analyses, it is confirmed that there was no degradation of the GFRP in the concrete environment of real-life engineering structures exposed to natural environmental conditions for durations of 5 to 8 years. According to the OM analyses, there is no evidence of debonding between GFRP and concrete in any of the structures that have been exposed to wet-dry cycles, maritime environments, freeze-thaw cycles, or de-icing salts. All of the GFRPs' matrixes were intact and unmodified from their original state. The results of the FTIS and differential scanning calorimetry investigations support the findings of the OM examinations, which is encouraging. years. After exposure to the combined impacts of the concrete alkaline environment and the exterior natural environmental exposure for 5 to 8 hours, neither hydrolysis nor significant changes in the matrix's glass transition temperature occurred.

S.H. Alsayed, Y.A. Al-Salloum, and T.H. Almusallam investigated the performance of glass fibre reinforced plastic bars as reinforcing material for concrete buildings in Composites Part B: Engineering Volume 31, Issues 6–7, October 2000, Pages 555-567. The study found that utilising the ultimate design theory, the flexural capacity of concrete beams reinforced with GFRP bars may be accurately calculated. Deflection criteria may limit the design of intermediate and long beams reinforced with FDRP bars, according to the study, because GFRP bars have a low modulus of elasticity.

Jyothi Kumari, P. Jagannadha Rao, M. V. Seshagiri Rao Behavior of concrete beams reinforced with glass fibre reinforced polymer flats. The behaviour of concrete beams reinforced with glass fibre reinforced polymer flats was investigated, and it was discovered that beams with silica coated GFRP flats shear reinforcement failed at greater stresses. They also discovered that GFRP flats used as shear reinforcement are fairly ductile. The tensile strength of composites, flats, and bars is determined by the fibre orientation and fibre to matrix ratio, with the higher the fibre content, the higher the tensile strength.

4. Conclusion:

RCC Roads, Pavements, Parking Garages, Chemical Plants, Water Treatment Plants-water tanks, refinery reservoirs, sewage treatment facilities, acid ponds, and gold & salt mines are just a few examples of GFRP applications. Marine Structures, Highway Construction, Bridge Deck Slabs, Bridge Enclosures, Reinforcement of RCC Tanks, Radio frequency sensitive regions, swimming pool, and hospital MRI zones 'Soft eye' Tunnel Boring Machine (TBM) openings in Metro rail, Water breaks, seawalls, constructions and buildings near the water's edge, floating marine docks, and so on are all examples. Because concrete structures are not conductive, they should be avoided near high-voltage cables, substations, and transformers.

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