A Study On Comparison Between The Strength Of Glass Fiber Reinforced Concrete And Conventional Concrete (M30 Grade)- A Review

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ABSTRACT – It is a recent advancement in the construction technology, since it is light in weight, therefore bringing economy in the construction. Steel is replaced by the glass fibre helps in avoiding structural deterioration and corrosion in reinforced concrete structures. Keeping in mind about the global environmental conditions, many alternatives are searched to increase the strength, durability, shrinkage characteristics and serviceability of concrete. Hence, here glass fibre is added and tests have been performed with varying percentage of 1%, 2% and 3% of cement by adding as an admixture.

KEYWORDS: Glass fibre, Light weight, Economic, Eco friendly, Compressive strength.

I. INTRODUCTION

The construction industry is revolutionizing in two major ways. One way is the development of construction techniques, such as using automated tools in construction. The other is the advancement in high-performance construction materials, such as the introduction of high strength concrete. Among these high-performance materials, fibre reinforced concrete (FRC) is gradually gaining acceptance from civil engineers. In recent years, research and development of fibres and matrix materials and fabrication process related to construction industry have grown rapidly. Their advantages over other construction materials are their high tensile strength to weight ratio, ability to be moulded into various shapes and potential resistance to environmental conditions, resulting in potentially low maintenance cost. These properties make FRC composite a good alternative for innovative construction. Their application in construction includes both upgrading existing structures and building new ones, which can apply to various types of structure, for example offshore platforms, buildings and bridges.

Concrete is the most versatile construction material of use next to water. The simplest reason for its extensive use in the construction of almost all civil engineering works is that the properties can be controlled within a wide range by using appropriate ingredients and by special mechanical, physical land chemical processing techniques. Concrete is the most widely used construction material having several desirable properties like high compressive strength, stiffness and durability under usual environmental conditions. Plain concrete possesses a very low tensile strength, limited ductility and little resistance to cracking. This shortcoming is offset by providing steel bars at appropriate locations at the time of casting the members to take up the tensile stresses and sometimes the compressive stresses if required. Normally reinforcement consists of continuous deformed steel bars or pre-stressing tendons. The advantage of reinforcing and pre-stressing technology utilizing steel reinforcement as high tensile steel wires have helped in overcoming the in capacity of concrete in tension but the durability and resistance to cracking is not improved. These properties can be improved by the use of fibres in the concrete. It has been revealed that concrete reinforced with a permissible amount of fibre acquires better performance in compression, flexure, toughness and energy absorption, in which the degree of improvement relies on the types of fibres used.
Experiment have been carried out by several investigators using fibres of glass, carbon, asbestos, polypropylene etc. More over fibres also helps in restricting the growth of micro-cracks at the mortar-aggregate interface thus transforming an inherently brittle matrix i.e. cement concrete with its low tensile and impact resistances, into a strong composite with superior crack resistance, improved ductility and distinctive post cracking behaviour prior to failure.

Glass fibre–reinforced concrete (GFRC) is a type of concrete which basically consists of a cementitious matrix composed of cement, sand, coarse aggregate, water, polymer and admixtures, in which short length glass fibres are dispersed. In general, fibres are the principal load-carrying members, while the surrounding matrix keeps them in the desired location sand orientation, acting as a load transfer medium between the fibres and protecting them from environmental damage. In fact, the fibres provide reinforcement for the matrix and other useful functions in fibre-reinforced composite materials. Glass fibres can be incorporated into a matrix either in continuous or discontinuous (chopped) lengths. Glass fibres have large tensile strength and elastic modulus but have brittle stress strain characteristics and low creep at room temperature. Glass fibres are usually are usually round and straight with diameters from 0.005 mm to 0.015 mm. Different types of glass fibres are available in the market having different length, diameter and aspect ratio. In the present study alkali resistant glass fibres were used throughout the experiments. The study comprises of a comparative study of some of the properties of concrete for two different grades of concrete by varying the percentages of fibres. The aim of this study was to identify the improvement in strength characteristics of concrete with the addition of glass fibre. In the study, glass fibre is added to concrete and Plain Cement Concrete (PCC) is used as reference to study its effect on flexural, compressive and tensile strength properties and also drying shrinkage. Fibre is coated with oil so as to decrease the water absorption. Some of the advantages being observed are low-cost, low density, reasonable specific strength, good thermal insulation, reduced wear and ability to be coated with oil so as to decrease the water absorption. 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These studies made us adopt glass fibres which are easily available and cheap.

J.D. Chaitanya Kumar 2016, his study concluded that the addition of glass fibres at 0.5%, 1%, 2% and 3% of cement reduces the cracks under different loading conditions. It has been observed that the workability of concrete increases at 1% with the addition of glass fibre. The increase in compressive strength, flexural strength, split tensile strength for M-20 grade of concrete at 7 and 28 days are observed to be more at 1%. We can likewise utilize the waste product of glass as fibre. It has been observed that there is a gradual increase in compressive strength compared to the normal concrete. The workability of concrete decreases from 1% due to the addition of fibre. The compressive strength is very high at 1% having for 7 days is 20.76N/mm² and for 28 days is 28.46N/mm². The tensile strength is very high at 1% having for 7 days is 1.47N/mm² and for 28 days is 2.94N/mm². The split tensile strength is very high at 1% having for 7 days is 2.83N/mm² and for 28 days is 3.92N/mm².

Eng. Pshitiwan. N. Shakor 2011, conducted trial tests for concrete with glass fibre and without glass fibre to indicate the differences in compressive strength and flexural strength by using cubes of varying sizes. He concluded that glass fibre helped concrete to increase compressive strength until indicated limit. A limit exists to a particular percentage from glass fibre to be more at 1%. We can likewise utilize the waste product of glass as fibre. It has been observed that there is a gradual increase in compressive strength compared to the normal concrete. The workability of concrete decreases from 1% due to the addition of fibre. The compressive strength is very high at 1% having for 7 days is 20.76N/mm² and for 28 days is 28.46N/mm². The tensile strength is very high at 1% having for 7 days is 1.47N/mm² and for 28 days is 2.94N/mm². The split tensile strength is very high at 1% having for 7 days is 2.83N/mm² and for 28 days is 3.92N/mm².

C. SelinRavikumar and T.S. Thandavamoorthy 2013, conclusions drawn from the study on addition of glass fibre in concrete. With 0.5 per cent addition of fibre, the increase in the compressive strength is 23 per cent, the increase in flexural strength is 42 per cent and the increase in split tensile strength is 20 percent over conventional concrete. With 1 per cent addition of fibre, the increase in the compressive strength is 35 per cent, the increase in flexural strength is 42 per cent and the increase in tensile strength is 37 per cent. Therefore reinforcing with glass fibre contributes immensely in enhancing the compressive strength of concrete and the increase is 1.78 times that of normal concrete. From the test results, it is found that the glass fibre possesses the high flexural strength. The fire resistant test results show that there is a reduction in the compressive strength, after heating the concrete at 300°C for 2 hours. Without the addition of fibre, the decrease in the compressive strength is 32 per cent over its original strength. For 0.5% addition of fibre, the decrease in the compressive strength is 25 per cent over its original strength. Similarly, with 1 per cent addition of fibre, the decrease in the compressive strength 10 per cent over its original strength. This investigation shows a higher resistance of fibre reinforced concrete to fire when compared to normal concrete. So, glass fibre concrete has a better fire resistant characteristics.

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