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Fibre Mesh in Reinforced Slabs

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Abstract: Fiber Reinforced Concrete is gaining attention as an effective way to improve the performance of concrete. Fibers are currently being specified in tunneling, bridge decks, pavements, loading docks, thin unbonded overlays, concrete pads, and concretes slabs.

These applications of fiber reinforced concrete are becoming increasingly popular and are exhibiting excellent performance The usefulness of fiber reinforced concrete in various civil engineering applications is indisputable.

Fiber reinforced concrete has so far been successfully used in slabs on grade, architectural panels, precast products, offshore structures, structures in seismic regions, thin and thick repairs, crash barriers, footings, hydraulic structures and many other applications.

This study presents understanding srength of fibre reinforced conceret. Mechanical properties and durability of fiber reinforced concrete.

I. INTRODUCTION

Fibre mesh is typically polypropylene (plastic) fibre introduced into the mix during the batching process. These fibres serve as a secondary reinforcement in the concrete.

The fibre is produced by special technology with polypropylene as a raw material. The products appear net-like structure with many fibre monofilaments connected. When the fibre is put into the concrete, the horizontal structure in fibre monofilament can be destroyed in the course of stirring, owing to friction and rubbing, and the fibre monofilament or net-like structure will fully stretch, thus the concrete is reinforced by a very large number of polypropylene fibres.

Generally used fibre meshes include, Glass mesh, Basalt mesh, Carbon mesh, Kevlar (Para-Aramid), Polypropylene mesh. The important merits of fibre mesh over steel mesh are, resistant to corrosion, cover for reinforcements can be avoided if suitable materials such as Kevlar are used, light weight. Fiber mesh is made up of fibrous materials like synthetic fibers, glass fibers, natural fibers, and steel fibers. It is typically used in sidewalks, patios, and driveways. Rather than being laid down prior to the pour, this type of mesh is distributed evenly throughout the wet concrete.

The purpose of fiber mesh is to reduce water loss from the concrete as well as enhance its structural integrity. This type is also used to create a higher impact resistance in the concrete, prevent thawing, and increase its strength. Unlike wire mesh, this particular type of reinforcement provides more than just a single layer of support–it reinforces concrete throughout its entire surface.

STRENGTH It can be seen that for a constant mixed aspect ratio of fibres, there is an increase in compressive strength of concrete as the percentage of fibres is increased. The results show that in general, there is an increase in compressive strength varying from 1% to 31% on addition of fibres to the concrete mix. In a study, based on the direct tensile, the trends in the textile reinforced concrete‟s ultimate stiffness and strength with respect to the main grid ratio are linear. A new type of reinforcement, called a „strengthening net‟, was coupled to conventional reinforcement grids to improve the mechanical behaviour of the textile reinforced concrete.

II. EXPERIMENTAL STUDY

A. Materials Used

Fibre mesh reinforced concrete consisted of cement mortar and fibre mesh. Three types of mesh reinforcements were used for specimen casting. They include welded steel wire mesh, AR- Glass mesh, Fibre mesh, Plastic mesh. The details of mesh reinforcement are shown in Table I.

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Table - 1
Details of Fibre Mesh Used

Type of mesh used		*Aperture size(mm)*	*Thickness(mm)*
Plastic Mesh	P_{10}	*10 X 10*	*2*
Glass Mesh	G_5	*5 x 5*	*0.5*
	G_{10}	*10 x 10*	
Steel Mesh	S_{10}	*10 x 10*	*1*

The cement mortar imparts the strength to the fibre mesh reinforced concrete. The ratio of cement to fine aggregate was 1:2 and the water/cement ratio was taken as 0.40

Fig. 1: Process of casting slab cube

B. Details of Specimen

A square slab of 2m x 2m with a thickness of 4cm was taken as the specimen. Slabs with different meshes were casted in order to compare the strength of slabs as well as to find the effect of different aperture size. Specimen with 12mm aperture size is used to compare the strength. In case of glass mesh, two layer of mesh is used to cast specimen. Two specimens of each were casted.

Timber mould was used for casting slab. In order to reduce water absorption during casting of slabs, the mould was placed on a plain surface and water was sprinkled on the base. Slabs with steel mesh, fibre mesh and plastic mesh were casted with single layer of reinforcement while slabs with glass mesh were casted with double layer of reinforcement.

Fig. 2: Slab cube casted

C. Testing of Specimen

The specimens were tested after 28 days using loading frame of 120 tonne capacity. The slab specimens of size 2m x 2m x 4cm were prepared and tested with simply supported condition prevailing on all four sides, for finding the breaking load capacity. Hydraulic jack of 60T capacity was used for testing the slab. Point load was applied at the centre of the slab using hydraulic jack. Load applied was measured using a dial gauge with 0.1T accuracy.

1) Point Load Is Applying On Slab Cube

Fig. 3: Experimental setup of slab.
(A)

Fig. 4: Crack Pattern in slab

In order to compare the strength of slabs with different mesh, breaking load capacity of fibre mesh reinforced slabs with 12mm aperture size was taken. The breaking load capacity of fibre mesh reinforced slabs with 12mm aperture size obtained after testing is as given in table 2.

Table - 2
Test Results of Fibre Mesh Reinforced Slabs with 10mm Aperture Size

Designation	Type of Mesh	Breaking Load		
		tonnes	kN	% increase / decrease in load
S_{10}	Steel Mesh	1.25	12.26	0
G_{10}	Glass Mesh	1.2	11.77	-4
P_{10}	Plastic Mesh	1.25	12.26	0

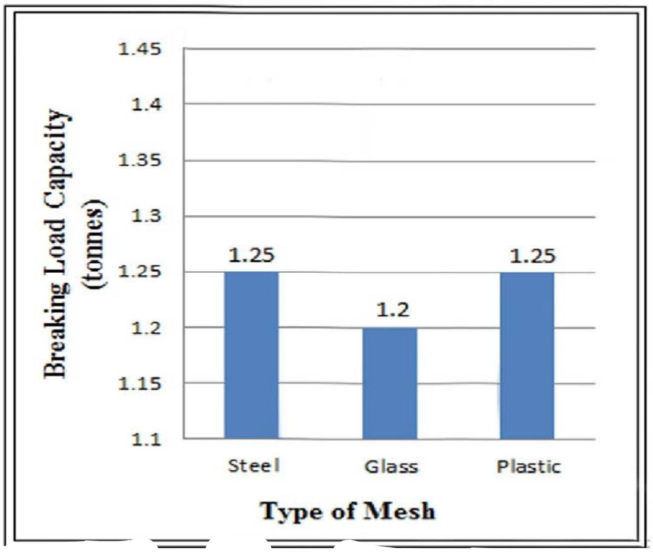

Fig .5: Graph showing breaking load of slabs with 10mm aperture size

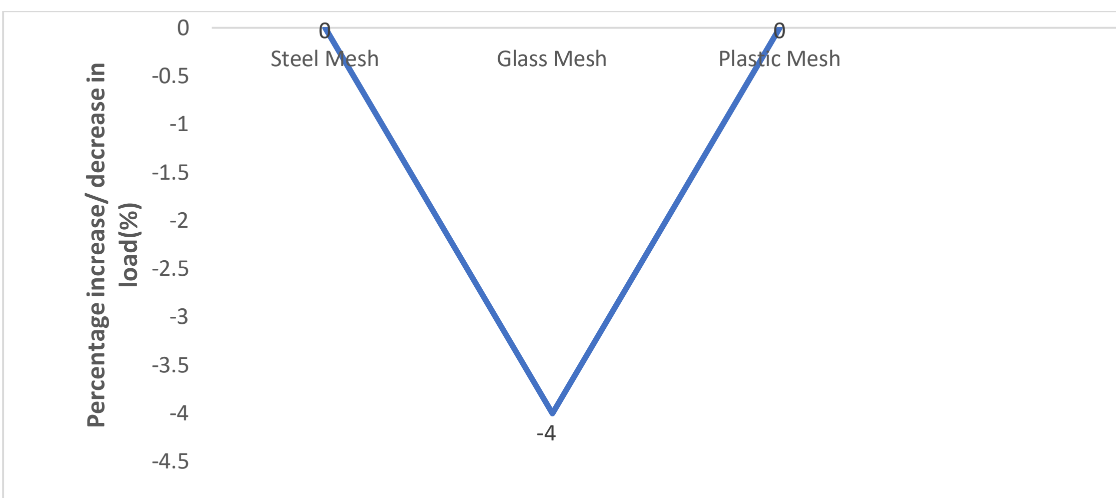

Fig. 6: percentage increase/decrease in load of slabs with 10mm aperture size

It was noticed that for the same area of reinforcement in slab, as aperture size increases, the breaking load capacity also increases. As aperture size was increased keeping the area of reinforcement of slab being the same, it has shown a greater percentage increase in breaking load capacity of slab.

In case of glass mesh, two varieties (G_5, G_{10}) were taken by keeping the thickness of reinforcement being the same. The breaking load capacity of glass mesh reinforced slabs with different aperture size obtained after testing is as given in Table IV.

Table - 4
Test Results Of Glass Mesh Reinforced Slabs With Different Aperture Size

Designation	*Breaking Load*		
	tonnes	*kN*	*% increase / decrease in load*
G_5	*1.3*	*12.75*	*0*
G_{10}	*1.2*	*11.77*	*-7.7*

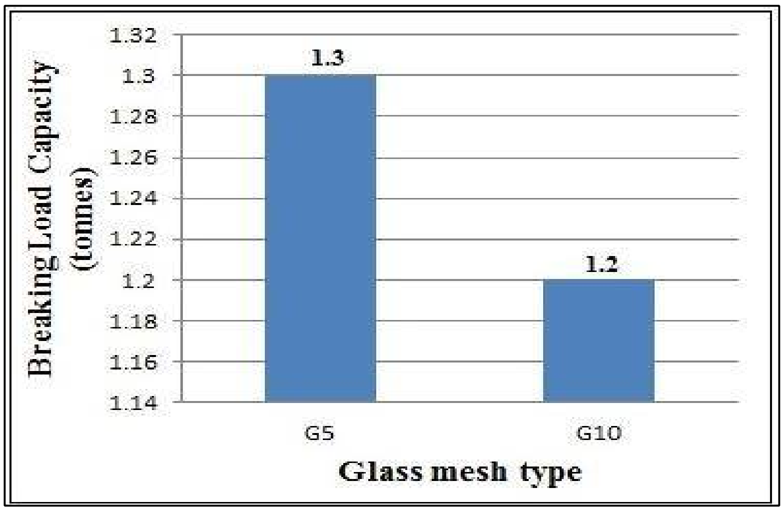

Fig. 7: Graph Showing Breaking Load Of Slabs With Glass Mesh

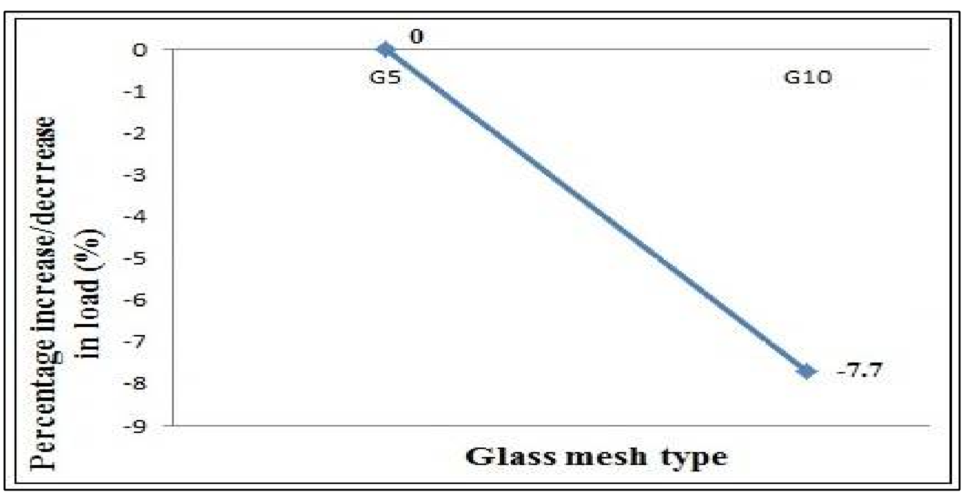

Fig. 8: Percentage Increase/Decrease In Load Of Slabs With Glass Mesh

It was noticed that for the same thickness of reinforcement mesh, as aperture size increases, the breaking load capacity decreases. When the aperture size of glass mesh was reduced from 10mm to 5mm, it showed about 7.7% reduction in breaking load capacity of slab.

III. CONCLUSIONS

A brief state-of-the-art report on fiber reinforced concrete is presented.Our understanding of fiber-matrix interaction, reinforcement mechanisms and performance characteristics is fairly advanced. Fiber reinforced concrete is a promising material to be used in the Middle-East for sustainable and long-lasting concrete structures. Its performance has already been proven in other hot and arid climates and in other chemically deleterious environments. Fiber reinforced concrete pavements prove to be more efficient than conventional RC pavements, in several aspects Compressive strength for fibre reinforced concrete is seen to be improved. It can be clearly seen that strength at 28 days

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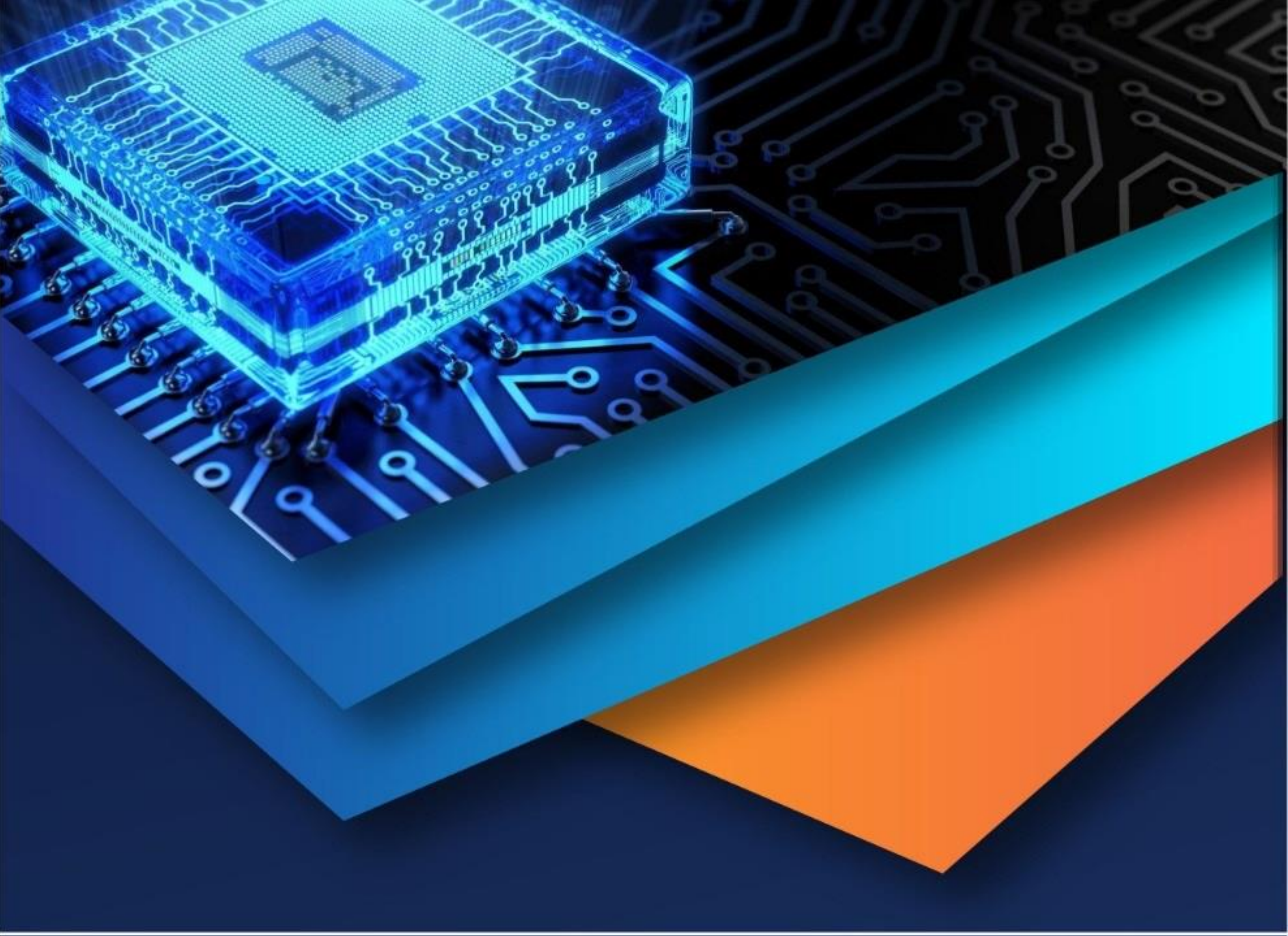

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