International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 12 | Dec 2020 www.irjet.net p-ISSN: 2395-0072

To Study the Effect of Chopped Glass Fibers on the Strength of Concrete Tiles

Sagar Gogade[1], Rahul Sharma[2]

[1]PG Student, Dept. of Structure Engineering, Prashanti Institute of Technology & Science college, Ujjain, India
[2]Assistant Professor, Dept. of Civil Engineering, PITS College, Ujjain, India

---

Abstract - *The impact of glass fiber on flexural quality, part elasticity and compressive quality was read for various fiber content on M-20 evaluation concrete planned according to IS 10262.The most extreme size of totals utilized was 20mm. To examine the impact on compressive quality, flexural quality, part rigidity 6 cubes,6 crystals and 6 chambers were casted and tried. After that a functional utilization of GFRC as concrete solid tiles was taken into thought and no unique procedure was utilized to create this tiles. The thickness of the tiles was 20mm and greatest size of totals utilized was 8mm.The water concrete proportion was kept reliable and the admixture content was differed from .8 to 1.5 percent to keep up droop in between 50mm to 100mm.The blend extent utilized was 1:1.78:2.66. The size of short strands utilized were 30mm and the glass strands were salt safe. The impact of this short strands on wet cross over quality, compressive quality and water ingestion was completed. Six full measured tiles 400mm*400mm*20mm were tried and the outcomes recorded. Pulse velocity tests was excessively driven.*

***Key Words*: Cement, Concrete, Glass Fiber, Tiles,**

1. INTRODUCTION

One of the main structure material is concrete and its utilization has been ever expanding in the whole world. The reasons being that it is generally modest and its constituents are without any problem accessible, and has convenience in wide scope of common framework works. Anyway concrete has certain burdens like fragility and helpless protection from break opening and spread. Concrete is fragile essentially and have exceptionally low rigidity and subsequently strands are utilized in one structure or another to expand its rigidity and reduction the weak conduct. With time a parcel of investigations have been done to improve the properties of cement both in new state as well as solidified state. The essential materials continue as before however super plasticizers, admixtures, miniature fillers are likewise being utilized to get the ideal properties like usefulness, Increase or decline in setting time and higher compressive quality. Strands which are applied for basic cements are ordered by their material As Steel strands, Alkali safe Glass filaments (AR), Synthetic strands, Carbon, pitch and polyacrylonitrile (PAN) strands.

Glass fiber fortified cement (GFRC) is a cementitious composite item strengthened with discrete glass filaments of changing length and size. The glass fiber utilized is soluble safe as glass fiber are defenseless to antacid which diminishes the solidness of GFRC. Glass strands are used generally for outside claddings, facade plates and extraordinary parts where their fortifying effects are needed during development. GFRC is firm in new state has lower droop and henceforth less functional, thusly water lessening admixtures are utilized. Further the properties of GFRC relies upon different boundaries like technique for delivering the item. It tends to be finished by different strategies like showering, projecting, expulsion procedures and so forth Concrete sort is additionally found to have significant impact on the GFRC. The length of the fiber, sand/filler type, concrete proportion strategies and length of restoring additionally impact the properties of GFRC.

2. OBJECTIVE

The reason for this examination is to investigate the compressive quality, part elasticity and flexural quality properties of cement fortified with short discrete filaments. The examination was completed on M-20 evaluation concrete the size of glass filaments utilized was 30mm and the fiber content was shifted from 0% to 0.3% of the absolute load of cement. In contemplating the over three properties no admixture was utilized. Likewise the impact of glass fiber on concrete a lot tiles was examined whose fiber content was fluctuated from 0% to 0.7% of the all out weight of cement. Concrete constantly are substantial tiles which are utilized at different places and is of handy use.

3. MATERIAL

3.1 Cement

The cement commonly used is Portland cement, it is also defined as hydraulic cement, i.e. a cement which hardens when it comes with water due to chemical reaction but there

By forming a water resistant product when blast furnace slag is also used as one of the ingredients than the cement obtained is called Portland slag cement (PSC). Portland slag cement (PSC) – 43 grade (Konark Cement) was used for the experimental programme.

3.2 Fine Aggregate

The fine aggregate used for the experimental programme was obtained from river bed of Koel. The fine aggregate

passed through 4.75 mm sieve and had a specific gravity of 2.68. The sand belonged to zone III as per IS standards.

3.3 Course Aggregate

The aggregates the vast majority of which are held on 4.75mm IS sieve and contains just that a lot of fine material as is allowed by the code specifications are termed as coarse aggregates. In our case crushed stone was used with a nominal maximum size of 20 mm and specific gravity of 2.78.

3.4 Glass Fiber

Various types of fibres have been added to concrete some have high modulus of elasticity some have low modulus of elasticity each category can improve certain properties of concrete. In our case short discrete glass fibres were used and as glass fibre is susceptible to alkali we used alkali resistant glass fibres. A fiber is a material made into a long filament with a diameter generally in the order of 10 tm.

4. EXPIRIMENTAL PLAN

A. Preparation of Concrete and Concrete Tiles

B. Different batches of M-20 grade concrete was prepared with 0, 0.1, 0.2 and 0.3 percent fibre.

C. Tests carried out on cement and concrete tiles

5. RESULT & DISCUSSIONS

5.1 Compressive Strength of Concrete (in N/mm2)

Serial number	Without fibre	0.1% fibre	0.2%	0.3%
1	16.89	17.77	21.33	22.22
2	16.44	17.33	20.88	22.67
3	16.44	17.33	21.33	23.11

Table -1: 7 days Compressive Strength of Concrete

Table -2: 28 days Compressive Strength of Concrete

Serial number	Without fibre	0.1%	0.2%	0.3%
1	25.33	28	28.88	30.22
2	25.77	31	28.88	28.88
3	25.33	28	31	30.66

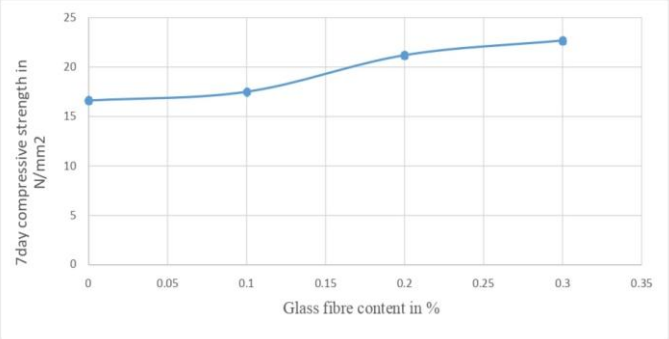

Chart -1: Effect of Glass fibers on 7 day Compressive Strength

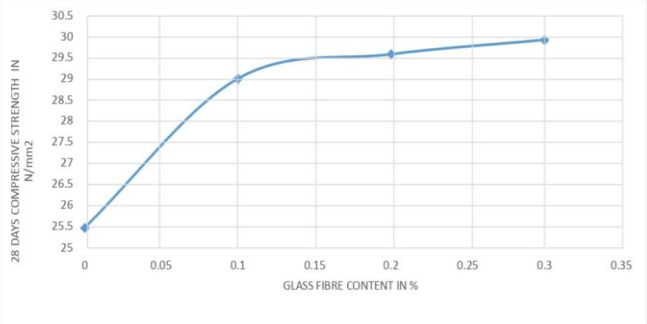

Chart -2: Effect of Glass Fibers on 28 day Compressive Strength

5.2 Split Tensile Strength comparison (in N/mm2)

Serial number	Without fibre	0.1%	0.2%	0.3%
1	1.485	1.84	2.405	2.405
2	1.626	1.70	2.26	2.405
3	1.45	1.84	2.26	2.263

Table -3: 7 days Split Tensile Strength of Concrete

Table -4: 28 days Split Tensile Strength of Concrete

Serial number	Without fibre	0.1%	0.2%	0.3%
1	2.829	2.83	2.97	2.97
2	2.76	2.83	2.97	2.97
3	2.829	2.97	3.35	2.97

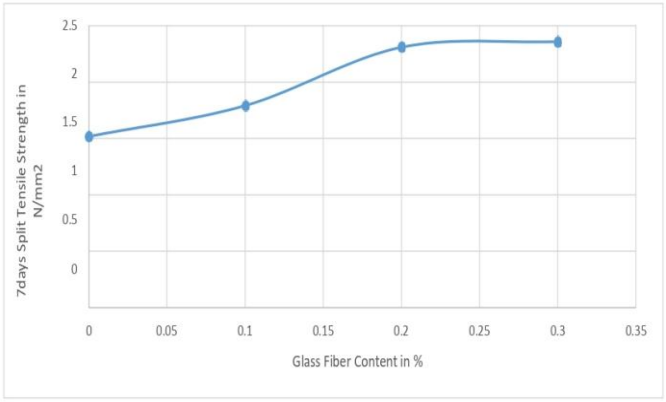

Chart -3: Effect of Glass Fibers on 7 days Split Tensile Strength

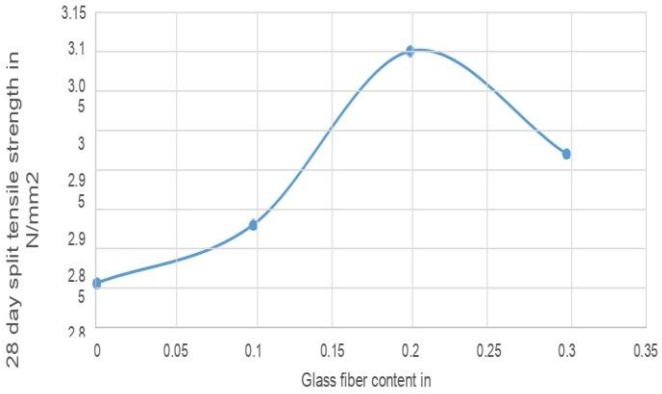

Chart -4: Effect of Glass Fibers on 28 days Split Tensile Strength

5.3 Flexural Tensile Strength (in N/mm2)

Table -5: 7 days Flexural Tensile Strength of Concrete

Serial number	Without fibre	0.1%	0.2%	0.3%
1	4.6	4.744	4.988	5.744
2	4.7	4.776	4.988	5.424
3	4.8	4.756	4.9	5.704

Table -6: 28 days Flexural Tensile Strength of Concrete

Serial number	Without fibre	0.1%	0.2%	0.3%
1	5.104	6.368	7.544	7.156
2	5.204	6.456	7.104	7.96
3	5.242	6.652	6.844	8.32

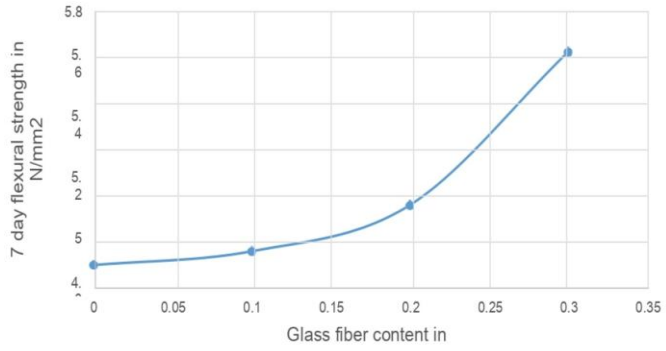

Chart -5: Effect of Glass Fibers on 7 days Flexural Tensile Strength

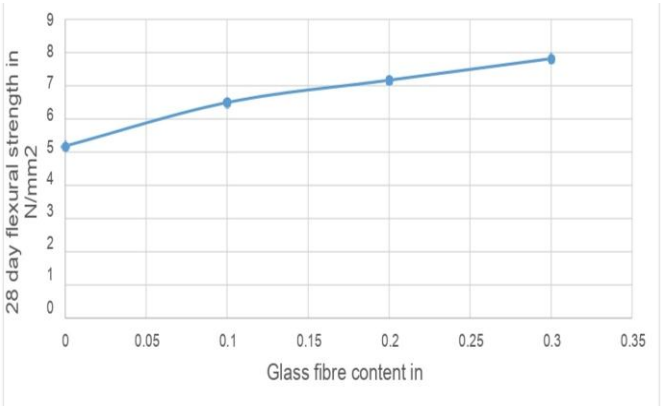

Chart -6: Effect of Glass Fibers on 28 days Flexural Tensile Strength

5.4 Tests carried out concrete tiles

A. Compressive strength test

Table -7: 7 days Compressive Strength Concrete

Fibre content(% of the total weight of concrete)	WEIGHT(KG)	Average 7 days compressive strength (N/mm2)
0	2.495	32
0.1	2.478	28
0.2	2.478	30
0.3	2.500	31
0.4	2.487	28
0.5	2.500	27
0.6	2.400	26
0.7	2.390	25

Table -8: 28 days Compressive Strength Concrete

Fibre content (% of the total weight of concrete)	WEIGHT(KG)	Average 28 days compressive strength (N/mm2)
0	2.495	45
0.1	2.478	37
0.2	2.478	37
0.3	2.500	36
0.4	2.487	38
0.5	2.500	33
0.6	2.400	32
0.7	2.390	31

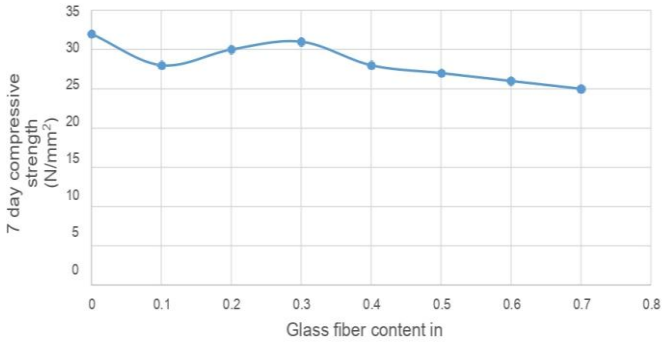

Chart -7: Effect of Glass Fibers on 7 days Compressive Strength

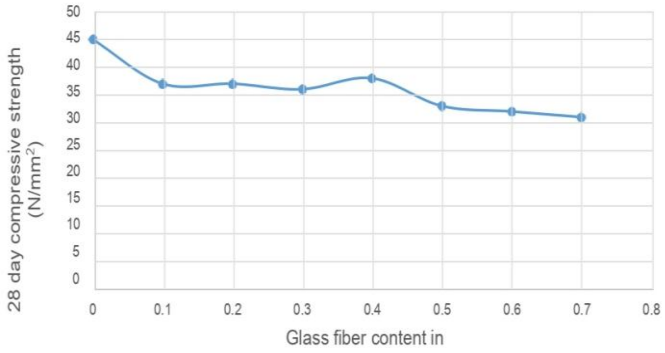

Chart -8: Effect of Glass Fibers on 28 days Compressive Strength

5.5 Wet transverse strength

Table -9: 28 days Wet Transverse Strength of Concrete

Fibre content (% of the total weight of concrete)	Average 28 day transverse strength (N/mm2)
0	1.41
0.1	1.64
0.2	1.72
0.3	1.87
0.4	1.944
0.5	2.24
0.6	2.39
0.7	2.542

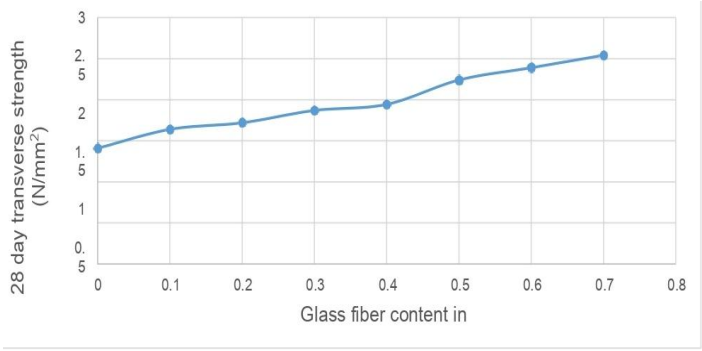

Chart -9: Effect of Glass fibers on 28 days Wet Transverse Strength of concrete

5.6 Water absorption

Table -10: 28 days Water Absorption of Concrete

Fibre content(% of the total weight of concrete)	Average water absorption after 28 days (%)
0	2.69
0.1	2.30
0.2	1.95
0.3	1.57
0.4	1.22
0.5	1.19
0.6	1.17
0.7	1.02

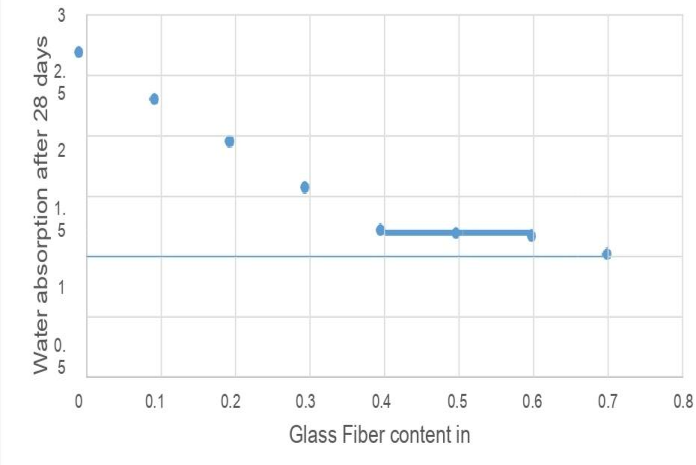

Chart -10: Effect of Glass fibers on 28 days Water absorption of concrete

6. CONCLUSIONS

The effect of glass fibres on cement and concrete tiles which are produced by vibration method are also studied. The properties studied are compressive strength, wet transverse strength and water absorption .The concrete mix gets harsher and less workable with increase of fiber content therefore use of admixture become necessary. However even after giving dosage of admixture as high as 1.5% proper workability could not be obtained and some segregation was observed. Therefore it was not possible to go beyond 0.7% fiber content.

The compressive strength of concrete without admixture is not affected by the presence of short discrete glass fibers with fibre content in the range 0.1 to 0.3 % of fiber content by weight of concrete.

The split tensile strength of concrete increases with the addition of glass fibers.

The flexural strength of concrete increases with increase in fiber content and as such the tension carrying capacity of concrete may increase in flexure

The wet transverse strength of tiles increases and the increase has been found with addition of fibers

The water absorption of the concrete also decreases with increase in fiber content.

The compressive strength of concrete with admixture was not affected upto 0.4 % fiber content but decreased with the presence of higher amount of fibers.

REFERENCES

[1] Cook D.J., Pama R.P., Weerasingle H.L.S.D. "Coir fibre reinforced cement as a low cost roofing material". Build Environ 1978;13(3):193–8.

[2] Perez-Pena .M and Mobasher .B, "Mechanical properties of fiber reinforced lightweight concrete composites ". Cement and Concrete Research, Vol. 24, No. 6, pp. 1121-1132, 1994

[3] Brandt AM. "Cement-based composites: materials, mechanical properties and performance". London: E&FN Spon; 1995. p. 470

[4] Nakamura H, Mihashi H. "Evaluation of tension softening properties of fiber reinforced cementitious composites." Fracture Mechanics of Concrete Structures 1998; I:499e510.

[5] Mirza F.A., Soroushiannd P. "Effects of alkali-resistant glass fiber reinforcement on crack and temperature resistance of lightweight concrete." Cement and Concrete Composites 2002;24(2):223–7

[6] Robert S.P. Coutts ."A review of Australian research into natural fibre cement composites" Cement & Concrete Composites 27 (2005) 518–526

[7] Khosrow Ghavami. "Bamboo as reinforcement in structural concrete elements" .Cement & Concrete Composites 27 (2005) 637–649

[8] Huang Gu, Zuo Zhonge "Compressive behaviour of concrete cylinders reinforced by glass and polyester filaments". Materials and Design 26 (2005) 450–453

[9] Andrzej Brandt .M "Fibre reinforced cement-based (FRC) composites after over 40 years of development in building and civil engineering". Composite Structures 86 (2008) 3–9

[10] Luiz C. Roma Jr., Luciane S. Martello, Holmer Savastano Jr ."Evaluation of mechanical, physical and thermal performance of cement-based tiles reinforced with vegetable fibers". Construction and Building Materials 22 (2008) 668–674

[11] Filho Toledo Dias Romildo, Andrade Silva Flavio de, Fairbairn E.M.R.."Durability of compression molded sisal fiber reinforced mortar laminates". Construction and Building Materials 23 (2009) 2409–2420

[12] Wu. Y.-F. "The structural behaviour and design methodology for a new building system consisting of glass fiber reinforced gypsum panels" Construction and Building Materials 23 (2009) 2905–2913

[13] Swami B.L.P. , "Studies on glass fiber reinforced concrete composites – strength and behaviour Challenges", Opportunities and Solutions in Structural Engineering, 2010,pp-1-1

[14] Tonoli G.H.D., S.F. Santos,A.P. Joaquim,H. Savastano Jr "Effect of accelerated carbonation on cementitious roofing tiles reinforced with lignocellulosic fibre" Construction and Building Materials 24 (2010) 193–201

[15] Enfedaque .A, D. Cendon, F. Galvez, Sanchez-Galvez .V,"Failure and impact behavior of facade panels made of glass fiber reinforced cement(GRC)". Engineering Failure Analysis 18 (2011) 1652–1663.

[16] Mohamed S. Issa, Ibrahim M. Metwally, Sherif M. Elzeiny "Influence of fibers on flexural behavior and ductility of concrete beams reinforced with GFRP rebars" Engineering Structures 33 (2011) 1754–1763.

[17] Sung-Sik Park "Unconfined compressive strength and ductility of fiber-reinforced cemented sand." Construction and Building Materials 25 (2011) 1134–1138

[18] Majid Ali , Anthony Liu, Hou Sou, Nawawi Chouw "Mechanical and dynamic properties of coconut fibre reinforced concrete" Construction and Building Materials 30 (2012) 814– 825

[19] Frank Schladitz , Michael Frenzel , Daniel Ehlig "Bending load capacity of reinforced concrete slabs strengthened with textile reinforced concrete" Engineering Structures 40 (2012) 317–326

[20] Shasha Wang, Min-Hong Zhang, Ser Tong Quek "Mechanical behavior of fiber- reinforced high-strength concrete subjected to high strain-rate compressive loading" Construction and Building Materials 31 (2012) 1–11

[21] Alberto Meda, Fausto Minelli, Giovanni A. Plizzari "Flexural behaviour of RC beams in fibre reinforced concrete" Composites: Part B 43 (2012) 2930–2937

[22] Funke H. , Gelbrich .S , Ehrlich .A "Development of a new hybrid material of textile reinforced concrete and glass fibre reinforced plastic" Procedia Materials Science 2 (2013) 103 – 110

[23] Xiangming Zhou, Seyed Hamidreza Ghaffar, Wei Dong, Olayinka Oladiran, Mizi Fan "Fracture and impact properties of short discrete jute fibre-reinforced cementitious composites" Materials and Design 49 (2013) 35–47

[24] Mohammad Sayyar , Parviz Soroushian "Low-cost glass fiber composites withenhanced alkali resistance tailored towards concrete reinforcement" .Construction and Building Materials 44 (2013) 458–463

[25] Gowri .R, Angeline Mary.M., "Effect of glass wool fibres on mechanical properties of concrete". International Journal of Engineering Trends and Technology (IJETT) - Volume4 Issue7- July 2013.

[26] Wai Hoe Kwan , Mahyuddin Ramli, Chee Ban Cheah "Flexural strength and impact resistance study of fibre reinforced concrete in simulated aggressive environment"

[27] Construction and Building Materials 63 (2014) 62–71

[28] Mobasher Barzin, Dey Vikram, Zvi Cohen,Alva Peled "Correlation of constitutive response of hybrid textile reinforced concrete from tensile and flexural tests" Cement & Concrete Composites 53 (2014) 148–161.

[29] Ali Shams, Michael Horstmann, Josef Hegger "Experimental investigations on Textile- Reinforced Concrete (TRC) sandwich sections" Composite Structures 118 (2014) 643– 65