DURABILITY STUDY ON GLASS FIBRE REINFORCED CONCRETE

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Abstract- *Concrete is one of the most widely recognized development material for the most part delivered by utilizing locally accessible ingredients. The main aim of the project is to study the comparative analysis and to determine the durability of M40 grade concrete by acid attack test, sorptivity, sulphate attack test, rapid chloride permeability test and alkalinity test using glass fiber in the concrete. By the addition of (0-3%) glass fiber improves brittleness and workability of concrete. Therefore, cube size of 150x150x150mm were casted and conducted the strength and durability test to determine the durability of glass fiber reinforced concrete with various proportion of 0.5%,1%,1.5%and 2% of glass fiber.*

Keywords: glass fiber reinforced concrete

1. INTRODUCTION

GENERAL

Glass fiber reinforced concrete (GFRC) is made by adding a mixture of fine sand, cement, polymer, water, glass fiber, coarse aggregate and other admixture to improve workability. Glass fiber reinforced concrete is a specialized form of concrete with versatile casting system. It can be effectively used in construction of wall panels, surrounding of fire station, countertops and also architectural works due to its high tensile strength, impact resistance and cost effective.

2. LITERATURE REVIEW

Vishnu ram et al.," improves the strength and performance of concrete to resist the chemical attack when adding glass fiber". Amar Patil et al.," Addition of glass fiber within (0-2%) increases the performance of concrete for M20 grade". Kumar et al.," When adding 1% of fiber with GGBS, the strength of concrete for M40 grade increases at 40% replacement of cement". Bekir Karasu et al.," the compressive strength will be decreased when the glass fiber added in excessive amount". Komal Chawlal et al.," the addition of glass fiber increases, toughness also increases when using 0.67% of fiber content". Samprati Mishra et al.," adding glass fiber in plain concrete increases its strength properties and the maximum compressive strength attained in 0.2% of glass fiber with M40 grade concrete. After study the journals like above, the materials are collected and then casting and curing is done with the M40mix and durability test were made for 28days of cube size 150x150x150 mm and beam is casted for flexural strength test of specimen size is 500x100x100 mm.

3. PROPERTIES OF MATERIAL

TABLE 3.1 PROPERTIES OF CEMENT

SL.NO	SPECIFICATIONS	RESULTS
1	Type	OPC 53 Grade
2	Specific Gravity	3.15
3	Consistency	36
4	Initial setting time	30 minutes
5	Final setting time	420 minutes
6	Fineness	5%

TABLE 3.2 PROPERTIES OF FINE AGGREGATE

SL.NO	SPECIFICATIONS	RESULTS
1	Type	River sand
2	Specific Gravity	2.5
3	Fineness Modulus	2.742
4	Grading zone	Zone II

TABLE 3.3 PROPERTIES OF COARSE AGGREGATE

SL.NO	SPECIFICATIONS	RESULTS
1	Type	Crushed
2	Specific Gravity	2.7
3	Fineness Modulus	7.164

For the investigation, potable water was used.

TABLE 3.4 PROPERTIES OF GLASS FIBRE

SL.NO	SPECIFICATIONS	RESULTS
1	Type	Graded 0.5mm
2	Specific Gravity	2.68
3	Aspect ratio	80

CHEMICAL ADMIXTURE:

ConplastSP430 is used to speed up the strength gain at its early stages. It is also provided to improve the life period of the concrete mixes.

4. CASTING AND TESTING OF SPECIMENS

The cubes and beams are casted with and without glass fiber and keep the cubes and beams for 28days. After curing is over, the specimens were taken for various tests such as strength test and durability tests. The various tests are conducted as per IS CODES. Each mix proportion 3cubes and 3beams are casted and taken for strength testing and each mix 3cubes are casted for durability tests after curing of 28 days.

4.1 TEST RESULTS:

A. STRENGTH TESTS:

COMPRESSION STRENGTH TEST:

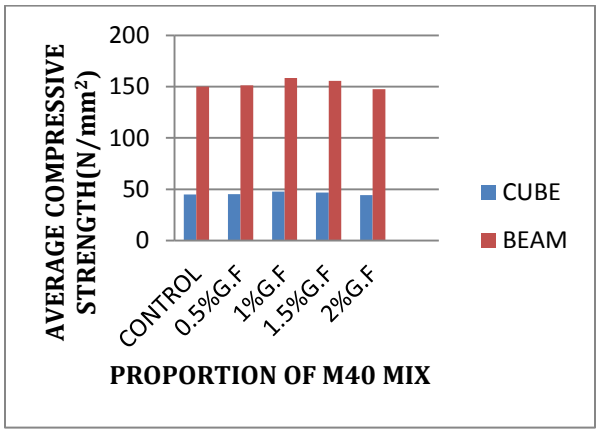

Chart -1: COMPARISION OF COMPRESSIVE STRENGTH FOR M40 MIX

FLEXURAL STRENGTH

TABLE.1 FLEXURAL STRENGTH FOR M40 DESIGN

Mix ratio	FLEXURAL STRENGTH (N/mm²)		
M40	@7days	@14days	@28days
Conventional concrete	3.51	6.96	7.53
0.5% G.F	3.57	7.19	7.83
1% G.F	3.64	7.39	8.59
1.5%G.F	3.69	7.23	7.69
2%G.F	3.65	7.06	7.83

Fig -1: Flexural strength test

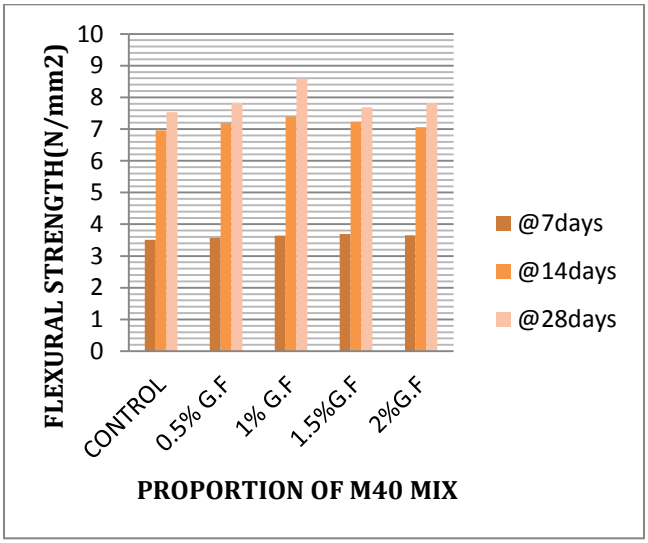

Chart -2: COMPARISION OF FLEXURAL STRENGTH FOR M40 MIX

B DURABILITY TEST RESULTS

ACID RESISTANCE TEST

Fifteen concrete mixtures of 15 cubes specimens were cast and tested for acid resistance. Each mixture consists of 3 cubes of various proportions of glass fibre in concrete. Cubes were tested for acid resistance at 28days.The results are shown in Table

Fig -1: Acid attack cubes

TABLE.2 RESULTS FOR STRENGTH LOSS

Proportion (CUBE)	Initial Compressive strength	Compressive strength loss
M40	(N/mm²)	(%)
CONTROL	45	5.11
0.5%G.F	46.6	4.94
1%G.F	47.5	5.26
1.5%G.F	49.2	4.87
2%G.F	45.8	4.58

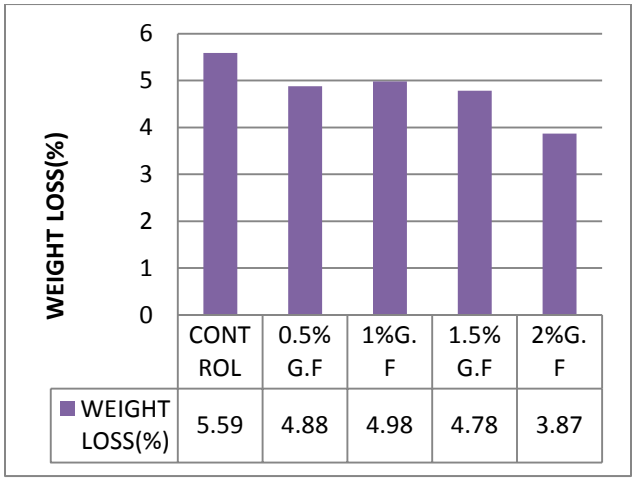

Chart -3: COMPARISION OF WEIGHT LOSS

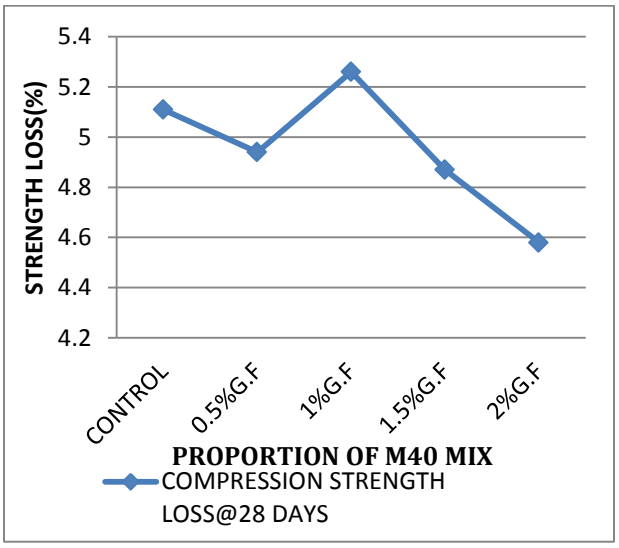

Chart -3: COMPARISION OF STRENGTH LOSS DUE TO ACID ATTACK

SULPHATE ATTACK TEST

Fifteen concrete mixtures of 5 specimens were cast and tested for sulphate resistance. Each mixture consists of 3 cubes of various proportions of glass fibre in concrete.. Three cubes were tested for sulphate attack at 28 days. The results are shown in Table 4 and plotted in Graph3.

Fig -1: Sulphate attack cubes

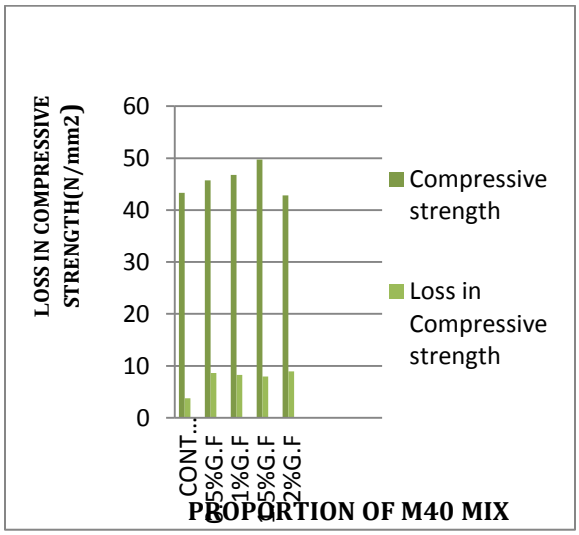

Chart -4: COMPARISION OF STRENGTH LOSS DUE TO SHULPHATE ATTACK

WATER ABSORPTION TEST

Water absorption test on concrete was conducted:

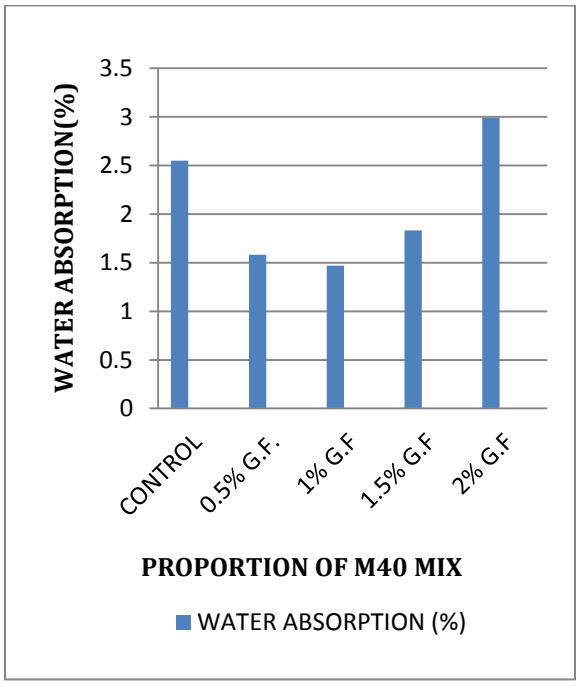

Chart -3: COMPARISION OF STRENGTH LOSS DUE TO ACID ATTACK

ALKALINITY OF CONCRETE

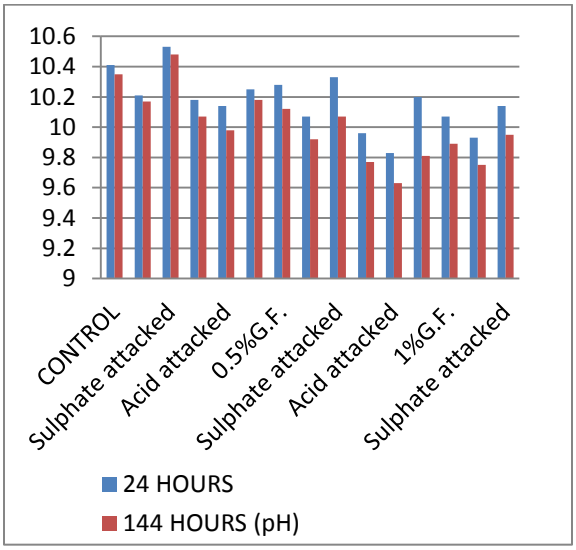

Chart -5: COMPARISION OF ALKALINITY OF CONCRETE

RAPID CHLORIDE PERMEABILITY TEST:

Rapid chloride permeability test on concrete was conducted:

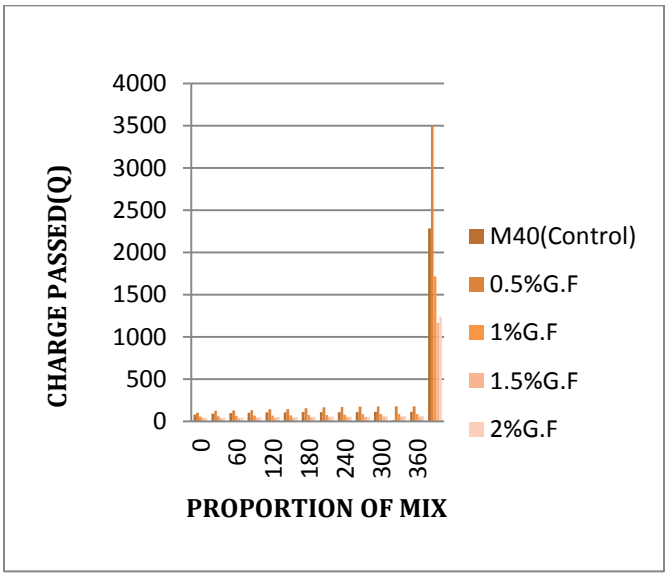

Chart -6: COMPARISION OF RCPT RESULT

SORPTIVITY TEST:

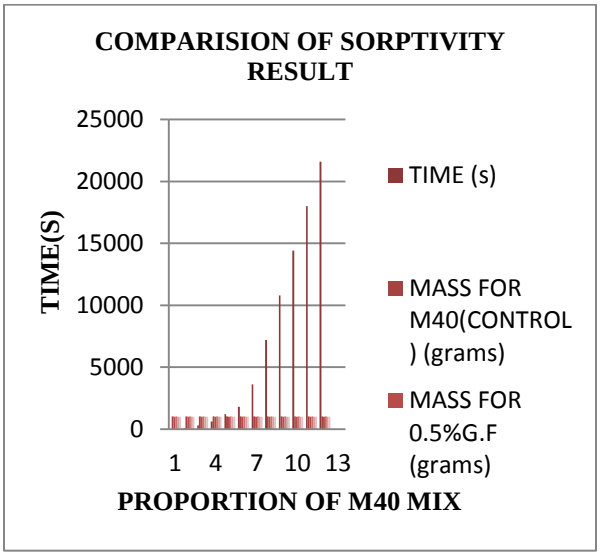

Chart -7: COMPARISION OF SORPTIVITY RESULT

CONCLUSIONS:

From the tests carried out, the following conclusions have been made:

1. From this investigation, the preliminary properties of fine aggregate and coarse aggregate were studied.
2. Mix design for M40 grade concrete was used. From the trial design mix, the selected cement content and water cement ration are 450kg/m^3 and 0.4.
3. The strength of M40 concrete increases gradually when adding glass fiber up to 0.5%-1%
4. Increases of dosages of glass fiber in M40 mix decreases in strength.
5. The maximum flexural strength of concrete is achieved in 1% of glass fiber.
6. Maximum flexural strength attained in 1% of glass fiber.
7. Addition of glass fiber in M40 mix increases the compressive and tensile strength within certain limit.
8. Glass fiber at 1% gives good resistant to sulphate attack at 28 days compared to conventional concrete specimen.
9. The alkalinity value of conventional concrete is higher than the glass fiber mixture concrete specimens.

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