Study On Strength Aspects of M50 Grade Self Compacting FRC

Dr.B.Jayarami reddy[1] ,D.Mohammed Rafi [2], V.Madhava[3]
[1]*Professor, Yogi Vemana University*
[2]*Research Scholar, Yogi Vemana University*
[3]*Asst.prof., SVIST*

Abstract **- Self compacting concrete is a relatively invention in concrete and the addition of fibres to it shows improved strength properties. Several studies have been done on self compacting concrete with fibre addition. In this work, an attempt has been made to make a comparative study on the fresh and hardened state properties of M20 and M30 grades of concrete mixes of self compacting concrete(SCC) and glass fibre reinforced self compacting concrete(GFRSCC). The SCC and GFRSCC mixtures had a cement replacement of 35% fly ash and addition of glass fibre at 0.05%, 0.10%, 0.15% and 0.2% on total volume of mix. For testing its properties in the fresh state, slum−flow test, L−box and V−funnel were used. Compression (strength of 7,14 & 28 days), flexural and split tensile strength tests were carried out.**

Index Terms **- Reinforced, Compression, flexural, funnel.**

I.INTRODUCTION

1.1 GENERAL

Concrete is individual of a large amount versatile building materials. It can be cast to well any structural outline from a cylindrical water storage space tank to be rectangular beam or column in a high-rise structure unsurprising concrete is composed of aggregates (sand, gravel...), cement, water and admixtures where it is necessary. Concrete with a consistent structure, good smoothness and the aptitude of bend by form, sound and thermal lagging and the ability of excellence developed by admixtures, is getting more and more popular in structural industry all day. consider all the solid profit, we cannot refuse its weakness.

The first essential setback of concrete is a lower tensile strength which is just about 10%-15% of its compressive strength yet this vital problem can be solved by the strengthening. During adding, support have to be planned to check delicate collapse in organize to have copied actions; the limit values must be appreciated to avoid decomposition of strengthening. The advantages of using concrete consist of high compressive strength, good fire confrontation, elevated water resistance, low protection, along with extended repair being. The disadvantage of use solid take in broke tensile power, low strain of fracture and formwork necessity. The main difficulty is that concrete develop micro cracks through curing.

1.2. Fiber reinforced concrete

Fiber reinforced concrete is comparatively new constructional fabrics urbanized from side to side wide investigate and growth work throughout the last three decades. The fibers are arbitrarily tilting, separate, irregular elements made from steel, glass or organic polymers (Synthetic Fibers). The fibers are bring in in the average as ‘micro reinforcement’ so as to get improved the tensile strength by delaying the swelling of cracks, and to add to the unevenness by transmit pressure crossways a broken piece so that very much better bend is likely exterior the hit the highest point stress.

Fiber glass is enormously multipurpose substances which combine its brightness influence with an natural power to present a conditions opposing terminate, with a variety of outside texture. chop thread carpet or CSM is a appearance of strengthening second-hand in fiberglass. It consists of beaker fibres laid arbitrarily across every other and held jointly by a folder. It is naturally process use the give place –positive procedure, where sheets of substance are located in a shape and brushed with resin. since the folder dissolve in resin, the substance simply conform to unusual shape when wet out. Behind the resin cures, the tough

produce can be in use from the form and completed. Using chopped thread mat gives a fiberglass with isotropic in-plane fabric properties.

Normal or E-glass is exaggerated in the attendance of alkalinity where as alkali-resistant glass fiber by the trade name "CEM-FIL" has been urbanized and worn. Cem-Fil alkali challenging (AR) beaker fibre contain been in use for 40 days in other than 100 country universal to create some of the world's most dramatic structural design while contribution strong and tough presentation in widely unreliable cement and mortar based applications, counting floor covering, renders, top screeds, tunnels, utility poles, etc. Cem-FIL AR beaker fibres are exceptional as a solid support. Cem-Fil fibres have the equal detailed importance as the aggregate, so confident fiber spreading is easier to complete than with added fibres. Cem-Fil string have a say professionally to the tensile power previous to the fabric is clever to crack merit its high stretch Modulus, its similarity and its professional bond with the material. Cem-Fil fibres present better presentation to standard fiber reinforcing with extensively unreliable adding up rates intended to meet your exact project stipulation. Since there has been immense research on Cem-fill in the concrete industry as modifying agent for mechanical properties, hence it has been selected for present scope of work. The Cem-Film has given a good contribution towards the construction industry basically increasing the compressive strength of concrete. In this experimental study the contribution of the Cem-file is analyzed for compressive strength.

1.11 Scope of present work

Appraisal and investigate of glass fibres1.10 Need for the present work

The arrival of high strength concrete has helped the construction action in many ways, for example to build high rise buildings by plummeting column sizes and increasing obtainable space and to put the concrete into repair at a much previous age, etc.Concrete the most extensively used structural fabric in the world is prone to furious for a diversity of reasons. These reason may be recognized to structural or ecological factor, but mainly of the crack are created due to the natural failing of the matter to resist tensile military, when it shrink and it is reserved, it will split.The accidentally receptiveness fibres support in calculating the dissemination of micro-cracks nearby in the environment, first by humanizing the generally slow resistance of the medium and later by bridge across even less important crack formed after the request of load on to the associate, thereby prevent their widen into major crack. Thus, proper preface of fibres in concrete improves both mechanical properties and toughness.

Build the concrete specimen by 81 cubes by incomplete substitute of cement by fiber with dissimilar percentages (0%, 0.1%, 0.2%, 0.3% and 0.4%, 0.5%, 0.6%, 0.7%, 0.8%.)by mass of cement.

Study and laboratory trying on concrete cube.

Analysis the results and recommendation for additional investigate work.

II.LITERATURE REVIEW

2.1 Generals

The applications of Glass Fiber unbreakable Concrete are getting wider day by day. This investigate is going away on in many countries and some reviews are as follows:

Shah and Naaman (1976) approved out an examination to establish the tensile, flexural and compressive strengths of concrete specimens unbreakable with dissimilar lengths and volumes of steel and glass fibres.

The tensile or flexural strengths of unbreakable specimen ware at the majority two to three times that of plain concrete while the matching strains or deflections were as much as ten times that of simple concrete. The stresses and strains at first furious were not considerably different from those of plain concrete. general micro crack were observed on the outside of unsuccessful flexural specimen representative a important donation of the medium smooth after the first cracking.

For steel fiber unbreakable specimens, the peak loads and deformations come into view to be linearly connected to the fiber factor: VF L/D. following breakdown, steel fibres pulled out while mainly of the glass fibres ruined.

Swamy and Stravrides (1979) Carried out an investigation to decide the power of fiber reinforcement on restrain shrinkage and furious of concrete.

A circle type of preventive decrease test is report to articulate the capacity of short, detached fibres such as polypropylene, glass, and steel to organize crack and

oppose tensile stress arise from controlled decrease. Three sequence of free and reserved shrinkage tests are reported with dissimilar matrices, types of fibres, and fiber filling.

It is exposed that the attendance of fibres movements a clear but small restaurant to free shrinkage, and reduce ventilation shrinkage by up to 20 per cent. When shrinkage is reserved, fiber strengthening delays the configuration of the first crack, prevents unexpected failure observed with unreinforced matrices, enables the composite to suffer manifold cracking with no failure, and reduce cracking widths substantially.

The fiber unbreakable specimen be able to oppose 50 to 100 percent more tensile stress, and continuous to oppose the decrease stress even after 8 to 12 months.

Banter (1991) conducted a study of silica fume treatment as a income for civilizing durability of glass fiber cements and found the action of alkali opposed to glass fiber with silica fume was effectual in civilizing durability presentation of alkali resistant glass fiber unbreakable cement composite (GFRC), to retain more than 50% of the composite toughness over accelerate aging periods of 5 to 9 months.

Is is suggested that fiber treatment eliminates the aging induced by micro structural effects, while the matrix modification reduces the power of chemical attack.

Saadatmanesh & Ehsani (1991) conducted a full scale GFRP repaired beam test in the combined States of Arizona. The tests consist of six large concrete beams; five rectangle cross sections and one T-beam.

All the specimens be 192" long and experienced as a easy span in four point loading. Steel reinforcement ratios, shear reinforcement, and cambering were varied in the six beams. However, the externally applied GFRP was identical for each beam. The research concluded added GFRP plates better strength and stiffness of the specimens.

The tests showed the GFRP sheets carried a piece of the tensile force, which decreased the stress in the steel reinforcement. This was particularly evident with the small steel reinforcement ratios.

Yeol Choi and Robert yuan (2005) consider the organization linking the split tensile strength and compressive power of glass fiber unbreakable concrete (GFRC) and polypropylene string rock-hard material (PFRC). The splitting tensile strength and compressive strength of GFRC and PFRC at 7, 28, 90 days are second-hand.

Test outcome point to that the computation of glass and polypropylene fibres to solid enlarged the split tensile strength of concrete by more or less 20-50 %, and the splitting tensile strength of GFRC PFRC range from 9% to 13% of its compressive strength. Based on this examination, a easy 0.5 power association flanked by the splitting tensile strength of GFRC and PFRC.

Yuwaraj Google & Santosh Deshmukh (2006) Conducted an experimental examination on the glass fiber modified properties of structural concrete. Alkali-resistant glass fibres are second-hand in the examination. The effect of these fibres on workability, density, and on a variety of strengths of M20 grade concrete is deliberate. Fiber content varies from 0.5 to 4.5% by weight of cement. The a variety of strengths careful for examination are compressive strength and beams of 100x100x500mm for flexural strength are throw.

All the specimens are water cured and experienced after 28 days. effective day of soaking merge is start to be abridged to add to in glass fiber unbreakable concrete (GFRC) as experiential from the learn of deflection actions. A important development in the a variety of strengths is experiential due to addition of glass fibres in the concrete. Optimum fiber content is establish to be strength needy.

Asthana et al. (2008)) investigated the mechanical properties, concrete mixed by means of glass fibres at a lower to higher volume % were balling did not occur. Specimens were cast, cure and tested compressive strength, split tensile strength and flexural strengths. The new results showed the add to of 17.49% for M20 grade mix at 28 days at higher volume of 1.5% of glass fibres.

2.2 History of glass fiber reinforced concrete

Glass fiber reinforced concrete (GFRC), in simplest terms, is the substitute of conservative big aggregate and steel rebar by means of a homogeneously discrete system of tiny strand of glass a slurry of cement and sand. Concrete is used as a structure substance primarily since of its confrontation to aging and its compressive strength.

By using glass fibres as the matrix bound by cementations adhesion, substantial increase in flexural, tensile and impact strengths are achieved with no behind the superb aging properties of concrete. The mixture of cement and glass fibres allows the homogeneously reinforced part (GFRC) to be

complete much thinner than one with only intermittent reinforcement.

Glass Fiber reinforced Concrete(GFRC) is calm of concrete, reinforced with glass fibres to create a light weight, yet strong matter. GFRC elements are able to endure structural loads and so can replace conventional, heavy precast concrete basics in the construction sector.

2.3. Summary

Glass fiber unbreakable concrete, GFRC is an ultra-thin form of concrete by means of the AR glass fibers compliment the elevated compressive strength of the observer matrix with the soaring tensile strength of the beaker fiber.

The resultant merged, frequently only thick, offers a exclusive equilibrium of property such as strength, hardiness, dimensional stability, environmental stability, moisture resistance, gel thaw resistance, fire resistance, esthetics, and effortlessness of usage and mechanism. Because of this merge of attractive properties, GFRC has found a wide variety of uses in additional than 40 country across a era of more than 30 years.

The fibers are easy to integrate using a diversity of production methods to suit the end need. Applications range from the extremely observable large architectural panels on low and far above the ground rise buildings to enhancing rudiments to more ordinary uses such as channel and channel and tunnel lining.

III.CONCRETE MIX DESIGNS

3.1 Generals

The development of choose appropriate element of actual and determining their relation quantity with the object of produce a solid of the compulsory, force, stability, plus workability as inexpensively as likely, is term the offered mix suggest. The proportioning of element of concrete is govern by the necessary presentation of concrete in 2 states, that is the synthetic and the toughened state.

If the synthetic existing is not prepared, it cannot be correctly placed and compressed. The belongings of workability, therefore, become of vital magnitude. The compressive strength of hard-bitten concrete, which is usually measured to be an directory of its other property, depends upon many factor, e.g. excellence and quamaritaltity of cement, water and aggregates; batching and addition; insertion, compaction and medicinal.

The charge of concrete is completing awake of the charge of resources, plant and labor. The difference in the cost of resources arises beginning the fact that the cement is additional than a few times more costly than the aggregate, thus the aim is to create a lean a mix as likely.

From a scientific point of view the rich mixes may guide to a high shrinkage and cracking in the structural concrete, and to the evolution of the high heat of hydration in mass concrete which may origin furious. The definite cost of existing is connected to the price of resources necessary for produce a lowest amount mean power called feature power that is particular by the expensive of the arrangement. This depends on the value organize actions, but present is no reservation that the excellence organize add to the cost of existing.

3.4 Factors to be measured in mix propose

The score description, giving the feature potency necessity of material.

The kind of cement influences the rate of growth of compressive strength of concrete.

Greatest supposed dimension of aggregate to be second-hand in concrete may be as great as likely within the limit agreed by IS 456:2000.

The cement satisfied is to be unfinished from shrinkage, cracking and creep.

The workability of material for acceptable insertion and compaction is associated to the dimension and profile of the slice, the measure and spacing of support and practice used for transport, introduction and compaction.

3.5 Concrete Mix Design – M 50 Grade of Concrete

The mix design M-50 grade (Using Admixture – Sikament) provided here is for reference purpose only. genuine location situation differ and thus this must be in step as per the spot and other factor.

Parameters for mix design M50

2.4 Glass fiber

During universal, fibres are the major load transport member. While the nearby matrix keeps them in the preferred locations and compass reading, acting as a load move medium between them, and protects them from ecological damage. In detail, the fibres give reinforcement for the matrix and other helpful

functions in fiber - reinforced compound resources. Glass Fibers can be included into a matrix either in incessant lengths or in irregular (chopped) lengths CEM-FIL Anti-Crack TM HD is a particular reason AR glass thread chop strand calculated for addition with existing, field gun and other cement-based mix where consistent dispersal of the fibres is wanted. Cem-Fil HD is characteristically second-hand at a low level in adding to prevent cracking and get better the presentation of ready mix concrete, floor screeds, render or other particular mortar mixes.

CEM-FIL Anti-Crack TM HD chopped strands have a sizing system which is water dispersible, allowing full dispersion into individual filaments in mixing in an aqueous environment. They include with no trouble into mixes, charitable a very large number of dispersed reinforcing fibres from a small weight of the product. Anti-Crack fibres do not stick out from the outside and require no additional finishing. In the present study CEM-FIL anti crack HD glass character was used and its property are exposed in the table

Fibers	CEM-FIL Anti Crack HD Glass Fiber
Density in t/m3	2.6
Elastic Modulus GPA	72
Tensile Strength in MPa	1700
Diameter in microns	14
Length in mm	3
No. of fibers in million /kg	212
Electrical conductivity	Very low
Chemical resistant	Very high
Aspect ratio	80

Table : properties of Cem-Fil Anti Crack HD Glass Fiber

Appearance	White or off-white
Physical state	Solid
Softening point	>800 C (1560 F)
Melting point	Non applicable
Density	2.7g/cm3
Water solubility	Insoluble
Moisture content	< 0.6 % (ISO 3344)
Dispersion	Excellent
Acid resistance	Excellent
Alkali resistance	Good

Table:characteristics of Cem-Fil Glass Fiber

4.3.1. Compressive strength:

The compressive force of any fabric is definite as the fighting to breakdown beneath the achievement of compressive military. Especially for concrete, the compressive strength is an significant parameter to decide the presentation of the fabric during repair conditions. Concrete mix can be intended or regular to obtain the necessary engineering and durability property as necessary by the design engineer. Some of the other engineering properties of hard-bitten concrete comprise Elastic Modulus, Tensile Strength, Creep coefficients, density, coefficient of thermal development etc.

4.4.2 Split tensile strength:

The split tensile experiment was conducted as per IS 5816:1999. The size of the cylinder is 300mm long with 150mm diameter. The specimen was reserved in water for curing for 7 days,14 days and 28 days and for taking away be experienced in wet state by wiping water and grit in attendance on the outside. The test is approved out by insertion a cylindrical example parallel flanked by the load surface of a density difficult mechanism and the load is practical to stop working of the pot along the perpendicular diameter.

Split tensile force = 2P/ (p DL)

Where : P=split tensile weight,

D=distance of the cylinder

5.4 Summary

In this chapter, the results obtain beginning the experimental program are tabulated and are represented in the shape of graphs. The results were studied and based on this study, the conclusion was drawn. The conclusions of the present study are specified in the next part.

5.5 Scope for further investigation

To strengthen the comments and conclusion made in the there investigation, a figure of cubes with higher grades, and varying percentages of fibres may be investigated.

Mathematical formulations may be developed to confirm the experimental observations.

Further research can be approved out to learn the automatic property of glass fiber unbreakable self compacting concrete.

Experimental Investigation to be carryout on beams also.

Use Different types super plasticizers.
Take different aspect ratios.

IV.CONCLUSION

This investigate project is to establish the strength individuality of glass fibre reinforced concrete for possible request in the structural concrete. Based on the new results the following conclusions were drawn.
The compressive strength of glass fibre concrete for cube is establish to be maximum at 0.65% of fibre at 28days is 67.05 N/mm2.
The compressive strength of glass fibre concrete for cylinder is establish to be maximum at 0.65% of fibre at 28days is 16.25 N/mm2.
The split tensile strength of glass fibre concrete for cylinder is establish to be maximum at 0.65% of fibre at 28days is 6.55 N/mm2.
The Flexural strength of glass fibre concrete for cylinder is establish to be maximum at 0.75% of fibre at 28days is 4.63 N/mm2.
This is an suggestion of higher toughness which is a calculate of ability to watch energy during buckle.
Higher percentages of glass fibres from 0.65% affect the workability of concrete, and may need super plasticizer to uphold the workability.
With the use of glass fibre in concrete it has shown an development in automatic properties such as compressive strength for M50.
Cracks could be restricted with adding of glass fibre. Cracks have occur and propagate slowly till the final breakdown. This incident is true with all the percentages of fibre. Glass fibre also helps in calculating shrinkage cracks.

REFERENCES

[1] ASTM C-1018 (1997) “Standard Specification for flexural toughness and primary crack strength of fibre unbreakable concrete & shotcrete” American society for testing and materials
[2] “Measurement of Fibre unbreakable Concrete,” ACI Committee 544, American Concrete Institute Materials Journal, Vol. 85, No. 6, pp. 583-593, American Concrete Institute 1988.
[3] I.S: 10262-1982 “Indian code for suggested strategy for concrete mix design
[4] I.S 456-2000 “Indian code of perform for plain and reinforced concrete (Fourth Revision)”.
[5] I.S 516-1959 “Indian code for technique of tests for concrete”.
[6] Bayasi, Z. Bhatacharya, R. and Posey, M. (1989) "Fibre unbreakable Concrete: Basics and Advancements," Events, Symposium on advancement in Concrete resources, Bradley University, pp. 1-1 to 1-27.
[7] Craig, R., S. Mahadev, C.C. Patel, M. Viteri, and C. Kertesz. "Behaviour of Joints Using Reinforced Fibrous Concrete." Fibre unbreakable Concrete International Symposium, SP-81, American Concrete Institute, Detroit, 1984,pp. 125-167.
[8] Craig, R. McConnell, J. Germann, N. Dib, and Kashani, F. (1984) "Behaviour of unbreakable Fibrous Concrete Columns." Fibre unbreakable Concrete International Symposium, SP-81, American Concrete Institute, Detroit,pp. 69-105.
[9] Gopalakrishnan, S. Krishnamoorthy, T.S. Bharatkumar,B.H. and Balasubramanian, K.(December 2003) “Performance estimate of Steel Fibre Reinforced Shotcrete” National seminar on advances in concrete technology and concrete structures for the future, Annamalai University