iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** VIII **Month of publication:** August 2017

DOI: http://doi.org/10.22214/ijraset.2017.8149

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue VIII, August 2017- Available at www.ijraset.com

Effect of Steel Fiber on M30 Grade Concrete with Varying Percentage of GGBS to the Cement and Replacement of Fine Aggregate by 60% M Sand

Dinesh Barad[1], Maneeth P D[2], Brijbhushan S[3], Dr.Shreenivasreddy Shahapur[4]
[1,2,3,4]*Construction Technology Department, Visvesvaraya Technological University*

Abstract: ***In today's construction industry the use of the concrete is increasing day-by-day at rapid rate .The concrete is basic and widely used construction material because of its high structural strength and stability. The examination is done for M30 grade of the concrete with M-Sand, 60% steady, and substitution of cement with GGBS (0%, 10%, 20%, 30%, 40%, and 50%) with steel fiber 1% constant. The cubes (blocks), Cylinder (barrels).And beams (prism) are tried for the compressive quality, split rigidity and flexural quality. The Durability Studies with H_2SO_4 corrosive was conducted various combination have been made with the different properties of cement, GGBS and steel fiber also the properties of concreate has been studied in fresh and in hardened state for all the combination which are made.***

Keywords: GGBS, Cement, Natural Sand, M-sand, Coarse Aggregate, Steel Fiber, Compressive Strength, Split Tensile, Flexural Strength, Acid Test

I. INTRODUCTION

"Concrete is known as a composite material" which is commonly used for various constrictions activates. Concrete is relatively brittle material which performs significantly well in compression but in tension, concrete consists of a binding material concrete is the probably the most generally utilized material globally .It is most extremely alongside the water regarding pre-individual utilization

In any constriction activity several materials are required steel, brick, concrete etc. However the cement remains the important constriction material which is used in construction industries and the excessive use of some conventional materials of concrete causes undesirable environmental problems. The production of "Cement" is increasing annually which emits the carbon dioxide because large amount of thermal energy is necessary to burn the ingredients of cement. Based on recent study the production of cement is exported to reach 5.5 billion tonnes which emitting large amount.

So the prime and most important is to reduce the cement production. There are various substitute material for cement like GGBS, Fly Ash, Silica Fume, Met kaolin. These materials are waste products from the industries. Therefore the use of substitute materials for the partial replacement of cement. These material possess similar properties to that of the cement. The important material is natural sand is one of the important material used in the production of concrete has become very expensive and scare. Hence demand for the alternative that replaces the both natural sand and cement without sacrificing the properties of concrete in new and solidify state. Crusher dust which is produced from the granite is one of the best alternative material for replacement of natural sand which is called M Sand. The M Sand is superior then that of natural sand and also its unit price is less. The addition of fibre in concrete is solution for enhancement of flexural and torsional strength of concrete. Fibre are generally discontinuous and are randomly dispersed over cement matrix. The advantage of adding fibre is that it restricts cracks and improves the load carrying capacity beyond cracking.

II. LITERATURE REVIEW

A. Santosh Kumar karri, GV Ramarao and P Markhandeya Raju [2015]

Studied on the quality and solidness properties of concrete with replacing the cement with GGBS. The GGBS is replaced with 30%, 40% and 50%.this paper focused on M 20 and M 40 grade of concrete. The following test where conducted on cubes, cylinder and prism, the compressive quality, split rigidity and flexural quality respectively. The study on durability with the H_2so_4 acid and HCl acid where directed. The following conclusion were made with increase in GGBS replacement the workability increases. At 40%

replacement concrete attains maximum strength in compressive quality, split ductile and flexural quality. Compared with conventional concrete and strength of the GGBS concrete decreases in acid test .The effect of HCL on the strength is less then H_2SO_4acid further study on other level of replacement on GGBS and for higher grade of concrete can be carried out.

B. Manoj kadiwal and Girish hombal [2016]

The paper focuses on study of M30 grade of concrete by replacing cement by GGBS and natural sand by the M Sand. GGBS was replaced by 10%, 20%, 30%, 40% and 50% with M Sand. The test led to decide the compressive quality, Flexural quality and the split-rigidity and water absorption test. While percentage of GGBS increases compressive quality (strength) also increases. Maximum compressive quality was at 40% replacement GGBS and 100% Sand replacement. On further increment in GGBS the quality reductions. The compressive quality was 3.71%cpmpared with conventional concrete. the result of split tensile strength show the same result as the compressive strength , maximum strength was at 40% replacement of GGBs and 100% M Sand. There was about 31.91% increment in the split- tensile strength compared with normal concrete. In flexural strength there was 22.03% of increase in strength. The water absorption was found to be increase with increase in percentage of GGBS.

C. Dr T Suresh Babu, M Anvesh kumar [2016]

In this paper the properties of concrete with M Sand and GGBS with M 20 grade of concrete were carried out by replacement with cement by GGBS that is 5%, 10%, 15%and 20% were carried out and natural sand was replaced by M Sand that is 25%, 50%, 75% and 100%. The optimum replacement of GGBS was found to be 20% with water cement ratio 0.45. The compressive is found to be increased by 3.6% workability increases by addition of admixture. By substitution of Natural sand (NS) with M-Sand (MS) the workability and also quality increases. Weight loss was found in admixture concrete then the normal concrete.

D. J Parvesh [2014]

In this paper the review is done to locate the consolidated impact of fine aggregate which is replaced with M Sand and course aggregate with coconut shell 50% both with addition of steel fibre. In this paper the compressive strength of cube and split rigidity of barrel for 28 days were carried out. The replacement for natural sand 0%, 20%, 40%and 60% by steel fibre 0%, 0.25%, 0.5%, 1%and 1.5% were done with M 20 grade of concrete by water cement ratio 0.45. This paper concludes that the split rigidity, compressive and also flexural strength revels the increase of strength at 60% substitution of M Sand. The ordinary concrete achieves 55% more compressive strength .The course aggregate can be fully replaced by coconut shell also the flakiness index of coconut shell is greater than gravels.

E. Likhil L Raut and D B Kulkarni [2014]

The paper deals with the addition of steel fibre in SFRC with conventional concrete in beams to enhance the tensile strength with fraction of fibres added varying from 0% to 1% with regular interval 0.25% with aspect ratio 38. Crimped steel with M20 grade of concrete. The paper concludes that the tensile strength of beam was increased 47.27% compared to normal concrete. The fibre reinforcement has increased the stiffness and decrease the angle of twist compared with conventional concrete. The initial cracks were seen at high loads. The 0.75% of steel gives the optimum results.

1) Observation:

a. To decide the ideal rate supplanting of the regular sand with M-Sand at which ideal quality is acquired.
b. To locate the greatest rate of substitution of GGBS and M-Sand in the concrete.
c. To review the quality attributes of both conventional concrete and modified concrete.
d. Utilising the waste material to safeguard the environment.
e. To offer economical construction material.

III. METHODOLY AND MATERIALS

The research work is to analysis the strength properties. GGBS which is replaced by the cement and natural sand is replaced by M Sand with addition of fibre. The tests on concrete are carried out according to IS Code. The tests are carried out on conventional concrete and also on GGBS 0%, 10%, 20%, 30%, 40% and 50% and M Sand 60% constant with fibre 1% proportion. Before arriving to final conclusion on both i.e. conventional and also on modified concrete the comparative study is done.
The following methodology is adopted for the proposed work

A. Collection of articles and journals to understand and get the idea on the research work conducted on subject of work.
B. The properties of materials such as cement ,GGBS, natural Sand , M-Sand , coarse aggregate and fibre to be studies by conducting the tests as per BIS
C. To obtain the mix proportion for M30 Grade concrete by IS method 10260 : 2009
D. Calculate the mix proportion of various material such as cement replaced by GGBS (0%, 10%, 20%, 30%, 40%, and 50%), natural sand with M-sand (60%), coarse aggregate with fibre (1%).
E. The concrete specimens are prepared such as cube for compression, cylinders for split-tensile and prisms for flexural strength, and also cubes for acid test.
F. The curing of specimens for 7 days and 28days.
G. The compressive quality, split-tensile test and flexural quality were evaluated.
H. Durability test M30 grade with replacement of GGBS and M Sand with fibre replacement concrete by 5% concentration of sulphuric acid
I. Analysis is carried out with modified concrete and conventional concrete.

The material used in this project and its properties are as follows

1) *Cement:* Cement is restricting material in concrete OPC 43 grade cement is used conforming to IS 8112:1989 for investigation.

Table. No. I Cement Properties

SL. NO	PROPERTIES	TEST OUTCOME
(1)	Specific Gravity	3.13
(2)	Initial setting time	45min
(3)	Final setting time	600min
(4)	Normal consistency.	32%
(5)	Finesse modulus	97.45

2) *GGBS*: Ground-granulated impact heater slag (GGBS) is acquired by the extinguishing liquid iron slag(which is a by-result of iron and steel-production industry) the slag from the impact heater by the water or by the steam, to create the lustrous, granular item which is then dried and ground into a fine powder. The particular gravity of GGBS 3.2

Table.No.II GGBS Properties

PARAMETERS	PERCENTAGE
Calcium oxide	37.34%
Aluminium oxide	14.42%
Iron oxide	1.11%
Silicon dioxide	37.73%
Magnesium oxide	8.71%
Manganese oxide	0.02%
Sulphide Sulphur	0.40 %

3) *Natural Sand:* The natural sand which is obtained from the river beds is used as the inert material in concrete and also act as the filler material in the concrete mass. The sieve analysis was carried out IS 2386:1963 conforming to zone II.

Table.No.II Natural sand Properties

SL. NO	PROPERTIES	TEST OUTCOMES
(1)	Specific Gravity	2.68
(2)	Finesse modulus	4.45
(3)	Water absorption	0.85%

4) *M Sand:* Manufactured Sand which is eco-friendly which serves the substitute for the natural sand. The M Sand with size 0 to 4.75mm is used for all the concrete preparation.

Table .No IV M Sand Properties

SL. NO	PROPERTIES	TEST OUTCOMES
(1)	Specific Gravity	2.5
(2)	Finesse modulus	5.2
(3)	Water absorption	1.25%

5) *Coarse-Aggregate:* The Coarse-Aggregate is used are maximum 20mm down size which are crushed angular aggregate. The parameters of coarse-aggregate are given beneath.

Table.No.V Coarse Aggregate Properties

SL. NO	PROPERTIES	TEST OUTCOMES
(1)	Specific Gravity	2.7
(2)	Finesse modulus	7.15
(3)	Water absorption	1.2%
(4)	Impact value	8.5%

6) *Water:* Portable water free from the organic substances is used for the investigation both for curing and mixing.

7) *Steel Fibre (crimped steel):* The conventional concrete possess low tensile strength. The internal micro cracks are present in the concrete. These internal micro cracks can be prevented by addition of closely spaced, uniformly dispersed which arrest the cracks and improves the compressive quality and flexural quality of the concrete. The crimped steel fibre are used for the investigation. Aspect Ratio=Length/Dia= 50mm/1mm = 50

IV. MIX DESIGN

Table.No.VI Mix Design for M30 Grade

SL. NO	MATERIAL	QUANTITY Kg/M^3
1	Cement	481.47
2	Fine aggregate	662.97
3	Coarse aggregate	1088.1
4	Water	197 Lts
5	Water-Cement Proportion	0.41

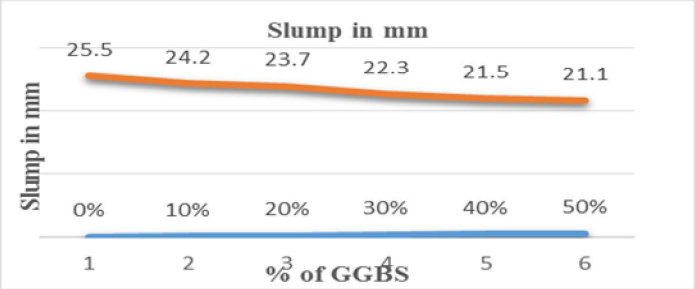
V. RESULTS AND DISCUSSIONS

A. Slump Test

The slump test measures the consistency of fresh concrete before it sets. The test use to check workability of fresh concrete and accordingly the ease with which the concrete flows. It also shows mixed quality of batch.

Table. No VII Slump Test Values

SL.NO	PERCENTAGE	SLUMP VALUE[MM]
1.	0%	25.50
2.	10%	24.20
3.	20%	23.70
4.	30%	22.30
5.	40%	21.50
6.	50%	21.10



Graph 1: Shows Slump Test Outcomes

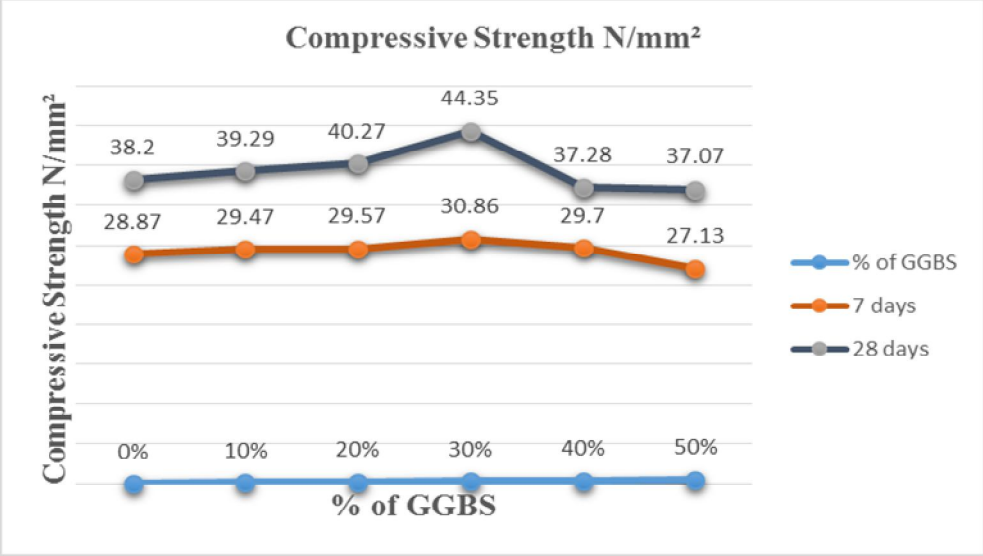
B. Compressive Strength

Compressive strength of M30 grade concrete with varying percentages of Ground Granulated Blast Furnace Slag as substitute for cement and using manufactured sand. Compressive Testing Machine (CTM) has been used for testing of concrete cubes. For every variation, three cubes of cross section 150 X 150mm were cast, average compressive strength was determined. To evaluate the compressive strength of concrete following formula has been used.

Compression Strength = (Failure Load / Area) in N/mm^2

Table. No VIII Compressive Strength of Cube

SL.No	% of GGBS + M Sand 60% + Fiber 1%	Comp. Strength 7days N/mm^2	Comp. Strength 28days N/mm^2
1	0%	28.87	38.20
2	10%	29.47	39.29
3	20%	29.57	40.27
4	30%	30.86	44.35
5	40%	29.7	37.28
6	50%	27.13	37.07



Graph 2: Shows The Compressive Strength Results at the Age 7 and 28 Days. The optimum Strength is at 30%

C. Split Tensile Strength

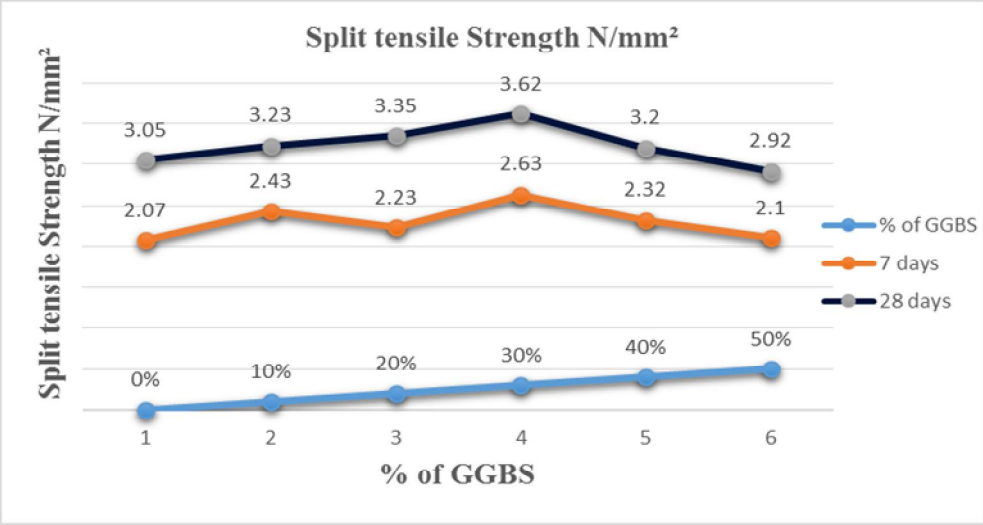
It defines the strength of concrete in tension. Due to the brittle nature of concrete, it is very weak in tension and takes less tensile load. Whenever tensile force is applied it develops cracks and leading to failure. To calculate the tensile strength, cylinder of 150mm dia and 300mm in length were cast and tested at the age of 28 days. For each variation, average of three specimen readings

was determined. The compression load is applied uniformly in the diametrical form, till the failure of the specimen. The SPT strength is evaluated in the following way.

Split tensile strength = (2*failure load) / (Π*dia of specimen*length of specimen)

Table. No IX Split Tensile of Cylinder

SL.No	% of GGBS + M Sand 60% + Fiber 1%	Split Strength 7days N/mm^2	Split Strength 28days N/mm^2
1	0%	2.07	3.05
2	10%	2.43	3.23
3	20%	2.23	3.35
4	30%	2.63	3.62
5	40%	2.32	3.20
6	50%	2.10	2.92



Graph 3: Shows The Split-Tensile Strength Results at the Age 7 and 28 Days. The optimum Strength at 30%

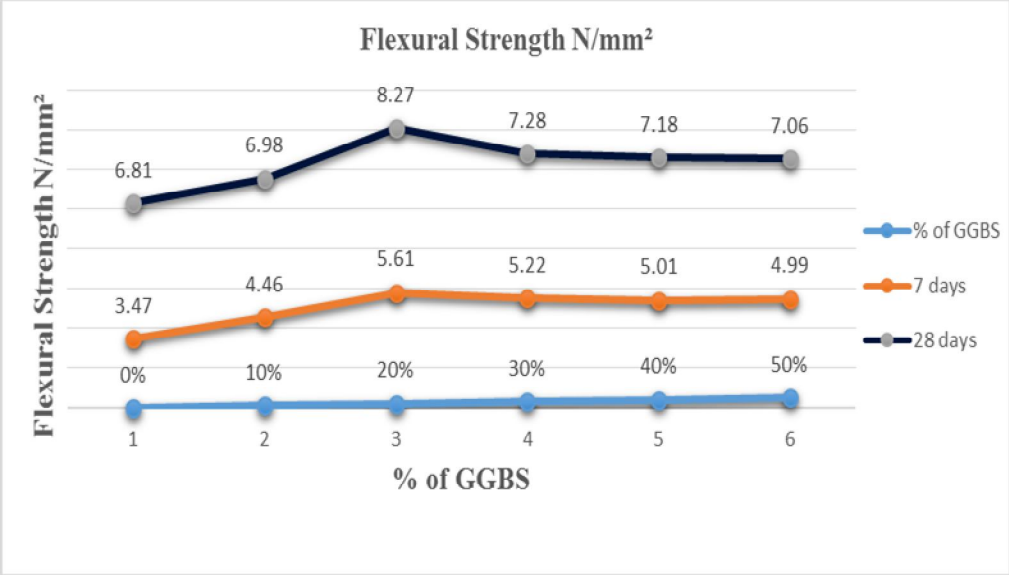
D. Flexural Strength

Flexural concrete strength is the ability of unreinforced (Plain) concrete specimen (beam) to withstand the deflecting action. Flexural concrete strength is also known as modulus of rupture and it is the property of material. Flexural test gives the value of highest stress just before the material yields. Also, defined as maximum tensile stress resisted before the specimen fails. For each variation, three beams of 100 x 100 x 500mm were cast and cured for a period of 28 days. Average of three specimen readings was determined. Compression Testing Machine (CTM) has been used for testing of specimens. Bending strength is calculated using the following expression.

Flexural concrete Strength= (Failure load*length of specimen) / (Breadth of specimen*Sq. of depth of specimen)

Table. No X Flexural Strength of Beam

SL.NO	% OF GGBS + M SAND 60% + FIBER 1%	FLEXURAL STRENGTH 7 DAYS N/mm^2	FLEXURALSTRENGTH 28 DAYS N/mm^2
1	0%	3.47	6.81
2	10%	4.46	6.98
3	20%	5.61	8.27
4	30%	5.22	7.28
5	40%	5.01	7.18
6	50%	4.99	7.06



Graph 4: Shows The Flexural Strength Results at the Age 7 and 28 Days. The optimum Strength at 20%

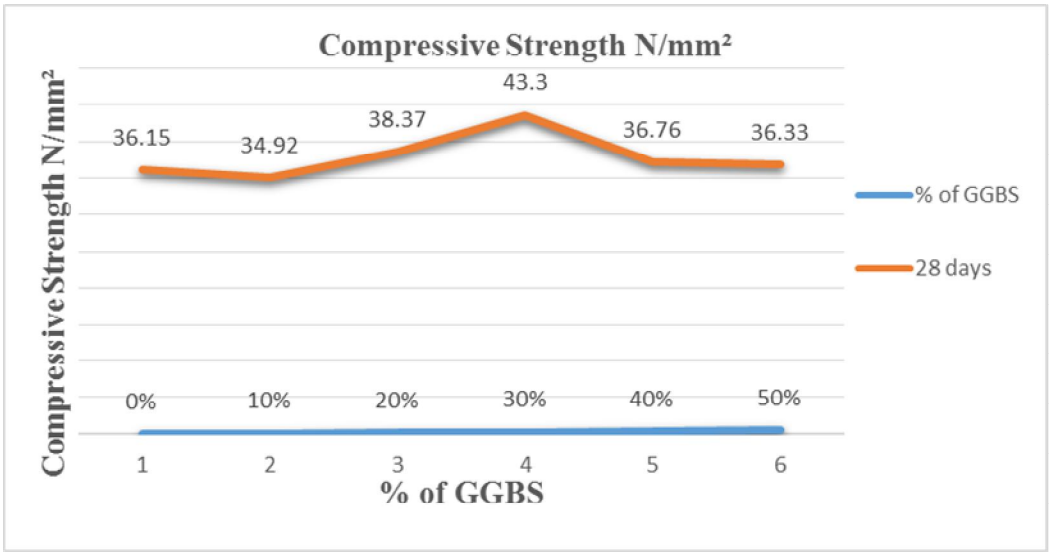
E. Durability Test

The Durability Studies with H_2SO_4 corrosive (Acid) was conduct with 5% concentration.

Compression Strength = (Failure Load / Area) in N/mm^2

Table. No XI Compressive Strength of Cube

SL.NO	% OF GGBS + M SAND 60% + FIBER 1%	COMPRESSIVE STRENGTH N/mm^2
1	0%	36.15
2	10%	34.92
3	20%	38.37
4	30%	43.30
5	40%	36.76
6	50%	36.33



Graph 5: Shows The Compressive Strength Results at the Age of 28 Days in Acid Curing. The optimum Strength at 30%

VI. CONCLUSION

In view of the above outcomes, the accompanying conclusion are made

A. The M-sand is the best alternative for fine aggregate to the river sand which fulfil all the technical specification in IS CODES and also M-sand it does not contain any impurities.

B. At 30% replacement of cement with GGBS, M-sand at 60%substitutionand Fibre with 1% replacement in concrete shows the optimum substitution percentage in compression strength.

C. On further increment in percentage of GGBS lower the compression strength of the concrete.

D. The outcome of the split-tensile strength shows same trend as that of compressive strength, the maximum strength is at mix of 30% GGBS.

E. The concrete which is modified with M-sand performs better than conventional concrete.

F. The flexural test results was at 40% replacement of cement with GGBS , M-sand at 60% and 1% fibre all these combination shows increase in flexural strength.

G. With increase of M-sand percentage decreases the workability.

H. In durability test the compressive strength of acid effected concrete is reduced compared to conventional concrete but with increase in percentage of GGBS the effect of acid on concrete can be decreased. At 30% replacement of cement with GGBS the concrete is more resistant.

VII. SCOPE FOR FURTHER STUDY

A. The GGBS replacement can be researched with other percentages.

B. GGBS Combination with different other admixture can be carried out.

C. The Studies on replacements can be done by high grade concrete can be carried out.

D. The study can further be extended to know the behaviour of concrete whether it is suitable for pumping purpose or not as present day technology is involved in ready mix concrete where pumping of concrete is being done to large heights.

E. Use of fiber has found very beneficial to increase the torsional strength of RC beam subjected to pure torsion.

F. Some tests relating to durability aspects such as water permeability, resistance to penetration of chloride ions, corrosion of steel reinforcement, durability in marine environment etc. need to investigation.

G. For use of GGBS concrete as a structural material, it is important to investigate the behaviour of reinforced GGBS concrete under flexure, shear, torsion and also compression.

VIII. ACKNOWLEDGMENT

The satisfaction that accompanies the successful completion of any task would be incomplete without mentioning of the people who make it possible with their constant guidance and encouragement crowns all the efforts with success. We are grateful to our Professor, Parents and Friends who have been great support throughout the development of my project.

REFERENCES

[1] Santosh Kumar Karri1, G.V.Rama Rao, P.Markandeya Raju, Strength and Durability Studies on GGBS Concrete-SSRG .International Journal of Civil Engineering (SSRG-IJCE) – volume 2 Issue 10 October 2015.

[2] Manoj Kadiwal1, Girish Hombal, Experimental Study on Strength Characteristics of Concrete by Replacement of Cement and Fine Aggregate by GGBS and M Sand -IJSART - Volume 2 Issue 8 –AUGUST 2016.

[3] Dr. T Suresh Babu, M Anveshkumar, An experimental investigation on the properties of concrete containing manufactured sand & GGBS-International Journal of Applied Research 2016; 2(1): 362-369.

[4] J.Parvesh, Concrete Added with Manufactured Sand, Coconut Shell, Steel and Sisal Fibres- International Journal of Latest Trends in Engineering and Technology (IJLTET).

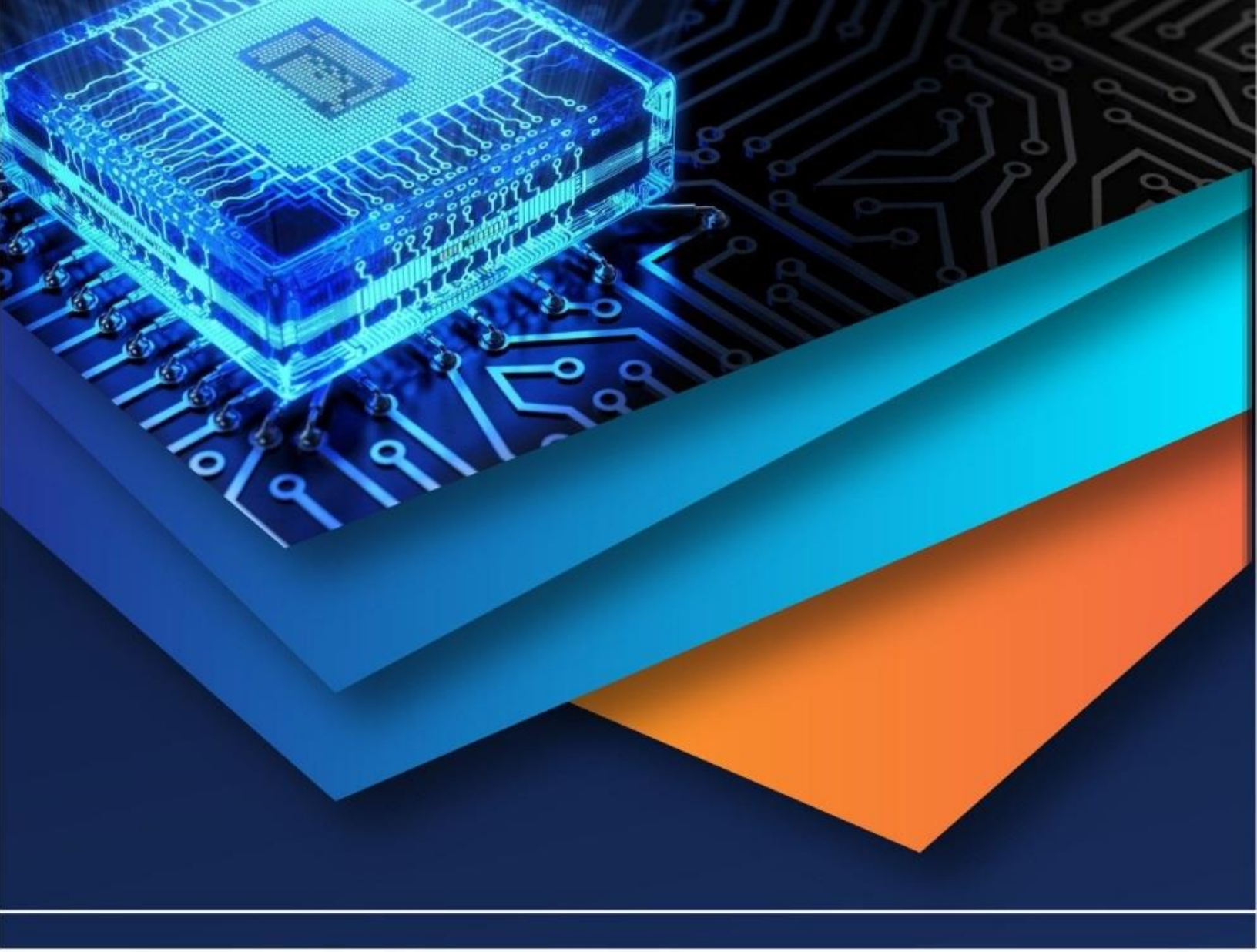
[5] Likhil L. Raut1, D. B. Kulkarni, Torsional Strengthening of under Reinforced Concrete Beams using Crimped steel fiber- IJRET: International Journal of Research in Engineering and Technology.

[6] Mohammd Moyunddin, Varnitha MS, Sathish , To Study the partial Replacement of Cement by GGBS and Natural sand by Manufactured sand in concrete using different dosages of admixture.

[7] Pazhani.K., Jeyaraj.R ―Study on durability of high performance concrete with industrial wastes‖ ATI - Applied Technologies & InnovationsVolume 2 August 2010.

[8] Kumar Shantveerayya, Vikas Nikkam, An Experimental Study on the Properties of Glass Fibre Reinforced and Ground Granulated Blast Furnace Slag Concrete- SSRG International Journal of Civil Engineering (SSRG-IJCE) – volume 3 Issue 3–March 2016.

[9] Vinayak Awasare, Prof. M. V. Nagendra, Analysis of Strength Characteristics of GGBS concrete- , International Journal of Advanced Engineering Technology E-ISSN 0976-3945.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY