ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

EXPERIMENTAL INVESTIGATION ON CONCRETE BY PARTIALLY REPLACEMENT OF CEMENT AND FINE AGGREGATE WITH STEEL DUST AND GLASS FIBRE

K.Kanimozhi[1], P.Swaminathan[2]

1- M.E (Structural) Student 2- Assistant professor
Department of Civil Engineering
M.I.E.T Engineering College, Tirchirappalli-620 007

Abstract- The development of concrete has brought about the essential need for additives both chemical and mineral to improve the performance of concrete. Nowadays the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. The increase in demand for the ingredients of concrete is met by partial replacement of materials by the industrial waste material as steel dust and an attempt has been made in the present investigation to study the behaviour of glass fibre in concrete. This material is used only as landfills because of its larger production in an year. Over the decades. There has been a significant increase in the use of fibres in concrete for improving its properties such as tensile strength and ductility. To attain the setout objectivs of the present investigation, sand has been replaced with glass fibre by 10% ad steel dust has been replaced with 10, 15, & 20% to produce concrete. Experimental investigation was done using M30 mix and tests are carried out as per recommended procedures by relevant codes. Average compressive strength v/s various mix designations for cubes and cylinders are plotted graphically.

Key words: Cement, Fine aggregate, Steel dust, Glass fibre, partial replacement.

1. INTRODUCTION

Concrete is a composite consists of aggregate enclosed in a matrix of cement paste. It is one of the most widely used construction material in developed and developing countries. The performance of concrete depends on its ingredients. Cement is a binding material, a substance that sets and hardens independently, and can bind other materials together. Construction aggregate or simply aggregate is a broad category of coarse particulate material used in construction including sand, gravel, crushed stone. aggregates used in concrete should comply with the requirement of IS 383:1970.The production of Portland cement is not only costly and energy intensive, but it also produces large amounts of carbon emissions. The production of one ton of Portland cement produces approximately one ton of co_2 in the atmosphere. The main reason behind its popularity is its high strength and durability. But it is well known that plain concrete is brittle and weak in tension. To overcome this weakness in concrete, partial replacement of glass fibre by fine aggregate is adopted. It arrest micro cracks which causes gradual failure. As cement emits 900kg of CO_2 from every 1000kg (1 ton) while production, an alternative of steel dust for cement is about to be used. Steel dust is the wastes from the steel industry which ultimately end in landfills but can never be recycled. Moreover, steel dust is a great absorbent of atmospheric CO_2. The major advantage of using fibre in concrete is to transform a brittle concrete into a pseudo ductile material. The ductility depends on the

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

ability of the fibre to form bridging cracks at higher levels of strain due to higher loads applied. The fibres interlock and stay around aggregate particles and considerably reduce workability, while the mix becomes more cohesive and less prone to segregation. The fibres are dispersed and distributed randomly in the concrete during mixing and thus improve concrete properties in all directions. Different fibres like glass, steel, carbon, synthetic organic and natural fibres have been incorporated in concrete and mechanical properties of such concrete. . [8] analyzed microwave waveguides and components such as microwave T junctions , circulators, attenuators and Isolators.

2. MATERIAL USED

A. Cement: Portland cement (often referred to as Ordinary Portland Cement or OPC) is the most common type of cement in general use around the world. The OPC grade 53 available in local market is used in this investigation. The strength of cement at 28 days when tested is conforming to the code as per IS 4031-1988.

Physical Properties of cement

Property	Value
Specific gravity	3.15
Particle size	(0.1-50) μm
Consistency	31%

B. Fine aggregates: The various physical properties of fine aggregate and results indicate that the sand conforms to IS 383-1970 is given below

Physical properties of fine aggregate

Property	Value
Specific Gravity	2.6
Water Absorption	0.8%
Fineness Modulus	2.86
zone	III

As per IS 383: 1970, the results are within maximum limits.

C. Coarse aggregates: Crushed stone of size 20 mm are used as coarse aggregate. The coarse aggregate is the strongest and least porous component of concrete**.**

Physical properties of coarse aggregate

Property	Value
Specific gravity	2.8
Water Absorption	0.42%
Fineness modulus	7.67
Moisture content	NIL

D. Steel dust : Steel dust is created when scrap metal is melted in electric arc furnaces. And it was also known as EAF dust. These materials are used as landfills but every year million tons of steel dust is produced by EAF

Chemical composition of steel dust

Sl. No	Chemical composition	percentage
1	Al_2O_3	21.4
2	CaO	0.32
3	Fe_2O_3	64.35
4	SiO_2	13.210
5	MnO	0.06
6	PbO	0.04
7	ZnO	0.45
8	MgO	0.1

E. Glass fibre : Glass fibre is also called as fibre glass. It is material made from extremely fine fibres of glass. Fibre

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

glass is a lightweight, extremely strong, and robust material.

Chemical composition of glass fibre

Sl. No	Chemical composition	percentage
1	SiO_2	52-56
2	CaO	21-23
3	Al_2O_3	12-15
4	B_2O_3	4-6
5	MgO	0.4-4
6	TiO_2	0.2-0.5
7	Fe_2O_3	0.2-0.4
8	Na_2O	1

F. Water: Portable water is used in the study for both mixing and curing as per IS 456:2000 recommendations.

G. Superplasticizer: Superplasticizers, also known as high range water reducers, are chemical admixtures used where well-dispersed particle suspension is required.

Mix Ratio

M30 Grade	Cement (kg)	FA (kg)	CA (kg)	Water
Quantity	404.7	703.46	1236.03	153.8l
proportion	1	1.73	3.05	0.28

Super plasticizer- 0.5% weight of cement

% of Replacement

steel dust	Glass fibre
10%	10%
15%	
20%	

% of Trial mixes

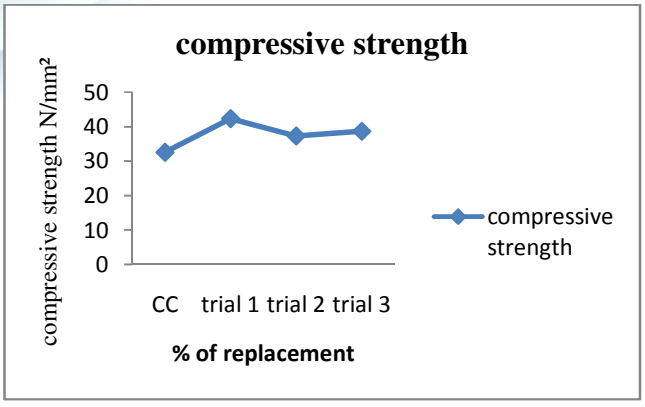
Trial	Steel dust	Glass fibre
Mixes		
Trial mix 1	10%	10%
Trial mix 2	15%	10%
Trial mix 3	20%	10%

3. RESULT& DISCUSSION:

A. Compressive strength Test: For 7 and 28 days, three cubes are tested for the various proportion of partial replacement and compressive strength of MIX 1, MIX 2, MIX 3 are given below in the table. The cube specimen is of the size 150mm x150mmx150mmis used for testing. The compressive strength test of concrete is done by using compressive testing machine.

COMPRESSIVE STRENGTH (N/mm^2)

MIX	7 days	14 days	28 days
CC mix	23.44	28.32	32.56
Trial 1	35.47	38.16	42.35
Trial 2	34.18	35.91	37.3
Trial 3	33.69	36.24	38.66



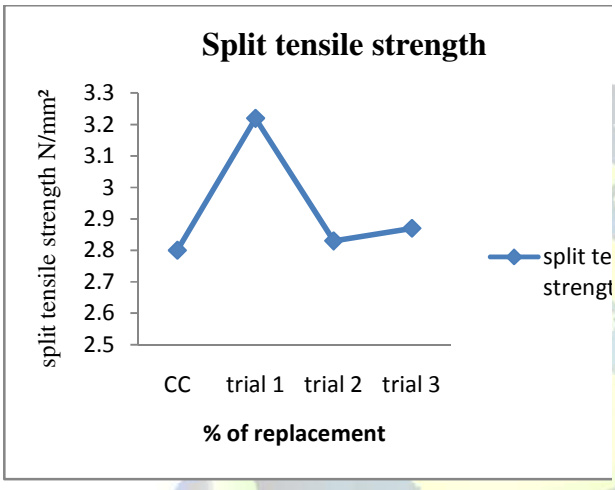
ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

B. Split tensile strength test: Splitting tensile strength test on concrete cylinder is a method to determine the tensile strength of concrete

Split tensile strength = 2P/3.14LD

SPLIT TENSILE STRENGTH (N/mm^2)



4. CONCLUSION

The conclusion is arrived for this experimental investigation, by finding optimum percentage of replacement of cement by steel dust and fine aggregate by glass fibre in concrete

- Use of steel dust as a replacement material for cement will produce low cost concrete and also helpful in industrial waste management.
- From this test, replacement of fine aggregate with 10% glass fibre and replacement of cement with steel dust with 10 % provides maximum compressive strength.
- .Split tensile strength is also increase in 10% of steel dust replacement.
- Application of this study leads to develop in construction sector and innovative building material..

REFERENCES

[1] A.Azadmehr et al *"Investigation of possible usage of EAF dust in cement*

% of Replacement	7 days	14 days	28 days
CC mix	2.55	2.64	2.8
Trial 1	2.64	2.91	3.22
Trial 2	2.57	2.7	2.83
Trial 3	2.67	2.77	2.87

industry" international journal of ISSI vol.6

[2] Anzar Hamid Mir " *Replacement of Natural Sand with Efficient Alternatives: Recent Advances in Concrete Technology"* Journal of Engineering Research and Applications

[3] Chandramouli. K et al *"strength properties of glass fibre"* APRN journal of engineering of applied sciences

[4] C.Selin Ravikumar and T.S.Thandavamoorthy "*Glass Fibre Concrete: Investigation on Strength and Fire Resistant Properties"* IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)

[5] Eng. Pshtiwan et al "*glass fiber reinforced concrete use in construction*" international journal of technology and engineering system vol no.2

[6] Fredrick.T et al *"Glass fibres"* ASM international. Vol.21

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

[7] G.Murali,et al (2012) *" Experimental investigation on fibre reinforced concrete using waste materials"* International Journal of Engineering Research and Applications. Vol.2

[8] Christo Ananth, "A Detailed Study Of Microwave Passive Components [RF & Microwave Engineering Book 3]", Kindle Edition, USA, ASIN: B06XRXJ6MK, ISBN: 978-15-208-926-1-0, Volume 10, March 2017, pp:75-128.

[9] P. Vipul Naidu and Pawan Kumar Pandey *"Replacement of Cement in Concrete"* International Journal of Environmental Research and Development

[10] Yasir khan et al "*Experimental Investigation on Strength and Durability properties of Steel and Glass fibre reinforced concrete composite"* International Journal of Advanced Research in Science, Engineering and Technology Vol. 3, Issue 6 , June 2016

[11] Indian Standards 10262:2009 (concrete mix proportioning-guidelines)

[12] Indian Standards 383:1970 (specification for coarse and fine aggregates from natural sources for concrete)

[13] Indian Standards 9103.1999 (concrete admixtures-specifications)

[14] Indian standard 456:2000 (plain and reinforced concrete)