Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 05, May-2018

Experimental Analysis of Partial Replacement of Cement by Ggbs and Fly Ash in Concrte

Virendra Desale [1], Aarti Kamble [2], Palash Borwal [3], Akshay Ingole[4] Prof. Sudhanshu Pathak (Asst.Professor)
Dept of Civil Enggineering(1,2,3,4,5)
DYPCOE Akurdi
Pune,India

Abstract **- Construction industry is one of the biggest industries in globe. The increase in population directly affects the construction industry since it demands development of more infrastructural growth. It eventually increases demand of cement. But the production of cement causes production of very huge amount of CO_2 which causes green house effect, global warming, etc. Hence to find an optional material to replace cement if not fully but partially. GGBS (Ground Granulated Blast Furnace Slag) is the waste product from the iron manufacturing industry, which may be used as partial replacement of cement in concrete due to its inherent cementing properties. And also Fly ash which is a byproduct from burning pulverized coal in electric power generating plants. Hence various proportions are made to replace cement partially by GGBS and Fly Ash.**

Keywords: GGBS,Fly Ash,Cement,Concrete

I. INTRODUCTION

Concrete provides many advantages for construction industry since it is more traditional way of construction and provides impeccable strength and is available more easily at any part of globe. The advantages of using concrete are enhanced durability, low maintenance and being aesthetically pleasing to the consumer. In this research paper we aim to provide those qualities of concrete while by reducing cement content, high economy and high environmental cost.

Cementitious constituents allow for cement reduction in concrete mixes, while maintaining and in some cases enhancing the strength and durability properties of concrete. GGBS and fly ash are two cement replacements which are grown in popularity.

GGBS is a by-product from blast furnace used to make iron. Advantages of GGBS are greater compressive and flexible strengths, greater workability and the ability to produce a denser matrix. GGBS provides greater mechanical and durability properties. The effect of GGBS and fly ash as partial cement replacement was examined on concrete cubes, cylinder and beams. In this research paper we have kept percentage of fly ash for every trial constant except for conventional trial and GGBS was used to replace cement partially from 40% up to 70% while keeping fly ash 25% as constant throughout.

II. OBJECTIVE OF THE PROJECT

India is a developing country with construction industry serving as one of the biggest industry by revenue. We are at a developing stage where we are building skyscrapers and struggling to deal with the slums. Our main objective is to reduce the production of CO^2 from cement production and eventually finding a liable solution for cement in order to replace it partially with the help of GGBS and fly ash. As we know GGBS and fly ash are considerably cheap as compare to cement hence if we can find a solution to make construction cost low, we can help our economy to grow even faster.

So the main question – if GGBS and fly ash amended concrete are so good and are considerably cheap why aren't we using GGBS and fly ash amended concrete for construction? After doing our research we came to know that as compare to conventional concrete, GGBS and fly ash based concrete takes considerably more time to gain strength.

- To study the strength parameters of concrete.
- To increase the strength of concrete.
- To compare the strength parameters with conventional concrete.
- To find out durability of concrete with GGBS and fly ash.
- To study chemical properties of GGBS.

III MATERIALS AND METHODOLOGY

1) Materials:-

43 Grade of Portland cement was used in all types of concrete mixtures. The fine aggregate of maximum size of 5mm wad used. Coarse aggregate of 20 mm was used. The grading of fine and coarse aggregate was confirmed as per IS 383(1970). A dry granular product as fine product powder of glassy white colored GGBS was used. A product obtained from coal combustion in a powder form called flyash. Fly ash of grayish white colored was used. Water using for making lean mix of concrete if should be free from any impurities, pure and portable water should used.To hydrochloric acid is used to placed beams, cubes and cylinders to check durability of concerete.

2) Methodology:-

- Concrete mix design:- Mix Design for concerete grading M30 was esigned as per IS 10262:2009
- Specimen Casting:- Cubic mould of size 150*150*150 was casted and tampered, Similarly Beams of sized 150*150*700 werw casted and tampered. Cylinder of size 15 mm in diameter and 30mm height.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 05, May-2018

- Compressive strength of Cubes and Cylinder on 7^{th} ,14^{th} , 28^{th} days were tested.After 7 days test , the strength of concrete fradually increases for 14^{th} days and 28^{th} days test.
- Flextural strength on beams on 7^{Th},14^{th},28^{th} days were tested.In general the early strength is decrease with increase of GGBS content.

MATERIAL QUANTITY: BEAMS

% OF GGBS	0	40	50	60	70
% OF FLY ASH	0	25	25	25	25
CEMENT(KG)	28	9.8	7	4.2	1.4
GGBS(KG)	0	11.2	14	16.8	19.6
FLY ASH(KG)	0	7	7	7	7
20 MM AGGR.(KG)	41	41	41	41	41
10 MM AGGR.(KG)	29.5	29.5	29.5	29.5	29.5
RIVER SAND(KG)	55	55	55	55	55
WEIGHT OF WATER(KG)	10.5	10.5	10.5	10.5	10.5
NO OF BEAMS	6	6	6	6	6

MATERIAL QUANTITY:CUBES

% OF GGBS	0	40	50	60	70
% OF FLY ASH	0	25	25	25	25
CEMENT(KG)	12.5	4.375	3.125	1.875	0.625
GGBS(KG)	0	5	6.25	7.5	8.75
FLY ASH(KG)	0	3.125	3.125	3.125	3.125
20 MM AGGR.(KG)	18.5	18.5	18.5	18.5	18.5
10 MM AGGR.(KG)	13	13	13	13	13
RIVER SAND(KG)	24.5	24.5	24.5	24.5	24.5
WEIGHT OF WATER(KG)	4.6	4.6	4.6	4.6	4.6
NO OF CUBES	12	12	12	12	12

MATERIAL QUANTITY:CYLINDER

% OF GGBS	0	40	50	60	70
% OF FLY ASH	0	25	25	25	25
CEMENT(KG)	19	6.65	4.75	2.85	0.95
GGBS(KG)	0	7.6	9.5	11.4	13.3
FLY ASH(KG)	0	4.75	4.75	4.75	4.75
20MM AGGR.(KG)	28	28	28	28	28
10MM AGGR.(KG)	19.5	19.5	19.5	19.5	19.5
RIVER SAND(KG)	37	37	37	37	37
WEIGHT OF WATER(KG)	7	7	7	7	7
NO OF CYLINDER	9	9	9	9	9

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 05, May-2018

RESULTS:-

SR NO	MOULD	QUANTITY	TEST ON	STRENGTH(KN)
TRIAL NO 1				
1	CUBES	3	7^{TH} DAY	900
		3	14^{TH} DAY	1050
		3	28^{TH} DAYS	1200
2	CYLINDERS	3	7^{TH} DAYS	140
		3	28^{TH} DAYS	300
3	BEAMS	3	28^{TH} DAYS	1450
TRAIL NO 2				
1	CUBES	3	7^{TH} DAY	295
		3	14^{TH} DAY	350
		3	28^{TH} DAYS	408
2	CYLINDERS	3	7^{TH} DAYS	128
		3	28^{TH} DAYS	150
3	BEAMS	3	28^{TH} DAYS	1250
TRAIL NO 3				
1	CUBES	3	7^{TH} DAY	290
		3	14^{TH} DAY	358
		3	28^{TH} DAYS	400
2	CYLINDERS	3	7^{TH} DAYS	90
		3	28^{TH} DAYS	125
3	BEAMS	3	28^{TH} DAYS	1000
TRAIL NO 4				
1	CUBES	3	7^{TH} DAY	245
		3	14^{TH} DAY	290
		3	28^{TH} DAYS	350
2	CYLINDERS	3	7^{TH} DAYS	86
		3	28^{TH} DAYS	110
3	BEAMS	3	28^{TH} DAYS	950
TRAIL NO 5				
1	CUBES	3	7^{TH} DAY	210
		3	14^{TH} DAY	274
		3	28^{TH} DAYS	336
2	CYLINDERS	3	7^{TH} DAYS	121
		3	28^{TH} DAYS	139
3	BEAMS	3	28^{TH} DAYS	850

V CONCLUSION:

Replacing cement partially by GGBS and Fly Ash gives similar strength after 28 days.Various combinations of concrete gives variable results and maximum quantity of GGBS is 60% that can be replaced by cement and gains the required strength after 28 days.The use of GGBS and Fly Ash is more cheaper than cement and ecofriendly than conventional**.**

VI REFERENCES:

[1] Huiwen Wan,Zhonghe Shui,Zongshou Lin,Analysis of geometric characteristics of GGBS particles and their influences on cement properties.(July 2003)

[2] Tung Chailing,Chi Sun Poon,Feasible use of large volume of GGBS in 100% recycled glass architectural mortar.(June 2014)

[3] A.Oner,S.Akyuz,An experimental study on optimum usage of GGBS for compressive strength of concrete.(January 2007)

[4] Ali Rafeet,Raffaele Vinai,Marious Soutsos,Wei Sha,Guidelines for mix proportioning of Fly Ash/GGBS basedalkali activated concretes.(April 2017)