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Ternary Blended Concrete by Using Microsilica &GGBS

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This paper study about ternary blended concrete by using admixtures and its properties like compressive strength. Economic and environmental considerations are the key factors in the growth of mineral admixtures usage Cement concrete is the most widely used material for various constructions. Properly designed and prepared concrete results are good strength and durable properties The amount of cement production emits approximately equal amounts of carbon dioxide into atmosphere. Availability of mineral admixtures marked opening of new era for designing concrete mix of higher and higher strength. As result, the use of new mineral admixtures has considerably increased within the concrete by using MicroSilica,fly ash, rice husk.GGBS in concrete up to certain proportions.For attaining a high strength and durable concrete for major application in the construction and such as high rise building, tall structure, etc., the essential need for additives both chemical and mineral is a must to performance of concrete. Compressive strength results of ternary blended concrete using mineral admixtures for different combinations with various water binder ratio of 0.55,0.45,0.35, at 28,90,180days.

Key Words: MICROSILICA, GROUND GRANULATED BLAST FURNACE SLAG,COMPRESSIVE STRENGTH

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1. INTRODUCTION

The consumption of cement in concrete industries increasing day by day. Concrete is the most widely used construction material in civil engineering industry because of its high structural strength and stability. The most important part of concrete is the cement. Use of cement alone as a binder material produces large heat of hydration since the production of this raw material emits huge amount of CO2. The carbon dioxide emission from cement is very harmful to the environmental changes. The concrete industry is looking for supplementary cementations material with the objective of reducing the carbon dioxide emission which is harmful to environment. The effective way of reducing CO2 emission from the cement industry is to use the industrial by products or use of supplementary cementing material such as ground granulated blast furnaces slag (GGBS), fly ash, silica fume and metakaolin. The availability of materials with good quality is less and also economically very high. So we need a material which is cheaper as well as eco-friendly for the environment like microsilica ,cow dung ash, rice husk ash, metakaolin & ground granulated blast furnaces slag (GGBS).In both developed and developing countries recent researchers amide at the energy conservation in the cement and concrete industry, focused on the use of less energy intensive materials such as Fly-ash, slag and natural pozzolanas. Later some attention has been given to the use of pozzolana, Micro silica as partial replacement to Portland cement. Unlike natural pozzolanas and fly ash, the silica reaction involving Micro silica is rapid and therefore, a long curing period is not necessary.

2. LITERATURE REVIEW

Roland Bleszynski, R.Doug Hooton, Michael D.A. Thomas, an Chris A. Rogers (1998) [1]. Investigate the Durability of Ternary cementitious systems. Seven concrete mixtures. A.K.Mullck(2007) [2]:. the advantages of part replacement of OPC by fly ash, granulated slag and silica fume- either singly or in combination in ternary blends.M.D.A. Thomasa, M.H. Shehata, S.G. Shashiprakash, D.S. Hopkins, K. Cail (1991)[3]Presented the test results from laboratory studies on the durability of concrete that contains ternary blends.Tahir Kemal Erdem a, Onder Kırca(2007) [4]Discussed the Combinations of cement additions may provide more benefits for concrete than a single one. In this study, 80 high strength concretes containing several types and amounts of additions were produced. M.G. Alexande, B.J. Magee (1999)[5]Describes a short-term study carried out to examine the durability performance of various condensed silica fume (CSF) concretes in comparison to Portland cement (PC) and PC/ground granulated blast furnace slag (GGBS) controls up to the age of 28 day. **P.** Murthi and V. Sivakumar (2008)**[6]** Describes a detailed experimental investigation on the acid resistance of ternary blended concrete immersed up to 32 weeks in sulfuric acid (H_2SO_4) and hydrochloric acid (HCl) solutions.P. Srinivasa

Rao, Seshadri Sekhar. T and P. Sravana (2009) [7]:Conducted experiments to study the Effect of glass Fibres on the Durability parameter of self compacting concrete.

RESEARCH SIGNIFICANCE

It is necessary to have done work for triple blended concrete using mineral admixtures like micro silica, GGBS. Ground granulated blast furnace slag, micro silica and fly ash are some of the mineral admixtures used in varying proportions to achieve such results. Due to its finer size and higher pozzolan city compared to other mineral additives, micro silica incorporation leads to improved mechanical properties of concrete at early ages.
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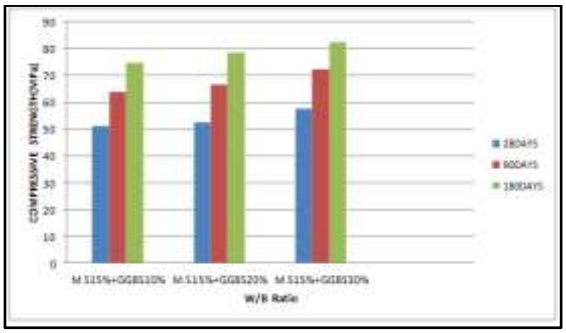
EXPERIMENTAL PROGRAM

The experimental Program consisted of finding the mechanical properties of ternary blended concrete by casting specimens for different a binderratio to meet the target strength, were casted and tested for determining mechanical properties i.e., compressive strength for 28,90,180days

Mix Proportions: In the present investigation an experimental program was designed to determine the optimum mix proportions of concrete with GGBS and micro silica. Before carrying out actual experimentation several trials were carried out for control mixes as per IS: 10262-2009 for M20 grade of concrete.
Casting of Specimens: The cast iron moulds are cleaned of dust particles and applied with mineral oil on all sides before concrete is poured in the moulds. The moulds are of size 100mm x 100mm for cubes and 100x200mm for the cylindrical specimens.The moulds are placed on a level platform. The well mixed green concrete is filled in to the moulds by vibration with needle vibrator. Excess concrete was removed with trowel and top surface is finished level and smooth.
Curing of the Specimens: The specimens are left in the moulds undisturbed at room temperature for about 24 hours after casting. The specimens are then removed from the moulds and immediately transferred to the curing pond containing clean and fresh water.

Testing of Specimens: A time schedule for testing of specimens is maintained to ensure their proper testing on the due date and time. The cast specimens are tested as per standard procedures, immediately after they are removed from curing pond and wiped off the surface water. The test results are tabulated carefully.



Compressive Strength of Ternary Blended Concrete of W/b ratio 0.35

Casting the specimens

Selection And Proportioning Of Mix Ingredients Are:

The minimum compressive strength required from structural consideration. The adequate workability necessary for full compaction with the compacting equipment available. Maximum water-cement ratio and/or maximum cement content to give adequate durability for the particular site conditions. Maximum cement content to avoid shrinkage cracking due to temperature cycle in mass concrete.

Testing Procedures

Compressive Strength Test: The cube specimens are tested on compression testing machine of capacity 2000kN.The specimen is placed on the machine in such a manner that the load applied to opposite sides of the cubes as caste that is, not top and bottom. The axis of the specimen is carefully aligned at the center of the loading frame. The load applied is increased continuously at a constant rate until the resistance of the specimen to the increasing load breaks down and no longer can be sustained. The maximum load applied on the specimen is recorded.

Strength Studies of Ordinary And Ternary Blended Concrete:

The present project work experimental investigation is carried out on triple blended concrete mixes using two mineral admixtures GGBS and micro silica along with ordinary portland cement. various proportions of ggbs and micro silica are used as partial replacement of cement. strength properties of concrete mixes prepared using these triple blended cement mixes are determined. From all the combinations 10%microsilica+30%GGBS gives high compressive strength, as a filler, micro silica decreases the average size of pores in the cement paste and as the dense microstructure of GGBS as it improves the bond strength of concrete. Themicro silica due to its pozzolanic reactivity, improves the bond at the aggregate paste interface, which increases the strength of concrete.

Table -1: Mix proportion of Ternary Blended Concrete

Mix type	**W/C**	%of cement	**%of Micro Silica**	**% of GGBS**
Control mixes	0.55	100	-	-
	0.45	100	-	-
	0.35	100	-	-
Ternary mixes	0.55	85	5	10
		75	5	20
		65	5	30
		80	10	10
		70	10	20
		60	10	30
		75	15	10
		65	15	20
		55	15	30
	0.45	80	5	10
		75	5	20
		65	5	30
		80	10	10
		70	10	20
		60	10	30
		75	15	10
		65	15	20
		55	15	30
	0.35	85	5	10
		75	5	20
		65	5	30
		80	10	10
		70	10	20
		60	10	30
		75	15	10
		65	15	20
		55	15	30

3. CONCLUSIONS

1. Triple blending of cement with micro silica and GGBS proved to be cost effective and eco friendly without loss in strength of concrete.
2. The combination of 10% Micro Silica + 30% GGBS performed the best at all ages from 39MPa to 88MPa were at all the W/B ratios studied in terms of Compressive Strength among the combinations studied.
3. The combination of 15% Micro Silica with different percentages of GGBS gave the least Compressive Strength among the ternary mixes at all ages and at all W/B ratios.
4. In ternary blended concrete micro silica act as filler and GGBS controls the workability.
5. The percentage increase in Compressive Strength of Ternary Blended Concrete (10% Micro Silica + 30% GGBS) at the age of 90 and 180 days with its 28 day strength is observed to be 17% to 60%.
6. The percentage increase in Compressive Strength of Ternary Blended Concrete is found to be higher at higher ages for all water to binder ratios.
7. In microsilica of its pozzolanic reactivity, improves the bond of aggregate paste interface, thus it increases the strength of concrete. The dense microstructure of GGBS improves the bond strength of concrete.
8. Therefore, this combination is more effective in improving the properties of ternary blended concrete.

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