

To Study On Effect Of High Performance Concrete With Alccofine And Waste Glass Powder

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Abstract— This Paper Presents the Compressive Strength and Flexural Strength of high performance concrete with the Replacement of cement with Alccofine and Waste glass Powder and new Synthetic polymer master Rehobuild 823 PQ (Chloride Free Product). The necessity of High Performance concrete is increasing because of demands in the construction industry. Efforts for improving the performance of concrete over the past few years Suggest that cement Replacement materials along with Mineral & chemical admixtures can improve the Strength and Durability characteristics of concrete. Alccofine (1203) Micro Materials and Waste Glass Powder that can be utilized to produce highly durable concrete composites. The Concrete specimens were cured on normal moist curing under normal atmospheric temperature. The compressive and Flexural Strength was determined at 7,14 and 28 days. The addition of Alccofine shows an early strength gaining property and that of Waste Glass Powder Shows long term Strength. The ternary System that is Ordinary Portland Cement – Alccofine- Waste Glass Powder Concrete was found to increase the Compressive and Flexural Strength of Concrete on all age When Compared to Concrete made with Alccofine and Waste Glass Powder alone.

Key words: Compressive Strength, Flexural Strength, Alccofine, Waste Glass Powder, Master Rehobuild 823PQ.

I. INTRODUCTION

ALCCOFINE 1203 is a specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation. Owing to its unique chemistry and ultra fine particle size, ALCCOFINE 1203 provides requirement of concrete performance. ALCCOFINE 1203 can also be utilized as a high range water reducer to improve compressive and flexural Strength or as a super Workability aid to improve flow. Alccofine1203 is Known to produce a high strength concrete and is used in two different ways as a cement replacement, in order to reduce the cement content (usually for economic reasons) and as an additive to improve concrete properties (in both fresh and hardened states). Therefore, utilization of Alccofine1203 together with Waste Glass Powder and Synthetic polymer provides an interesting alternative and can be termed as high strength and high performance concrete.

The use of Recycled waste glass in Portland cement and concrete has attracted a lot of interest worldwide due to the increased disposal costs and environmental concerns. Glass used for containers, jar and bottles is soda lime silica counts for 80% of the recycled glass. The Glass being mainly a silica-based material in amorphous form can be used in cement-based applications. The main concerns for the use of crushed glasses as aggregates for the Portland cement concrete are the expansion and cracking crushed by

the glass aggregate due to alkali silica Reaction. This Paper Reports the preliminary results of an experimental investigation on the use of Glass Powder to Partially Replace Cement in Concrete Applications.

Although there is Strength Reaction in the presence of glass powder, However, glass powder can be used to Replace 30% of the cement in a concrete mix with satisfactory strength development due to its pozzolanicreaction. Authors found that using glass in mortar applications caused more expansion compared with mortars without glass particles. This expansion can in some cases caused deterioration to the materials.

This Paper Reports the results of an Experimental Investigation of Compressive and Flexural Strength of Concrete. The HPC of Concrete in less Water cement ratio having made workability to use of Super Plasticizer (Master Rehobuild 823 PQ). These include a control mixture, Mixture containing 6%, 8%, 10%, and 12% of Alccofine as Replacement of cement and 30% Waste Glass Powder Constant as Replacement of Cement. A Large number of Specimen were cast and subjected to normal curing at atmospheric temperature. The compressive Strength determined as 7, 14, and 28 days and Flexural Strength of 14 and 28 days.

II. EXPERIMENTAL PROGRAM

Experimental Program has been Designed to provide results of Alccofine and Waste glass powder with Synthetic Polymer based on High Performance Concrete. To check the performance of Alccofine and Waste Glass Powder with use of synthetic polymer based concrete have been Studied in this investigation

A. Material used :

1) Cement:

Ordinary Portland Cement 53 grade (Ambuja Cement) have used in investigation. The cement was tested according to IS 4031:1988. It confirmed to IS 12269:1987. Its Properties is given in Table.

Sr. No.	Properties	Value	As per IS:12269-1976
1	Specific Gravity	3.15	3.15
2	Normal Consistency	31%	30-35%
3	Initial Setting Time	38	>30
4	Final Setting Time	453	<600
5	Fineness(% passing 90 IS Sieve)	3%	<10%
6	Soundness (mm)		<10
7	Compressive Strength	38 (3 days)	>27

		40.34 (7 days)	>37
		57.30 (28 days)	>53

Table 1: Property of OPC 53 Grades

B. Fine and Course Aggregate:-

Conforming IS 383 (1987) have used. Fine and Course aggregate make up the bulk of concrete mixture. Sand, Natural Gravel and Crushed stone are mainly used for this purpose. For Fine aggregates natural sand is provided with maximum size of 4.75mm. Sp.gr of Fine aggregate is 2.64, Fineness Modulus $2.9 < 3.2$ and Grading Zone II.

Coarse aggregate is used with size between 20mm-10mm. Specific gravity of fine aggregate 2.64 and Specific Gravity of Course aggregate 2.68 and $7.08 < 8$ Fineness Modulus of CA. Water Absorption 1.5%

C. Alccofine:-

Alccofine is Specially processed product based on slag of high glass content with high reactivity obtained through the process of controlled granulation. Alccofine have used conforming to ASTM C989-99. Physical and chemical Properties of Alccofine,

Physical Properties	
Fineness (cm ² /gm)	>12000
Specific Gravity	2.9
Bulk Density (Kg/m ³)	700-900
Particle Size Distribution	d10 1.5 micron
	d50 5 micron
	d90 9 micron

Table 2: Physical Properties of Alccofine

Chemical Properties	
CaO	61-64%
SO ₃	2-2.4%
SiO ₂	21-23%
Al ₂ O ₃	5-5.6%
Fe ₂ O ₃	3.8-4.4%
MgO	0.8-1.4%

Table 3: Chemical properties of Alccofine

D. Waste Glass Powder:

Glass is a transparent material produced by melting a mixture of materials such as silica, soda ash, and CaCO₃ at high temperature followed by cooling during which solidification occurs without crystallization. Glass is widely used in our lives through manufactured products such as sheet glass, bottles, glassware, and vacuum tubing. The amount of waste glass is gradually increased over the recent years due to an ever-growing use of glass products. Most waste glasses have been dumped into landfill sites. The Land filling of waste glasses is undesirable because they are not biodegradable, which makes them environmentally less friendly. So we use the waste glass in concrete to become the construction economical as well as eco-friendly. Composition of cement and Glass Powder is as shown in Table 4

Sr. No	Properties	Waste Glass Powder (GLP)
1	SiO ₂	67.330
2	CaO	12.450
3	MgO	2.738
4	Al ₂ O ₃	2.620
5	Fe ₂ O ₃	1.420
6	TiO ₂	0.157
7	Na ₂ O	12.050
8	K ₂ O	0.638
9	ZrO ₂	0.019
10	ZnO	0.008
11	SrO	0.016
12	P ₂ O ₅	0.051
13	NiO	0.014
14	CuO	0.009
15	Cr ₂ O ₃	0.022

Table 4: Chemical Properties of Waste Glass Powder

Sr.No	Physical Properties	
1	Sp.Gr	2.6
2	Fineness Passing 150µm	99.5
3	Fineness Passing 90µm	98

Table 5: Physical Properties of Waste Glass Powder

Sr. No	Chemical Properties	
1	pH	10.25
2	Colour	Grayish white

Table 6: Chemical Properties of Waste Glass Powder

E. Master Rebuild 823 PQ:-

The basic components of Master Rebuild 823PQ are synthetic polymers which allow mixing water to be reduced considerably and concrete strength to be enhanced significantly, particularly at early ages. Master Rebuild 823PQ is a chloride free product and it is a new product of BASF. It allows the production of very flowable Concrete, with a low Water/cement ratio. Concrete with Rebuild shows Strengths higher than concrete without admixture having the same workability. The Master Rebuild is used that ready mix Concrete, Pumped Concrete, Mass Concrete Pours etc.

F. Mix Design:

Alccofine Varies from 6, 8, 10, and 12%, and Waste Glass Powder will be constant 30%. Finally as optimum dosage of Alccofine and WGP is 8 or 10% and 30% respectively.

Material	Volume (Kg/m ³)
Cement	378
WGP	162
FA	641.52
CA	1046.729
Water	156

Table 7: mix Design M70 Grade

Mix Design For M70 grade:-

Design Stipulation : Grade M70
 Size of aggregate : 20mm, 10mm
 Degree of workability : Collapsible
 Degree of Quality control : Good
 Type of exposer : Sever
 Grade of Cement : OPC 53

Test data for materials:-

Sp.gr of cement : 3.15
 Sp.gr of FA : 2.64
 Sp.gr of CA : 2.68
 Water absorption of FA : 1 %
 Water absorption of CA : 0.6 %
 Bulk density of CA : 1691 kg/m³
 Agg. Impact value : 8.2% or 8.4 %
 (exceptionally Strong)

FA : sand Zone II according to IS : 383 – 1970

CA : Confirming to IS : 383 - 1970

Cement	FA	CA	Water
600	641.52	1046.729	156
1	1.0692	1.7445	0.26

Table 8: Proportion of M70 Mix Design: (1:1.0692:1.7445)

G. Experimental Process:-

The Specimen of standard cube has (150mmX150mmX150mm) used for Compressive Strength by Compression Testing Machine and (100X100X500mm) used for Flexural Strength by Universal Testing Machine. The binder ratio adopted was 0.26 concrete cubes and beams of Actual Size dimension were casting for Compressive and Flexural Strength. They have tested for Compressive and Flexural Strength after 7, 14 and 28 days of water curing. Taken As per IS 516-1959 Specification by Compression and Flexural Machine for different proportion of Concrete Mix.

III. RESULTS OBTAINED

The results of ternary blend of compressive and flexural strength have presented in Table No: 7. The test has carries out conforming to IS: 516 – 1959 Reaffirmed 1999 Size of cube to obtained the Compressive and Flexural Strength of Concrete.

Mix	% of Alccofine	% of WGP	SP (Master Rebuild823PQ)
M1	0	0	1.5%
M2	6	0	1.5%
M3	8	0	1.5%
M4	10	0	1.5%
M5	12	0	1.5%
M6	0	30	1.5%
M7	6	30	1.5%
M8	8	30	1.5%
M9	10	30	1.5%
M10	12	30	1.5%

Table 10: Optimum Dosage of Alccofine and Waste Glass Powder

IV. CONCLUSIONS

- (1) Where, I gat perfect Proportion of replacing cement material as Alccofine and Waste Glass Powder (WGP) without losing its Strength.
- (2) Alccofine has better performance compare to other Slag materials and microsilica. It is helpful to make concrete workable.

- (3) By increasing or trying various dosage of Alccofine and Waste Glass Powder we get better result on 10% Alccofine and 30% WGP.
- (4) All Mix Proportions are using the Synthetic polymer (Master Rebuild 823PQ) add By weight of cement in concrete it allows the Production of very flowable Concrete by use of Ready Mixed Concrete.
- (5) I have conclude that by verifying the various dosage of Alccofine and WGP we get different Strength at different Proportion at starting age of concrete till end we get perfect strength at 28 days, so that Alccofine helps to increase Strength in both compressive and Flexural Strength up to certain limit (6%, 8% and 10%).

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