Honeycomb Free Self Compaction Concrtr by Fcg Admixture

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ABSTRACT - Honeycomb occurrences are caused majorly due to air voids because the concrete could not fill up the space entirely. It lead to shrinkage cracks, reduced compressive strength, reduced durability and other issues that affect the performance of the concrete over time. It can also cause weakened load bearing capacity and negative impacts on waterproofing and corrosion protection systems In self compaction concrete an FCG - Fly ash, Glass powder, Coal dust admixtures are added to the concrete before or during the mixing process. Then will be used as a fine aggregate along with river sand for M25 grade concrete. Admixtures can be used to reduce the cost of building with concrete and to increase strength from 10 – 20% (Mpa), or to ensure certain required properties or quality of the cured concrete An admixture is a substance which can be added to concrete to achieve or modify its properties. Reduce the labor requirements needed for consolidation, finishing and eliminate and environmental pollution. Such valued added construction material has been used in application justifying the higher material and quality control cost when considering the simplified placement and handling requirements of the concrete.

Keywords- Fly ash, Glass powder, Coal dust, viscosity modify agent, self compaction concrete.

1 INTRODUCTION

During the last forty years, self-compacting concrete (SCC) has shown obvious advantages in working environment and technology. Due to high fluidity, SCC relies on self-weight automatic compaction and non-required vibrations during construction, which accelerates construction, reduces the use for human resources and increases the degree of freedom of structural design. SCC is also conducive to avoiding quality defects such as under vibration, leakage vibration or over vibration during the vibration process. Therefore, SCC is suitable for complex structures, thin walls and dense reinforcement structures, and large-section concrete slabs and beams that require horizontal long-distance filling in these cases, there are more demanding requirements for deformation performance , volume stability, durability and economy.

The use of supplementary cement materials to offset a portion of the cement in concrete is a promising method for reducing the environmental impact from the industry. Several industrial byproducts have been used successfully, including water reducer,viscosity modify agent,coal dust and fly ash

These materials are used to cements which can improve concrete durability, early and long term strength, workability and economy.Another material which has potential as a cement material, however, has not yet achieved the same commercial success is waste glass powder.cement is partially replaced with milled waste glass for production of concrete. Studies also focused on used of waste glass as aggregate in concrete Production.. Study on durability of concrete with waste glass pointed better performance against chloride permeability in long term but there is concern about alkali-silica reaction.

Objectives

The Main objective of this experimental work is to study the structural behavior of M25 grade self compacting capacity of the concrete cast by partial replacement of cement with cement replacement materials. The main objectives are :

- a range of results for the chosen tests to identify suitable self compaction concrete.
- Compare the mechanical properties between control mix and mix of cement replacement materials .

2 MATERIALS

1 Cement *:*
To meet the need for higher strength concrete OPC grade 43 can be used. The minimum compressive strength of OPC 43 Grade Cement should not be less than 43 N/mm2 . For concrete of grade M-25 and above a saving of 8 to 10 % of cement may be achieved by using OPC 43 grade cement.

Table 1. Properties of Portland cement

Properties	Test results
Specific surface(m^2/kg)	293
Setting time test (minutes)	
Initial setting	190
Final setting	245
Specific gravity	3.15
Compressive strength (MPa)	
7-day	40.9
28-day	56

2.Fly Ash

The Fly ash is an industrial waste resulting from the combustion of pulverized coal in the boiler at the thermal power plants.The main source of fly ash in our country is mainly from thermal power plants.Fly ash exhibits the pozzlonic properties. The addition of fly ash concrete significantly influences the properties of concrete. For our project we have opted for fly ash from METTUR THERMAL POWER PLANT.The specific gravity of fly ash used here is 2.41.

3. Super plasticizer

admixture based on modified polycarboxylic ether. This product has been developed primarily for applications in high performance and highly durable concrete. Table 2. Provides the physical and chemical properties of the admixture. Master glenium SKY 8233 is Chloride free & low has low alkali content. It is compatible with all types and grades of cements. For improving of the workability of high strength concrete, CERA HYPER PLAST XR-W40 super plasticizer is used.

Table 2. Properties of *S*uper plasticizer

Particulars	Value
Chemical content	Polycarboxilic ether
Specific gravity	1.08
Chloride content	<0.2%
Solid content	35.46%
Compatibility	All types of cement
ph	7.02
viscosity	50-150s

***4.*Aggregates**

Generally aggregates occupy 70% to 80% of the volume of concrete. Aggregate strength can play an important role,in high –strength concrete. In order to obtain a good concrete quality, aggregates should be hard and strong, free of undesirable impurities, and chemically stable. Table 3 represents the physical properties of fine and coarse aggregate. Fine aggregate with 4.75 mm maximum size of close by accessible river sand was applied,The nominal size of coarse aggregate used is 12.5mm.The amount of coarse aggregate used in selfcompacting concrete is much lower when compared to the normal vibrated concrete.The fine aggregate is conforming to Zone III.

The crushed stone was used as a coarse aggregate. The maximum size of coarse aggregate was 15 mm with average particles within a range of 5 mm–15 mm. The compacted bulk density of coarse aggregate was about 1600 kg/m3 . The physical properties of coarse aggregates.

Table 3. Physical properties of fine and coarse aggregate

S.no	Physical Properties	Test Results	
		Fine Aggregate	Coarse Aggregate
1	Specific gravity	2.66	2.85
2	Water absorbtion	3.09%	0.85%
3	Bulk density	1706 Kg/m^3	1758 Kg/m^3

5.Waste glass powder

WG was brought from a glass factory wastes then pulverized in apparatus of abrasion (Los Angeles), and then was ground in a mill. Glass powders of grain size less than 0.075 mm are utilized in this research. illustrates the mill used and WG samples before and after grinding.

(a) The mill (b) the WG before and after grinding

MIX DESIGN

Grade of concrete = M25
Type of cement = OPC (43 grade)
Minimum nominal size of aggregate = 20mm
Workability = 75 – 100 (mm) slump
Specific gravity of cement = 3.14
Specific gravity of coarse aggregate = 2.79
Specific gravity of fine aggregate = 2.66

Target mean strength
f'ck = fck + 1.65s
=25+(1.65) (4)
f'ck = 31.6N/mm2 .

Selection of w/c ratio
For M20 concrete, maximum w/c ratio = 0.47

Selection of water content
From table 3, of IS 10262-2009
Maximum water content for 20mm aggregate, = 186kg/m3.
To attain max of 100 mm slump range = 6% increase in water content.
Estimated water content for 100 mm slump =186+(6/100)(186)

Calculation of cement content
Water cement ratio = 0.47
Cement content = 158/0.47
= 336kg/m3
Weight of coarse aggregate = (d * volume of coarse aggregate*sp. Gravity of coarse aggregate *1000)
= 0.723*0.59*2.7*1000
= 1192.26kg
Weight of fine aggregate = (d* volume of fine aggregate* sp. Gravity of fine aggregate *1000)
= 0.723*0.41*2.66*1000
=788.50kg

Final proportion

Cement	: fine aggregate	: coarse aggregate	: water
350	: 788.50	: 1192.26	: 186
1	: 2.25	: 3.406	: 0.47

Quantity of material (for one cube)
(150mm*150mm*150mm)
Cement = 1.12kg
Fine aggregate =2.245kg
Coarse aggregate =3.814kg

Quantity of material (for one cylinder)
(dia = 150 mm , height = 300 mm)
Cement =2.09kg
Fine aggregate =3.55kg
Coarse aggregate = 6.14kg

MIX PROPORTIONS

One control and two mixes with cement replacement materials is prepared and examined to determine the properties of self-compacting concrete. Table 5 represents the Mix Proportion of self-compacting concrete mixtures.

Table 5 Percentage of replacement FCG admixtures:

MIX	CEMENT	FLY ASH	GLASS POWDER	F.A	COAL DUST	C.A
A	100	--	--	100	--	100
B	70	15	15	98	2	100
C	70	15	15	96	4	100
D	70	20	10	98	2	100
E	80	10	10	98	2	100

The increase in the replacement of SCC shows significant performances and the higher compressive strength has been obtained for combination of fly ash , glass powder and coal dust.

PROCEDDURE

Mixing
Concrete mixing is the process of properly mixing the materials needed to form concrete , such as cement, river sand, glass powder, water, fly ash,coal dust, coarse aggregate and viscosity modify agent.

Fig 5.1 Mixing

Casting
This is the process involves preparing the mold or formwork, mixing the concrete, placing the concrete in the mold and allowing the concrete to cure.

Fig 5.2 Casting

Demoulding
Demoulding is a process that should be done after 24 hours of casting time. When the concrete reaches a certain strength, demoulding can be carried out from mould.

Fig 5.3 Demoulding of cubes

Curing
Curing is the process of maintaining satisfactory temperature and moisture conditions in concrete long enough for hydration to develop the desired concrete properties. Here the concrete cubes are cured for 7 days, 14 days and 28 days.

Self curing and water curing of specimens.

TEST ON CONCRETE

Test on fresh concrete

This chapter deals with mixing and preparation of cubes and the test is done on the fresh concrete to determine the workability of that mix and the compression test is done on the hardened concrete at the 3rd day, 7th day and 28th day of the curing period to determine its compressive strength of the concrete.

Test on harden concrete

Testing hardened concrete plays an important role in controlling and conforming the quality of concrete works. Systematic testing of raw materials, fresh concrete and hardened concrete are inseparable part of any quality control program for concrete, which helps us to achieve higher efficiency of the material used and great assurance for the performance of concrete with regards to both strength and durability. The test methods should be simple, direct and convenient to apply.

Compression test

The test is done to determine the compressive strength of concrete specimens as per IS: 516 - 1959.Tests should be done at recognized ages of the test specimens usually being 3, 7 and 28 days. The cube specimen should be in the size 150 mm × 150 mm × 150mm.

RESULTS AND DISCUSSION

The increase in the replacement of SCC shows significant performances and the higher compressive strength has been obtained for combination of fly ash , glass powder and coal dust.The results reveal that the 7, 14 and 28 days strength of the concrete mixes designed by Indian code.

Testing:

After complete the curing process the testing of cube is done by using the compression testing machine.

Compression test:

Compressive strength of concrete made with 15cm x 15cm x 15 cm Cubes are made with M25 grade of concrete, concrete mixed and cured and tested with reference to Indian standard code.

Average compression test for replaced concrete with fly ash,coal dust and glass powder.

SAMPLE No	WEIGHT (kg)	DENSITY (gm/cm^3)	Average compressive strength (MPa)		
			7th DAY	14th DAY	28th DAY
1	5.54	1638	19.31	25	29.42
2	3.4	1007	20.25	26.54	30.7
3	2.79	828	17.70	22.73	26.6
4	2.49	728	14.34	18.4	21.9

CONCLUSION

The project is to increase the compressive strength of a self compaction concrete by using fine aggregates. Here the fine aggregates such as glass powder & coal dust has been chosen for preparing self compaction M25 grade concrete. Along with aggregates, viscosity modify agent such has been used.Then varying ratio of fly ash & glass powder has been selected for preparing. Replacement of this material helps to save large amount of cement, fine aggregate and coarse aggregate. After curing of a specimen upto 28 days. A compressive test has been taken for a interval of 7,14 and 28 days. This shows that increase in compressive strength of a concrete with increase in curing days. The maximum compression value has been got from 15% fly ash and 20% glass powder Specimen for both viscosity modify agent used specimen and not used specimen. Minimum density can be obtained at 28% fly ash specimen with the value of 728 gm/cm^3. By comparing these values, this shows that maximum and minimum value of compressive and density is obtained at different proportions. This concludes that, there is a chance of increasing compression value of self compaction concrete

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