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A Study On High Performance Concrete With Partial Replacement Of Cement By Using Silics Fume,Fly Ash And Ggbs.

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ABSTRACT:Highstrengthandhighperformanceconcretearebeingwidelyused through out the world and to produce them, it is necessary to reduce the waterbinder ratio and increase the binder content. High strength concrete means goodabrasion,impactandcavitationsresistance.Using highstrengthconcreteinstructures today would result in economical advantages. In future, high range waterreducing admixtures (Super plasticizer) will open up new possibilities for use ofthese materials as a part of cementing materials in concrete to produce very highstrengths, as some of them are make finer than cement. The brief literature on thestudy has been presented in following text.(Hooten RDC,1993) investigated oninfluenceofsilicafumereplacementofcementonphysicalpropertiesandresistance to sulphate attack, freezing and thawing, and alkali silica reactivity.

KEYWORDS: High strength concrete(HSC),High performance concrete (HPC), Silica fume, GGBS, Fly ash.

I. INTRODUCTION

It was observed and noted that since decade of years that the cost of buildingmaterials is currently so high that only corporate organizations, individual, andgovernment can afford to do meaningful construction. Waste can be used as fillermaterial in concrete, admixtures in cement and raw material in cementclinker, oras aggregates in concrete (Olutoge, 2009). Ordinary Portland cement (OPC) isacknowledgedasthemajorconstructionmaterialthroughouttheworld.Theproduction rate is approximately 2.1 billion tons per year and isexpected to growto about 3.5billion tonsperyear by2015(Coulinho,2003).

According to Adepegba (1989), the annual cement requirement is about 8.2million tones and only 4.6 million tons of Portland cement are produced locally.The balance of 3.6 million tons or more is imported. If alternativecheap cementcan be produced locally, the demand for Portland cement will reduce. The searchforsuitablelocalmaterialstomanufacturepozzolanacementwasthereforeintensified (Adepegba, 1989).Most of the increase in cement demand could be metby the use of supplementary cementing materials, in order to reduce the green gasemission (Bentur, 2002). Industrial wastes, such as silica fume, blast furnace slag,flyasharebeingusedassupplementarycementreplacementmaterialsandrecently,agriculturalwastesarealsobeingusedaspozzolanicmaterialsinconcrete (Sensale, 2006).

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Fig 1.1 Ground granulated blast furnace slag

Fig 1.2 FLY ASH

1.1 FLYASHCONCRETE

Thepulverizedflyash,generallyreferredtoasf lyashisabyproductresulting fromtheburning ofpowdered coal in thermal powerstations.The requirements for fly ash to be used in concrete mixture are stated inASTM C. 618. A finely divided inorganic material used in concrete in order toimprovecertain propertiesortoachievespecialproperties.Fly ash improves concrete‟s workability, pump ability, cohesiveness, finish,ultimate strength, as well as solves many problems experienced with concretetoday.

1.2 GROUNDGRANULATEDBLASTFURNACESLAG(GGBS)

The replacement ratio of GGBS has significant impact on the strength developmentof concrete; hence, the user should determine the best range of replacement ratiothroughexperiment,inaccordancetothedesignand constructionrequirements.Underthecuringconditions, HighSlagCementConcretewith30-50%replacement ratio would achieve 50 – 60% compressive strength of plain concretein 3 days, 70 – 80% achieved in 7 days, and its compressive strength is equivalenttoplain concrete‟s in28days andcontinues to growsincethen.

1.3SILICAFUME

Silicafumeisabyproductofproducingsilicon metalorferrosiliconalloys.Oneofthe most beneficial uses for silica fume is in concrete. Because of its chemical andphysical properties, it is a very reactive pozzolan. Concrete containing silica fumecan have very high strength and can be very durable. Silica fume is available fromsuppliers of concrete admixtures and, when specified, is simply added duringconcrete production. Placing, finishing, and curing silica-fume concrete requirespecial attentionon the partof theconcrete contractor.

1.4 PROPERTIESOFSILICAFUMECONCRETE

Toomuch silicafumescause the concrete to becomesticky andthus reduces theworkability.Silicafumeadditionupto15%byweight ofcementdoesnotresultinanylossofworkability.Silicafumeconcrete,duetolargersurfaceareaoffineparticlereq uireshigherwatercontentforsame workabilitythanordinaryconcrete.

1.5 SCOPE

Theintroductionofflyashreducestheheatofhydrationandimproveworkability. The aggregate size and quality should be considered seriously. Thereinforcement barsshouldbegood strengthasperthe specification.The wide use of fly ash in reinforced concrete structures.Useofindustrialwastematerialsforconstructionindustry.

1.6TYPICALAPPLICATION

- SUPERPLAST840isusedinareasofcongestedreinforcementwherethe flowingofconcrete isdesired
- ConcretingofBridgegirders,Prestressedconcrete memberswherehighcompressivestrengthscoupledwithhighworkabilityisofparamount importance.
- Hot weather concreting where set retardation and avoidance of coldjoints isessential.
- Underwaterconcretinganddiaphragmwalls.]
- Pillingmixes.
- Fairfaced concrete.
- Industrialfloors,roofsandfloorstoppings.
- Inconcretemixescontainingpozzolonicmaterialsandsulphateresistingcementsandcementscontainingfumedsilica,flyashetc.,

II. EXPERIMENTAL INVESTIGATION

For the preliminary investigations, micro silica, Fly ash and cement wassubjected to physical and chemical analyses to determine whether they are incompliance with the standard used. The experimental program was designed toinvestigateFlyash,silicaFumeandGGBSasthepartial cementreplacementinconcrete. The replacement levels of cement by Fly ash, silica fumeand GGBSareselected as(0%,2.5%,5%,7.5%,10%,12.5%and15%)and(0%,5%,10% ,15% ,25and 30%) by weight t of Cement for standard size of cubes. Thespecimen of standard cubes (150 x 150 x 150 mm), cylinders (150mm diameter300 mm height), and prism (100x100x500mm) was casted for compression,Split tensile strength and flexure test. The specimens were casted with M25gradeconcretewithdifferentreplacementlevelsof cement.Sampleswascasted and put in curing tank for 3, 7, 14, and 28 days and density of the cube,and compressive strength, split tensile strength, Flexural strength weredetermined and recorded down accordingly.

Table 1Physical propertiesofthe cements

Cementsort	P.O52.5
Normalconsistency/%	29.5
Initialsettingtime/min	110
Finalsettingtime/min	160
Strengthfor3d(flexural/compressive)/MPa	5.2/26.5
Strengthfor28d(flexural/compressive)/MPa	9.0/64.5

Table2 Chemicalcompositionsof rawmaterials w/%

Rawmaterial	CaO	SiO_2	Al_2O_3	Fe_2O_3	MgO	SO_3	Loss
Cement	60.68	21.96	5.86	3.01	2.91	2.38	2.58
GGBS	35.36	33.14	13.47	1.15	2.51	1.12	1.8
Silicafume	0.45	96.23	0.72	0.05	0.4	0.43	0.92

Table3Mixproportionof theoriginalconcrete

Rawmaterial	content(kg/m3)
Cement	391.01
GGBS	110.06
Silicafume	43.88
Water	150.05
Sand	611.89
Stone	1087.88
Additiveagent (JG–3)	6.606
Water/bindermassratio	0.28

2.1 Specimenpreparation

The aggregate interlocking concrete test specimenswere prepared by a simulating scattering-filling aggregateprocess. First the original concrete mixture with the mix-ture proportions listed in Table 3 was prepared accordingto a general process. The original concrete had a slumpconstant of 180 mm. One layer of the mixture was scat-tered onto the bottom of the mold, and then a layer ofcoarse aggregate, followed by another layer of the mix-ture and then another layer of the coarse aggregate and soon, generally with three layers of aggregate in each mold.Then the mold was vibrated for 40 to 75 seconds until theconcreteswere consolidated.

2.1 SPECIMENS CASTED

III. CONCLUSION

- ❖ MixM$_{40}$canbeeffectivelyusedinreinforcedconcretestructureforincreased durabilityandeconomy.
- ❖ Workabilityofconcretedecreasedaspercentageofflyashincreaseincement.
- ❖ The specimen F.A 10%, F.A 20%, F.A 30%, F.A 40% are subjected tocompressive strength, split tensile strength and Flexural strength tests.
- ❖ Further in this experimental study, this F.A 30% ,Silica Fume,GGBS, andPolymer Fiber are also added in the cement concrete is modified by partiallyreplacing the Cement,percentages such as 10%, 20%, 30%, 40%.

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