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AN EXPERIMENTAL STUDY ON HIGH STRENGTH SELF-COMPACTION CONCRETE WITH PARTIAL REPLACEMENT OF FLY ASH AS CEMENT AND COPPER SLAG AS COARSE AGGREGATE

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Abstract - In recent years, many of the structures are in complicated Architectural design, it is very difficult to compact the concrete in congested reinforcement. Self-Compacting Concrete (SCC) is a new kind of high performance concrete with excellent deformability and segregation resistance and that can flow through the gaps, corners and joints of reinforcement, without any vibration or compaction. It was first developed in japan, 1986. But in our country usage of SCC is very less when compared with other countries like japan, European countries etc. Construction industry is facing a lot of problem with availability of natural resources. To overcome this, we need to go for alternative material in place of conventional aggregate. The attention for the environmental aspects moves the research towards recycling industrial by-products, as Fly ash and copper slag. In this experimental study M60 grade of concrete is to be adopted. The cement and fine aggregate is partially replaced with fly ash and copper slag respectively. Fly Ash will be replaced 5%, 10%, 15%, 20%, 25% by weight of cement And copper slag by weight of fine Aggregates in various percentages such as 10%, 20%, 30%, 40%, 50% .The compressive strength, Flexural strength, split tensile strength on hardened concrete with various replacements is to be investigated. Slump cone, V-funnel, L-box, J-box, T-50 will also be conducted.

Key Words: Fly Ash, Copper Slag, slump cone, T50 test, L-box, J-box, V-funnel, Compressive Strength, Split Tensile Strength, Flexural Strength super plasticizer, high water redusizer, viscosity modified agent (VMA).

1. INTRODUCTION

Self-consolidating concrete is a highly flowable type of concrete that spreads into the form without the need for mechanical vibration. Self-compacting concrete is a non-segregating concrete that is placed by means of its own weight. The importance of self-compacting concrete is that maintains all concrete's durability and characteristics, meeting expected performance requirements.

Copper slag is by-product of the manufacture of copper. Large amount of copper slag are generated as waste Worldwide during the copper smelting process. To produce every ton of copper, approximately 2.2–3.0 tons copper slag is generated as a by-product material. Utilization of copper slag in applications such as Portland cement substitution and aggregates has threefold advantages of eliminating the costs of dumping, reducing the cost of concrete, and minimizing air pollution problems. Many researchers have investigated the use of copper slag in the production of cement, mortar and concrete as raw materials for clinker, cement replacement, fine and coarse aggregate. The use of copper slag in cement and concrete provides potential environmental as well as economic benefits for all related industries.

Fly ash is a finely divided powder obtained from the combustion of bituminous coal or sub-bituminous coal (lignite). It is also known as Flue Ash. It is available in large quantities in the country as a waste material which is obtained at the thermal power plants. Fly Ash is used as a partial replacement of cement for cement mortar and concrete and this has been taken into consideration from the recent years in the countries. The recent investigations have declared that it is necessary to investigate the proper collection methods for fly ash of quality and uniformity which requires for fly ash for use as a construction material. This utilization of fly ash in construction material as an alternative material will help for saving from scarcity of raw materials and also it decreases the disposal of the waste at the thermal power plants. More than 65% of the fly ash is obtained as a waste at the thermal power plants and this can be reduced when we use fly ash as an alternative material for concrete manufacturing.

2. MATERIALS

Irjet Template sample paragraph .Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

Cement

Ordinary Portland cement of 53grade is produced by mixing of calcareous and argillaceous and other silica, alumina or iron oxide bearing material, burning them at a high temperatures and grinding the resultant clinker to produce the cement with high standard quality. After burning the constituents of cement no material should be added other than gypsum, water, performance improver and not more

than 1.0 percent of air-entraining agents or other agents including color agents which are not harmful.

Fly Ash

Fly ash, also known as "pulverized fuel ash" in the United Kingdom, is a coal combustion product that is composed of the particulates(fine particles of fuel) that are driven out of coal-fired boilers together with the flue gases. Ash that falls to the bottom of the boiler is called bottom ash. In modern coal-fired power plants, fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys. Together with bottom ash removed from the bottom of the boiler, it is known as coal ash. Depending upon the source and makeup of the coal being burned, the components of fly ash vary considerably.

Fine Aggregate

In our present work we take fine aggregate as well graded river sand passing through 4.75 mm. It consists of natural sand, other inert materials with similar properties, or combinations having hard, strong, durable particles. Before using this natural sand as a fine aggregate the properties of natural river sand must be known to use as a fine aggregate.

Copper slag

Copper slag is a byproduct created during copper smelting and refining process. Copper slag is an abrasive blasting grit made of granulated slag from metal smelting processes. Copper slag abrasive is suitable for blast cleaning of steel and stone/concrete surfaces, removal of scale, rust, old paint, dirt etc. properties are below

Particulars	Values
Particle shape	Irregular
Appearance	Black & glassy
Fineness modulus	3.59
Specific gravity	3.218

Copper slage

Coarse Aggregate

Coarse aggregate is nothing but consisting of naturally occurring materials such as gravel, resulting from the parent rock, to include natural rock, slag, expanded clay and shale (light weight aggregates) and other accepted inert materials with similar properties having hard, strong, durable particles, conforming to the specific requirements of this materials substantially retained on IS sieve No:-4, can be taken as coarse aggregate.

3. TESTS ON MATERIALS

- Fineness of cement Results: 4.33%
- The standard consistency of cement is 31 % of water for 6mm penetration
- the test the Specific Gravity of Cement = 3.12
- Specific Gravity of fly ash = 2.625
- Fine modules of fine aggregate = 2.81
- Fine modules of copper slag = 3.59
- Fine modules of coarse aggregate =7.29

4. MIX DESIGN FOR SELF-COMPACTING CONCRETE

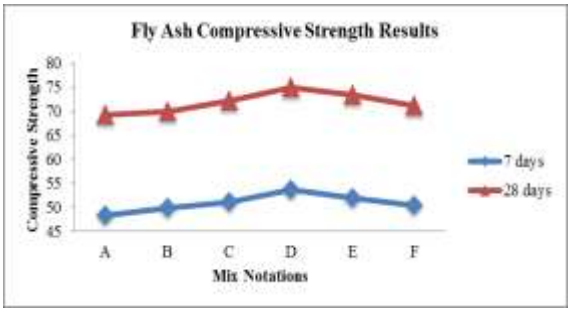
- Cement content - 550 kg/m^3
- Fine aggregate – 649.94 kg/m^3
- Coarse aggregate – 1164.47 kg/m^3
- Super plasticizer – 8.25 litters
- Water content – 165 litters
- Water cement ratio - 0.30

Mix proportion = 1:1.18:2.11

5. HARDENED STATE CONCRETE TESTS AND RESULTS

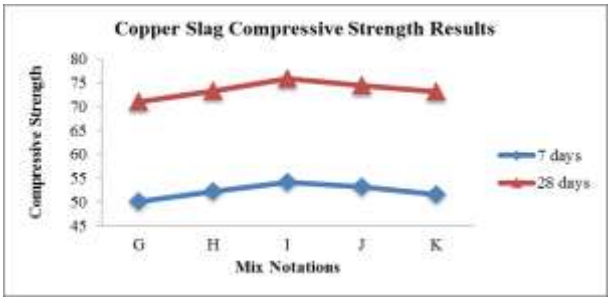
Compressive strength test

Compressive strength		
Fly ash %	7 days	28 days
0	48.33	69.23
5	49.81	70.02
10	51.12	72.25
15	53.72	74.95
20	52.02	73.40
25	50.43	71.08



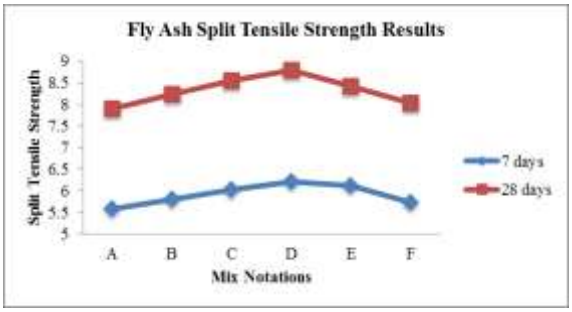
Compressive strength for Fly ash optimum dosage with different copper slag percentages

Fly ash optimum dosage 15%	Compressive strength		
	Copper slag %	7 days	28 days
	10	50.11	71.12
	20	52.23	73.33
	30	54.15	75.85
	40	53.15	74.41
	50	51.53	73.23



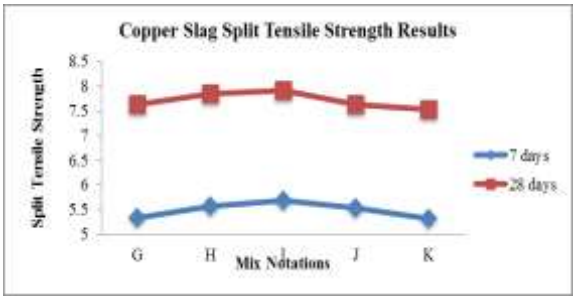
Split Tensile Strength test

Split tensile strength		
Fly ash %	7 days	28 days
0	5.58	7.91
5	5.81	8.23
10	6.02	8.56
15	6.21	8.80
20	6.11	8.43
25	5.72	8.03



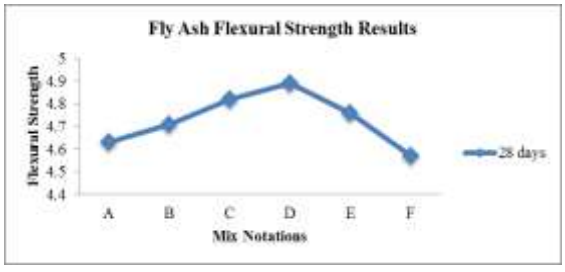
Tensile strength for Fly ash optimum dosage with different copper slag percentages

Fly ash optimum dosage 15%	Split tensile strength		
	Copper slag %	7 days	28 days
	10	5.33	7.63
	20	5.56	7.85
	30	5.68	7.91
	40	5.53	7.62
	50	5.31	7.53

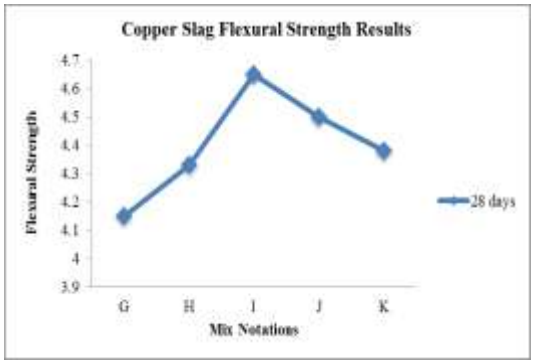


Flexural Strength test

Flexure strength	
Fly ash %	28 days
0	4.63
5	4.71
10	4.82
15	4.89
20	4.76
25	4.57



Fly ash optimum dosage 15%	Flexure strength	
	Copper slag %	28 days
	10	4.15
	20	4.33
	30	4.65
	40	4.50
	50	4.38



6. CONCLUSIONS

The test result on fresh concrete are within the limits of follows EFNARC-2005 guide lines decrease of water to powder (W/P) ratio increase compressive strength Self-compacting concrete is a relatively new form of concrete which is used for general applications. The main advantages that scc has over standard concrete is its high compressive strength and self-compacting properties, inched high flow ability ,workability and passing ability.

In this super plasticizer is water reducing agent in the range of (0 to 40%) of water. The optimum dosage of chemical admixture is 1.5% of super plasticizer (GLENIUM B223)chemical composition is poly-carboxylic ether dosage of super plasticizer require painting of the self-compatibility of concrete

It is recommended that 15 wt% of fly ash can be used as replacement of cement, and 30 wt% of copper slag can be used as replacement of sand in order to obtain high strength self-compacting concrete with good property Use of copper slag and fly ash in construction is possible to work and it is very cheap and gives good result this study points out the beneficial aspects of using copper slag as a replacement material of fine aggregate. So compared to conventional concrete and self-compacting concrete is higher mechanical strength properties.

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