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Experimental Evaluation of Self Curing Self Compacting Concrete using Sintered Fly ash Light weight Aggregate as Partial Replacement of Coarse Aggregate

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Abstract - *Sintered Fly ash light weight aggregate substitute's regular stone total contributes Concrete, diminishing dead weight. It can likewise be utilized as a part of creation of light weight precast Concrete Blocks, for use in stack and non-stack bearing components. This study presents an experimental investigation for the design of self curing self compacting concrete using sintered fly ash light weight aggregate at 10%, 20%, 30% and 40% replacement by weight of coarse aggregate by adding super plasticizer STRUCTURO-203 by 0.6% and self curing agent POLYETHYLENE GLYCOL600(PEG600) 1% by weight of binder. The test results for characteristics of self compacting concrete such as Slump flow T50 cm test, V-funnel test, L-box test and U-box test are presented.*

The experimental results show that the strength of concrete specimens by addition of 0.5% of PEG600 is bigger than that of the addition of 1% of PEG600. The strength of concrete cube and concrete cylinder specimens decreases by increasing the partial replacement of sintered fly ash by weight however the strength of prism specimens' i.e. flexural strength will increase by increasing the replacement values.

Key Words: **PEG600, Sintered Fly Ash, Self Compacting, Self Curing, Super Plasticizer**

1. INTRODUCTION

Civil engineering is a strategically necessary profession for each developed and developing countries. With ability and technical skills, Civil engineers set up, style construct, maintain and operate infrastructure facilities essential to trendy life, starting from bridges and highways to water and waste treatment facilities and buildings. Civil engineering could be a broad field that spans variety of branches as well as subjects like structural engineering, water resources engineering, environmental engineering, transportation engineering and geotechnical engineering. As countries develop, and their population's increase, and as environmental issues mount, engineering skills are going to be more and more required throughout the planet.

1.1 SELF COMPACTING CONCRETE

Self compacting concrete (SCC) which offers benefits in workability, decreases work expenses and high quality strength with ordinary cement has as of late risen as another solid innovation and its utilization has expanded quickly finished the most recent three decades and reflected in the quantity of distributed works.

1.2 SELF CURING CONCRETE

Self curing or internal curing is a technique that offers further wetness in concrete for more practical hydration of cement and reduced self desiccation. The advantage of internal curing is the process of increased hydration and strength development, reduced autogenously shrinkage and cracking.

1.3 SINTERED FLY ASH (SFA)

Fly ash is a waste material of coal terminating warm power plant and its aggregation close power plant. Sintered fly ash aggregate is a gathering of material that can fluctuate altogether in arrangement. Sintered fly ash as light weight total substitute's regular stone total in concrete, decreases dead weight. Sintered Fly ash light weight aggregate substitutes regular stone total/contributes Concrete, diminishing dead weight.

2. METHODOLOGY

The work is split into completely different stages.

The primary stage includes the choice of materials to be used like cement, natural fine aggregate (NFA), natural coarse aggregate (NCA), sintered fly ash light-weight aggregate, silica fume, fly ash, super plasticizer , synthetic resin glycol .

In second stage, the concrete combine was ready for normal concrete mix with water binder ratio of 0.45. The proportion for normal concrete mix is 1:1.26:2.90. Then concrete mix design for self compacting concrete and self curing self compacting concrete has been applied.

Mix Proportions for Conventional Concrete:

Grade of concrete	Cement (kg/m3)	NFA	NCA	Water
M30	438	1273.28	552.44	197

Percentage of aggregate used

Mix designation	Normal aggregate%	SFA(%)
Mix 0	100	0
MSCSCCSFA10	90	10
MSCSCCSFA20	80	20
MSCSCCSFA30	70	30
MSCSCCSFA40	60	40

Mix Proportions for Self curing Self compacting concrete (SCSCC)(per cum.)

Grade of concrete	Cement(kg)	NFA(kg)	NCA(kg)	Silica fume	Water	Fly ash	Super plasticizer PEG600	Water/Binder
M 30	350	820	817.47	44	221.711	44	2.628 4.38	0.5

Fresh Concrete Test

The three main properties of SCC in plastic state are

1. Filling ability

2. Passing ability

3. High resistance to segregation

Figure-1: Slump flow test

Figure-2: U-box test

HARDENED CONCRETE TEST

Figure-3: Cube Specimen after failure

3. RESULT

Slump flow test and slump flow T50cm test results:

Sample	Slump flow(mm)	Slump flow T50cm	Concrete condition	Remarks
MSCC4	675	3.5	Flow	SATISFIED
MSCSCC0.5%	670	3.9	Flow	SATISFIED
MSCSCC1%	670	3.8	Flow	SATISFIED

MSCSCCSFA10	675	3.8	Flow	SATISFIED
MSCSCCSFA20	675	3.9	Flow	SATISFIED
MSCSCCSFA30	674	3.7	Flow	SATISFIED
MSCSCCSFA40	670	3.7	Flow	SATISFIED

L-BOX test results

Sample	Blocking ratio (h2/h1)	Remarks
MSCC4	0.91	SATISFIED
MSCSCC0.5%	0.87	SATISFIED
MSCSCC1%	0.89	SATISFIED
MSCSCCSFA10	0.90	SATISFIED
MSCSCCSFA20	0.87	SATISFIED
MSCSCCSFA30	0.86	SATISFIED
MSCSCCSFA40	0.85	SATISFIED

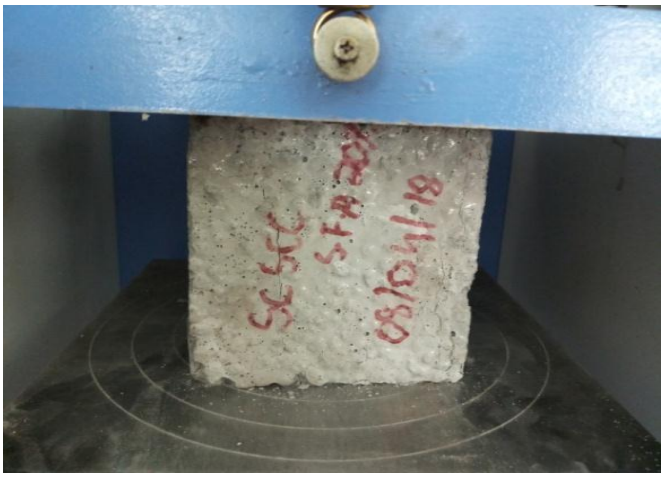
V-Funnel test and V-Funnel T5 Minutes test

Sample	V-Funnel test	V-funnel T5 minutes(<6 sec)	Remarks
MSCC3	6.5	3.4	SATISFIED
MSCC4	7	3.7	SATISFIED
MSCSCC0.5%	7.2	3.8	SATISFIED
MSCSCC1%	7.2	3.7	SATISFIED
MSCSCSFA10	7.3	3.8	SATISFIED
MSCSCCSFA20	7.4	3.7	SATISFIED
MSCSCCSFA30	7.8	3.6	SATISFIED
MSCSCCSFA40	7.8	3.9	SATISFIED

HARDENED CONCRETE TEST RESULTS

Compressive Strength

Mix Identification	7 Days		28 Days	
	Compressive strength(MPa)	% change in strength w.r.t MNC	Compressive Strength(MPa)	% change in strength w.r.t MNC
MNC	33.485	0	44.06	0
MSCSCCSFA10	39.15	16.91	50.19	13.91
MSCSCCSFA20	36.15	7.9	47.56	7.9
MSCSCCSFA30	34.45	2.8	45.32	2.9
MSCSCCSFA40	31.18	-6.8	41.02	-6.8

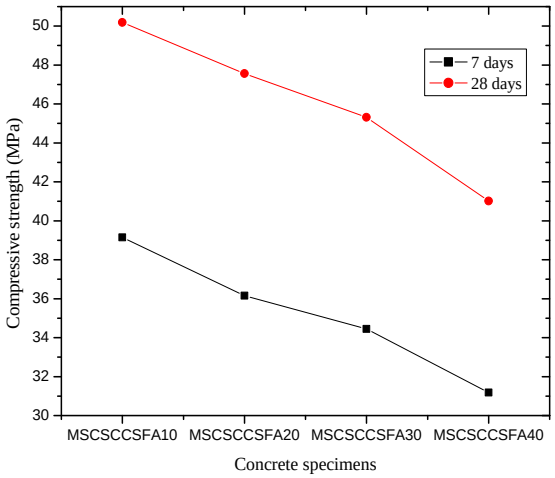


Split Tensile Strength

Mix Identification	7 Days		28 Days	
	Split tensile strength(MPa)	% change in strength w.r.t MNC	Split tensile Strength (MPa)	% change in strength w.r.t MNC
MNC	3.5	0	4.01	0
MSCSCCSFA10	3.745	7	4.50	12.21
MSCSCCSFA20	2.818	-19.4	3.65	-8.9
MSCSCCSFA30	2.468	-29.4	3.11	-22.44
MSCSCCSFA40	2.315	-33.85	2.93	-26.93

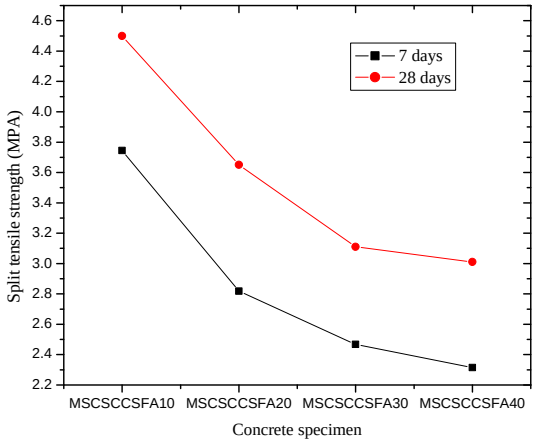
4. GRAPHICAL PRESENTATION

Compressive strength



Graph 1-Compressive strength verses concrete specimens of SCSCC with partial replacement of sintered fly ash

Spilt tensile strength



Graph 2-Split tensile strength verses concrete specimen for SCSCC with replacement of sintered fly ash

5. CONCLUSIONS

1. All the self compacting self curing concrete had a satisfactory performance with replacement of sintered fly ash light weight aggregate as coarse aggregate.

2. The slump flow value decreases as the percentage of sintered fly ash increases.

3. The value of the compressive strength decreases as the percentage content of sintered fly ash increases.

4. The percentage change in compressive strength of SCSCC with partial replacement of sintered fly ash at 10%,20%,30%,40% w.r.t the strength of normal concrete is 13.91, 7.9, 2.9, -6.8 respectively.

5. The value of split tensile strength decreases as the percentage content of sintered fly ash increases.

6. The percentage change in split tensile strength of SCSCC with partial replacement of sintered fly ash at 10%, 20%, 30%, 40% w.r.t to the strength of normal concrete is 12.21,-8.91, -22.44, -26.93 respectively.

7. So it has been found that the addition of 0.5% of PEG600 and 10% of sintered fly ash light weight aggregate gives better result.

REFERENCES

[1] **Sivakumar, A., and Gomathi, P. (2012),** "Pelletized fly ash lightweight aggregate concrete: A promising material"., Journal of Civil Engineering and Construction Technology., Vol. 3(2), 42-48.

[2] **Basa, B., and Sethi, J. (2015),** "Fresh and hardened properties of self compacting concrete using fly ash lightweight aggregate as partial replacement of natural coarse aggregate", IJCIET.,Volume-7, Issue 4, 498-505.

[3] **Vakhshouri, B., and Nejadi, S. (2016),** "Mix design of light-weight self-compacting concrete", Case Studies in Construction Materials. 4, 1-14

[4] **Persson,B. (2001),** "A comparison between mechanical properties of self-compacting concrete and the corresponding properties of normal concrete" Cement & Concrete Research**.,** 31, 193-198

[5] **Borsoi, Collepardi, Collepardi and Troli, R. (2007),** "Light weight self-compacting Concrete", The New Boundaries of Structural Concrete., Session B - Controlled-performance Concrete, 127-131

Code of Practice

[1] IS: 10262:2009, "Concrete Mix Proportioning-Guidelines", Bureau of Indian Standards, New Delhi, India.

[2] IS: 383-1970 Indian Standard Specification for Coarse and Fine aggregates from Natural Sources for Concrete (Second Revision).Bureau of Indian Standards, New Delhi.

[3] IS: 516 –1999 Method of Test for Strength of Concrete.

[4] IS: 5816-1999 Splitting tensile strength of concrete-Method of Test.

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