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"Use Of Waste Foundry Sand And GGBS In Concrete"

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1. Abstract

Unlike green sand, chemically-bonded sand cannot be used again and again without reclamation because in this system, the mixed sand gets its strength through chemical reaction, which is irreversible in nature. Each sand particleis coated with this reacted chemical, which behaves like an inert element after it is used once. This inert coating called"Dead" binder needs to be removed from the used sand because it being brittle in nature gives rise to increased fines in the sand. "Dead" binder is present in the form of layers adhering to the surface of the sand grains. These layers, if not removed, changes the property of the sand and makes it totally unsuitable for further because proper strength.

2. Introduction:

Foundry Sand has been used for centuries as a moulding material in the ferrous and nonferrous metal casting industrydue to its special engineering features. Foundry sand is a by Product of this business. Approximately 100 million tonnes of sand are reportedly utilised in production each year, according to industry estimates. Four to seven million tonnes of that are discarded each year and can be recycled into other goods and businesses.

The amount of solid waste produced by manufacturing businesses is regularly and alarmingly rising. Used Foundry Sand (UFS) is an example of an industrial solid waste. Waste sand is a significant issue for small and medium-sized foundries in India. Sand is frequently used in foundries as a basic direct material, so regenerating this sand can be thought of as . The option, adopted by some, is to discard and dispose of the used sand altogether after and start withnew sand in every cycle. This is not a feasible proposition on economic and environmental consideration. The availability of dumping ground for used chemically bonded sand is becoming difficult day by day. Cost of dumping is also increasing exorbitantly. In addition to non-availability of dumping ground and high dumping cost, the environmental problem is of critical concern. The dumped sand, being toxic, would pollutethe atmospheric air as wellas the groundwater, having a long Lasting effect on the environment and plants. The Government authority is becoming stricter on these issues. Onthe other hand, availability of new sand is becoming a problem these days. Local authoritiesare imposing restrictions on mining / extraction of sand altogether. Therefore, supply of newsand to foundries shall be very little or it may even stop altogether. Therefore, they will be compelled to survive on sand obtained by reclaiming used /de-molded sand. In addition to above compulsion, there are other good technical reasons for reclamation of chemically bonded sand for re-use.

3. Objectives:

- To use the waste Foundry sand and GGBS in concrete.
- To study the economical aspects of concrete by using Foundry sand and GGBS.
- To reduce the dumping of waste foundry sand.
- To study the mechanical properties of concrete.

4. Testing of cube:

A series of 36 cubes specimens and 3 conventional concrete cubes are cast and tested for compressivestrength.

To accomplish the aim and objectives, a methodology developed is as follows:

1. Casting of the cube and check for Compressive Strength with conventional concrete for mix M20 iscarried out.
2. The Casting of the cube with replacement of Fine Aggregate with waste Foundry Sand for mix M20with varying percentage is done.
3. Cube specimens of 150 mm x 150 mm x 150 mm are casted.
4. Testing of the above said cube at 7, 14 & 28 days for compressive strength is done respectively.

Preliminary test:

*Standard Consistency of Cement

For finding out initial setting time, final setting time and soundness of cement, and strength a parameterknown as standard consistency has to be used. The standard consistency of a cement paste is defined asthat consistency whichwill permit a Vicat plunger having 10 mm diameter and 50 mm length to penetrate to a depth of 33-35 mm from thetop of the mould.

Sr. No.	Weight ofcement (gms)	Percentage by water of dry cement (%)	Amount of wateradded (ml)	Penetration (mm)
1.	300	25	75	0
2.	300	27	81	10
3	300	30	90	12
4.	300	33.33	100	32

Observation table of std consistency of cement

Result – The normal consistency of a given sample is **32%.**

Determination of Setting Time of Standard Cement Paste:

For convenience, initial setting time is regarded as the time elapsed between the moments that the water is added to the cement, to the time that the paste starts losing its plasticity. Thefinal setting time is the time elapsed between the moment the water is added to the cement, and the time when the paste has completely lost its plasticity and has attained sufficient firmness to resist certain definite pressure.

Observations:

Sr. No	Setting Time(mm)	Penetration(mm)	Remark
1.	75	33	Initial
2.	530	40	Final

Weight of given sample of cement is **300gms,**

The normal consistency of a given sample of cement is **32%.**

Volume of water addend (0.85 times the water required to give a paste ofstandardconsistency) for preparation of test block **84.15 ml.**

Result:

The initial setting time of the cement sample is found to be **75min.**

The final setting time of the cement sample is found to be **530min.**

Silt Content in Fine Aggregates:

There are two types of harmful substances preset in fine aggregates i.e. organic matter produced by decay of vegetable matter and/or clay and silt, which form coating thus preventing a good bond between cement and the aggregates. If present in large quantities, result in the increase water-cement ratio and finally affecting the strength of concrete.

Field test is generally conducted in order to determine the volumetric percentage of silt in natural sand for percentage up to 6%, otherwise more detailed test as prescribed by standardcode are requiredto be conducted.

Sr. No.	Description	Sample Numbers			
		Sample 1	Sample 2	Sample 3	Sample 4
1.	Volume ofsample, **V1**(ml)	4	4	5	5
2.	Volume of siltafter 3 hours, **V2**(ml)	150	150	150	150
3.	% silt byvolume =**(V2/V1)*100**	2.67	2.67	3.33	3.33

Note : If the average value of silt content exceeds 6% by volume, the aggregate requireswashingbefore use.

IS Sieve	Weight retained on sieve (gms)	Cumulativeweight retained	Cumulative percentage weight retained	Cumulative percentage passing(%)
4.75 mm	-	-	-	-
2.36 mm	52.09	52.09	26.045%	73.95 %
1.18 mm	35.78	87.87	43.935 %	56.06 %
600 micron	21.50	109.37	54.685 %	45.32 %
425 micron	26.09	135.46	67.73 %	32.27 %
300 micron	24.08	159.54	79.77 %	20.23 %
212 micron	24.84	184.38	92.19 %	7.81 %
150 micron	6.035	190.415	95.2 %	4.8 %
75 micron	7.768	198.175	99.08 %	0.92 %
PAN	2.711	200	100 %	0 %
Total			658.62	

Observation table of fineness modulus of fine aggregate

Sample 2 – Foundry Sand:

IS Sieve	Weight retained on sieve (gms)	Cumulativeweight retained	Cumulative percentage weight retained	Cumulative percentage passing(%)
4.75 mm	-	-	-	-
2.36 mm	-	-	-	-
1.18 mm	-	-	-	-
600 micron	1.107	1.107	0.554 %	99.446 %
425 micron	36.57	37.64	18.82 %	81.18 %
300 micron	59.77	97.41	48.71 %	51.29 %
212 micron	71	168.41	84.21 %	15.79 %
150 micron	18.66	187.07	93.54 %	6.46 %
75 micron	10.19	197.26	98.63 %	1.37 %

Determination of Specific Gravity of Fine Aggregates:

Specific gravity of fine aggregate (sand) is the ratio of the weight of givenvolume ofaggregates to the weight of equal volume of water.

Mix design details:

	SAMPLE 1	SAMPLE 2	SAMPLE 3	SAMPLE 4
GGBS	0	52.5 KG/CU.M(15%)	70 kg/cu.m (20%)	87 kg/cu.m (20%)
WFS	0	130 kg/cu.m (20%)	194.5kg/cu.m (30%)	259.6 kg/cu.m (40%)
CEMENT	350 kg/cu.m	297 kg/cu.m	280 kg/cu.m	262 kg/cu.m
FINE AGGREGATE	649 kg/cu.m	520 kg/cu.m	454.3 kg/cu.m	389.4 kg/cu.m
COARSE AGGREGATE	1168 kg/cu.m	1168 kg/cu.m	1168 kg/cu.m	1168 kg/cu.m
WATER	160 litre/cu.m	160 litre/cu.m	160 litre/cu.m	160 litre/cu.m
ADMIXURE	4.7 kg/cu.m	4.7 kg/cu.m	4.7 kg/cu.m	4.7 kg/cu.m
Wc ratio	0.38	0.38	0.38	0.38

Result:

COMPRESSIVE STRENGTH OF CONCRETE BLOCK In (Mpa)				
Sr. No	**% of WFS**	**7 Days**	**14 Days**	**45 Days**
1	0	19.02	32.8	33.1

Compressive strength of concrete block in (mpa)

AVG COMPRESSIVE STRENGTH OF CONCRETE BLOCK In (Mpa)				
	CONCRETE WFS-0% GGBS 0%	**CONCRETE WFS-20%GGBS 15%**	**CONCRETE WFS-30%GGBS 20%**	**CONCRETE WFS-40%GGBS 25%**
7 DAYS	19.02	20.1	22.2	18.30
28 DAYS	32.8	33.45	35.73	29.6
45 DAYS	33.1	33.7	35.9	29.4

Result:

1. Improve acceptance of this valuable material (the cleaned foundry sand) in engineering .
2. We can reuse waste foundry sand as clay replacement for tile manufacture andalso in brickmanufacture.
3. It can be used for compound walls & plastering of verandah.
4. GGBS can be used to reduce the micro cracking in the concrete.

Conclusion:

1) The paper presented a comprehensive parametric study on a wide range of properties and durabilitycharacteristics of concrete, on which there is little information.
2) Use of waste foundry sand in concrete reduces the production of waste through metalindustries i.e.,WFS is eco-friendly building material
3) The problems of disposal and maintenance cost of land filling is reduced.
4) Application of this study leads to develop in construction sector and innovative buildingmaterial.
5) Compressive strength increases on increase in percentage of waste foundry sand And GGBS as compare to traditional concrete. In this study, maximum compressive strengthis obtained at 30%replacement of fine aggregate with waste foundry sand and 20 % GGBS with cement.
6) Total Cost saved in case of cement is 20 % And in case of fine aggregate 26.26 %.

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