JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

INCREASING PROFITS OF READY-MIX CONCRETE BY USING CUTTING-EDGE NEW ADDITIVE

[1]Kowshika. V.R 1st, [2]Dr. VijayaBhaskaran 2nd, [3]Dr. Ram Kumar NataRajan 3rd

[1]Research Scholar, International School of Management Excellence, Research Centre affiliated to University of Mysore.

Civil Engineer with 32 years experience, Presently Director of QCRETE Ready-mix (India) Pvt Ltd.

[2] Research Supervisor, International School of Management Excellence, Research Centre affiliated to University of Mysore.

[3]Inventor holding several patents worked in Concrete & many other Construction industry solutions. Principal Scientist, AMAZECRETE PRIVATE LIMITED.

Abstract: A new revolutionary patented additive for concrete was used in series of trials to check for its suitability to Ready-mix Concrete industry. Commercial production of Concrete was also taken up to check the fresh and hardened properties of additive incorporated concrete. The study showed that additive (commercially known as ICRETE) showed impressive results in concretes as it demonstrated comparable strengths even at reduced Cement contents. In addition the striking feature of the product is to improve the profits for Ready-mix Concrete producer, without affecting the quality & durability

Key words **- Ready-mix Concrete, Profits, Quality, Durability, additive.**

I. INTRODUCTION

The recent times showed that Covid19 had almost irreversible effects on lives of not only individuals but also many organizations. The Ready-mix Concrete industry is an abused child in the construction industry, whose growth was further crippled by Covid 19 lock down. In such testing times, ICRETE was extensively tested to check its benefits for the Ready-mix Concrete. Initially both fresh and hardened properties were studied in reputed 3rd party laboratory. The fresh properties and hardened properties were found to be satisfactory. At this stage authors took the next step of exploring the possibilities of measuring the Cost benefits/savings on the material cost for each m^3. This exercise was basically aimed to quantify the savings both in laboratory and field conditions in Ready-mix Concrete industry. The product in question is in powder form, a grayish color powder.

II. MATERIALS

For the study 53 GRADE cement conforming to IS 269 was selected. GGBS was taken from JSW. The crushed aggregates and manufactured sands were used after checking all properties. The novel additive ICRETE properties have also been given. All the trials were conducted with a pre-selected PC based Hyperplasticiser. All the trials and production was repeated with same sources of ingredients.

Table 1 Chemical & Physical Properties of Cement

Sl No	Particulars	Test Results	Specifications As Per Is:269:2015
A	**Chemical Requirements**		
1	LSF(Lime Saturation factor)	0.89	0.8-1.02
2	Alumina Modulus	0.82	Min 0.66
3	Insoluble residue (%)	4.19	Max 5.0
4	Magnesia (%)	1.76	Max 6.0
5	Sulphuric Anhydride (%)	2.67	Max 3.5
6	Loss on Ignition (%)	3.41	Max 4.0
7	Chloride Content (%)	0.021	Max 0.1
8	Tricalcium Aluminate (%)	4.08	-
B	**Physical Requirements**		
1	Specific Surface Area (M^2/Kg)	311	Min 225
2	Normal Consistency (%)	25	
3	Soundness		
	a) Le Chatelier (mm)	1	Max 10
	b) Autoclave (%)	0.04	Max 0.8
4	Setting Time (Minutes)		
	a) Initial	150	Min 30
	b) Final	210	Max 600
5	Compressive Strength (Mpa)		
	a) 72 ± 1 h	33	Min 27
	b) 168 ± 2 h	43	Min 37
	c) 672 ± 4 h	56	Min 53

Table 2 Chemical & Physical Properties of GGBS

Sl No	Characteristics	Test Results	Specifications As Per Is:16714:2018
A	**Chemical Requirements:**		
1	Manganese Oxide (MnO) %	0.1	5.5 Max
2	Magnesium Oxide (MgO) %	7.69	17.0 Max
3	Sulphide Sulphur (S) %	0.44	2.0 Max
4	Sulphate (as SO3) %	0.22	3.0 Max
5	Insoluble residue (I R) %	0.39	3.0 Max
6	Chloride Content (CI) %	0.009	0.1 Max
7	Glass Content %	92	85 Min
8	Loss on Ignition (L.O.I) %	0.26	3.0 Max
9		0.05	1.0 Max
10	$\frac{CaO+MgO+1/3\ Al_2O_3}{SiO_2+2/3\ Al_2O_3}$	1.09	1.0 % (Min)
11	$\frac{CaO+MgO+\ Al_2O_3}{SiO_2}$	1.93	1.0 % (Min)
B	**Physical Requirements**		
1	Specific Gravity	2.91	-
2	Specific Surface Area (M^2/Kg)	366	320 (Min)
3	Slag Activity		
	a) 7 Days	71.64	60 % (Min)
	b) 28 Days	81.33	75 % (Min)

Table 3 Aggregate Properties

IS Sieve Designation	Cumulative % Passing 20mm	Cumulative % passing 12.5 mm	Crushed Stone Sand	Cumulative % passing when 20mm & 12.5mm are mixed in 35:35:30 Ratio	Requirements as per IS:383-2016 (Table 10)
80 mm	100	100	100.00	100.00	-
40 mm	100	100	100.00	100.00	100
20 mm	89.7	100	100.00	96.40	95-100
4.75 mm	0	1.2	100.00	30.40	30-50
0.6 mm	0	0	47.70	14.30	10.0-35.0
0.15mm	0	0	17.70	5.30	0-6

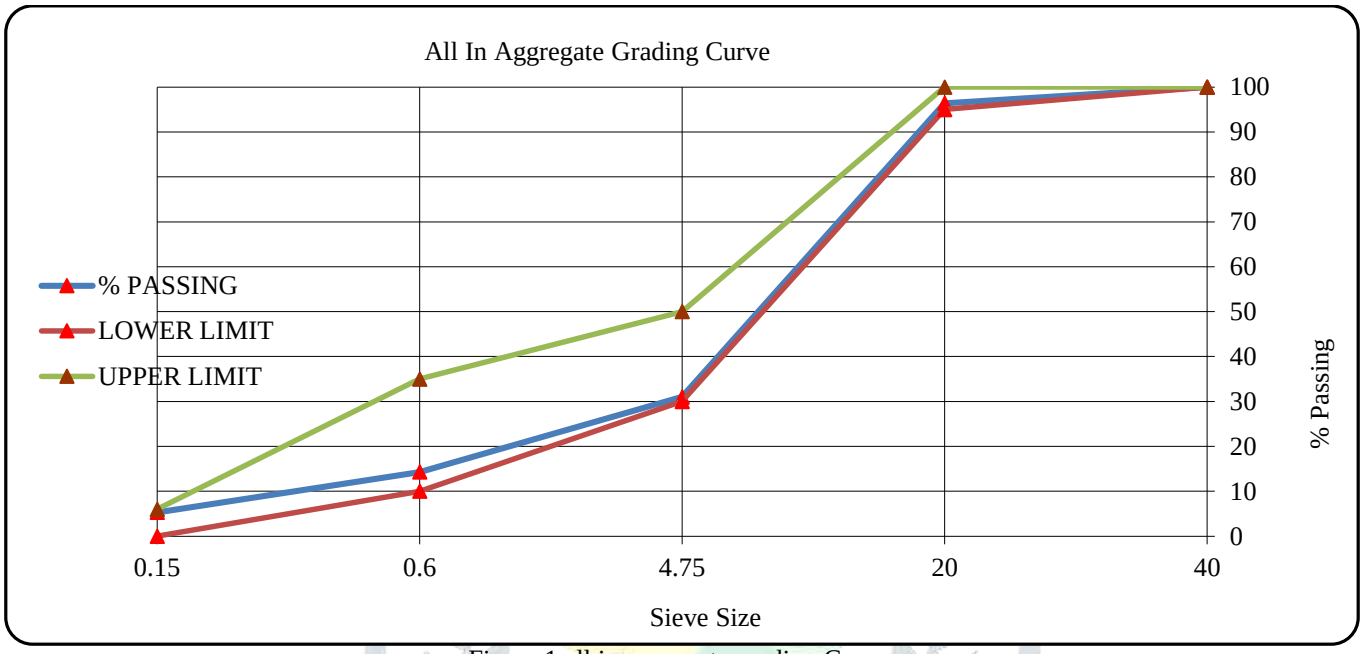

Figure 1 all in aggregate grading Curve

Table 4 Properties of ICRETE

Sl No.	Parameters	Testing Protocol	Results	ASTM C1797
1	Particle size % by mass passing in 45 micron Test sieve by wet sieving method	ASTM C117	90.5	90 Min
2	Bulk dinsity (Loosed) gm/cc	-	0.75	-
3	PH in 10% Solution at 28 deg. C	-	9.9	-
4	Moisture Content % by mass	ASTM C566	0.97	1.0 Max
5	Methylene Blue Value MBf (mg/gm)	ASTM C1779	1.8	3.0 Max
6	Specific Gravity	-	2.13	-

III. EXPERIMENTS

The lab experiments and later Real Time Ready-mix Concrete production were done to examine the efficacy of Novel additive for concrete against bench mark Ready-mix concrete mixes. Series of Trials were done in Laboratories of many Ready-mix Concrete companies in Bangalore, Mangalore, Cochin. The production of concrete using same mixes was done later. The mixes are given as below. The mixes with coding IC, means mixes incorporated with ICRETE. In general the net profit per m3 of Ready-mix Concrete in a professionally managed Ready-mix Concrete company is said to be 125 to 200Rs/m3.

Table 5 Mix Design

Mix Design	Unit	OPC l	OPC (IC) 1	OPC 2	OPC (IC) 2	GG 3	GG (IC) 3	GG (IC) 4	GG (IC) 5
OPC	Kg	340	300	370	330	160	140	108	120
GGBS	Kg	0	0	0	0	160	140	162	180
20 mm	Kg	583	597	598	613	589	599	595	591
12.5 mm	Kg	467	478	485	497	472	480	487	474
M Sand	Kg	852	875	810	830	862	880	890	868
Water	Kg	155	150	150	145	148	148	145	150
Admixture	Kg	1.53	1.5	1.85	1.65	1.44	1.12	1.08	1.2
lcrete	Kg	0	3	0	3.3	0	2.8	4.05	2.1
Icrete	%	0	1	0	1	0	1	1.5	0.7
Slump at 2 Hrs	mm	140	135	130	145	140	130	150	135
7 Days Compressive Stren gth	Mpa	25.1	26.7	30.6	30.2	20.79	20.9	19.4	20.7
28 Days Compressive Stren gth	Mpa	32.8	33.7	41.6	43.8	32.84	33.19	32.76	31.7

Table 6 Savings

Mix Design	Unit	Rate/Kg	OPC l	OPC (IC) 1	OPC 2	OPC (IC) 2	GG 3	GG (IC) 3	GG (IC) 4	GG (IC) 5
OPC	Kg	4.5	340	300	370	330	160	140	108	120
GGBS	Kg	3.75	0	0	0	0	160	140	162	180
20 mm	Kg	0.7	583	597	598	613	589	599	595	591
12.5 mm	Kg	0.7	467	478	485	497	472	480	487	474
M Sand	Kg	0.7	852	875	810	830	862	880	890	868
Water	Kg	0.05	155	150	150	145	148	148	145	150
Admixture	Kg	46	1.53	1.5	1.85	1.65	1.44	1.12	1.08	1.2
lcrete	Kg	33	0	3	0	3.3	0	2.8	4.05	2.1
Mix Cost			2940	2891	3083	3035	2740	2678	2664	2700
Savings			49		48		62		75	40

IV. RESULTS

OPC1, OPC2, GG3 (Bench mark mixes) showed similar slumps to that of Cement Reduced ICRETE incorporated mixes. The novel additive did not change the workability and those mixes were found to be fit for pumpable mixes. Even at a reduced Cement content of 40kg/m3, the OPC(IC) mixes showed almost similar strengths. Table VI gives savings per m3 due to use of ICRETE.

V. CONCLUSIONS

1. Based on both lab trials and Production results, we can see a saving of Rs 40 to 75Rs in various low to medium strength concretes. This translates to 32% to 60% increase in Net profit on lower end of Net profit and 20% to 37.5% increase on the higher end of net profit, when a normal 125 to 200Rs/m3 net profit is considered. Based on this even a worst case scenario of 20% jump in net profit is a big boost to a cash starved Ready-mix Organization or any Readymix company.
2. The Cement (Cementitious) Reduced Icrete incorporated mixes have equally performed in terms of both slump& strength compared to reference Concrete.
3. As any cement (Cementitious) reductions, means lesser OPC usage, the concretes become more sustainable by using ICRETE.
4. The 3RD PARTY reports (which are not added part of this article) also depicted the said additive reduces permeability and all other durability properties are improved.
5. The Ready-mix Companies after using ICRETE reported reduced plastic shrinkage cracks, which is another benefit of using the product.

VI. ACKNOWLEDGEMENT

Authors are thankful to QCRETE Ready-mix (India) Pvt Ltd, for data on the trials.

VII. REFERENCES

1) IS: 10262-2019, "Concrete Mix Design - Guidelines", Bureau of India Standard, New Delhi.
2) A Oner, S Akyuz, An experimental study on optimum usage of GGBS for the compressive strength of concrete, www.sciencedirect.com, Cement and concrete composites 29 (2007) 515-514.
3) IS 16714:2018: Ground Granulated Blast-Furnace Slag for Use in cement, concrete and Concrete and Mortars-specification, Bureau of Indian Standards, New Delhi, India.

4) ASTM: C 989-04, "Standard Specification for Ground Granulated Blast-Furnace Slag for use in Concrete and Mortars", ASTM, America.
5) Manjunatha, L. R., & Anvekar, S. R.(2015) Transition of Concrete Industry From Cement to Eco Friendly Industrial by-Products for Sustainable Green Growth in the Indian Construction Industry. https://www.researchgate.net/publication/283350119.
6) L.R. Manjunatha, Sandhya. R. Anvekar, M.V. Yogananda (2014). Recent Developments In The Indian Concrete Industry In The Use Of GGBS In Concrete At RMC Batching Plants As Partial Replacement To OPC Cement And Its Effects On Concrete Durability And Sustainability In The Indian Context. December 2014. Conference: International Congress on Durability Of Concrete. Volume: 1. Doi:10.13140/2.1.3123.3609
7) Raghavendra Y. B, Y. Ramalinga Reddy (2019) "Optimum Usage of GGBS In Ready Mix Concrete Industry". International Journal Of Engineering And Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-8 Issue-6, August 2019 .Pages 4542 -4553, Retrieval Number F8861088619/2019©Beiesp DOI: 10.35940/Ijeat.F8861.088619
8) Manu Mohan, Dr. Elson John (2020) Study On Slump Retention Of Ready-Mix Concrete: A Review. pages 1784-1789, International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 07 Issue: 07 | July 2020 www.irjet.net p-ISSN: 2395-0072
9) Kanta Naga Rajesh, Ponnada Markandeya Raju, Kapileswar Mishra, Pavan Kumar Madisetti (2019) A review on sustainable concrete mix proportions. Pages 1-10, International Conference on Sustainable Systems and Structures (ICSSS 2019) IOP Conf. Series: Materials Science and Engineering 1025 (2021) 012019 IOP Publishing doi:10.1088/1757-899X/1025/1/012019
10) IS: 516-1959, "Methods of Tests for Strength of Concrete", Bureau of India Standards, New Delhi.