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RESEARCH ARTICLE OPEN ACCESS

Behaviour of Barite Concrete in alkaline environment

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ABSTRACT:
Structures built in the vicinity of sea waters and industrial areas are affected by alkaline environments. In this study effect of alkaline environment on mechanical and permeability properties of high-density concrete made with barite aggregates, mostly used in strategic constructions is carried out. It is found that the same resulted in durable concrete mix with the reduced strength at the end of 90-day exposure to alkaline environment being 79Mpa as compared to the designed strength of 60Mpa and the permeability of the concreteis found to be extremely low.

Keywords: High density concrete, Barite concrete, Alkaline environment, Rapid chloride permeability test

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I. INTRODUCTION

High density concrete is generally used in nuclear industry or in the areas where radiation materials are used like hospitals, power production plants, factories in which nuclear materials are processed, underwater constructions, offshore pipelines, Breakwater structures, Gravity seawalls, Ballast in mass concrete projects in seas, Off-shore platforms for noise and vibration dampers, bridge counter weights. and strategic constructions with regard to defense, where in it has the potential to shieldthe radiation, resist high temperatures, provide heavy mass in limited areas and also exhibit good mechanical properties and durability. High density concrete is made with aggregates with high specific gravities like Hematite, Barite, Goethite, Serpentine,Limonite, Ilmenite, steel punches andiron shots.Any structure which is constructed in and around water bodies such as oceans, seas and in industrial areas willcontinuously get affected by the surrounding environment. Sea or Ocean water is an aqueoussolution which principally contain Sodium Chloride and Magnesium sulphate. In this study an attempt is made to evaluate mechanical and durability properties of M60 grade concrete with conventional granite coarse aggregate and that made with Barite coarse aggregates, exposed to alkaline environment by curing the concrete for 90 days in NaOH solution with a pH value of 13 after nominal curing for 7 days.

II. LITERATURE REVIEW

S.Kilincarslan,et.al [4],reported their work on Barite aggregate in different percentages and at different water cement ratios. Desirable values were obtained at 100% replacement and water cement ratio of 0.43 with regard to UPV, rebound hammer and Modulus of Elasticity tests.Harshavardhan.C, BalaMurugun S [5] studied conventional and high-density concrete made with Barite as aggregate and steel fibre reinforcement as additive subjected toelevated temperature. Barite concrete could withstand temperature around 200degC and addition of fibres reduced spalling and sudden failure of concrete while testing.Athira Suresh [6] used Hematite and Laterite stones as replacement to coarse aggregate at 0%,25%, 50% and 100% to obtain M30 grade of concrete with a water cement ratio of 0.42, 25% replacement concrete has achieved highest strengthin terms of compression, tensile and flexural strengths when compared to other mixes in both cases. Osman Gencel [7], reported thatconcrete withvaried replacement levels of hematite coarse aggregates and cement contents at a constant water-cement ratio of 0.40,resulted in increased density, strength and UPA values with Hematite content.D. Ramachandran, et.al.,[8] in their work compared M35 grade of concrete with Hematite coarse aggregates, 10% of fine aggregate replacement with Hematite aggregates and Flyash replacing 20% of cement. Curing done at 7 days, 28 days and 56 days reported that Hematite and fly-ash combination concrete exhibits better compression, split-tensile and flexural strength than the fly-ash alone replaced concrete and also exhibited low values of permeability.

III. MATERIALS USED

53 grade cement procured locally is used in this experimental work. Fine aggregate confirming to zone II of Indian standard [2] and 20mm down coarse aggregate from granite source is used..

Water, of potable quality confirming to standards is used. Barite aggregates are procured for a quarry with a nominal size of 20mm down, NaOH procured form loacal chemical distributors is used to make alkaline water to simulate alkaline environment.

IV. METHODOLOGY

Concrete mix design for M60 grade concretes is done with granite coarse aggregate and river sand for conventional concrete mixes[1] and high-density concrete is obtained using Barite coarse aggregates and river sand. Mix design is done in confirmation with IS 10262 [2] and ACI 2114R-93 [3]to obtain M60 mixwith a mix ratio of1: 1.15: 1.95 for conventional concrete and 1:1.2:3.15 for Barite concrete at a w/c ratio of 0.30 and superplasticizer dosage of 0.46% is considered. Cement replacement with flyash at 10% is done. Experimental work includes evaluating strength properties of concrete namely, compressive, tensile and flexure properties of concrete along with determination of permeability using rapid chloride permeameter test. Alkaline environment is created by curing concrete samples in alkaline water prepared using NaOH pellets to maintain a pH of 13. Alkaline exposure was considered for 90 days for both conventional and Barite concrete after a nominal curing period of 7 days to simulate alkaline environment conditions. Another set of conventional and Barite concrete samples were nominally cured in potable water for 28 days period and exposed to natural environment before testing at the end of 90 days, hence forth referred to as normal exposure.

V. RESULT AND DISCUSSION

The properties of concrete viz,. % loss in weight, compressive strength, tensile strength and flexural strength of conventional and Barite concrete after stipulated subjection to normal and alkaline exposure conditions are as depicted in Table 1 and 2 respectively. Table 3 represents the results of rapid chloride permeability test to evaluate permeability of the concrete samples. Fig.1 represents the compressive strength. Fig.2 indicates the split tensile and Fig.3 shoes flexural strength of both conventional and Barite concrete with normal and alkaline exposure.

Table 1. Properties of conventional and Barite concrete with nominal exposure.

Type of Mix	% Loss in Weight	Compressive strength in Mpa	Split tensile strength in Mpa	Flexural strength on Mpa
Conventional	Nil	70	4.0	6.0
Barite	Nil	82	4.9	6.4

Table 2. Properties of conventional and Barite concrete with alkaline exposure.

Type of Mix	% Loss in Weight	Compressive strength in Mpa	Split tensile strength in Mpa	Flexural strength on Mpa
Conventional	1.21	65	3.8	5.2
Barite	0.48	79	4.8	6.3

Table 3. RCPT test results at 90 Days of alkaline exposure

Type of Mix	Charge passed in Coulombs	Permeability
Conventional	2100	Moderate
Barite	980	Very low

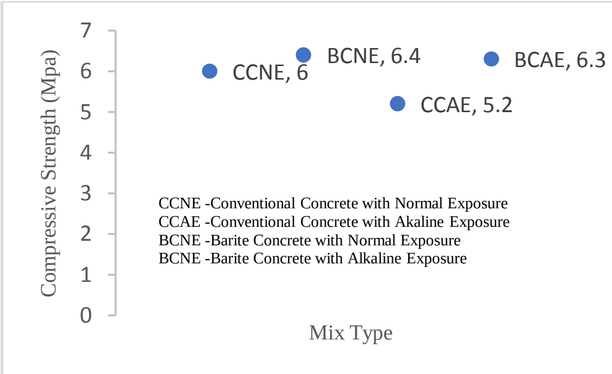

Figure 1. Compressive strength of Conventional and Barite concrete

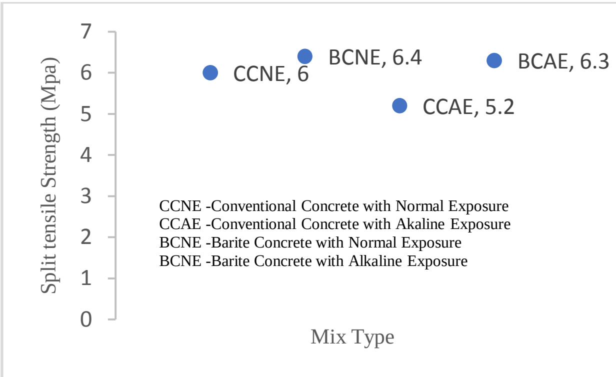

Figure 2. Split tensile strength of Conventional and Barite concrete

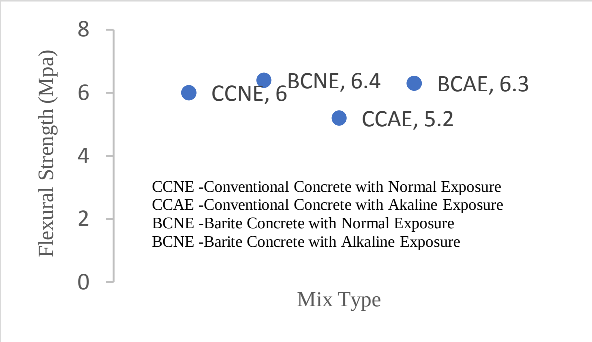

Figure 3. Flexural strength of Conventional and Barite concrete

VI. CONCLUSION

1. Barite concrete exhibited a high strength of 82 Mpa as compared to 70 Mpa for conventional concrete under normal exposure conditions when designed for a characteristic compressive strength of 60Mpa.
2. Barite concrete showed a high split tensile and flexural strength,4.9 Mpa and 6.0Mpa respectively on normal exposure conditions.
3. The Compressive strength of Barite concrete reduced by a nominal value of 3.8% on exposure to Alkaline environment and the reduction was 8% in conventional concrete.
4. Barite concrete produced a compressive strength of 79 Mpa which is almost 27%more than conventional concrete after exposure to Alkaline environment for 90 days and the same is 17% in case of concretes with normal exposure
5. Split tensile strength of Barite concrete on exposure to Alkaline environments showed a reduction of less than 1%, while flexural strength showed a reduction of around 1.5%.
6. In case of conventional concrete, the reduction in split tensile strength on alkaline exposure was 5% and that in flexural strength was observed to be 15%.
7. Rapid Chloride Permeability test results showed that the Barite concrete even after exposure to Alkaline environment showed that the permeability is very low indicating Barite concrete is more durable than high strength conventional concrete mixes.

REFERENCES

[1]. IS.: 383-1970 (2007), “Specification for coarse and Fine Aggregate from Natural source for concrete,” Bureau of Indian Standards, New Delhi.
[2]. IS.: 10262–2009, “Indian Standard Recommended Guidelines for concrete mix design,” BIS, New Delhi.
[3]. “Guide for Selecting Proportions for High-Strength Concrete with Portland cement and Flyash”, ACI 211.4R-93, Reported by ACI Committee 211
[4]. S. Kilincarslan, I. Akkurt and C. Basyigit Suleman Demirel University, Turkey: “The effect of barite rate on some physical and mechanical properties of Concrete”, ELSEVIER, Material Science and Engineering A424(2006) pp 83-86.
[5]. Harshavardhan.C, BalaMurugun, School of Civil and Chemical Engineering, VIT University, Vellore: “Study on High Density Reinforced with steel fibre at elevated temperatures”, ISSN 1898-6608, (ARPN) Vol.11, No-9, October 2016.
[6]. Athira Suresh, Ranjan Abraham M.Tech student and Professor Ilahia College of engineering and Technology, Kerala: “Experimental study on Heavy weight concrete using Haematite and Laterite as Coarse aggregate”, (IJETT)-Volume 28 Number 4-October- 2015
[7]. Osmen Gencel, Depertment of Civil engineering, Bartin University, Turkey: “Concretes containing Haematite for use as Shielding barriers”, ISSN 1392-1320 Material science Vol.16, No-3, 2010.
[8]. D. Ramachandran, Centre for nanoscience and Nanotechnology, Satyabama university, Chennai: “Studies on mechanical and microstructural properties of Haematite modified concrete”, IJCRGG, ISSN: 0974-4290, ISSN (Online): 2455-9555 Vol.10 No.4, 2017,pp 464-472.

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