A Review on "EXPERIMENTAL STUDY OF PARTICLE SIZE OF SAND ON PROPERTIES OF MORTAR WITH PARTIAL REPLACEMENT OF CEMENT BY FLY ASH AND RICE HUSK ASH"

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Abstract: ***Use of various industial by product has been done in the past to enhanced the properties of construction. The paper discusses the effects of using different pozzolonic materials as a partial cement replacement material in mortar mixes. An experimental study of mortar made with Ordinary Portland cement (OPC) and 12% of OPC, replaced by different pozzolanic materials such as Fly Ash, Rice Husk ash, Silica Fume, Calcined Clay (Grog) and Slag (GGBS) were tested for the strength and durability properties, to determine the effect of these materials on mortar properties and was compared to control mortar mix. Mortar specimens were tested for compressive strength at age of 3, 7 and 28 days and flexural strength at age of 28 days. The paper discusses the effects of using different pozzolonic materials as a partial cement replacement material in mortar mixes. An experimental study of mortar made with Ordinary Portland cement (OPC) and 12% of OPC, replaced by different pozzolanic materials such as Fly Ash, Rice Husk ash, Silica Fume, Calcined Clay (Grog) and Slag (GGBS) were tested for the strength and durability properties, to determine the effect of these materials on mortar properties and was compared to control mortar mix. Mortar specimens were tested for compressive strength at age of 3, 7 and 28 days and flexural strength at age of 28 days.***

Keywords:*Partial replacement,fly ash,mortar,cement ,sand ,pozzolanic material andRice husk ash*

Introduction:

Mortars are typically made with a mixture of sand, a binder such as cement, pozzolanic materials and water. Sand plays an important role for the preparation of mortar. Sand is a naturally occurring granular material composed of finely divided rock and mineral particles depending on the local rock sources and conditions. Sand to be used should be natural sand or crushed sand or river sand. It should be well graded, dry, hard, durable, clean and free from clay, dirt, organic matter and adherent coating. It should not contain harmful impurities such as iron, pyrites, alkalies, shale or other mineral in such a form or in such quantity as to affect the hardening, strength and durability of the mortar.Engineers have been looking for mortar which is ever stronger and more durable against aggressive environments. Fine aggregates (sand) make up the main bulk of masonry mortar therefore having the significant effect on the properties of product in both fresh and hardened state. The selection of suitable aggregate which are capable of producing a product with the optimum properties is very essential. It has been found that mortar is influenced greatly by the type of sand and particle size grading of the sand.A number of studies have deal with the influence of both grading and particle shape of the fine aggregate in mortar. They have found that the shape of the fine aggregate has a more significant impact on water demand than the shape of the coarse aggregate. Further, within the permitted standard limits, the particle size distribution of the fine aggregate was found to have a greater influence in the properties of mortar and concrete than that of the coarse aggregate. As a result, the choice of the appropriate type of fine aggregate for a given application is of primary importance as far as properties of concrete and mortar are concerned.Fly ash is finely divided residue resulting from the combustion of powdered coal and transported by the flue gases and collected by Electrostatic, Precipitator. Fly ash is the most widely used as a pozzolanic material all over the world. As per IS 3812-1981fly ash can be classified as grade 'I' and grade 'II' and as per ASTMC-618 as class 'F', class 'N', class 'C'. Class 'F' Fly ash normally produced by burning anthracite or bituminous coal, usually has less than 5% CaO. Class F fly ash has pozzolanic properties only. Class 'C' Fly ash normally produced by burning lignite or sub-bituminous coal. Some class C fly

ash may have CaO content in excess of 10%. Fly ash is not highly reactive; the heat of hydration can be reduced through replacement of part of the cement with fly ash. Effects of Fly Ash on Hardened Concrete, contributes to the strength of concrete due to its pozzolanic reactivity. Continued pozzolanic reactivity concrete develops greater strength at later age not at initial stage, contributes to making the texture of concrete dense, resulting in decrease of water permeability and gas permeability.

II. Literature Review:

Chandra Prakash Bastani & R. Kansal (2015):- The Cement Sand mortar 1:6 is commonly used in the masonry work. The sand is an important ingredient of mortar. Various studies on mortar properties have been done with correlating its Fineness Modulus to various parameters. It is a fact that the same fineness modulus may have different particle size distribution patterns. Sand is composed of different sized particles e.g. ranging from 4.75mm to 150 micron in varying proportions, These gradation of particles affect the performance of mortar by improving the workability,compressive strength etc. and vice versa. The presence of fine particles in sand is of a paramount importance. An attempt has been made to study the effect of fine particles i.e. passing 600 micron sieve in different percentages as specified by IS code; on cement sand mortar 1:6 .The main objective is to identify a particle size distribution which requires less water for better workability of mortar without sacrificing the strength of mortar

I. O Obilade [16], this paper summarizes the research work on the properties of ternary blended cement concrete containing Rice Husk Ash (RHA) and Saw Dust Ash (SDA). Eight mixes of ternary blended cement mixes with 70% Ordinary Portland Cement (OPC) and 30% of combined Rice Husk Ash (RHA) and Saw Dust Ash (SDA) was adopted. Compacting factor test was carried out on fresh concrete while Compressive Strength test was carried out on hardened 150mm concrete cubes after 7, 14 and 28 days curing in water. The results revealed that the Compacting factor increased as the RHA percentage increased relative to SDA percentage in the ternary blends. The results also revealed that the Compressive Strength of concrete cubes also increased as the RHA percentage increased relative to SDA percentage in the ternary blends. The Optimum Compressive Strength of all the ternary mixes considered was 70% OPC combined with 25% RHA and 5% SDA with a value of 15.08N/mm2. The results showed that OPC-RHA-SDA ternary blended cement concrete could be used as lightweight concrete in Civil Engineering and Building works.

B. Madhusudhana Reddy H. Sudarsana Rao M.P George[17], in this paper Study of effect of Hydrochloric acid (HCl) on Blended Cement (Fly ash based(BC)) and Silica Fume Blended Cement(SFBC) and their concretes The setting times and compressive strength were evaluated for 28 and 90 days. The results show that, as HCl concentration increases, there is retardation in initial and final setting of cements (BC and SFBC) Compressive strengths of BCC and SFBCC have decreased in the range of 2 to 19%, at 28 and 90 day age respectively.

C. M. Ravikumar, M. B. Sreenivasa, K. Abdul Raheem, M. H. Prashanth, M. Vijay Sekhar Reddy4 [18], In this paper experimental study of mortar made with Ordinary Portland cement (OPC) and 12% of OPC, replaced by different pozzolanic materials such as Fly Ash, Rice Husk ash, Silica Fume, Calcined Clay (Grog) and Slag (GGBS) were tested for the strength and durability properties. It has been observed that compressive strength increases as the period of curing in water increases for all types of mortar mixes. It was observed that the compressive strength of all the mortar mixes with 12% replacement of cement with pozzolanic material were higher, when compared to compressive strength of control mortar for immersion in water, immersion in 10% sodium sulfate solution and 10% magnesium sulfate solution indicating better durability of various mortar mixes compared to control

mortar. Magnesium sulfate ($MgSO_4$) solution has a more severe effect on the durability than with that of compared with that of sodium sulfate (Na_2SO_4) solution.

Ali reza Naji Givi, Suraya Abdul Rashid, Farah Nora A. Aziz, Mohammad Amran Mohd Salleh[19], This paper presents an overview of the work carried out on the use of RHA as partial replacement of cement in mortar and concrete. RHA as a partial cement replacement between 12% and 15% may be sufficient to control deleterious expansion due to alkali-silica reaction in concrete, depending on the nature of the aggregate. It can be concluded that the use of rice husk ash leads to enhanced resistance to segregation of fresh concrete compared to a control mixture with Portland cement alone. Also RHA can significantly reduce the mortar-bar expansion.

III. Conclusion

Following important conclusions are made after studying literature review.

1. Mortar mixes with sand gradation showed the variation in compressive strength for 1:4 cement sand mortar.
2. M41 (100% CS+0% FS) showed the minimum values of compressive strength at 7, 28, 90 and 135 days of curing.
3. The compressive strength of M41 for 28 days is minimum 7.45 N/mm^2 which is less than 7.5 N/mm^2 as per IS-2250. Hence the value is not acceptable
4. Water absorption values are much higher for 30 day curing for all six mortar mixes.
5. M41 (1:4) showing the minimum water absorption value at 30, 90 and 135 days i.e. 4.77%, 3.74% and 3.18% respectively and M46 has maximum absorption level at 30 days as 7.94%.
6. Drying shrinkage of all six mortar varies due to the variation in fineness modulus of each sand mixes.

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REFERENCE

[1] ***Chandra Prakash Bastani & R. Kansal,*** *" Effect of Fine Aggregate Particles on Compressive Strength of Cement Mortar," International journal of engineering studies and technical approach,ISSN No. 2395-0900, Volume 01, No.7, July, 2015.*

[2] ***E. Rivet and T. Ritchie,*** *"The influence of sand grading on mortar properties." National Research Council Canada Division of Building Research Internal Report No. 201 of the Division of Building Research, Ottawa July, 1960.*

[3] ***B.V. Venkatarama Reddy and Ajay Gupta.*** *"Influence of sand grading on the characteristics of mortars and soil – cement block masonry." Construction and Building Materials 22, 1614 – 1623, 2008.*

[4] ***G. De Schutter and A.M. Poppe****. "Quantification of the water demand of sand in mortar. Construction and Building Materials." Volume 18, Issue 7, Pages 517-521, September 2004.*

[5] ***M.A. Amjad.*** *" Elasticity and Shrinkage of Cement: Sand Mortar Produced in Riyadh." JKAU: Eng. Sci., vol. 11 No. 2, pp. 91-105 (1419 A.H. / 1999 A.D.)*

[6] ***R. Malathy and K. Subramanian****. "Drying shrinkage of cementitious composites with mineral admixtures." Indian Journal of Engineering & Sciences. Volume 14, April 2007, pp 146-150.*

[7] ***J.A.Canova1, G.de Angelis Neto and R. Bergamasco***. ***"****Mortar with unserviceable tire residues." Journal of Urban and Environmental Engineering, Volume03, N.2 (2009), Page No, 63–72 ISSN 1982-3932.*

[8] ***Wenyan Zhang, Mohamed Zakaria, Yukio Hama***. *"Influence of Aggregate Materials Characteristics on the Drying Shrinkage Properties of Mortar and Concrete." Journal of Construction and building materials volume49 page 500-510, 2012-13*

[9] ***Se Jin Choi; Sang Soo Lee; and Paulo J. M. Monteiro,*** *"Effect of Fly Ash Fineness on Temperature Rise, Setting, and Strength Development of Mortar". Journal of ASCE.*