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A Review on Experimental Study on Properties of Mortar with Gradation of Sand Particle Sizes

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ABSTRACT

Mortar has generally two deficiencies, low durability and low strength. The present trend is toward increasing the durability and strength of mortar to meet the modern construction demand. For that purpose we have done the gradation of sand particles which is used as an aggregate in mortar. A modified mortar of same design mix proportion (1:3) and (1:4) but varying the percentage of different sizes of sand to achieve higher durability and strength. Mortar specimens were tested for compressive strength at age of 7, 14 and 28 days of curing in potable water. The properties are then compared with the controlled mortar mix.

I. INTRODUCTION

Mortar is workable paste used to bind building blocks such as stones, bricks, and concrete masonry units. Mortars are typically made from a mixture of sand, a binders, and water. Mortar mixes include ingredients that give it strength (i.e. cement) and those that promote workability and good bond with the masonry units. Good workability and water retentivity are crucial for maximum bond. A mortar with high cement content is stronger, but it may produce less bond. Contract wise, a mortar having moderate cement content will not be as strong, but it will have better bond strength. The compressive strength of mortar only has a small effect on the bearing strength of the wall, but it adversely affects durability.

II. LITERATURE REVIEW

Cheah Chee Ban, Mahyuddin Ramli[1]:- In this paper the investigation work on Optimization of Mix Proportion of High Performance Mortar for Structural Applications is carried out. ASTM Type I cement having specific gravity of 3.15 as binder and Type F super plasticizer of sulfonated melamine formaldehyde condensates category was used to maintain the desired level of workability. In first laboratory investigation, a total of 20 batches of mortar mix with cement: Sand ratio of 1: 2.0, 1:2.25, 1:2.5 and 1:2.75 each with water binder ratio varied from 0.40-0.5 with stepped increment of 0.025 was fabricated. In second part of the laboratory investigation, additional 8 batches of mortar mix (Batch 21-28) with cement: Sand ratio of 1:2.25 and 1:2.5 with varying water/binder ratio of 0.35-0.425 at stepped increment of 0.025 were fabricated. To maintain slump of mix at dosage super plasticizer was used within the range of 50-90mm. All mortar mixes were proportioned using absolute volume method as prescribed in ACI Manual of Concrete Practice, Part 1 (American Concrete Institute, 1999).Rheological properties of the mortar mixes were investigated in term of mix slump, besides flow test was performed to

determine flow value of each mix in fresh state. From each batch of mix, a total of 6 numbers of 100x100x100 mm cubes were fabricated. Mortar mix were cured in the mould for 24 h covered completely with polyethene sheeting prior to being remolded and cured in water tank at curing temperature of 20±2°C till age of test. After determination of bulk density, compression test is subjected under continuous loading condition. Throughout the test of cube specimens loading rate were maintained constant at 3mm minimum up to failure. The observation is consistent with the fact that the water content of the mix is the main factor affecting workability of concrete whereby increase in water content will result in higher workability of mix. Optimum cement content is achieved at cement: sand ratio of 1:2.25 for water/cement ratio ranging between 0.40 and 0.50 to ensure maximum compressive strength of mortar mix produced. Also, economical use of binder can be achieved with the use of mortar mix with cement: sand ratio of 1: 2.25. Incorporation of super plasticizer in the mortar mix with cement: Sand ratio of 1:2.25 results in higher degree of enhancement in workability as to 1: 2.5. Rate of early strength gain of mortar mix with cement: Sand ratio of 1:2.25 is significantly higher. Incorporation of super plasticizer in mortar mixes resulted in reduction of compressive strength of hardened mortar mix.

L. O. Ettu, F. C. Njoku, J. I. Arimanwa, K. C. Nwachukwu and H.E. Opara[2]:- OPC-RHA composites vary with mix proportion in a similar way as those of normal OPC composites (with 0% RHA). The compressive strength of OPC_RHA cement composites increased with leanness of mix up to some level of leanness after which the strength reduced. On the basis of compressive strength and obvious cost implications, mix proportion of 0.7:1:3:5 would be ideal for OPC-RHA binary blended cement concrete. Similarly, mix proportion of 0.7:1:9 would be ideal for OPC-RHA binary blended cement sandcrete and soilcrete. The 50 days strength values of OPC-RHA blended composites are comparable to those of 100% OPC composites are comparable to those of 100% OPC composites at OPC replacements with RHA up to 20%. The results seems to suggest that the variation of OPC-RHA cement concrete strength with mix proportion does not depend so much on the ratio of fine aggregate to coarse aggregate as on the proportion of total aggregate. Further studies would be required to determine the most suitable fine to coarse aggregate ratio for OPC-RHA blended cement concrete.

Archana Katroliya, Archana Tiwari[3] :- The work presented in this paper reports an investigation on the behavior of concrete produced from blending cement with RHA and FA. The physical and chemical properties of RHA, FA and OPC were first investigated. The effects of RHA on concrete properties was studied i.e. Compressive strength was studied as the time dependent property.

The result of the study show that the RHA produced from agro waste can be used as partial replacement of ordinary Portland cement in concrete.

From the test result it can be concluded that if approximately 20 % of cement is replaced by equal amount of RHA, there is not any significant depreciation in the compressive strength but it slightly increase. Thus the RHA and FA can be used as partial replacement of cement in the regions where the material is locally available.

Narayan Sambu Potty Kalaikumar Vallyutham M. F. Yusuf A. Anwar M. F. Haron M. N. Alias[4]:- This paper summarizes the research work on the properties of Rice Husk Ash (RHA and MIRHA) Mortars. The parameters of RHA and MIRHA mortar were vary as w/c ratio of 0.50, 0.55, 0.60 and 0.65 taken and 0, 5, 10, 15, 20, 25 and 30% of OPC RHA and MIRHA were taken respectively. 1:3 and 1:4 c/s proportions were used. The Compressive strengths were evaluated at 7, 28 and 60 days using ASTM of sample. The results revealed that when the RHA replacement is increased the compressive strength of most RHA mortars

decreases. It is found due to the grain size of RHA is coarser than the cement, due to which porous surface and more voids inside the mixtures were produced.

Er. S. Thirougnaname, Er. S. Segaran[5]:- Experimental investigation was carried out to study the feasibility of unsieved stone dust (a product obtained from crushing of granite) as fine aggregate in place of river sand in making cement mortar 1:3, 1:4, 1:5, and 1:6, which are the mixes usually adopted in various construction activities. Stone dust obtained from various sources in and around Pondicherry satisfies the requirement as specified in IS standards. More quantity of water is required for unsieved Stone Dust mortar when compared to conventional mortar, irrespective of the mix proportion. Stone Dust mortars are equal or slightly higher strength than reference mortar for different mix proportions, namely for 1:4, 1:5, 1:6 at 100% flow. Hence, it is concluded that stone dust mortars can also be used with confidence in construction.

III. CONCLUSION

Following are the important conclusions made after studying literature review:

1. Optimum cement content is achieved at cement: sand ratio of 1:2.25 for water/cement ratio ranging between 0.40 and 0.50 to ensure maximum compressive strength of mortar mix produced. Also, economical use of binder can be achieved with the use of mortar mix with cement: sand ratio of 1: 2.25.
2. The variation of OPC-RHA cement concrete strength with mix proportion does not depend so much on the ratio of fine aggregate to coarse aggregate as on the proportion of total aggregate.
3. Approximately 20 % of cement is replaced by equal amount of RHA, there is not any significant depreciation in the compressive strength but it slightly increase. Thus the RHA and FA can be used as partial replacement of cement in the regions where the material is locally available
4. The compressive strength of most RHA mortars decreases when the RHA replacement is increased. This is due to the coarser grain size of RHA than the cement which produces porous surface and more voids inside the mixtures.
5. Stone Dust mortars are equal or slightly higher strength than reference mortar for different mix proportions, namely for 1:4, 1:5, 1:6 at 100% flow. Hence, it is concluded that stone dust mortars can also be used with confidence in construction

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