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Setting Time and Sem Analysis For Cement Mortar Containing Partial Replacement Of Fine Aggregate By Green Sand And Bottom Ash

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Abstract: Cement, Sand and Aggregate are essential need for construction firm. Consumption of cement is high, due to large use of concrete and mortar. Cement, sand and aggregate are basic needs for any construction industry. Sand is a prime material used for preparation of mortar and concrete and which plays a major role in mix design. Now a day's erosion of rivers and considering environmental issues, there is a scarcity of river sand. The non-availability or shortage of river sand will affect the construction industry, hence there is a need to find the new alternative material to replace the river sand, such that excess river erosion and harm to environment is prevented. Many researchers are finding different materials to replace sand. Using different proportion of green sand and bottom ash along with sand the required concrete mix can be obtained. One of the best method to overcome this consumption is usage of alternative material, instead of sand. The ultrafine bottom ash and green sand was used here, as a replacement of sand. The 30% of sand was replaced by using both bottom ash and green sand. Setting time, cube compression test, split tensile test were studied for the replacement of bottom ash and green sand. Scanning Electron Microscopy (SEM) applied to investigate the micro structural behaviour and chemical element distribution, inside cement- binder matrix. Further, the replacement of bottom ash and green sand with sand will be analysed by testing the initial setting time, final setting time, compressive strength and split tensile strength.

I. INTRODUCTION

Cement, Sand and Aggregate are essential need for construction firm. Cement and sand is a major material. Consumption of sand is high, due to large use of concrete and mortar. Major components of mortar are sand, which has its own Environmental and social impacts and contributes largely to those of mortar. Sand is one of the natural resource.

Now days, the cost of sand is increasing because of its demand in the construction industry. Due to this condition, research began for cheap and easily available alternative material instead of cement. Some alternative materials have been used as a replacement of sand such as green sand,bottom ash, copper slag, filtered sand etc. Normally mortar is a workable paste used to bind building blocks such as stones, bricks and concrete masonry units together, fill and seal the irregular gaps between them, and sometimes add decorative colors or patterns in masonry walls.

The possibility of substituting natural fine aggregate with industrial by-products such as waste foundry sand and bottom ash offers technical, economic and environmental advantages which are of great importance in the construction sector. The study investigated the effect of waste foundry sand and bottom ash in equal quantities as partial replacement of fine aggregates in various percentages on concrete properties such as mechanical and durability characteristics of the concrete along with SEM.

Cement mortar mixtures prepared with fine aggregate made up of different proportions of green sand and bottom ash tested for use as masonry mortars and plastering. In the method to vary the ranging of green sand and bottom ash content. The concrete mixes were evaluated for workability, density, and compressive strength.By varying percentage of green sand and bottom ash upto 30% to determine the cube compression, split tensile, SEM test.

II. LITERATURE REVIEW

Abhishek Jain et al., has proposed that the experimental studies on mortar containing flyash as a partial replacement of sand by weight as well as by volume were carried out to quantify its utilization. Both the types of pond and bottom flyash in various ratios were used in preparing cement mortar and their strengths in compression and tension were tested.Out of the various proportions the mortar mix 1:2.5:2.5 (cement: coarse sand: pond flyash) designed by method of volume is found satisfactory as for as the strength is concerned. The maximum utilization of flyash almost 75% and cost saving about 58% were ascertained with the plain mortar of ratio 1:5 (cement : sand). The utilization of flyash in mortar designed by weight provides 50% to 60% financial saving while 9% to 16% by method of volume. However, the flyash mortar mix 1:1:5 (cement:flyash:sand) by weight consumes about 20% less

quantity of cement and overall consumption of flyash is also less.

Out of the various proportions under study the mortar mix containing 1:2.5:2.5 (cement : coarse sand : pond flyash) by method of volume is observed to satisfy the strength criteria very well whereas the same ratio when considered by the method of weight is found to be most economical. With the view of maximum utilization of flyash almost about 75% and cost saving about 58% are ascertained with 1:2:3 mortar (cement : coarse sand : pond ash) when compared withplain mortar 1:5 (cement : coarse sand). Similarly the mortar containing 1:1:5 (cement : flyash : sand) replacing cement by flyash saves 20% cement. However, the strength of 1:2:3 mortar and 1:1:5 mortar is not as good as the strength of mortar of 1:2.5:2.5 ratio. In statistical analysis of experimental results reveals that water absorption of flyash mix mortar of ratio 1:2:3 and 1:2.5:2.5 is twice to that of plain cement mix mortar of ratio 1:5. For workability the flyash, mixed mortar required 5% to 10% more water than that of plain cement mix mortar of ratio 1;5. Utilization of flyash in mortar designed by the method of weight gives 50% to 60% financial savings while the saving is 9% to 16% in case of the method of volume. When the cement is replaced by flyash in mix of 1:1:5 (cement :flyash : sand) mortar, 20% saving of cement is achieved by the method of weight but the strength and consumption of flyash reduced significantly.

Saveria Monosi et al., has proposed that the properties of mortars and concretes containing different dosages of used foundry sand (UFS) as partial replacement of sand were investigated in both fresh and hardened conditions. In particular, higher percentages of addition, but lower if referred to the whole aggregate (fine and coarse), were considered in concretes than in mortars. Both mortars and concretes were evaluated with respect to consistency of the fresh mixture and compressive strength of the hardened material. Elastic modulus determination of the hardened material was carried out on concretes. A low (10%) amount of used foundry sand does not change the mortar‘s performances. In the presence of higher additions a workability decreasing can be outlined, and then a higher dosage of superplasticizer is required in order to keep it constant. Mechanical performances lower of about 20-30% than those of the conglomerate without used foundry sand are observed. The higher penalization it seems to concern to the conglomerates of better quality. It can be concluded that structural mortar and concrete can be manufactured with UFS as a partial replacement of natural sand. A suitable recycling of the discarded foundry sand as building construction material could be suggested.

Sivakumar Naganathan et al., (2013), Fly ash from thermal plant is used as partial substitute for cement. Fly ash is used as received and also processed by grinding. The study involves four replacement levels of fly ash into cement at 10%, 20%, 30% and 40% for each mix design. Mortar cubes are tested for strength, water absorption and sorption. Water absorption and sorption show a decreasing trend with the increase of fly ash fineness; whereas the strength increases with the increase of fineness. It is concluded that increasing the fineness of fly ash increases the strength and reduces absorption by 15% and hence is an effective method to improve its performance in cement mortar.

V G. Havanagi, et al., (2013),Rapid industrialization and large scale infrastructural development in India, has resulted in huge scarcity of construction materials and tremendous increase in the environmental pollution. The government is strictly implementing already laid down guide lines for sustainable development. There is a thrust to investigate the feasibility of local soil and industrial waste materials to replace the conventional construction materials. Different industrial by products viz. copper slag, zinc slag, steel slag, jarofix, pond ash, red mud, jarosite, lead slag etc. are produced in the country as waste materials. Copper slag and zinc slag are waste materials generated during the extraction of metals from their respective ore. Steel slag is generated from iron and steel industries. Similarly, pond ash is a waste generated from the coal based thermal power station. In this study, four different waste materials viz. copper slag, zinc slag, steel slag and pond ash were collected from different industries in the country and were investigated for their suitability in road embankment and sub grade layers. Design and stability analysis of embankment was carried out under different saturation, traffic and seismic conditions. The suitability of these waste materials as a replacement of fine aggregate in base and bituminous layers was also investigated. The paper presents the results of physical, chemical and geotechnical properties of these waste materials and was compared with the characteristics of conventional local soil. It was concluded that all waste materials have potential for the construction of road embankment, while copper slag and zinc slag may be used as a partial replacement of fine aggregate for the construction of sub base, base and bituminous layers.

Mostafa Khanzadi et al., (2010), Nano particles have been gaining increasing attention and have been applied in many fields to fabricate new materials with novel functions due to their unique physical and chemical properties. In this paper the influence of nano silica particles on the mechanical properties and durability of concrete has been studied through measurement of compressive and tensile strength, water absorption, and the depth of chloride penetration**.** The experimental results show that the mechanical properties measured, and the durability of the concrete mixed with the nano particles were better than that of a plain concrete, also

the SEM study of the microstructures showed that the nano particles filled the cement paste pores and, by reacting with calcium hydroxide crystals from calcium silicate hydration, decreased the size and amount of these crystals. Therefore the results indicate that nano scale silica behaves not only as a filler to improve microstructure, but also as an activator to promote pozzolanic reaction.

Akshay C. Sankh et al., India ranks fourth in terms of total foundry production (7.8 million tonnes) according to the 42nd Census of World Casting Production of 2007. Foundry sand which is very high in silica is regularly discarded by the metal industry. Currently, there is no mechanism for its disposal, but international studies say that up to 50 percent foundry sand can be utilized for economical and sustainable development of concrete. There is improvement in the compressive strength and flexural strength of the concrete by partial replacement of foundry sand with sand. It is observed that there is increase in compressive and flexural strength with increase in foundry sand replacing natural sand. The maximum compressive strength and flexural strength obtained at 50% replacement of natural fine aggregate with used foundry sand.

III. CONCLUSION

According to the obtained test results, it can be concluded that structural mortar and concrete can be manufactured with UFS as a partial replacement of natural sand. A suitable recycling of the discarded foundry sand as building construction material could be suggested. The fresh concrete data shows that all mixtures, containing UFS, require high superplasticizer dosage in order to maintain a good workability. Substantially, UFS addition gives low slump (or slump flow) mainly due to the presence of very fine binders. As far as mechanical performances it concerns, mortars containing UFS at water cement ratio equal to 0.5 show a compressive strength lower by about 20-30% compared to that of the reference mix.

Same percentage could be reached in concrete at the same water cement ratio. The modulus of elasticity doesn't vary significantly; in the highest penalization it is about the 94% of the elastic modulus of the control mix. Drying shrinkage increases with the decrease of mechanical performances. More investigations are focusing to clarify the influence of UFS on the cement hydration kinetic and on the opportunity to clean UFS from the fine binder.

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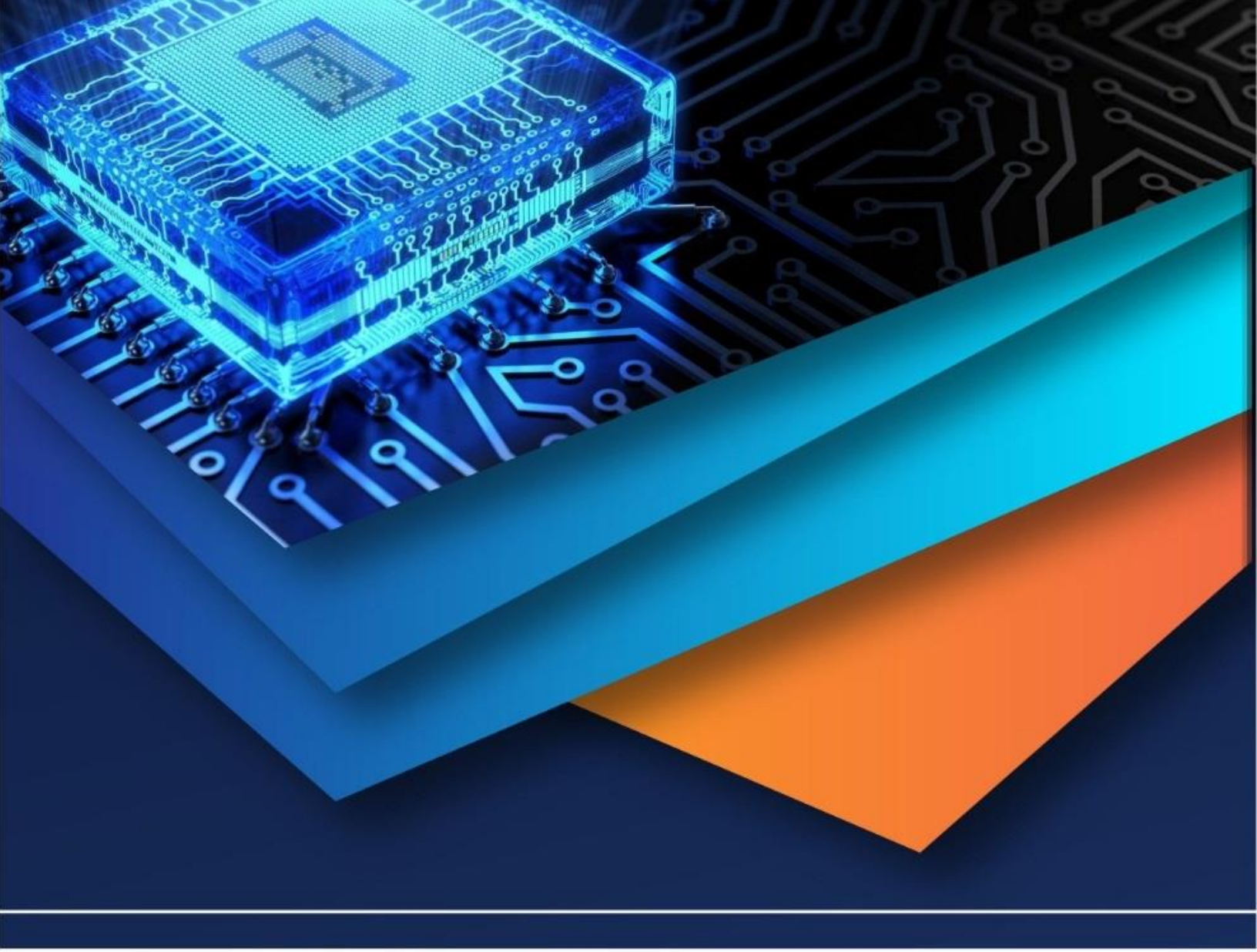

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