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Study of behaviour of concrete when replacement of fine aggregate with other materials

Amol Srivastava[1], Amit kumar[2], Amit Bharti[3], Ankur Chaurasiya[4]

([1,2,3,4]Civil Engineering, NIET, Greater Noida, Uttar Pradesh, India)

ABSTRACT

With increase in the demand of aggregate specially fine aggregate and decrease in its availability, there is immediate need for finding suitable alternatives which can be replace partially or completely Many research studies investigates the effect of several waste product such as glass sheet powder,Incinerated sewage sludge ,crushed rock flour, building demolition waste in the partial replacement of river sand.Over burnt bricks,glass powder and ceramic dust can be the best alternative of fine aggregate. This paper deals with experimental study on mechanical strength property of specific grade of concrete when replacement of fine aggregate with other materials.With increase in the demand of aggregate specially fine aggregate and decrease in its availability, there is immediate need for finding suitable alternatives which can be replace partially or completely.Many cement of fine aggregate with other materials. The optimum of percentage addition of other materials is analyzed.

Keywords:Best alternative, partial replacement,specific grade

I.INTRODUCTION

Cement is the binder substances that sets and hardens and might bind other alternative material as replacement of fine aggregate too.Ceramic waste, over burnt bricks, glass powder and other materials can be use as replacement of fine aggregate in the concrete .Ceramic waste is an inorganic,non-metallic,solid material comprising metal, non metal or metalloid atoms primarily held in ionic and covalent bonds.

In India ceramic production is 100 millions tons tons per year.In this industry about 15% to30% production goes as waste.This waste is not recycled in any form at present.However the ceramic waste is durable,hard and highly resistant of biological, chemical and physical degradation this leads to serious environment and dust pollution occupation of vast area land.The advancement of concrete technology can reduce the consumption of natural resources.Ceramics waste can be used as a partial replacement of cement or fine aggregates as a supplementary addition to achieve different properties of concrete.

There are also various material which we can use as replacement of fine aggregate and can be analyzed to find out the optimum value percentage and demand of concrete industry can be fulfilled as concrete industry require huge amount of fine aggregate nearly 10 billion tons of fine aggregate.

In general , concrete is a made up of basically three components namely water, aggregate (rock , sand or gravel) and cement all have their own distinct properties compromise poured and harden into the durable material . Here the discussion is basedon depletion of natural fine aggregate by extracting it in an in – ecological way. Due to this ecological imbalance, in India, the government has banned the illegal extraction of natural sands in maximum areas. To overcome from this scarce and high cost incurred, fine aggregate should be replaced with other materials. In India numbers of waste materials are produced by different manufacturing companies, thermal power plant, municipal solid wastes and other wastes. Solid as well as liquid waste management is one of the biggest problems of the whole world. With disposal of waste in to the land causes serious impact on environment. It spoils the land. This paper is based on the review of literature which gives the idea about different waste available and possibility of use of this waste material in concrete.

Use of concrete is very large so availability of natural material is reduced and there is no material which plays the role of this ideal material (concrete) so to full fill the requirement of industries we have to replace fully or partially the fine aggregate whose quantity is reducing but increasing demand.

II.OBJECTIVE

1.To effectively utilize the waste materials.

2.To conduct the various test to find out the optimum value of replacement of fine aggregate with other materials.

3.To reduce the problem of disposal of industry waste.

III.LITERATURE REVIEW

1.**G.Sivaprakas,v. Sarvana kumar and lakhi jyoti saika**,"Experiment study on partial replacement of sand by ceramic waste in concrete"(2016) says clearly that it can be used as replacement,10% to 20% strength.

2**.Monshi and Asgargani(1999)** producing portland cement from iron and steel slag after magnetic separation are mixed with limestone of six different composition.Samples with higher lime saturation factor developed higher C3S content and better mechanical properties.From the six different mixture of lime stone,blastfurnace slag, and converter slag,samples M3,M5 and M6 showed relatively good mechanical property

3.**Abdullah Anwar et al.2** teammates stated that marble dust powder is now days intensely focused research topic in which many problem related to environmental well as civil engineering are associate

They stated that marble dust powder is settled by alleviation then drop away which end up in environmental contamination additionally to forming dust in summer and threatening each agriculture and public goodness.

4.**osmanSimsek et al.3** mates investigated that sulphate resistance of cement mortar when subjected to different exposure condition.They added that cement mortar were prepared using ground waste brick as apozzolanic partial replacement for cement at replacement levels of 0%,2.5%,5%,7.5%,10%,12.5%and 15% and mortar and mortar specimen stored under three condition: continuous curing in lime saturated tab water(TW), continuous exposure to 5%sodium sulphate solution(SS), and continuous exposure to 5% ammonium nitrate solution(A), at

a temperature of 20 degree celcius approx for 7, 28,90 and 180 days. They also stated that prism with dimension of 25*25*285mm, to determine the expansion of mortar sample; and another determined that the GWB replacement ration between 2.5%,and 10 % decreased the 180 days expansion values. They concluded that higher compressive strength values were found for the samples with 10% replacement ratio in the TW,SS, and AN conditions for 180 days and the microstructure of the mortars were investigated using scanning electron microscopy (SEM) and the Energy dispersive X-ray(EDX).

5.**C Meyer et al. [9]** studied that the reuse of waste glass poses a major problem in large municipal areas of the United States. They stated that the post-consumer glass is often mixed-color and commingled with plastics and metals, contaminated with other materials like ceramics and organic matter and partially broken & this reduces its value and complicates the ability to achieve the cullet specifications of bottle manufacturers or other markets such as the construction industry. They studied that most of these markets make little use of the inherent chemical and physical properties of glass; therefore its market value is very low. they investigated that specific products such as paving stones, concrete masonry blocks, terrazzo tiles, and precast concrete panels are close to commercial production. In their research, they concluded the various steps that need to be taken by recyclers like to collect the glass, separate it from the other materials, clean it and crush it to obtain the appropriate grading to meet the Specification for specific application.

6. **Somani et al. (2016)** conducted experimental investigations to study the impact of the partial replacement of coarse aggregate by demolished waste. Workability and compressive strengths were used as performance indicators. For the study 3, 7 and 28 days compressive strengths were recorded. The previous study on the same topic had shown that if demolished aggregate concrete is used upto 30%, its compressive strength was similar to the conventional concrete. So in this study we have taken the demolished concrete aggregate 10%, 20%, 30% by weight of the conventional coarse aggregate and the concrete cubes were cast by that demolished concrete aggregate then further tests conducted such as workability , compressive strength for that DAC and the result obtained are found to be comparable with the conventional concrete.

7.**Adigun (2013)** performed a study to investigate the economic gain of replacing sand with Crushed Granite Fines in the production of concrete. Compressive strength and slump tests were performed on fresh and hardened concrete using two nominal mixes of 1:1:2 and 1:1½: 3 with the sand component being partially replaced with Crushed Granite Fines. When sand was partially replaced with 25 – 37.5% Crushed Granite Fines compressive strength values exceeding 30 N/mm² and 35 N/mm² were obtained for nominal mixes of 1:1:2 and 1:1½: 3 respectively. Based on the economic analysis of the test results, replacement of sand with 25 – 37.5% Crushed Granite Fines is recommended for use in concrete production.

8. **Abuamer and Sadat et al. (2017)** performed case study in Istanbul involving traffic data. They performed statistical tests on volume count and speed values obtained from radar sensors. Thus this study we performed statistical analysis of data comprised of compressive as well tensile strengths of the sample cubes.

9 **Ankit Nileshchandra Patel et al. [5]** researched that stone waste is one of the most active research areas that encompass a number of disciplines including civil engineering and construction materials. They stated that the stone dust is settled by sedimentation and then dumped away which results in environmental pollution, in

addition to forming dust in summer and threatening both agriculture and public health & therefore, utilization of the stone dust in various industrial sectors especially the construction, agriculture, glass and paper industries would help to protect the environment. They stated that, it is most essential to develop eco-friendly concrete from stone waste & in their research study, the (PPC) cement has been replaced by stone waste accordingly in the range of 0%, 10%, 20%, 30% 40%, & 50% by weight for M-25 grade concrete & concrete mixtures were produced, tested and compared in terms of workability and strength to the conventional concrete. These tests were carried out to evaluate the mechanical properties for 7, 14 and 28 days & as a result, the compressive strength increased up to 20% replacing of stone waste. This research work is concerned with the experimental investigation on strength of concrete and optimum percentage of the partial replacement by replacing (PPC) cement via 0%, 10%, 20%, 30%, 40% and 50% of stone waste. The aim of their investigation was to check the behavior of concrete while replacing of waste with different proportions of stone waste in concrete by using tests like compression strength.

10.**Candra Aditya et al. [6**] researched on alternative materials primarily from waste have been additional material at area manufacture of building materials, especially concrete roof tile. Their research would expand utilization of marble waste in East Java region of Indonesia in the manufacture of concrete roof tiles by combining the use of sand and waste marble powder as a substitute for river sand and portland cement. Their research would create a material innovation product of environmentally friendly with relatively low prices without compromising quality. The purpose of their research was to find the composition of the mixed-use waste marble tile that produces the most optimal strength & experimental method used in this study to test the basic material and test physical and mechanical properties of concrete roof tiles (bending loads , water absorption and resistance to water seepage) in accordance with ISO 0096 :2007 with eight variations in material composition .They stated that the concrete tile with marble waste produces a lighter weight 3.6 % - 12.3 % & replacement of PC with marble powder by 20 % qualify flexural strength , water absorption (no more than 10 %) and there is no seepage within 20 hours ± 5 minutes .They concluded that composition tile marble concrete using waste as a substitute for river sand PC and a decent and qualified SNI 0096:2007 is a composition of 0.8 PC : 0.2 SL : 1 Ps : 2 PSL and composition 0.8 PC : 0.2 SL: 3 PSL , while most optimum is 0.8 composition PC : 0.2 SL :1 Ps : 2 PSL which produces Flexture1141 N.

11.**Vilane, B. R. T., & Sabelo, N. (2016).**The Effect of Aggregate Size on the Compressive Strength of Concrete. Journal of Agricultural Science and Engineering, 2(6), 66-69.

12.**Karuna Devi, K., Arun Kumar, & S.Balaraman, R.(2017)**. International Journal of Civil Engineering and Technology, 8(8), 520-536.

IV.METHODOLOGY

1.Identification of problem(demand of fine aggregate).

2.Literature reference(characteristics properties of materials).

3.Procurement of materials.

4.Testing of materials.

5.Mix design calculation.

6.Casting and curing.

7.Testing of specimen.

8.Result of discussion

V.CONCLUSION

After studying various research paper,we have got that there are various alternative with optimum number of percentage of fine aggregate can be used and we can overcome with problem of scarce of fine aggregate and fulfil the high demand of fine aggregate.We can say that replacement of fine aggregate with other materials does not much effect behaviour of concrete ,it can be worked out if optimum percentage is replaced.The material used as fine aggregate are mostly waste product and so using such waste product in concrete can solve the problem of waste product disposal in country like India.The use of stone dust and blast furnace slag in the concrete is beneficial in a different manner such as environmental aspects, non availability of good quality and good strength of fine aggregate.

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