ISSN: 2347-6540

International Journal of Latest Research In Engineering and Computing (IJLREC)
Volume 5, Issue 3 , Page No. 91-94 May-June 2017
www.ijlrec.com

A REVIEW STUDY ON THE STRENGTH OF CONCRETE BY REPLACING THE FINE AGGREGATE WITH FOUNDARY SAND

Rouoof Ahmed Malik[1], Er. Sarvjeet singh[2]
M.Tech Scholar in GEC, Panipat,
Assistant Professor in Civil Engineering, GEC, Panipat

Abstract: Now days, the construction sector is exploring rapidly on a large scale and also involves new techniques for rapid and comfort works on the field. Concrete as a building material plays an important role in this sector. The consumption of natural resources as an ingredient of concrete, costs high as well as it is on verge of extent. These problems force us to recover the natural resources or to find an alternative option to overcome this problem. Presently, the production of waste foundry sand as a by-product of metal casting industries causes various environmental problems. Foundry sand is basically high quality silica sand which is a by-product of both ferrous and non-ferrous metal casting industries. This paper reviews the Utilization of waste foundry sand in Civil Engineering field. It comprises the important findings from the experimental works of many researchers. Due to over dependence on non-renewable energy material is becoming an imminence and therefore it is necessary to look for the possibility of recycling. Generation of waste foundry sand as by-product of metal casting industries causes environmental problems due to its inappropriate disposal so it can be used as a partial replacement of the fine aggregate with the foundry sand in concrete. It was observed that about 15-30% of replacement of fine aggregate to waste foundry sand gave good result for all practical purpose.

Keywords: Waste foundry sand, cement concrete, Silica sand

1.0 INTRODUCTION

In twenty first century construction industries plays vital role in development of infrastructure sector. The use of natural resources as natural sand in concrete. The cost of concrete also very high, these problems can recover to use waste material. Now days huge production waste material from metal industries used foundry sand as byproducts of metal industries cause varies environmental problems. To use these waste of products in building material can help in reduction of stress on environment. Metal industries can used as silica sand which is uniform size, high quality silica content that is bound to form mould for casting of ferrous & non ferrous metal. Sand is used for metal casting industries, finer than normal sand natural sand. After the metal casting processes burnt sand is cannot be longer used it is removed from foundry as a waste for disposed known as " waste foundry sand " the used waste foundry sand as a partial substitutes or total substitutes by fine aggregate in concrete leads in production of economic, light, weight, high strength of concrete. The Concrete is a material which is composed of coarse aggregate, fine aggregate, cement & water each material in concrete contributes its strength or durability of so, by partial or material which harms the environment can be used for the development of low cost & eco-friendly building materials .

Waste Foundry Sand (WFS) is generated by industries that use sand to form moulds and cores for castings. There are about 6000 foundries in India, which is placed as rank three in the global position in terms of casting production in a year [18]. India is currently producing nearly 10 million metric tons in a year and has generated export revenue of Rs.12180 crores. Indian Foundry Industry has targeted to produce about 20 million metric tons in the year 2020.To achieve this target it has planned to pump 20,000 crores rupees in Indian Foundry Industry. This is a high volume waste and in most cases is non-hazardous. Over the past few years foundries have seen the cost of operations increase and the demands for castings decrease. One area which is being looked at by the foundry manager today is in cutting the cost of waste disposal. The scarcity of landfill space has also resulted in costly land disposal facilities. This turn of events has fostered new and innovative approaches to cost control. Constructive applications of foundry wastes may include use in embankments, sub-grades, Sub-bases, backfills, Portland cement kiln feed, Portland cement concrete aggregate, aggregates for bituminous mixtures, rock wool silica and alumina additive, and, snow and ice abrasive. In view of the benefits to be gained from the utilization of WFS as a construction material, research on this subject is desired. Unfortunately, an extensive review of the literature reveals that the amount of laboratory and field data on the properties and performance of this material for highway purposes is very limited. In order to develop constructive uses of foundry sand, a substantial database on their properties is needed. This study presents a review of available information on the WFS, their generation process including molding and casting processes, potential variables, environmental concerns and beneficial uses of waste foundry sand.

2.0 LITERATURE REVIEW

Khatib and Baig investigated fresh and hardened properties of concrete containing waste foundry sand (WFS) replaced with 0 to 100% with fine aggregate. The water to cement for all mixes was kept constant. Testing on hardened properties was mainly conducted at 14, 28 and 56 days. The results show that the incorporation of waste foundry sand in concrete causes a systematic decrease in workability, ultrasonic pulse velocity and strength and an increase in water absorption and shrinkage of concrete. They also reported that an acceptable concrete strength can be achieved using foundry sand.

Kumbhar investigated the various mechanical properties of concrete containing used foundry sand. Concrete was produced by replacing natural sand with UFS in various percentages (10%, 20%, 30% and 40%). Based on the test results they concluded that (i) workability goes on reducing with increase in UFS content; (ii) At 28-days, Compressive strength, splitting tensile strength and flexural tensile strength for different replacement levels of UFS is increased whereas flexural tensile strength goes on reducing for UFS content more than 20%; (iii) At 28-days, the modulus of elasticity values increases with replacement of UFS up to 20%. They also concluded that the UFS can be utilized as a replacement to regular sand in concrete up to about 20%.

L Da Silva et al investigated the influence of the use of foundry sand waste (FSW) on concrete properties. The properties on the fresh state were evaluated by means of flow table test and the determination of the incorporated air content. On the hardened state, compressive strength tests were performed. Their initial results have shown that the use of FSW leads to an increase in the air content and cracking, caused by expansive reactions. As a result of that, a reduction in the compressive strength has been noticed. They added that the application of mixtures made with FSW becomes risky as to the structural and durability requirements. However they also added that their work may not be generalized, because the FSW composition varies according to the manufacturing process and in all cases it is advisable to carry out preliminary tests in order to verify the effects caused by the use of FSW in the concrete production.

Gurpreet Singh et al investigated the strength and durability properties of concrete mixtures, in which natural sand was replaced with five percentages (0%, 5%, 10%, 15% and 20%) of waste foundry sand (WFS) by weight. Compression test and splitting tensile strength test were carried out at the age of 7, 28 and 91 days and Modulus of elasticity; ultrasonic pulse velocity and Rapid Chloride Permeability test were conducted at the age of 28 and 91 days. The abrasion resistance of concrete containing WFS was also investigated. Based on the results obtained they concluded that

- Maximum increase in compressive strength, splitting tensile strength and modulus of elasticity of concrete was observed with 15% WFS, both at 28 and 91 days;
- WFS increases the ultrasonic pulse velocity values and decreased the chloride ion penetration in concrete;
- Abrasion resistance of concrete increased with the increase in WFS content. They also added that WFS can be suitably used in making structural grade concrete, as well as for applications where abrasion is also important parameter.

Khatib et al investigated the concrete produced by replacing the fine aggregates with 0%, 30%, 60% and 100% WFS. The water content, coarse aggregate, cement and the water to cement ratio remained constant. The properties investigated at 7, 28 and 90 days curing times. The results indicate that there is systematic increase in water absorption by capillary action, a decrease in compressive strength and Ultrasonic pulse velocity with increasing amounts of WFS in concrete. They also reported that adequate strength can be achieved using an appropriate replacement level of foundry sand.

Eknath et al investigated the comparative study of the properties of fresh & hardened concrete containing ferrous & non-ferrous foundry waste sand replaced with four (0%, 10%, 20% and 30%) percentage by weight of fine aggregate & tests were performed for M20 grade concrete. Result showed that

- addition of both foundry sand gives low slump mainly due to the presence of very fine binders;
- Compressive strength at 7 days of both ferrous & nonferrous mixtures increases and maximum increase was observed with 20% WFS of both types of sand, at 28 days 30% addition of ferrous WFS & 10% addition of nonferrous WFS gives same strength as ordinary concrete and goes on decreasing for higher percentages of replacement;
- Split tensile strength gives maximum values with 20% WFS for both types of sand;
- Water absorption is minimum with 20% ferrous WFS & with 10% nonferrous WFS. They also reported that both ferrous & nonferrous WFS can be suitably used in making structural grade concrete.

B. J. Lee et al investigated the physical and chemical properties of concrete containing waste foundry sand as a partial replacement to natural sand. Strength and durability properties were evaluated in order to determine the influence of waste foundry sand on the behavior of concrete. From their study it was concluded that, control mix shows almost equal strength as that of the concrete mix with 30% of WFS. The durability properties of concrete mixtures containing waste foundry sand also showed a similar trend in their results as that of mechanical properties. From the entire test

results it was concluded that, the concrete mixture containing 30% replacement of WFS can be effectively used in the construction industry without affecting the strength and durability properties of the concrete.

J. M. Khatib et al investigated the properties of concrete incorporated with waste foundry sand. In their research fine aggregates were replaced with 0%, 30%, 60% and 100% WFS. Water content, water to cement ratio, cement content and coarse aggregate content were kept constant throughout the research. The properties like compressive strength, water absorption, ultra-sonic pulse velocity were studied at different curing periods (7, 28 and 90 days). The results showed that due to capillary action there was a systematic increase in water absorption. Compressive strength and ultrasonic pulse velocity indicated a decreasing trend in their values with the increase in waste foundry sand (WFS) content. They also concluded that sufficient strength can be attained by suitable replacement of WFS.

R. Siddique et al. In this literature the investigators have shown that WFS can be effectively used in the production of low strength concrete. The study concludes that, with the increase in waste foundry sand the fluidity and the slump value of the fresh concrete decreases. It is due to the presence of clayey particles in foundry sand. Water absorption capacity showed a decreasing trend in their values with the increase in WFS content. Strength properties increased significantly when higher amount of WFS was used. The result of various studies indicates that WFS can be effectively used for the production of concrete and other materials of high quality.

S. Monosi et al investigated the fresh and hardened properties of mortars and concretes containing different dosages of waste foundry sand (WFS) as partial replacement of natural river sand. Mortars and concretes were evaluated with respect to the uniformity of fresh mix and compressive strength of the hardened concrete material. Dynamic elastic modulus was determined for different concrete mixtures at 28 days curing. The performance of mortar at lower percentage of waste foundry sand doesn't indicate much variation. The test results showed that with the addition of WFS the resultant mixture gives low slump values mainly due to the presence of fine clay binders. Therefore, higher dosage of super plasticizer is needed in order to maintain the workability as constant. Compressive strength of mortars containing WFS at water cement ratio 0.5, showed a decrease of 20-30% when compared to the control mix. Drying shrinkage increases with the increase in WFS content and this increase was systematic.

T. A. Naik et al investigated the fresh and hardened properties of concrete containing waste foundry sand as a replacement of fine aggregate. Regular concrete sand in the concrete mixes were replaced with 25% and 35% of waste foundry sand and clean foundry sand by weight. The results indicated that the concrete mixture containing 25% of WFS showed an increase in their values by 10% when compared to the concrete mixture containing 35% of WFS. Compressive strength of the control mix was about 20-30% higher than the mixes containing waste foundry sands. The test results also indicate that there was not much difference in the values of density for both hardened and fresh concrete.

Bakis investigated the use of waste foundry sand (WFS) in asphalt concrete. Asphalt concrete mixtures were pre-pared with 0%, 4%, 7%, 10%, 14%, 17%, and 20% replacement of fine-aggregate with WFS. Grain size of the WFS ranged between 0.8 and30 mm. Tests were performed for the measurements of flow value sand Marshall Stability. The results showed that (i) replacement of10% aggregates with waste foundry sand was found to be most suitable for asphalt concrete mixtures; and (ii) waste foundry sand did not significantly affect the environment around the deposition.

Fiore and Zanetti studied the foundry sand reuse and recycling. They investigated the foundry sand of varying sizes. On the grounds of the gathered results, they concluded that residues may be divided in three categories according to the particle-size dimensions: below 0.1 mm, between 0.1 and 0.6 mm, and above0.6 mm. The fraction above 0.6 mm, mainly made of metallic iron, may be reused in the furnaces. The fraction between 0.1 and0.6 mm may be reused in cores production, after a regeneration treatment. The fraction between 0.1 mm and 0.025 mm may be recycled as raw material for the concrete industry, and the below0.025 mm fraction may be reused in green moulding operations. An economic evaluation of the proposed reuse and recycling solutions was performed

CONCLUSION

After reviewing the various studies, following points are concluded:

1. The Compressive strength of concrete increases with the increase in sand replacement with different replacement levels of foundry sand.
2. Waste foundry sand can be efficacious used as fine aggregate in place of regularly river sand in concrete.
3. Use of foundry sand in concrete reduces the production and disposal of waste through metal industries.
4. Split Tensile Strength also increased with increase in age.
5. Substitution of foundry sand in concrete decreases Compaction factor of concrete.
6. It is founded that use of foundry sand could be very conventionally used in making good quality concrete and construction materials
7. Earthquake resistant buildings can't be made by the use of foundry sand.
8. A better measure by an innovative Construction Material is formed through this research

REFERENCES

1. Bindu C.S.(2015), "Influence of Waste Materials on Flexible Pavement Construction" Indian Journal Of Applied Research, Vol.5, Issue 9, pp.427-430

2. Brajesh M and Ravi S.M.(2015) "A Study on Use of Industrial Wastes in Rural Road Construction" International Journal of Innovative Research in Science, Engineering and Technology, Vol.4, Issue 11, pp. 10387-10398

3. Debashish K., Mahabir P. and Jyoti P.G.(2014), "Influence Of Fly-Ash As A Filler In Bituminous Mixes" ARPN Journal of Engineering and Applied Sciences, Vol.9, Issue 6, pp.895-900

4. Dipu S., Mintu M., Golam J. C. and Mohd A.S.(2015) "Effect of Using Waste Material as Filler in Bituminous Mix Design" American Journal of Civil Engineering, Vol.3, Issue 3, pp.88-94

5. Gautam D., Patel V.M., Dhval M.P. and bhupesh K.(2015), "Comparative study on Use of Foundry sand as alternative filler in Micro-surfacing incorporating Type-III aggregate" Indian Journal Of Applied Research, Vol.5, Issue 1, pp. 81-83
6. Tarun R. Naik, Viral M. Patel, Dhaval M. Parikh, Mathew P. Tharaniyil, "Utilisation of used foundry sand in concrete", Journal of Materials in Civil Engineering, Vol. 6, No. 2, May, 1994.
7. Foundry Industry Recycling Starts Today (FIRST), Foundry Sand Facts for Civil Engineers, Federal Highway Administration Environmental Protection Agency Washington, DC; 2004.
8. Han-Young Moon, Yun-Wang Choi, Youg-Kyu Song and Jung-Kyu Jeon, "Fundamental properties of Mortar and Concrete using waste foundry sand", Journal of the Korea Concrete Institute, Vol.17, No.1, pp.141-147, February 2005.
9. Rafat Siddique, Geert de Schutter, Albert Noumowe, "Effect of used-foundry sand on the mechanical properties of concrete", Elsevier, Construction and Building Materials 23 (2009) 976–980.
10. Eknath P. Salokhe, D. B. Desai, "Application of foundry waste sand in manufacture of concrete", IOSRJMCE, ISSN: 2278-1684, PP: 43-48.