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A SURVEY OF TECHNOLOGY FOR UTILIZATION OF FOUNDRY SAND

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Abstract:

The management of solid industrial waste is of big global concern nowadays. Due to ever increasing quantities of waste materials and industrial by-products, solid waste management is the prime concern in the world. Scarcity of land-filling space and because of its ever increasing cost, recycling and utilization of industrial by-products and waste materials has become an attractive proposition to disposal. There are several types of industrial by-products and waste materials. The utilization of such materials in concrete not only makes it economical, but also helps in reducing disposal concerns. One such industrial by-product is waste foundry sand. Foundry sand, which is a byproduct of ferrous and nonferrous metal casting industries. Applications of foundry sand, which is technically, sound, environmentally safe for sustainable development. Land filling of used foundry sand not only causes significant economic burden to the foundries but is also a loss of energy and natural resources. So we need to find out beneficial applications of foundry sand in concrete. It is also rich in silica and alumina so it is used as a partial replacement of fine aggregate in conventional concrete.

1. Literature Review:

Mahima Ganeshan (2016) studied the making of commercially available solid masonry blocks to high strength so that it can be used in load bearing structures and replacement of fine aggregate in these blocks with waste foundry sand. Although many studies have been formulated using waste foundry sand in concrete, no such study has been reported so far with solid masonry blocks. It was inferred that about 20 to 30 percent of replacement of fine aggregate to waste foundry sand gave good results for all practical purposes. Incorporation of waste foundry sand increases the strength of blocks and optimum percentage of replacement was found between 20 to 30 %.

Janardhanan Thaarrini (2016) presented a feasibility study on the manufacture of geopolymer concrete at low concentrations of alkaline solutions and lower densities and incorporating waste products like Foundry sand without compensating for the strength properties. Ground Granulated Blast Furnace Slag (GGBFS) and Bottom ash (BA) were used as source materials. Test results show that satisfactory strength properties of geopolymer concrete using Foundry sand can be achieved even with lower concentrations of NaOH solution under ambient curing conditions. This would pave way for creating a greener environment by the efficient use of by-products and waste materials in concrete. The addition of Foundry sand up to 50% replacement for river sand does not affect the strength of geopolymer concrete.

Kewal (2015) analyzed the effect of fly ash based Geo polymer concrete with replacement of foundry sand by different percentages. For a specific mix design more than 30 MPA, Different mix proportions shall be prepared by using different molarity of sodium hydroxide solution, and then replace with the foundry sand in the different proportion. Tests will be performed for the compressive strength of concrete, Compressive strength test will be performing for at 7 and 28 days.

Kewal (2015) discussed that the partially replacement of fine aggregate in Geopolymer paver block by used foundry sand for determining the change in the compressive strength of paver blocks and cost of paver block. Partial replacement of fine aggregate in different percentage as like 0%, 20%, 40%, 60%, 80% and 100%. The compressive strength has been determined at the end of 7, 14 and 28 days and water absorption test has been determined at 28 days. The Compressive strength of Geopolymer Paver Block was found to be decreasing with replacement of foundry sand. Up to 60% replacement of fine sand by foundry sand gives slightly high compressive strength was found to be optimum.

Chinmay Buddhadev (2015) investigated the effect of waste foundry sand as partial replacement of fine aggregates in various percentages, on concrete properties such as mechanical (compressive strength, splitting tensile strength and flexural strength) and durability characteristics (rapid chloride penetration and deciding salt surface scaling) of the concrete. For M20 and M25 grade concrete, the optimum sand replacement proportion is generally 20 - 25%. Moreover, generally the sand can be replaced till 30 - 40% by foundry sand in concrete. Replacement of sand by foundry sand beyond 40% leads to decrease in strength and causes bleeding in concrete.

Dixit N. Pate (2014) evaluated the partial replacement of Cement (PPC 53 grade cement) in paver block by used foundry sand for determining the change in the compressive strength of paver blocks and cost of paver block. Partial replacement of cement (PPC 53 grade cement) in bottom layer in different percentage as like 10%, 20%, 30%, 40% and 50%. The compressive strength, flexural strength has been determined at the end of 7, 14 and 28 days and water absorption test has been determined at 28 days. Even though at extent of 50 % replacement of cement, compressive strength of 23.48 N/mm2 was obtained. So it's beneficially for general application as like footpath, parking, and street road.

Yogesh Aggarwal (2014) examined the effect of waste foundry sand and bottom ash in equal quantities as partial replacement of fine aggregates in various percentages (0–60%), on concrete properties such as mechanical (compressive strength, splitting tensile strength and flexural strength) and durability It was observed that the greatest increase in compressive, splitting tensile strength, and flexural strength compared to that of the conventional concrete was achieved by substituting 30% of the natural fine aggregates with industrial by-product aggregates. The mixes can be developed by varying the water content at constant rate as specified in the study till 30% and thereafter till 50% replacement of fine aggregates.

Hanan A. El Nouhy (2013) described the effect and possibility of using Portland slag cement in the production of interlocking paving units. The first mix was the control mix, in which Portland cement was used in the two layers. In the second mix, Portland slag cement was used in the upper layer, Portland cement was used in the backing layer. In the third mix, Portland cement was placed in the upper layer, while Portland slag cement was used in the backing layer. Finally, in the fourth mix, Portland cement was fully replaced by Portland slag cement in both layers. Tests were carried out in order to investigate the properties of the manufactured specimens at ages 28 and 180 days, respectively. The results indicate that it is feasible to use Portland slag cement in the manufacture of paving blocks as the conditions of the conducted tests were satisfied at age180 days except for the minimum splitting tensile strength test. Compressive strength requirement was almost met when slag cement was used in the upper layer at age 180 days.

Rafat Siddique (2011) presented an overview of some of the research published on the use of WFS in concrete. Effect of WFS on concrete properties such as compressive strength, splitting tensile strength, modulus of elasticity, freezing-thawing resistance, and shrinkage are presented. Waste foundry sand (WFS) is by-products from foundries. It exhibits lower unit weight, higher water absorption, and higher percent void compared to regular concrete sand. Strength properties results indicate that waste foundry sand could be very conveniently used in making good quality concrete and construction materials.

Rafat Siddique (2009) carried out the mechanical properties of concrete mixtures in which fine aggregate (regular sand) was partially replaced with used-foundry sand (UFS). Fine aggregate was replaced with three percentages (10%, 20%, and 30%) of UFS by weight. Tests were performed for the properties of fresh concrete. Compressive strength, splitting- tensile strength, flexural strength, and modulus of elasticity were determined at 28, 56, 91, and 365 days. Test results indicated a marginal increase in the strength properties of plain concrete by the inclusion of UFS as partial replacement of fine aggregate (sand) and that can be effectively used in making good quality concrete and construction materials. Increase in compressive strength varied between 8% and 19% depending upon UFS percentage and testing age, whereas it was between 6.5% and 14.5% for splitting-tensile strength, 7% and 12% for flexural strength, and 5% and 12% for modulus of elasticity.

2. Conclusion:

Many guidelines are reviewed regarding partial replacement of fine aggregate by foundry sand of different cases. Some of the researchers discussed the various concrete properties such as compressive strength, splitting tensile strength and flexural strength. For concrete 30% replacement of fine aggregate to waste foundry sand in concrete is Optimum, it gave good results for all practical purposes. For paver block up to 60% replacement of fine sand by foundry sand gave high compressive strength was found to be optimum. All these topics required for further research, as it is essential for replacement of different materials.

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