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Utilization of Waste Foundry Sand in the Production of Concrete

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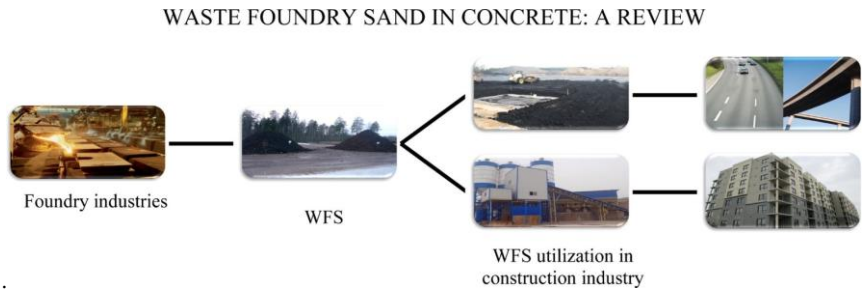
ABSTRACT

Second only to water, concrete is the most widely utilized construction material on the planet. Overexploitation of natural resources such as river sand and gravels has resulted as the rate of urbanization and industrialisation has increased, posing sustainability challenges. It's therefore more important than ever to explore for alternatives to concrete's basic ingredients. Waste foundry sand, which is a by-product of the ferrous and non-ferrous metal casting industries, is one such promising material that can be utilized as a concrete substitute for natural sand. Several studies have been undertaken in the last few decades to evaluate the effect of adding leftover foundry sand to concrete as a partial or total replacement for conventional sand. It has been discovered to be suitable for use in structural grade concrete as a partial replacement for sand. In the current paper, a number of properties have been reviewed; the findings from various studies show that replacing foundry sand improves the durability and strength properties of concrete to some extent, but simultaneously decreases the slump value as the replacement level of waste foundry sand increases



I. INTRODUCTION

Concrete is one of the most important and widely used construction materials. Incorporating waste foundry sand (WFS) into conventional concrete is a current subject of research in the concrete industry. Waste foundry sand is a by-product of the metal casting industry that, due to incorrect disposal, causes environmental issues. For M-40 grade concrete, an experimental investigation was carried out on concrete containing waste foundry sand (WFS) in the proportions of 0%, 10%, 20%, 30%, and 40% by weight. For workability, compressive strength, and split tensile strength, concrete was created, tested, and compared to ordinary concrete in both its plastic and hardened states. To assess the qualities of concrete, tests were conducted on a conventional cube and a cylinder for 7, 28, and 91 days.

In this study, natural sand and waste foundry sand were utilized to replace coarse aggregate at 10% intervals, ranging from 0% to 60%, and destroyed aggregate was used in place of natural coarse aggregate. Four sets of specimens with combinations of natural coarse aggregate and natural sand, natural coarse aggregate and waste foundry sand, demolished aggregate and natural sand, and demolished aggregate and waste foundry sand were cast in experimental work. By using the volume fraction approach, 2 percent of waste plastic is added to all of the mixes.

II. LITERATURE REVIEW

A Review on Utilization of Waste Foundry Sand for Producing Economical and Sustainable Concrete: International Journal of Advance Engineering and Research Development: Ms. Minakshi B. Jagtap, Mr. Vikram B. Gadade and Mr. Ganesh B. Salunke.

The study was conducted to find out the affect of waste foundry sand on strength properties of plain concrete. The effects of following parameters were studied. Compressive strength and Split tensile strength at various percentage replacement of fine aggregate with waste foundry sand on some of plain concrete.

Utilisation of Foundry Sand in Concrete - A Review: International Research Journal of Multidisciplinary Technovation: Sangavi D, Angu Senthil K

Fine aggregate is replaced with different proportions of waste foundry sand (0-100%). From the results obtained, the optimum % replacement of foundry sand is found to be in the range of 20% to 40% based on the grade of concrete.

A Review Study on Utilization of Waste Foundry Sand: International Research Journal of Engineering and Technology: Saif ali, Rajat Saxena, Sumit Yadav, Satyam Bhati, Nitin Kumar

Increase in the compressive strength was achieved when the replacement of foundry sand is between 10-20%. Decrease in compressive strength shown when 30% replacement done.

Effect of waste foundry sand and fly ash on mechanical and fresh properties of concrete: Research Gate: Reshma T.V, Manjunath Maddikeari , S Sankalpasri , Tanu T.M

This study reports the experimental investigation about the performance of fly ash and untreated waste foundry sand on fresh and hardened state of concrete mix. In this research, 30% fly ash is kept constant as a partial replacement of cement and Natural river sand is replaced with waste foundry sand (WFS) in varying percentages (0%, 10%, 20%, 30% and 40%) for M40 grade concrete.

EFFECT OF WASTE FOUNDRY SAND ON THE DIFFERENT PROPERTIES OF CONCRETE: INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY: Balte Sanjay Kumar & Supekar Gorakshanath Sonyabapu

The compressive strength of concrete from 0% to 15% replacement of sand by waste foundry sand is satisfactory. Replacement of natural sand with waste foundry sand showed increases in the split tensile strength and flexural strength up to the 15% replacement then after split tensile strength reduced.

UTILIZATION OF WASTE FOUNDRY SAND IN CONVENTIONAL CONCRETE: International Journal of Scientific Development and Research: Mr. Aniket Abasaheb Bandal, Mr. Suraj Laxman Patil, Mr .Rushikesh Ramrao Latpate, Mr. Saurabh Popat Bhand, Prof. Milind Manikrao Darade

Compressive strength, split tensile strength and flexural strength of concrete specimens increased, with increase in fine aggregate replacement by foundry sand, providing maximum strength at 40 % replacement on 7 and 28 days, and beyond that the strength parameters showed a decline in their respective values.

A Review on the Usage of Recycled Sand in the Construction Industry: intechopen: Parappallil Meeran Rawther Salim and Bellam Siva Rama Krishna Prasad

In these research findings, it's suggested that 10–30% fine aggregates can be replaced with used foundry sand for the manufacture of concrete and mortars with sufficient strength parameters with reduced cost.

Utilization of Industrial by-products in concrete: 2nd International Conference on Sustainable Civil Engineering Structures and Construction Materials: Raffat Siddique

Inclusion of waste foundry sand as partial replacement of fine aggregates adversely affects the slump and water absorption of the concrete. Increase in foundry sand contents increases the strength properties of concrete mixtures and also with the age. Foundry sand can be used as a replacement for regular sand and/or fly ash in making controlled low strength materials without any significant modification or adjustment.

Sustainable use of industrial-waste as partial replacement of fine aggregate for preparation of concrete – A review: International Journal of Sustainable Built Environment: Manoj Kumar Dash, Sanjaya Kumar Patro, Ashoke Kumar Rath

From this review it might be reasoned that the utilisation of copper slag up to 40% as sand substitution improves strength and durability characteristics at same workability and there is a decrease in the surface water absorption as copper slag quantity increased up to 40% replacement. Copper slag, an industrial waste material, makes it possible to produce ultra-high performance concrete.

Waste Foundry Sand Usage for Building Material Production: A First Geopolymer Record in Material Reuse: Advances in Civil Engineering – Hindawi: Evangelos J. Sapountzakis

The SiO_2/Al_2O_3 ratio in the WFS by weight was not in the range of 2–3.5. In addition to this, excessive rates of Fe_2O_3 (during metal moulding) slow down the geopolymer reaction and provide low CS in some samples (with different chemical compositions).

Used Foundry Sand in Cement Mortars and Concrete Production: The Open Waste Management Journal: Saveria Monosi, Daniela Sani and Francesca Tittarelli

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.

Experimental Investigation on concrete with replacement of Fine Aggregates by Foundry Sand and Cement by Cow dung ash: International Journal of Innovative Research in Science, Engineering and Technology: Divya.M.R, Shanmuga priya.S, Anukarthika.B

Among the various mixes it was observed at the age of 28 days the maximum strength attained at 15% of foundry sand with 10% of cow dung ash. Use of cow dung ash in higher proportion reduces the strength and hence, a constant value of 10% is maintained throughout the project. This concrete

preparation is eco-friendly and cost effective.

Utilization of Used Foundry Sand in Construction Industries: International Research Journal of Engineering and Technology: Orfanullah Usmani and Er. Deepak Guneja

Used foundry sand can be sustainable used material to replace fine aggregate in making high quality concrete. Utilization of used foundry sand increases compressive strength up to some in both ferrous & nonferrous mixtures increases as compared to conventional mixed.

Utilization of Used Foundry Sand in Concrete: Journal of Materials in Civil Engineering: Tarun R Naik, Viral M Patel, Dhawal M Parikh, Mathew P Tharaniyil.

Concrete performance was evaluated with respect to compressive strength, tensile strength, and modulus of elasticity. At 28-day age, concrete containing used foundry sand showed about 20–30% lower values than concrete without used foundry sand. But concrete containing 25% and 35% clean/new foundry sand gave almost the same compressive strength as that of the control mix.

UTILIZATION OF USED FOUNDRY SAND IN CONCRETE MIX DESIGN: International Journal of Engineering Science Invention Research & Development: Bipin Prajapati, Dr. R. P. Tiwari, Dr. A.K.Sachan

At 28-day age, concrete containing used foundry sand showed about 20–30% lower values than concrete without used foundry sand. But concrete containing 25% and 35% clean/new foundry sand gave almost the same compressive strength as that of the control mix.

III. CONCLUSION

This state-of-the-art assessment summarizes recent progress in the field of using spent foundry sand in cementitious concrete. The paper examines the use of foundry sand as a concrete element, as well as the notable and significant discoveries from various academics' experimental work. The historical development is also mentioned in the review's introduction. The authors believed it was necessary to consolidate all of the relevant discoveries for streamlining the potential of this area of research after a rigorous review of a large number of research publications on the subject. The report outlines the findings of experiments on qualities like as strength and durability. The addition or substitution of fine sand with used foundry sand in various amounts resulted in favorable alterations and improvements in the strength and durability attributes of traditional cementitious concrete. However, in a few situations, such additions have resulted in lower property prices. Based on a study of previous research, it can be concluded that using spent foundry sand has a lot of promise for the development of environmentally friendly and long-lasting cementitious concretes.

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