STRENGTH INVESTIGATION OF FOUNDRY SAND AS A REPLACEMENT OF FINE AGGREGATE

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KEYWORDS

Waste Foundry Sand, Replacement of Sand, Compressive Strength, Split Tensile Strength, Flexural Strength, and Waste Materials.

INTRODUCTION

As the population grows, the demand for housing and structures made of concrete is also rising. Concrete is a popular material for constructing infrastructure. Concrete is a combination of cement, aggregate and water. The most used fine aggregate is sand derived from riverbanks. The global consumption of natural sand is too high due to its extensive use in concrete. The demand for natural sand is quite high in developing countries owing to rapid infrastructural growth which results in supply scarcity. Therefore, it is important to search for alternate materials instead of sand. The practice of waste stuff makes concrete inexpensive, and reusing waste materials is one of the best options to resolve the waste disposal problem. Different industries are responsible for the source of waste, which is produced as a by-product during their manufacturing process. It is recommended that waste foundry sand (WFS) can be easily used in the construction industry to manufacture concrete. Waste Foundry Sand (WFS) is a by-product from the production of both ferrous and nonferrous metal castings. It is high quality silica sand. The physical and chemical characteristics of foundry sand depend upon the type of casting process and the type of industries.

OBJECTIVES

1. To know the effect of foundry sand on workability of concrete.
2. To know the effect of compressive strength of concrete for different proportion of foundry sand and Fine aggregate.
3. To know flexural and split tensile strength of concrete.
4. Comparison with convectional one (i.e, cement, fine aggregate, and coarse aggregate)
5. Utilization of byproducts or aggregates obtained as waste materials are used in concrete in the aspects of reduction in environmental load, waste management cost & reduction of production cost.

METHODOLOGY

MATERIALS USED

Cement: The cement used in this experiment is Ordinary Portland Cement of 43 grade, conforming to IS 8112 -1989

Fine Aggregate: Fine Aggregate passing through 4.75 mm was used in the concrete mixes.

Coarse Aggregate: Coarse aggregate of 20mm is used in this project.

Waste Foundry Sand: Waste Foundry Sand passing through 4.75 mm was used in the concrete mixes.

Super Plasticizer: Complast 430 of Forsoc of specific gravity 1.18 is used in the range (1% by weight of binder).

METHODS

- Basic Tests on materials i.e, Specific Gravity of Fine Aggregate, Waste Foundry Sand and Coarse Aggregate is done. Water Absorption Test, Sieve Analysis.
- Mix Design for M30 Grade Concrete is done as per IS 10262-2019. The ratio obtained is 1:1.5:2.77 and w/c is 0.45.
- In a fresh state of concrete mix Slump test is conducted to find the workability of concrete.
- Six identical cubes, cylinders, and beams were casted. Out of six cubes, cylinders, and beams, three were tested after 7 days and rest after 28 days of curing.
- In a hardened state of concrete Compressive Strength test, Split Tensile test and Flexural strength test is conducted.

Figure shows the compressive Strength test and Split tensile test.

RESULTS AND CONCLUSIONS

- As the replacement of fine aggregate with waste foundry sand in concrete increases, the workability of concrete decreases by 23.33%.
- The compressive strength is maximum at 30% replacement for both 7 days and 28 days of curing which is an increase of 3.8% & 4.8% respectively.
- The split tensile strength increases by 3.93% & 4.51% compared to 0% replacement of foundry sand.
- The flexural strength increases with 30% replacement of waste foundry sand for both 7 days and 28 days of curing which is 3.92% and 4% increased respectively.
- From above tests conducted we obtained the maximum strength at 30% replacement of waste foundry sand for both 7 and 28 days, then the strength decreases from 40% .

CONCLUSION

- Fresh concrete shows that the addition of foundry sands gives low slump values mainly due to the presence of very fine particles, so these mixtures require high super plasticizer dosage to maintain a good workability.
- Compressive strength, split tensile strength, flexural strength increases on increase in percentage of waste foundry sand as compared to the conventional mix.
- The replacement of natural sand with used foundry sand up to 30 % is desirable. as it is cost effective, reduce the amount of fine aggregate.
- Use of waste foundry sand in concrete reduces the production of waste through metal industries; it is an eco-friendly building material.

INNOVATION

Using of waste of materials (waste foundry sand) of moulding industries to solve problem of scarcity of sand in construction industries and load on land fill sites. In this experiment we have used waste foundry sand as a replacement of fine aggregate. This replacement reduces cost of construction.

SCOPE FOR FUTURE WORK

In the present scenario, the high cost of conventional buildings materials is a major factor affecting housing delivery in the world. This has necessitated research into alternative materials of construction. The use of industrial by-product waste foundry sand used in concrete for partial replacement of fine aggregate will reduce waste landfill sites as well as minimize the consumption of natural resources. It is a necessity considering the present environmental problems to encourage its use in the local construction industry for sustainable development free of environment concerns as far as possible.

In current study up to 40% of replacement has been considered. The other percentages i.e 50% ,60 % and so on, can be explored for future investigations. The studies can be conducted to know the performance under impact and torsion loading as well. Mathematical/ empirical models can be developed for foundry sand concrete. Durability of foundry sand can be checked by conducting the tests for different curing periods.