

Experimental Investigation of Coconut Shell with UFS in Concrete

Nagasubramanian G¹, E Ezhilarai², Santhosh Kumaar K³, Lavanya C⁴

^{1,2,3,4}Assistant Professor Department of Civil Engineering, Peri Institute of Technology

Abstract—high cost of conventional construction materials is a dominating factor affecting housing system around the world. This has necessitated research work into some other alternative materials in the construction field. Conventional coarse aggregate namely gravel and fine aggregate sand in concrete will be used as control. While natural materials are coconut shell as course aggregate and used foundry sand as affine aggregate will be investigate to replace the aggregate in concrete. In this study, M25grade concrete mix with different combination of natural material UFS and CS content in the proportion 10%UFS- 10%CS, 10%UFS-15%CS, 10%UFS- 20%CS, 20%UFS-10%CS, 20%UFS- 15%CS, 20%UFS-20%CS, 30%UFS- 10%CS, 30%UFS-15%CS, 30%UFS-20%CS will be replaced. Three sample specimens will be prepared for each combination of concrete mixes

Index Terms—waste foundry sand Coconut shell and Compressive strength

I.INTRODUCTION

Concrete is a composite material which composed of aggregates, cement and water. Concrete is used more than any other manmade material in the world. In addition, concrete is the second most consumed substance in the world-behind water. About 7.23 billion tons of concrete is produced every year. This huge demand of natural aggregate raises a serious question about preservation of natural aggregate sources for sustainable development. Extraction and processing of aggregates is also a major concern for environment. Therefore, consumption of alternative waste material in place of natural aggregate in concrete production not only protects environment but also makes concrete a sustainable and environment friendly construction material. Different waste material like rubber, fly ash, glass, bottom ash, artificial sand etc. has been used as alternative for replacing natural aggregates. Apart from the above

mention waste material, a few studies show that agriculture waste coconut shell and Used foundry sand can also be used as coarse aggregate and fine aggregate for concrete.

A. Coconut Shell

Coconut is grown in more than 93 countries. India is the third largest, having cultivation on an area of about 1.78 million hectares for coconut production. The coconut industry in India accounts for over a quarter of the world's total coconut oil output and is set to grow further with the global increase in demand. However, it is also the main contributor to the nation's pollution problem as a solid waste in the form of shells, which involves an annual production of approximately 3.18 million tonnes. It also presents serious disposal problems for local environment, is an abundantly available agricultural waste from local coconut industries. In developing countries, where abundant coconut shell waste is discharged, these wastes can be used as potential material or replacement material in the construction industry. This will have the double advantage of reduction



Many of the non-decaying waste materials will remain in the environment for hundreds, perhaps thousands of years. The non-decaying waste materials cause a waste disposal crisis, thereby contributing to the environmental problems. However, the environmental impact can be reduced by making more sustainable use of this waste. This is known as the Waste Hierarchy. Its aim is to reduce, reuse, or recycle waste, the latter being the preferred option of waste disposal.

B. Used Foundry Sand

Foundry sand is high quality silica sand that is a byproduct from the production of both ferrous and nonferrous metal castings. One of the main concerns for the foundry industry has been the need to reduce the disposal cost and minimize the maintenance costs of landfill sites. Also, old landfills are reaching capacity while new landfills will not be coming to market in sufficient numbers as desired by industries. Nationwide, this was mainly because of the passage of Public Law 94-580, the Federal Resource Conservation and Recovery Act of 1976, which is the nationwide program that regulates and manages by-product disposal.



II. REVIEW OF LITERATURE

A. Effect of Spent Foundry Sand as Partial Replacement of Fine Aggregate on The Properties of Concrete.

In 22nd International conference on solid waste technology and management, Widener University, Philadelphia, USA; 2007. Compressive strength, splitting tensile strength and MOE tests were carried out at the age of 28 and 56 days. Replacement percentages of natural fine aggregate with WFS was 10%, 20% and 30%. Based on test result they concluded that

(a) compressive strength increased slightly with increase in WFS at all replacement%; (b) compressive strength increased by 4.2%, 5.2% and 9.8% at the age of 28 days when compared with ordinary concrete mix where as 1.0%, 5.18% and 14.3% increased at the age of 56 days; (c) splitting tensile strength increased with an increase in the WFS and (d) the MOE of waste foundry sand concrete at all age was higher than the ordinary concrete.

B. K.Gunasekaran “Lightweight Concrete Using Coconut Shells as Aggregate

One such alternative is coconut shell (CS), which is a form of agricultural solid waste. Statistical data of coconut production shows that, India is producing nearly 27% of total world production and the annual production of coconut is reported to be more than 12 million tons.

These includes ordinary Portland cement conforming to Indian standard code IS 8112-1995, palar river sand as fine aggregate and crushed CS as coarse aggregate.

C. Effect of Used-Foundry Sand on The Mechanical Properties of Concrete

Construction Building Material 2009;23:976–80 . The author determined the compressive strength, splitting tensile strength, flexural strength and modulus of elasticity of concrete containing WFS at 28, 56, 91 and 365 days. Fine aggregate was replaced with waste foundry sand with 10%, 20% and 30%. They concluded that. (a) Compressive strength, splitting tensile strength, flexure strength and MOE of concrete mixtures increased with increase in waste foundry sand content; (b) Mechanical properties of concrete mixtures increase with age for all the foundry sand content; (c) 8% to 19% compressive strength increased depending upon WFS% and testing age (d) 6.5% to 14.5% splitting tensile strength, 7% to 12% flexure strength and 5% to 12% modulus of elasticity increased with age and waste foundry sand

D. Naik Et Al Properties Of Field Manufactured Cast-Concrete Products Utilizing Recycled Material

J Mater Civil Eng 2003;15(4):400–7. The effect of classfly ash, coal combustion bottom ash and waste foundry sand on cast concrete product (brick, block and paving stone). Replacement level by mass for sand was 25% and 35%. Replacement level by mass, for Portland cement with fly ash was 25% and 35% for brick and block. For paving stone it was 15% and 25%. They investigated that partial replacement of cement with FA consistently improved the strength and durability of concrete masonry units; Block (25% FA and UFS) could be used for building exterior walls and (35% FA and UFS) could be used for building interior wall in cold region; In warm region block and paving stone (contain 25%, 35% FA and

UFS) could be used for building both interior and exterior wall and up to 35% of sand in brick and block could be replaced with UFS for use where forest action is not a concern.

E. Re-Usage of Waste Foundry Sand in High Strength Concrete

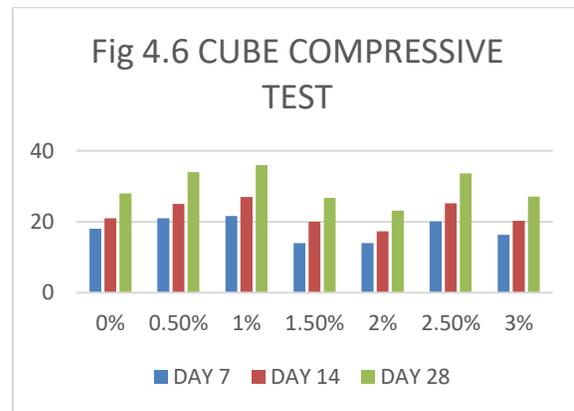
Waste Management 2010;30:1705-13.

The author Investigated the reuse of WFS in high strength concrete. In this study the natural sand was replaced by WFS by 0%,5%, 10%, and15%. They studied the slump test, compressive strength, splitting tensile strength, Water absorption, freezing thawing resistance and dynamic elasticity modulus. Based on the test result they concluded that (a) increase in the replacement level of standard fine sand with WFS, decrease the compressive strength, tensile strength and MOE of concrete, but similar compressive, tensile and MOE were obtained from the specimen with 10% WFS and control one; (b) Concrete with 5% WFS exhibited reduction in water absorption and void ratio (c) Reduction in compressive, tensile strength and MOE after freezing and thawing cycle were in allowable limits of the ACI code. They concluded that foundry sand can be successfully used in high strength concrete application if the particle size distribution is very carefully arranged.



III.METHODOLOGY

M25 Grade concrete was used with different mix proportions of used foundry sand and coconut shell in the concrete



Basalt fibre	Comp strength (N/mm)7 days	Comp strength (N/mm²)14 days	Comp strength (N/mm²)28 days	% Variation on comparison with CC
0%	18	21	28	0
0.5%	21	25	34	21.4%
1%	21.6	27	36	28.5%
1.5%	14	20	26.7	-4.64%
2%	14	17.3	23.1	-17.5%
2.5%	20.1	25.2	33.6	20%
3%	16.3	20.3	27.1	-3.21%

sand. Used foundry sands(ufs)& coconut shell(cs)

IV.CONCLUSION

The compressive strength values for concrete with addition of basalt fibre of 0.5%,1%,1.5%,2%2.5%,3% for M 30 mixes were tested. But concrete containing above 0.5% addition of basalt fibre replacement showed higher with the increase of 21.4%compressive strength near to that of the conventional concrete. Based on the results

obtained, it can be concluded that structural grade concrete can be produced using 0.5% addition of basalt fibre.

REFERENCE

[1] Fareed Elgabbas et all. “Experimental testing of basalt-fibre-reinforced polymer bars in concrete beams Composites” Part B 91 (2016) 205-218
 [2] Marek Urbanski et all. Investigation on Concrete

Beams Reinforced with Basalt Rebars as an Effective Alternative of Conventional R/C Structures *Procedia Engineering* 57 (2013) 1183 – 1191

- [3] Fathima IrineI. AStrength Aspects of Basalt Fibre Reinforced Concrete *International Journal of Innovative Research in Advanced Engineering (IJIRAE)*
- [4] KukarniVishwas P.,Gaikwad Sanjay kumar B. (2013) “Comparative Study on Coconut Shell Aggregate with Conventional Concrete (*IJEIT*