EXPERIMENTAL INVESTIGATION FOR STRENGTH OF CONCRETE BY USING RICE HUSK

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Abstract - Sixty six cube, twenty four cylinder and twenty four beam samples were casted for M60 design and then tested in laboratory. Eleven cubes were casted for each partial replacement of fine aggregate i.e. 0%, 5%, 10%, 15%, 20%, and 25% and w/c ratio were maintained as 0.36. Mineral admixture used is fly ash as 30% of cement by weight.

The effect of replacement of fine aggregate with processed rice husk with increase in percentage replacement lowers the compressive strength as accordingly. Same effects of replacement were found in case flexure rigidity of beams. However in case of split tensile strength its shows almost constant trend for the cylinder samples.

The slump values also decreases with increase in percentage of replacement and varies between 80-95mm.

In case of permeability test the value of "k" became larger as we replace more of fine aggregate with rice husk. In case of 25% replacement the order 10^-5 while in case of zero it is in order of 10^-7.

Key Words- Slump values, Permeability test, compressive strength and Flexure Rigidity.

1. INTRODUCTION

High performance concrete is augmented form of concrete which consign it with characteristics like High strength, High early strength, High modulus of elasticity, High abrasion resistance, High durability in severe environments, Low permeability with diffusion, Resistance to chemical attack, High resistance to frost and deicer scaling damage, Toughness, impact resistance, Volume stability, Ease of placement, Compaction without segregation, and Inhibition of bacterial growth.

Since allowance for use of mineral admixture is mentioned in Indian standard code IS 456-2000, so use of rice husk ash is both cost effective and as well energy saving.

1.1 ADVANTAGES OF FLY ASH

The utilization of rice husks in high performance concrete change it into eco-friendly material solution. The following are the effect on concrete

- Safeguard environment by utilizing rice husk there by using agro-waste material in place of natural sand.
- Heat of hydration is reduced which helps in drying and decreases shrinkage.
- Split tensile strength is one of the mechanical properties which remain constant after the use of RHA.
- Dependence on natural resource will reduce to some extent.
- It can also make the concrete industry sustainable.
- Disposal problem of land filling is minimized.

1.2 Disadvantages of Fly Ash

The various disadvantage of using rice husk is as follows:

- Compressive strength decreases as we increase the percentage of rice husk.
- Flexure property of concrete decline accordingly as percentage share of rice husk is extended.
- Durability also shows the same trend.

2. LITERATURE REVIEW

Following literatures have given support for this experimental program. Their conclusions are also helpful for initiating these research proposals.

1. Rice Husk Ash as Fine Aggregate Sustainable Material for Strength Enhancement of Conventional and Self Compacting Concrete.

S.S. Samantaray, K.C. Panda& Mishra.(2016) "Rice Husk Ash as Fine Aggregate Sustainable Material for Strength Enhancement of Conventional and Self Compacting Concrete", Key Engineering Materials, Vol. 692, pp. 94-103, 2016.

The test results indicate that up to 30% replacement of fine aggregate with RHA enhances the strength in Conventional Concrete whereas the strength enhancement in Self Compacting Concrete up to 20% replacement.

2. Tomas U. Ganiron.(2010). "Effects of rice husk as Substitute for fine aggregate in concrete mixture". Jr College of Architecture, Qassim University, Buraidah City.

This studies on the effect of rice husks as fine aggregate in terms of water-cement ratio, quality and size of coarse aggregate, and consistency of the mixture and determines how rice husk differ with other ordinary concrete mix as fine aggregate in terms of water adsorption, compressive strength, tensile strength and modulus of elasticity.

3. Nithyambigai G .(2006) "Effect of Rice Husk Ash in Concrete as Cement and Fine Aggregate" Assistant Professor Department of Civil Engineering, SRM University, Ramapuram Chennai, Tamil Nadu.

Percentage replacement of cement with RHA iskept constant at 10% and fine aggregate is replaced at 0%, 5%, 10% and 15% in a mix of M20 grade of concrete. The strength such as compressive strength and split tensile strength are found out at 7 and 28 days. The strength is compared with control concrete and the optimum % of replacement of RHA is found out.

4. Oblate,.(2002)"Experimental Study On Rice Husk As Fine Aggregates In Concrete" I.O. Department of Civil Engineering, Osun State Polytechnic, Iree, Nigeria

3. MATERIAL USED

Cement

OPC grade 43 conforming to IS: 8112-1989 was used in this experimental program. IS code 4031-PART1-1996 is used for determining fineness, for initial & final setting of cement IS code 4031-PART5-1988 code provisions are used, for knowing the consistency of cement IS code:4031-PART4-1988 is used and last but not the least for finding out the specific gravity of cement IS code:4031-PART11-1988 is used.

Fineness : 335m^2/kg

Consistency : 30%

Initial setting time : 30minutes

Final setting time : 600minutes

Specific gravity :3.15

Sand

River sand, sieved through the standard sieves as defined in Indian Standard (IS650 2007) to achieve a standardised grain size distribution, was used in this study. The specific gravity of the sand was found to be 2.62. All mortar mixes were prepared using this standardised sand. Several trials were done on mortars using different sand-to-cement ratios to obtain good consistency and compaction of the mix at all water to cement ratios and the sand-to-cement ratio was chosen to be 2.4. This sand-to-cement ratio was chosen since it was difficult to compact mortars with water-to-cement ratio of 0.4 and higher sand-to-cement ratio without using water reducers. Chemical admixtures were avoided to minimise the number of variables in the mixes.

CHEMICAL ADMIXTURES

Polycarboxylic ether based super plasticizer manufactured by Fosroc an international supplier was used in this experimental investigation..

Properties of chemical admixtures

Table-3.6.

Aspect	Light brown liquid
Relative density	1.06
PH	≥ 6 at 25 degree Celsius
Chloride	Less than 0.2%

4. Experimental Discussion

WORKABILITY

The workability of cement concrete is tested as per using standard sizes of Slump Moulds as per IS: 1199 - 1999.

COMPRESSIVE STRENGTH

Cube specimens were casted for investigating the compression test of the sample. Size of cube mouldedwere 150mm×150mm×150mm conforming to IS code IS: 10086-1982. The concrete cubes were casted in mould. After 24 hours of casting the cubes were taken out from mould and then cured in clean water at normal room temperature for 56days maximum. Test conducted was on 21 days, 28days and 56 days. Prior to test performed cubes were taken out form water and then allowed to dry for 2-3 hours.

Test was performed by the compressive testing machine on the dry cube specimen. After setting the specimen in right position the load was applied at a constant rate of 140/cm^2/min(approx.) until the specimen breaks

SPLIT TENSILE STRENGTH

Split tensile strength is an indirect tension method as failure of the cylindrical test specimen occurs by indirect tension. The splitting of the test specimens occurs along vertical diameter (fig 3.6) The load applied by the testing machine along the outward curved area produces a state as biaxial stress due to which due to which failure in compression does not take place. This test is also replaced by 'Brazilian test as it is developed in Brazil in 1943. The horizontal tensile stress is expressed as

Horizontal Tensile Strength $= 2P/\pi DL$

P = Compressive Load on the Cylinder

L = Length of Cylinder

D = Diameter of Cylinder

PERMEABILITY TEST

In this test first we take properly cured concrete cube specimen and then allow it to dry. After that we take the mould in which we place the cube specimen in it then we heat the wax to make it in liquid state and then pour it into the mould with the concrete cube and let the wax to solidify. Afterward we take the mould and with knife we make a circle of 10 cm size and cut the wax to meet the surface of the cube and make the machine arrangement for the permeability test. After 24 hours or may be more or less we note down the water collected in the bucket in milliliter and thus by putting these parameter in equation given in IS code 3085-1965 we determine the coefficient of permeability.

5. APPLICATION

Major applications of high-performance concrete in the field of Civil Engineering constructions have been in the areas of long-span bridges, high-rise buildings or structures, highway pavements, etc. Some of the application areas are discussed in brief below:

Bridges The use of high performance concrete would result in smaller loss in pre-stress and consequently larger permissible stress and smaller cross-section being achieved, i.e. it would enable the standard pre-stressed concrete girders to span longer distances or to carry heavier loads. In addition, enhanced durability allow extended service life of the structure. In case of precast girders due to reduced weight the transportation and handling will be economical. Concrete structures are preferable for railway bridges to eliminate noise and vibration problems and minimize the maintenance cost (Dr. R. B. Khadiranaikar).

High Rise Structures The reasons for using the high strength concrete in high-rise buildings are to reduce the dead load, the deflection, the vibration and the maintenance cost. 5.3 Highway

Pavements High Performance concrete is being increasingly used for highway pavements due to the potential economic benefits that can be derived from the early strength gain of high performance concrete, its reduced permeability, increased wear or abrasion resistance to steel studded tires and improved freeze-thaw durability. A durable concrete known as fast track concrete designed to give high strength at a very early age without using special materials or techniques has been developed. Fast Track Concrete Paving (FTCP) technology can be used for complete pavement reconstruction, partial replacement by an inlay of at least one lane, strengthening of existing bituminous or concrete pavements by a concrete overlay, rapid maintenance and re-construction processes. The benefits of applying FTCP technology in such applications are : (a) a reduced construction period, (b) early opening of the pavement to traffic, and (c) reducing the use of expensive concrete paving plant

6. CONCLUSIONS

From this experimental investigations following are the observations that can be summarized:

1. The slump value ranges in-between 80-90 mm. Maximum percentage decrease of slump value is for 5% rice husk replacement while lowest is for 15%.
2. Whenever there is increase in percentage partial replacement of rice husk from 0% to 25%, a decrease slope in compressive strength was recorded. 28 days strength show maximum fluctuations as the minimum percentage decrease is for 15% replacement while maximum percentage decrease is for 25% replacement.
3. Minimum percentage decrease in compressive strength is found in between 10% to 15% whether it is for 21days, 28 days or 56 days strength.

My experimental investigation data show a declining trend in split tensile strength however according to journal published on May 2015 by Nithyambigai. G shows there is increase in split tensile strength with percentage increase in replacement

7. REFERENCES

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