THINK INDIA JOURNAL

ISSN: 0971-1260
Vol-22-Issue-16-August-2019

An Experimental Investigation on Partial Replacement of Cement By RHA and Lime, Coarse Aggregates By Recycled Aggregates.

SHILPA S, Post Graduate Student,
Department of Civil Engineering,
S, J, C, I, T, Chickaballapur, Karnataka, India.

BHAVYA K N, Post Graduate Student,
Department of Civil Engineering,
S, J, C, I, T, Chickaballapur, Karnataka, India.

RAGHU K, Assistant Professor,
Department of Civil Engineering,
S, J, C, I, T, Chickaballapur, Karnataka, India.

MANJUNATH K A, Assistant Professor,
Department of Civil Engineering,
S, J, C, I, T, Chickaballapur, Karnataka, India.

Dr. G NARAYANA, HOD & Professor,
Department of Civil Engineering,
S, J, C, I, T, Chickaballapur, Karnataka, India.

ABSTRACT

As the cost of construction is increasing with time, demand for the construction materials also increases, the availability of natural materials is less when compare to demand so alternative materials are using. In this paper presented that results from a different percentage of recycled aggregates on concrete significant through 4 different mix proportions of 10%, 20%, 30%, 40% of recycled aggregates by weight of coarse aggregates, in addition to 5% RHA and 10% lime as a standard replacement by weight of cement. The standard cubes (150*150*150mm) are cast. All 72 specimens with the M30 grade mix case are cast and tested. The compressive strength at 3,7,14 and 28 days was tested and compared with normal concrete of M30 grade. By using superplasticizer achieved require workability that will be tested by slump cone test and compaction factor test.

Keywords -Workability; Lime; Rice Hush Ash; Recycled Aggregates; Compressive Strength.

I. INTRODUCTION

Concreteisaflexiblematerial thatcanbeusedfor the development ofseveraltypesofstructural components. Concrete is the source of a nation's infrastructure due to itsusage, economic progress and strength, and indeed to the dominanceof life. Almost 5% of global CO_2 emissions can be obtained due to Portland cement production. To reduce the usage of cement (OPC), it can be partially replaced with alternative materials that have binding properties.A number of binding materials has been studied for the replacement of cement partially like fly ash, ggbs, and ground nut shell ash, etc. which have been successful. The present paper shows the replacement of cement partially with Rice Husk Ash (RHA). India is one of the most producers of Rice. Around the world rice paddy of about 600 million tons is being produced, accounting for an annual production of 120 million tons Rice Husk. In most of the cases, the rice husk produced during the production of the rice is either fire or dumped as waste material. Rice husk ash contains 90%-95% of reactive silica.

It is obtained that the world rice harvest is about 588 million tons per year and India is the second-largest producer of rice in the global with a production of 132 million tons per year annually. An investigation has been carried out on the use of amorphous silica in the manufacture of concrete. Most of these researches have been performed to find the effectiveness of RHA as a pozzolan by concentrating on the amount of ash present in the mix and on the enhanced characteristics resulting from its use.

Usage of recycled aggregate generally increases the drying shrinkage creep & porosity to water & decreases the compression strength of concrete compared to that of natural aggregate concrete. It is nearly 10 to 30% as per the replacement of aggregate.Its presence spoils processing of bio-degradable as well recyclable waste, Construction & Demolition waste has potential use after processing and grading, Utilization of Construction & Demolition waste is quite common in industrialized countries but in India so far no organized effort has been made.

Natural lime powder is normally available in coal seam fires and volcanic ejecta. In ancient days, this material was used to make constructions. It has a good adhesive property. In the Engineering sector, it has been using mortar, concrete, cement. Natural lime can arrest the moisture content itself. So then it reduces the curing age.

RHA generally referred to an agricultural by-product of burning husk under a controlled temperature of below 800 °C. The process produces almost 25% rice husk ash containing 85% to 90% amorphous silica plus

ISSN: 0971-1260
Vol-22-Issue-16-August-2019

about 5% alumina, which makes it highly pozzolanic. Concrete with RHA required more water for a given consistency due to its absorptive character of the cellular RHA particles.

II. LITERATURE REVIEW

[1] M.R. Shatat, "Hydration behavior and mechanical properties of blended cement containing various amounts of RHA in presence of met kaolin".In this study, author replaced 30% OPC with RHA and MK by weight of cement for different ratios of blends.
For blends of RHA with 5% to 10% and MK of 15% to 20% by weight of OPC gives optimum results.
The compressive strength of all the blends increases with curing time.
[2] Ravande Kishore, "Study on strength characteristics of high strength RHA concrete" In this study, HSC of M40 and M50 grade mix cases were cast and test for various replacement of OPC by 0%,5%,10%,15% of RHA of two grades and compared with that of the concrete without RHA.
The optimum replacement of RHA found to be 10% in both the grades.
[3] Fapohunda Christopher, "Structure and properties of mortar and concrete with RHA as partial replacement of OPC".In his study he replaced the OPC with RHA up to 50% by weight of OPC but up to 10% replacement gives optimum results.
The use of RHA results in increased Ho_2 demand.
[4] Md. Safiuddin, "Use of recycled concrete aggregate in concrete"In this study NCA is replaced by RCA from 0% to 100% by the intervals of 10%.strength will decrease when compared to ordinary concrete.
30% replacement of NCA BY RCA gives optimum results.

III. OBJECTIVES

The main aim of this investgation work is to determine the strength characteristics of concrete grade M30 with partial replacement of cement by keeping RHA (5%) and lime (10%) as strand and by replacing CA with RA by 10%, 20%, 30%, and 40%.To reduce water content by using a superplasticizer.Casting and curing did for a time of 3,7,14 and 28 days to determine the strength characteristics,thefollowingtasksareinvolved:

- Incomplete replacement of cement with rice husk ash & lime along with partial replacement of coarse aggregates with recycled aggregates.
- To estimate the hardened concrete properties like compressive, split tensile and flexural strength.
- To reduce the overall cost of construction by using recycled aggregates.

IV. MATERIALPROPERTIES

A.Cement

OPCthatis53gradeconfirm toIndian standardcodeIS: 12269– 1987 accessibleinlocallyutilized as apartofthisexamination. Thephysicalproperties ofcement aredictatedbyperformingthedifferenttestsaccording tothe guidelines ofIS:269andIS:4831,fulfillsthenecessities of IS: 12269–1987asgiven.

Table1: Cementphysical properties.

Sl no	Testconductedon cement	Results	Permeablevalue IS:12269-1987
1	Normalconsistency	29%	28%-34%
2	Initialsettingtime	45min	Not<30min
3	Final settingtime	370min	Not>600min
4	SpecificGravity	3.08	2.95– 3.15

B. RHA

(RHA) rice hush ashisutilizedasanoptionalcement material,gottenfromBrick Factory

ISSN: 0971-1260
Vol-22-Issue-16-August-2019

Table2:RHAphysicalproperties

Sl no	Testconductedon RHA	Results
1	Bulk density	530 kg/m^3
2	Fineness modulus	13%
3	SpecificGravity	1.95

C. Lime

Lime additionallyutilized as tertiary cementitious materialitisalsogottenfromUltra-Tech.Thephysicalpropertiesof limeareorganizedinTable3.

Table3:Lime Physicalproperties

Sl no	Testconductedon lime	Results
1	Fineness modulus	6%
2	Specificgravity	1.98

D. Fine Aggregate

Becauseoftheshortageof riversand,variousexperimental worksareconductingforinterchange materialstouseassand contents. Fabricated sand(M-Sand) affirmingtoIS: 383–1970(ZoneII), gottenlocal marketisutilizedasa sandmaterial inthisproject.Thepropertiesof M-sandcharactarstics areappearedin Table4.

Table4: PhysicalpropertiesofFineaggregate

Slno	Testconductedonfine aggregates	Results
1	Specificgravity	2.68
2	Finenessmodulus	3.9
3	Loosebulkdensity	1575.33Kg/m^3
4	CompactedBulkdensity	1747.33Kg/m^3

E. CoarseAggregate

Thetotalaggregate–cementproportion isemphatically impacted bythesortofmaterialsutilizedfortheinvestigation, which assistantrequiredtogettheworkability and water-cementproportion.The coarsermaterialssizeof20mmdownsize areutilizedasapartofthisprojectand fulfillsthedetailsof IS: 383–1970. Theexperimentswerecarriedaccordingtothe guidelines IS: 2386Part-1andreadingsareenteredinthe Table5.

Table5:Physicalpropertiesofcoarseaggregate

Slno	TestconductedonCA	Results
1	Specificgravity	2.8
2	Waterabsorption	1.01%
3	Fineness modulus	6.75%

F. Chemicaladmixture

Chemicaladmixtures aretypicallyaddedtowatertoget greatflowabilityandmakeittotheworkable concrete.To accomplishsuperiorqualityconcrete,the utilization ofchemical admixture isbasicwhichwilldecreasethewater-cement proportion.Subsequently,theadmixtureutilizedasapartof thisworkisCONPLASTgivenfromthe BASF. The super plasticizer is addeduptoa volume of 0.4%tothe weight ofthecementations materials.

ISSN: 0971-1260
Vol-22-Issue-16-August-2019

G. Water

Consumablelocallyavailablewaterfreefroma widerange ofchemical,fulfillingthenecessitiesguidelinesofIS:456–2000 wasutilizedinthisproject.

V. MIXPROPORTIONS

Themixdesignfor M_{30} gradeconcrete hasbeen prepared basedontheprevious literaturesandtheuseofIS 456- 2000 and IS 10262- 2009guidelines.Inthepresentexamination, themixdesignfora conventional mixisgivenbelow.

Conventional Concrete

Mix design as per IS 456:2000 and IS 10262:2009
Grade of concrete is M30
W/c rati0 = 0.45
Mix proportions - 1: 1.56:2.77
Mix calculations for $1m^3$
Cement=425.7 kg/m³
Fine aggregate =664.76 kg/m³
Course aggregate =1182.6 kg/m³
Water=191.56litrs kg/m³

VI. TESTSON HARDENED CONCRETE

A CompressiveStrength

Thedifferentcementmixesfulfilling therheological properties arecastandcuredfor 3,7,14,28 days.The examplesareFixedincompression testingmachine(CTM)at thatpointanultimate failureloadisnoted.Theafter-effectsof thecompressivestrengthofnormalConcrete RHA, lime added to concretefordifferentratesofrecycled aggregatesareresolved. The consequencesofthecompressivequalityforvariousblends areenteredinTable6 and a varietyofqualityisgivenin Fig.1.

Table6:CompressiveStrength (N/mm^2) of concrete

DAYS	CS in N/mm^2				
	CC	**10%RA**	**20%RA**	**30%RA**	**40%RA**
3	20.35	14.4	11.05	8.96	7.4
7	27.6	23.9	21.6	14.01	12.87
14	33.2	30.17	26.25	24.32	21.78
28	39.86	37.12	33.62	31.56	29.89

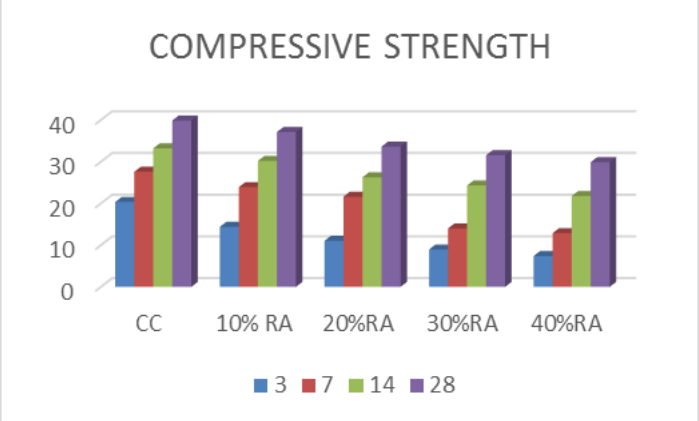

Fig 1: Compressive Strength of Concrete

ISSN: 0971-1260
Vol-22-Issue-16-August-2019

Table 7: Mix Proportions for Different Ratios of Recycled Aggregates.

MATERILS	CC	10% RA	20% RA	30% RA	40% RA
CEMENT	425.7 kg/m³	361.85 kg/m³	361.85 kg/m³	361.85 kg/m³	361.85 kg/m³
FINE AGGREGATES	664.76kg/m³	664.76 kg/m³	664.76 kg/m³	664.76 kg/m³	664.76 kg/m³
COARSE AGGREGATES	1182.6kg/m³	1064.34 kg/m³	946.08 kg/m³	827.82 kg/m³	709.56 kg/m³
WATER	191.56 liters/m³	191.56 liters/m³	191.56 liters/m³	191.56 liters/m³	191.56 liters/m³
SUPER PLASTIZER	-	1.7028liters/m³	1.7028liters/m³	1.7028liters/m³	1.7028liters/m³
RHA(5%)	-	21.28 kg/m³	21.28 kg/m³	21.28 kg/m³	21.28 kg/m³
RA	-	118.26 kg/m³	236.52 kg/m³	354.78 kg/m³	473.04 kg/m³
LIME(10%)	-	42.57 kg/m³	42.57 kg/m³	42.57 kg/m³	42.57 kg/m³

VII. CONCLUSIONS

1.As a replacement of cement by RHA in concrete increases, the workability of concrete decreases.
2.Replacement of coarse aggregates with recycled aggregates leads to a decrease in compressive strength.
3.Replacement of lime and RHA leads to decrease in compressive strength
4. The optimum dosage of recycled aggregate was found to be 10%.

VIII. FUTURESCOPE

1. Use recycled concrete as the base material for roadways reduces the pollution involved in trucking material.
2. To getthemechanicalproperties of gradeSCCutilizing otherinterchange cementitious materialsatvarious rates.
3.Toknow thefresh&hardness properties of concrete forM30grade.
4.Comparethestrength behaviorswithdifferentsizes ofRC beams.

REFERENCES

[1] Karan Verma, P S Pajgade, "Effect of partial replacement of natural sand with crushed sand along with supplementary cementing materials (Fly ash and GGBS)" IJRET, eISSN: 2319-1163 | ISSN: 2321-7308, Volume: 04, Jan-2018.
[2]Venu Malagavelli, "High-Performance Concrete with GGBS and Robo Sand"International Journal of Engineering Science and Technology, Vol, 2(10), pp 107- 511, Jun 2016 .
[3]Vinayak Awasare, Prof. M V Nagendra,"Analysis of strength characteristicsofGGBS concrete", E-ISSN 0976-3945 Int J Adv Engg Vol 82-84, july 2015.
4] K. Ganesh Babu, V. Sree Rama Kumar, "Efficiency Of GGBS In Concrete", Cement and Concrete Research 30, 2014, 1031± 1036.
[5]Bui D D, Hu J and Stroeven P "Particle size effect on the strength of rice husk ash" science direct 27 pp 357– 366, May 2012.
[6]Ganesan K, Rajagopal K, and Thangavel K, "Rice husk ash blended cement: Assessment of optimal level of replacement for strength and permeability properties of concrete Construction and Building Materials" 22 pp 1675–1683, 2012.

ACKNOWLEDGMENT

I am thankful to Mr. Raghu K, Mr. Manjunath K A and Dr.GNarayana for their guidance. I also thank the Department of Civil engineering S J C Institute of Technology, Chickaballapur. And last but not least my dear friends who have supported me to complete this project work.

ISSN: 0971-1260
Vol-22-Issue-16-August-2019

BIOGRAPHIS

Ms.SHILPA S,Pursuing Final Year M.Tech in Structural Engineering in S.J.C. Institute of Technology, Chickaballapur.Under the guidance of Mr. RAGHU K Assistant Professor, Dept. of Civil Engineering, SJCIT, Karnataka, India

Ms. BHAVYA K N, PursuingFinal YearM.TechinInfrastructure Engineering andManagement inS.J.C.Instituteof Technology,Chickballapur.Under the guidance of Mr. MANJUNATH K A, Assistant Professor, Dept. of Civil Engineering, SJCIT, Karnataka, India.

Mr.RAGHUK,AssistantProfessor,Department ofCivilEngineering, S.J.C.InstituteofTechnology, Chickballapur. Hehasa widerangeofknowledgeinStructural Engineeringwith7yearsofexperienceas AssistantProfessor and5.5yearsofindustrialexperience.

Mr.MANJUNATHA KA,AssistantProfessor,Department ofCivilEngineering, S.J.C.InstituteofTechnology, Chickballapur. Hehasa widerangeofknowledgeinStructural Engineeringwith6yearsofexperienceas AssistantProfessor. And1.5yearsofindustrialexperience.

Dr. G NARAYANA, Professor and Head of the department of civil engineering, S.J.C Institute of Technology, Chickballapur, He has a wide range of knowledge and experience in teaching as well as researches in structural Engineering field.He is also a structural designer and consultant for many projects.

PHOTO GALLERY

ISSN: 0971-1260
Vol-22-Issue-16-August-2019