Evaluation of Strength of Recycled Coarse Aggregate using Ternary Blended Concrete with Flyash and GGBFS: A Critical Review

Sagpariya Pratik[1] Prof. S. R. Vaniya[2] Prof. R. B. Bhatt[3]
[1,2,3]Department of Civil Engineering
[1,2,3]Darshan Institute of Engineering and Technology (Rajkot), Gujarat Technological University

Abstract— Here it is literature study of the recycled coarse aggregate in the concrete with the replacement of natural coarse aggregate in place of recycled concrete and the cementitious byproducts like ggbs, fly ash, silica and the others with replacement of cement. Hence it is also a study relates with the actual usage in the concrete without changing strength as compare to conventional concrete. This replacement will be done with varying water cement ratios.
Key words: Recycled Coarse Aggregate, Ternary Blended

I. INTRODUCTION

Today cement is the best material for global infrastructural development. In 2009 the expected cement production was 3 billion tons and in future 2020 the cement production will be about more than 5.9 billion tons. Cement reduces by using ggbfs and fly ash in proportion of cement without any changes of strength. As according to environment and nature aspect cement can be minimized, ggbfs and fly ash are the byproduct of industries and thermal power plant. So, both products reduce pollution and keep environment clean and also save natural material. The combination of fly ash and ggbfs with cement is called ternary blend material. The building age completing after demolished building, the demolition complete after demolition waste in coarse aggregate separated and this separated coarse aggregate reuse for concrete, this coarse aggregate is known as recycled coarse aggregates. In concrete mix combination recycled coarse aggregates with in ternary blended material which gives ternary blended concrete (TBC). TBC is increase in the demand of eco-friendly products and reuse of materials and also economical. As environmental point of view these type concrete will useful in all places but in our country less uses these type of concrete.

II. LITERATURE REVIEW PAPER

A. Performance Evaluation Of Recycled Aggregate Used In Concrete

1) Author
A.N.Dabhade, Dr.S.R.Choudhari, Dr.A.R.Gajbhiye Paul.
2) Published In Journal
International Journal of Engineering Research and Applications (IJERA)
Year: July-August 2012
3) Objectives Of Study
At present, Reuse of waste concrete aggregate is easily available. Conventional Coarse aggregate is changed with recycled aggregate and conventional. Here, No. of test conduct like water absorption, workability test, impact value test, Fineness modulus, compressive test, split tensile test, crushing value test, and bulk density.
4) Methodology
There were concrete mixes no. of batches consists of every 20% increment of recycled aggregate replacement from 0% to 100%.0.5,0.6 and 0.7 water/cement ratio are examined. The amount of recycled aggregate increased which reduce workability of concrete.

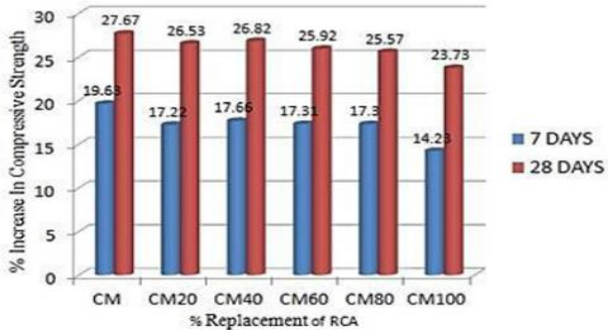

Fig. 1: Compressive Strength for W/C ratio 0.5

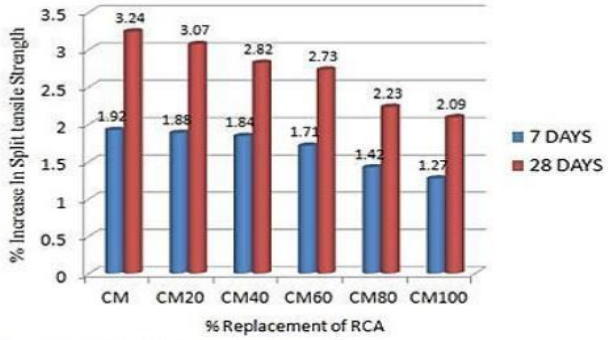

Fig. 2: Spilt Tensile Strength for W/C ratio 0.5

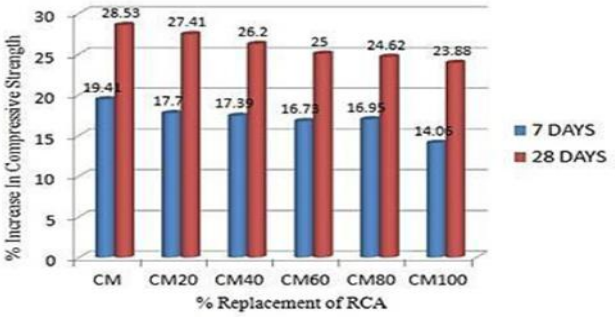

Fig. 3: Compressive Strength for W/C ratio 0.6

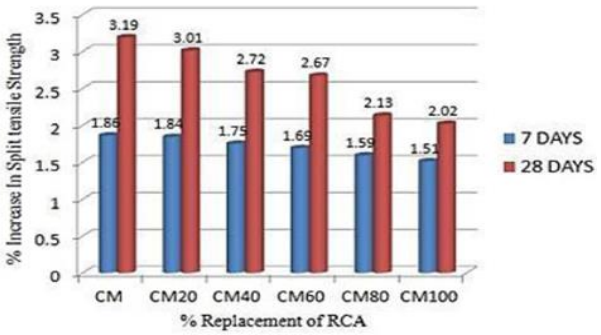

Fig. 4: Split Tensile Strength for W/C ratio 0.6

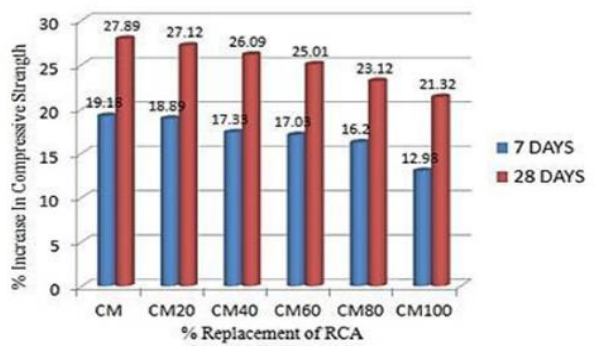

Fig. 5: Compressive Strength for W/C ratio 0.7

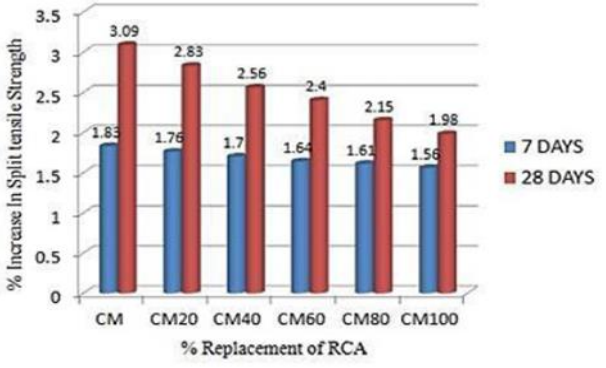

Fig. 6: Split Tensile Strength for W/C ratio 0.7

B. Outcome of Study

The strength of concrete depend upon percentage of RA when percentage increases than the strength of concrete will decrease. More water use as admixture required for using RA. It also help to reduce damage of our natural landscape. The compressive strength of recycled concrete depend upon w/c ratio. At lower w/c ratios, the compressive strength of recycled concrete is much lower than that of normal concrete and also higher w/c ratio give similar strength of conventional concrete.

III. Recycled Aggregate Concrete, a Sustainable Option from Demolition Concrete Waste - A Percentage Replacement Method

A. Author

Praveen Mathew, Jeevan Jacob, Leni Stephen, Thomas

B. Published in Journal

International Journal of Innovative Research in Science, Engineering and Technology.
Year: Feb-2014

C. Objectives of Study

In this study, Natural aggregate replaced by recycled aggrades, after is examined behavior concrete for its structural property. Compressive strength, splitting tensile strength, flexural strength and modulus of elasticity of recycled aggregate concrete (RAC) such as were examined. This gives a correct perception of RAC comparison with the natural aggregate concrete (NAC) which used as a structural material.

D. Methodology

The mix ratio was done as per the Indian standards. The Portland Pozzolana cement is used with specific gravity 2.6.After examined that full replacement of natural aggregates with recycle coarse aggregate, a part replacement that offers a better structural property in comparison with the conventional concrete. Here no. of replacements were selected i.e. 0% (NAC), 20% (RAC 20), 30% (RAC 30) and 40% (RAC 40) to behavior the various tests on its property.

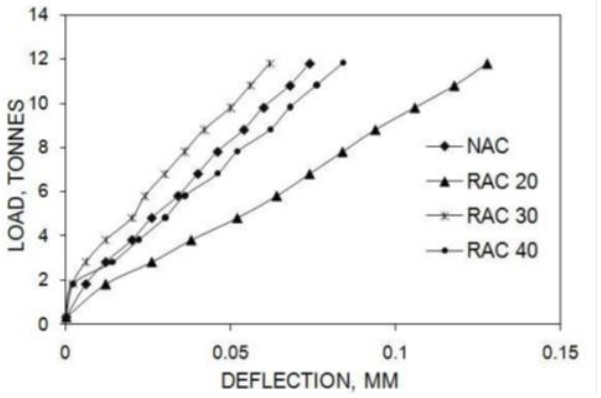

Fig. 7: Deflection, MM

E. Outcome of Study

Workability and modulus of elasticity will be decreased and also mechanical properties will be increased by using the w/c ratio – 0.45 and increment the percentage of RAC. Different properties of RAC were compared with NAC. In this study, at 40% replacement obtained maximum strength.

IV. Experimental Study of Compressive Strength of Recycled Coarse Aggregate Concrete

A. Author

Prof. D. K. Bhagat, J. P. Parmar, Y. R. Tank, D. H. Gadhiya, J.S. Goyani

B. Published in Journal

International Journal of Engineering Research and technology.
Year: April-2014

C. Objectives of Study

Material properties for concrete of M25 grade made with various percentages of recycled coarse aggregates with replacement percentage of 0, 20, 40 and 60. The basic properties like workability and compressive strength etc. observe with NAC with RCA. The goal of this study is to develop the economical and sustainable concrete by using the concrete waste available on the site.

D. Methodology

Waste was collecting the near gitanjali cinema to Surat. After material was crush by hammer to separate the aggregate and to reduce their sizes in small fraction. As per Indian Standard Codes various tests were conducted on separated aggregate and also results were compared to Natural aggregate. Concrete basic properties like compressive strength, workability test was evaluated on various combinations (0%, 20%, 40%, 60%) of RCA with NA. M25 grade mix was designed as per IS 10252:2009.

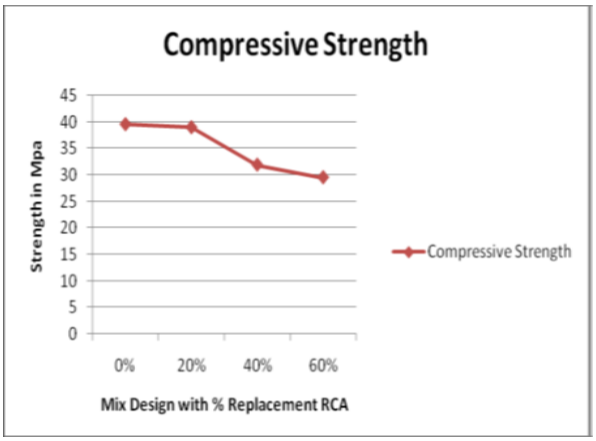

Fig. 8: Compressive Strength

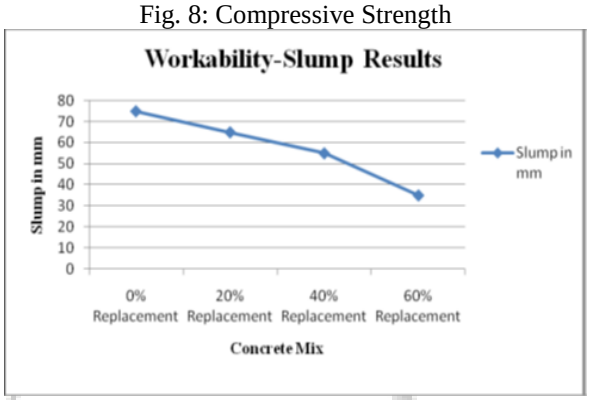

Fig. 9: Workbility-Slump Results

E. Outcome Of Study

The water absorption of RCA concrete increased with increase in replacement of NCA with RCA because od adhering mortar and cement paste. Specific gravity of RCA compare to less the NA. The results of compressive strength, the use of RCA up to 40% affect the functional requirements of concrete structure. Also the results of slump test continuous decrease in workability of concrete mix, as the cement mortar paste is attached to RCA.

V. An Experimental Study on Durability of Concrete Using Fly Ash and GGBS for M30 Grade Concrete

A. Author

S.P.S.RAMYA, A.M.N.KASHYAP

B. Published In Journal

International Journal of Engineering Research and Development
Year: November (2014)

C. Objectives Of Study

Concrete when subjected to severe environments its durability can significantly decline due to degradation. Degradation of concrete structures by corrosion is a serious problem and has major economic implications. In this study, an attempt has been made to study the durability of concrete using the mineral admixtures like Fly Ash & Ground Granulated Blast Furnace Slag (GGBS) for M30 grade concrete.

D. Methodology

In this study, an attempt has been made to study the durability of concrete using the mineral admixtures like Fly Ash & Ground Granulated Blast Furnace Slag (GGBS) for M30 grade concrete. Cube specimens were casted and are immersed in normal water, sea water, H2SO4 of various concentrations and were tested after 7 days, 28 days & 60days.

E. Outcome of Study

The results of fly ash and GGBS concretes when replaced with 20% of cement are more than compared to 100% cement at the end of 7 days, 28 days and 60 days for normal water curing. In sea water curing the GGBS when replaced with 20% of cement shows good response for durability criteria. In 1% H2SO4 solution curing the Fly Ash when replaced with 20% of cement shows good response for durability criteria.

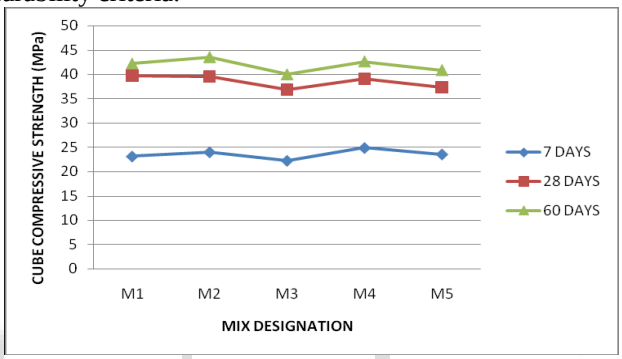

Fig. 10: Cube Compressive Strength (MPa) Cured in Normal Water

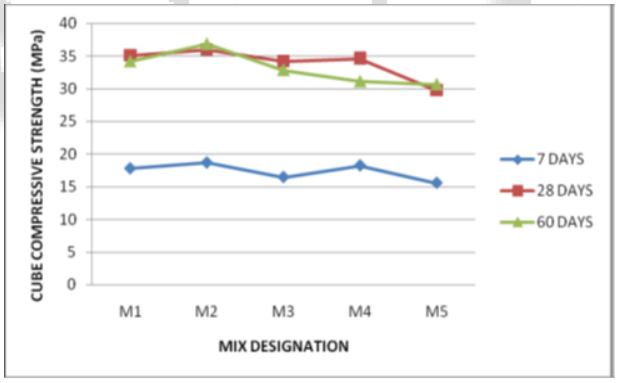

Fig. 11: Cube Compressive Strength (MPa) Cured in Sea Water

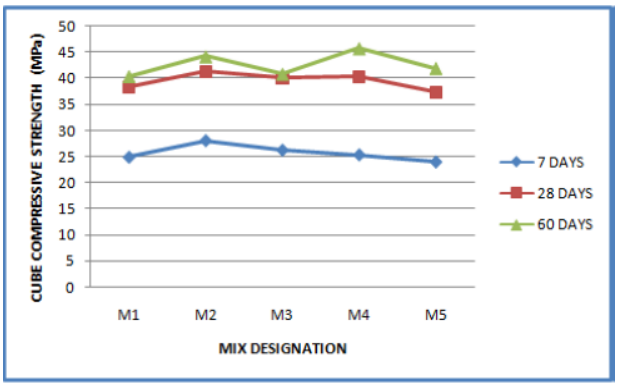

Fig. 12: Cube Compressive Strength (Mpa) cured in 1% H2SO4 Solutio

VI. ESTIMATION OF GGBS AND HVFA STRENGTH EFFICIENCIES IN CONCRETE WITH AGE

A. *Author*

K. Suvarna Latha, M V Seshagiri Rao, Srinivasa Reddy. V

B. *Published in Journal*

International Journal of Engineering and Advanced Technology (IJEAT)
Year: December 2012

C. *Objectives of Study*

The present paper is an effort to quantify the strength of ground granulated blast furnace slag (GGBS) and high volume fly ash (HVFA) at the various replacement levels and evaluates their efficiencies in concrete. In recent years GGBS when replaced with cement has emerged as a major alternative to conventional concrete and has rapidly drawn the concrete industry attention due to its cement savings, energy savings, and cost savings, environmental and socio-economic benefits.

D. *Methodology*

The present study reports the results of an experimental study, conducted to evaluate the strengths and strength efficiency factors of hardened concrete, by partially replacing the cement by various percentages of ground granulated blast furnace slag and high volume fly ash for M20, M40 and M60 grades of concrete at different ages. Here an effort is made towards a specific understanding of the efficiency of GGBS and HVFA in concrete, considering the strength to water cement ratio relations, age and percentage of replacement. The optimum GGBS and HVFA replacement as cementations material is characterized by high compressive strength, low heat of hydration, resistance to chemical attack, better workability, and good durability and cost-effective.

E. *Outcome of Study*

The partial replacement of cement with GGBS and HVFA in concrete mixes has shown enhanced performance in terms of strength and durability in all grades. This is due to the presence of reactive silica in GGBS and HVFA which offers good compatibility. Replacement of 40% HVFA and GGBS give good strength in all grade.

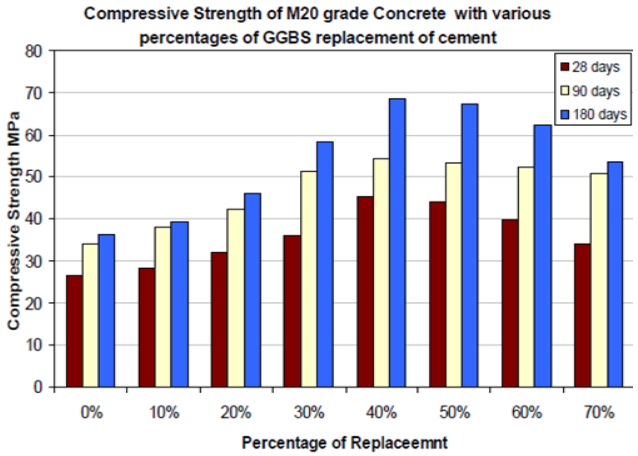

Fig. 13: Compressive Strength of Grade Concrete With Various Percentages Of GGBS Replacement Of Cement

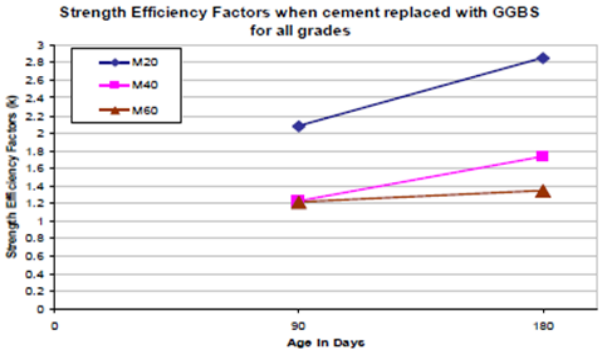

Fig. 14: Strength Efficiency Factors When Cement Replaced with GGBS for All Grades

VII. CONCLUSION

The different experiments have been performed with the comparative study of Natural Coarse Aggregate (NCA) with Recycled Coarse Aggregate (RCA) tried to use maximum proportion of byproducts without decrease in the strength. The RCA were used in the change of 0% to 100% with NCA. The byproduct Fly ash used with the different replacements of with cement and ggbfs or ggbs replacement is also done with different percentage with cement. Fly ash and ggbfs both had been used with every replacement of RCA.

REFERENCES

[1] A N Dabhade, Dr. S S R choudhary, Dr. A R Gajbhiye in international journal of engineering research and application in vol.2 issue for july august 2012.
[2] Basil Johny, Prof. M V Geoge, Dr. Elson John in international journal of engineering research and technology, vol. 3 issue 9 Sep 2014.
[3] Chetan M Vayas, Darshna R Bhatt in international journal of innovative technology and exploring engineering vol. 2, issue 3, Feb. 2013.
[4] IS 10262: 2009 (concrete mix proportioning)
[5] IS: 2386 (part 1, 2,3,4) 1963.
[6] IS 456 2000.
[7] IS 383 1970.
[8] IS 12269 1987.
[9] Jitender Sharma, Sandeep Singla in international journal of civil engineering in vol. 1, issue 4, Sep. 2014.
[10] K. Suvarna Latha, M V Seshagiri Rao, Srinivasa Reddy. V in international journal of engineering research and advanced technology in vol. 2, issue 2, Dec. 2012.
[11] M Prabu, S. Logeswaran, Dr. Sunilaa George in international journal innovative research in science, engineering and technology, vol. 4, issue 6, June 2015.
[12] M.S.Shetty,"Concrete Technology" (Theory and Practice), S.Chand & Company Limited, New Delhi, Sixth Edition, May-2005
[13] M.V.S.S. Sastri, Dr. K. Jagannadha Rao, Dr. V. Bhiksma in IJCIET, Vol. 5, Issue 3, March 2014.
[14] Praveen Mathew, Jeevan Jacob, Leni Stephen, Thomas Paul I international journal of innovative research in science, engineering and technolology, vol.3, issue to, feb. 2014.
[15] Prof. D K Bhagat, J P Parmar, Y R Tank, D H Gadhiya, J S Goyani in international journal of research and technology, volume 3, issue 4, April 2014.

[16] S.P.S. Ramya, A.M.N. Kashyap in the International Journal of engineering research and development, volume 10, issue 11, November 2014.
[17] Thavasumony D, Thanappan Subash, Sheeba D in IJSER, volume 5, Issue 7, July 2014.
[18] Wen-Ten kuo, Her-Yung Wang, Chun-Ya Shu in construction and building material.

