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Comparative Study of Compressive strength behaviour of LVFAC and HVFAC in partial replacement with stone dust and recycled aggregates

Saman Khan[1], Roohul Abad Khan[2], Amadur Rahman Khan[3], Shams Al Deen M Saad[4]

1. Integral University, Lucknow, India
2. King Khalid University, Abha, Saudi Arabia
3. Aligarh Muslim University, Aligarh, India
4. King Khalid University, Abha, Saudi Arabia

Abstract: **Fly Ash has been of interest for building materials since ancient times owing to its cementitious properties. The pozzolanic materials were obtained from the areas near volcanoes and used in construction. In modern day the thermal power plants are the largest source of Fly ash. One of the major solution provided for its disposal was to incorporate the fly ash in concrete and use it for various purposes. The study compares the compressive behaviour of Low Volume Fly Ash Concrete (LVFAC) and High Volume Fly Ash Concrete (HVFAC) in partial replacement of natural aggregates with stone dust and recycled aggregates. The specimens were tested at 28 days to determine the compressive strength. The study determined the effectiveness of Fly ash in enhancing the compressive strength of concrete.**

Index Terms: **Fly Ash, Compressive strength, LVFAC, HVFAC**

I. INTRODUCTION

Incorporation of Fly Ash in concrete for enhancing its mechanical properties is in practice in concrete industry for some time now. The addition of fly ash in low volume and high volume has already been researched by many researchers. The addition of fly ash has risen owing to the need of disposal of fly ash in vast amount by using it in building materials. The pozzolanic properties of fly ash has resulted in enhancing thee compressive strength of concrete owing to which fly ash is being added in varying volumes to improve the strength of concrete. [Saman et.al 1,2,3, Roohul et. al, 4]

Stone dust and recycled aggregates are also two more waste products which were a concern for disposal. Stone dust and recycled aggregates have also been researched upon to determine the changes in concrete properties owing to their additions. Stone dust and recycled aggregates are incorporated in concrete matrix in partial replacement of coarse aggregate. [Saman et.al 7,8, Roohul et. al 5,6]

II. MATERIALS

A. *Cement*

In the present study, 53 grade Ordinary Portland Cement (OPC) of a single batch was used throughout the investigation. The physical and chemical properties of OPC as determined are given in table 1. The cement satisfies the requirement of IS: 12269-1987.

B. *Fine aggregate:*

The fine aggregate used was locally available river sand, which was passed through 4.75 mm. The specific gravity of fine aggregate is 2.74 and fineness modulus is 2.87.

C. *Coarse aggregate:*

Two aggregate sizes (20 and 10 mm) were used in this investigation. The specific gravity of coarse aggregate was 2.76 for both the fractions. The 20 and 10 mm aggregate were mixed in the ratio of 60:40.

D. Stone dust:

Stone dust was obtained from local stone crushing units of Uttar Pradesh. It was initially dry in condition when collected and was sieved before mixing in concrete. Specific gravity of stone dust was 2.50 and water absorption was 0.5%.

III. METHODS AND METHODOLOGY

An experimental investigation was conducted Study of Low Volume Fly Ash Concrete with Recycled Aggregates (LVFAC) to get the strength of specimens (cubes) made with the use of stone dust and recycled aggregates as partial replacement of fine aggregates and coarse aggregates respectively. The strength of conventional concrete and other mixes were determined at the end of 7 and 28 days of water curing. To study the effect of stone dust and recycled aggregates inclusions, cubes of a design mix M25 grade concrete were cast. The 150 mm cubes were tested for compressive strength. The M25 mix proportion was (1:1.56:2.91) at w/c ratio of 0.40.

IV. RESULT AND DISCUSSION

The casted concrete specimen for low volume fly ash and high volume fly ash were tested for compressive strength of concrete at 28 days. A control specimen with 0% stone dust was also tested to determine the increase in strength owing to infusion of stone dust into concrete mix. The ratio of stone dust was varied at the rate of 5%, 10% and 15% for LVFAC and HVFAC is represented in Figure 1 & 5 respectively. The recycled aggregates were varied at eh rate of 5%, 10% and 15% along with stone dust for LVFAC and HVFAC and are represented in Figure 2-4 and Figure 6-8 respectively.

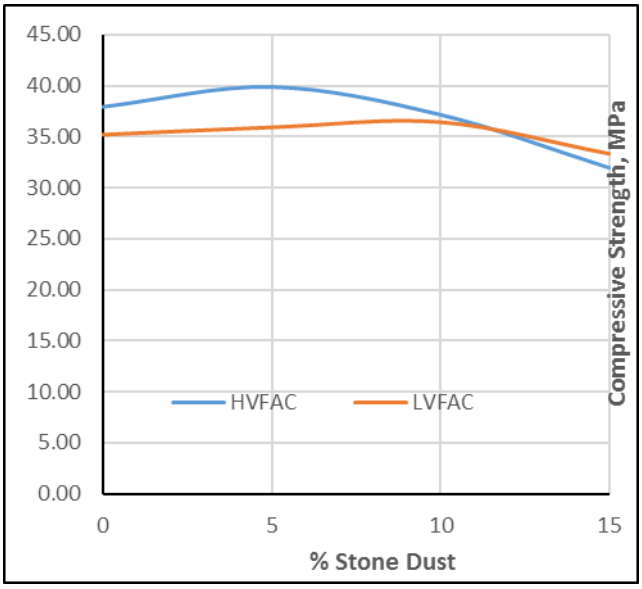

Figure 1 Compressive Strength of HVFAC and LVFAC with 0% Recycled Aggregates

The figure 1 represents the compressive strength behaviour of HVFAC and LVFAC in partial replacement with stone dust at 0% recycled aggregate. The compressive strength after 28 days for HVFAC increased to 37.98 MPa while for LVFAC it remained till 35.21. the percentage increase in HVFAC and LVFAC was about 151% and 141 % respectively.

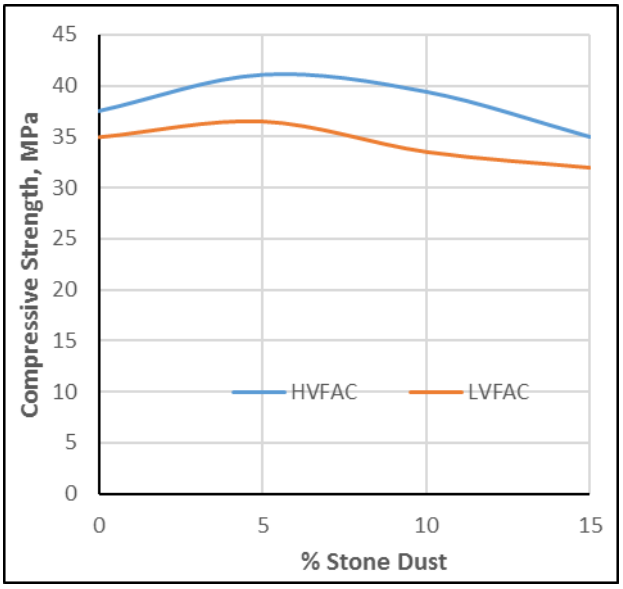

Figure 2 Compressive Strength of HVFAC and LVFAC with 5% Recycled Aggregates

The figure 2 represents the compressive strength behaviour of HVFAC and LVFAC in partial replacement

with stone dust at 5% recycled aggregate. The compressive strength after 28 days for HVFAC increased to 37.55 MPa while for LVFAC it remained 35 MPa. the percentage increase in HVFAC and LVFAC was about 150% and 140 % respectively.

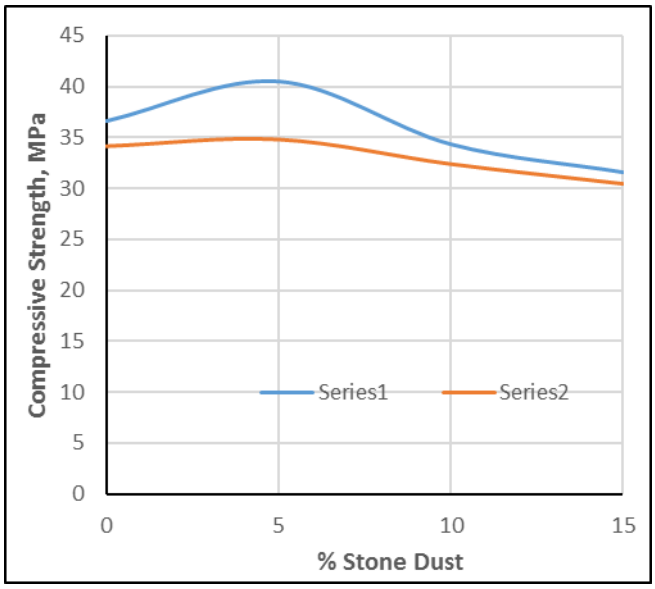

Figure 3 Compressive Strength of HVFAC and LVFAC with 10% Recycled Aggregates

The figure 3 represents the compressive strength behaviour of HVFAC and LVFAC in partial replacement with stone dust at 10% recycled aggregate. The compressive strength after 28 days for HVFAC increased to 37 MPa while for LVFAC it remained 34 MPa. the percentage increase in HVFAC and LVFAC was about 147% and 137 % respectively.

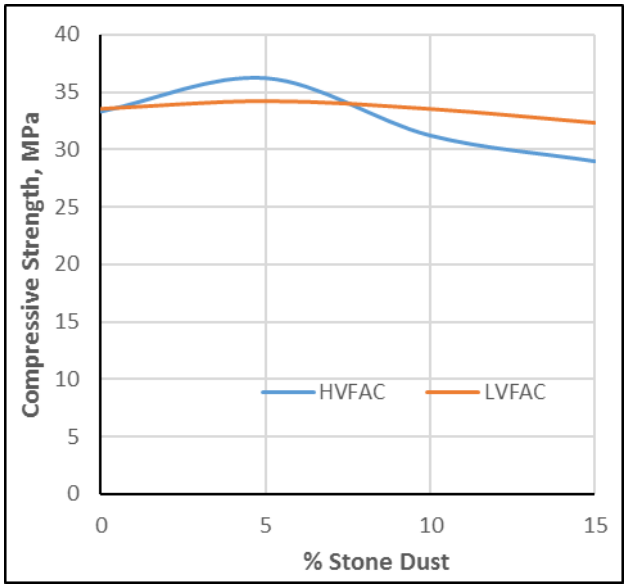

Figure 4 Compressive Strength of HVFAC and LVFAC with 15% Recycled Aggregates

The figure 4 represents the compressive strength behaviour of HVFAC and LVFAC in partial replacement with stone dust at 15% recycled aggregate. The compressive strength after 28 days for HVFAC increased to 33 MPa while for LVFAC it remained 34 MPa. the percentage increase in HVFAC and LVFAC was about 133% and 134 % respectively.

V. CONCLUSION

The HVFAC specimen depicted more strength than LVFAC at 0% natural aggregate replacement which is 37.98 MPa and 35.21 MPa.

Stone dust was used for partially replacing natural aggregates at the varied rate of 5%, 10% and 15% which resulted in increase of strength for both the specimen of HVFAC and LVFAC, the maximum being achieved at 5% of stone dust content i.e. 39.93 MPa and 35.93 MPa.

Recycled Aggregates were used in addition of stone dust for further replacement of natural aggregates at the rate of 5%, 10% and 15%. The maximum strength gain was achieved at 5 % of Stone dust in all the cases for both HVFAC and LVFAC i.e. 41 MPa, 40.55 MPa, 36.21 MPa and 36.53 MPa, 34.88 MPa and 34.24 MPa respectively.

The strength gain was 10-12% less for LVFAC as compared to HVFAC in all the cases of study. Suggesting the volume of fly ah contributes more to the strength owing to its cementitious properties.

References

1. Saman Khan, Roohul Abad Khan, Amadur Rahman Khan and Saiful Islam," Strength Gain Analysis of Polypropylene Fiber Reinforced Concrete," International Journal of Scientific Research in Science, Engineering and Technology Volume 2, Issue 1, Article first published online: January-Febuary – 2016, Available Online at: http://ijsrset.com/PDF.php?pid=734&v=2&i=1&y=2016&m=January-Febuary

2. Saman Khan, Roohul Abad Khan, Amadur Rahman Khan, Misbahul Islam and Saman Nayal, "Mechanical Properties of Polypropylene fibre reinforced concrete for M25 and M 30 mixes: A Comparative Study," International Journal of Scientific Engineering and Applied Sciences, Volume 1, Issue 6, September 2015. Available Online at: http://ijseas.com/volume1/v1i6/ijseas20150634.pdf
3. Saman Khan, Roohul Abad Khan, Saiful Islam, Suhaib Nazar, Nadeem A Khan, "Comparative study of Compressive and Tensile behaviour of Polypropylene Fibre reinforced Concrete of M 15 and M 20 Mix," IJEA Volume 4 Issue 3 March 2015. Available Online at: http://www.advanceresearchlibrary.com/temp/downloads/ijea/March2015/rk7.pdf
4. Roohul Abad Khan, Amadur Rahman Khan and Shashank Verma," Effect of Fibre Content on CBR for Unsoaked RDFS," International Journal for Research & Development in Technology, Volume-5 issue-3 March 2016. Available Online at: http://ijrdt.org/full_paper/326/14/Effect-of-Fibre-Content-on-CBR-for-Unsoaked-RDFS
5. Roohul Abad Khan, Amadur Rahman Khan and Saiful Islam," Analysis of Dry Unit Weight and optimum moisture content," American International Journal of Research in Formal, Applied and Natural Sciences, ISSN (Print) 2328-3777, ISSN (Online): 2328-3785, March 2016. Available Online at: http://iasir.net/AIJRFANSpapers/AIJRFANS15-523.pdf
6. Roohul Abad Khan, Amadur Rahman Khan and Saiful Islam," Behaviour of CBR for Soaked RDFS at varying fibre length," e-ISSN: 2394-3343, p-ISSN: 2394-5494, International Journal of Innovative and Emerging Research in Engineering, Volume 3, Issue 2, 2016. Available Online at: http://ijiere.com/FinalPaper/FinalPaperBehaviour%20of%20CBR%20for%20Soaked%20RDFS%20at%20varying%20fibre%20length170540.pdf
7. Saman Khan, Roohul Abad Khan and Amadur Rahman Khan," Strength gain Analysis of Polyethylene terephthalate (PET) fibre reinforced concrete," International Journal for Research and Development in Technology, Volume 5, Issue 6, June-2016, ISSN (O): - 2349-3585, Available Online at: http://ijrdt.org/full_paper/527/14/Strength-gain-Analysis-of-Polyethylene-terephthalate-PET-fibre-reinforced-concrete
8. Saman Khan, Roohul Abad Khan, Amadur Rahman Khan and Shashank Verma," Comparison of High Volume Fly Ash Concrete (HVFAC) and Low Volume Fly Ash Concrete (LVFAC) with Stone dust," EPRA International Journal of Research and Development (IJRD), ISSN (Online): 2455-7838, Volume 1 Issue 4, June 2016. SJIF Impact Factor: 3.476, Available Online at: http://eprajournals.com/jpanel/upload/320pm_4.Saman%20Khan-16.5.16.pdf