International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 06 | June 2020 www.irjet.net p-ISSN: 2395-0072

STRENGTH ANALYSIS OF REPLACEMENT OF FINE AGGREGATES WITH FLY ASH FINE AGGREGATES

Kumuda V[1], Usha K N[2], Sunny K[3], Pradeep Kumar[4]

[1]*Assistant Professor, Department of Civil Engineering, East West Institute of Technology, Bangaluru, India*
[2]*Assistant Professor, Department of Civil Engineering, East West Institute of Technology, Bangaluru, India*
[3]*Assistant Professor, Department of Civil Engineering, East West Institute of Technology, Bangaluru, India*
[4]*Technical Assistant Engineer, Mgnrega, Chikkaballapura District, India*

Abstract - *The research in relation to the use of flyash to produce structural lightweight concrete, because of economic condition and also due to scarcity of natural aggregates . By seeing this context fly ash can be much more effective material used as replacement in concrete as fine aggregate along with cement combination is summarized in this paper. As discussed above , fine aggregates are prepared by using fly ash with small portion of cement using Pelletisation technique with varying proportions like 15:85, 10:90 and 05:95 of cement: fly ash respectively. Thus in the present study, the effect of flyash fine aggregate proportions on the compressive strength and split tensile strength of the concrete in which the fine aggregates are replaced by a percentages of 25% , 50%, 75% and 100% by flyash fine aggregates with a different proportions are checked and the results are compared with a M_{30} grade conventional concrete results. Blocks and cylinders were casted for all FAFA proportions and cured for 7 days , 14 days, 28 days and 56 days compressive strength and 7 days , 14 days, 28 days split tensile strength of all proportions of FAFA concrete are calculated .The compressive strength and split tensile strength of 15:85 proportion FAFA concrete was found to be high when compared to other FAFA proportions such as 10:90 and 05:95 and it was equal to 28 days and 56 days strength of M_{30} grade concrete in all the replaced percentages.*

Key Words: **Fly ash, FAFA- fly ash fine aggregates, compressive strength, Split tensile strength**

1. INTRODUCTION

Pelletisation technique: Process of comprising or molding a material into the shape of pellets.(Reference [6])

In the present study, fly ash is used in the production of fine aggregate. As flyash is a waste material and also the outcome of it is very huge in thermal power plant, part of flyash obtained is used in cement industries and remaining of it is simply land filled or dumped. As it contains silica content, it can be effectively consumed in the preparation of aggregates along with a binder solution like water. In this study fly ash is mixed with sufficient quantity of water in the preparation of flyash fine aggregate.

2. COMPRESSION TEST:

For the test, the moulds of 0.15x0.15x0.15m is prepared. Mix of FA sand, CA, sand, binder and water are weighed and mixed thoroughly in the mixer and plasticizer of sufficient amount is added for the slump and ease of handling. After the process of mixing, the mixture is added to the oiled or greased cubical moulds in layers tamping the each layer. Then the cubical moulds concreted is allowed for drying for 24h and the oiled moulds are demoulded and are placed or immersed in water completely for the purpose of curing. The cured specimens of different ages are taken and are tested for strength due to compression. Here load is applied uniformly and the load the specimen takes ultimately is noted and strength aspect is determined using the formulae,

Compressive Strength= P/A Mpa

Where:

P= Load in kilo Newton
A= Area of cubical mould

2.1. RESULS AND DISCUSSIONS ON COMPRESSION STRENGTH

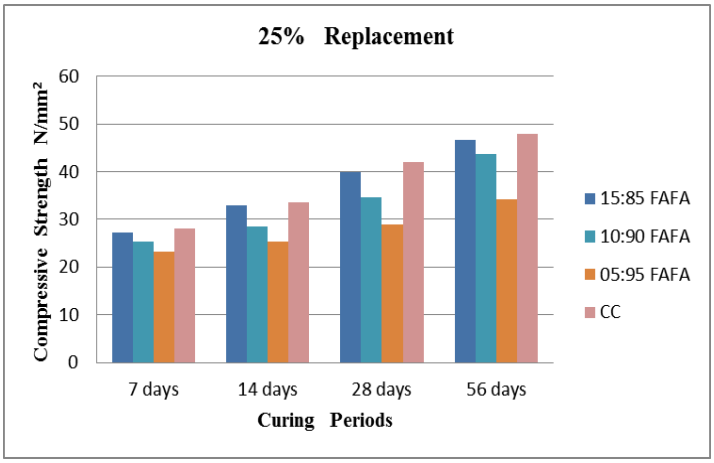

Chart 1 Bar Graph Showing Compressive Strength with 25% Replacement of FA with FAFA

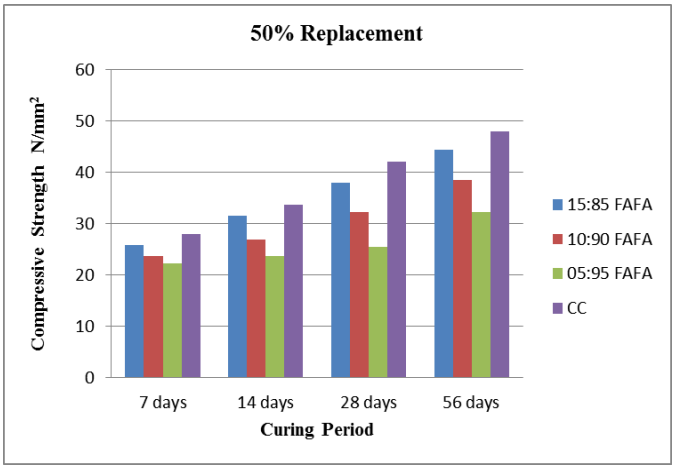

Chart 2: Bar Graph Showing Compressive Strength with 50% Replacement of FA with FAFA

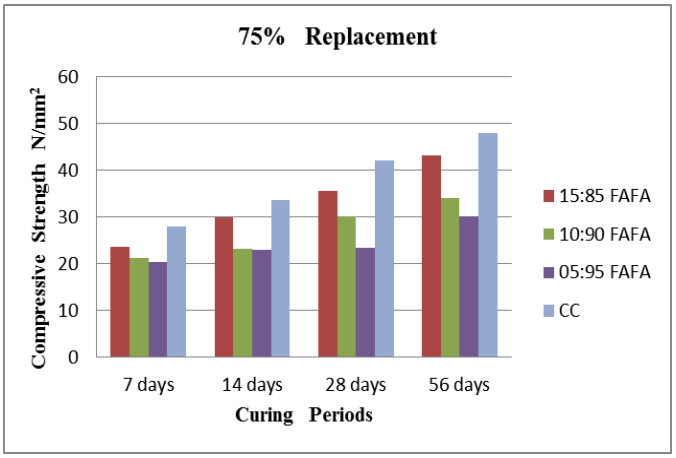

Chart 3: Bar Graph Showing Compressive Strength with 75% Replacement of FA with FAFA

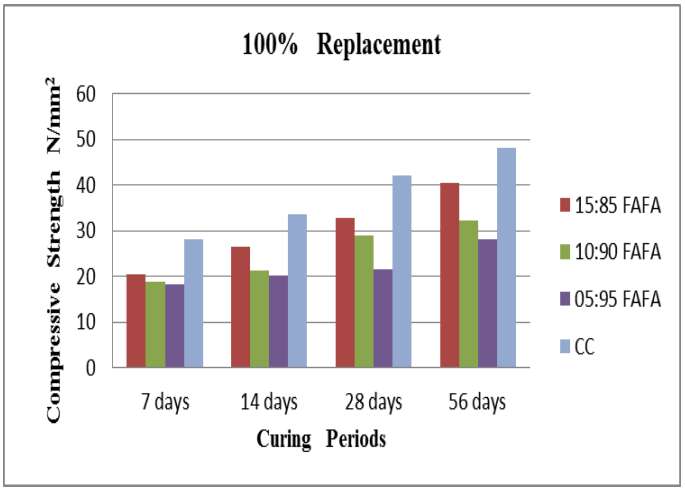

Chart 4: Bar Graph Showing Compressive Strength with 100% Replacement of FA with FAFA

From the Chart 1, the manufactured aggregate of 15:85 shows good compressive strength when compared to other ratios of aggregates prepared. 15:85 aggregates shows good compressive strength of 39.83 Mpa which is nearly equal to normal concrete of compressive strength 42Mpa,which shows a variation of 5.45% in compressive strength.

From the Chart 2 the manufactured aggregate of 15:85 shows good compressive strength when compared to other ratios of aggregates prepared. 15:85 aggregates shows good compressive strength of 37.96 Mpa which is 4.9% less when compared to 25% replacement and also which is nearly equal to normal concrete of compressive strength 42 Mpa with a variation of 10.6% in compressive strength.

From the Chart 3, the manufactured aggregate of 15:85 shows good compressive strength when compared to other ratios of aggregates prepared. 15:85 aggregates shows good compressive strength of 35.49 Mpa which is 6.9% less when compared to 50% replacement.

From the Chart 4, the manufactured aggregate of 15:85 shows good compressive strength when compared to other ratios of aggregates prepared. 15:85 aggregates shows good compressive strength of 32.73 Mpa which is 5% less when compared to 75% replacement.

2.1.1 Discussions on Compressive Strength Results

The cube of dimension 0.15m x 0.15m are casted for both conventional as well as FAFA aggregate replacement of 25% , 50%, 75% and 100% respectively and are cured for the ages of 7days, 14days, 28days and 56days. The conventional concrete compressive strength for M30 grade shows 48 Mpa but as the 15:85 proportion aggregates are replaced by 25%, 50%, 75% and 100% the strength slightly varies. Comparing 15:85 proportion aggregates are compared with other proportions10:90 and 05:95 , it has shown higher strength.

3. SPLIT TENSILE STRENGTH

For the test, the mould of 0.15m dia and 0.3m length is prepared. Mix of FA sand, CA, sand, binder and water are weighed and mixed thoroughly in the mixer and plasticizer of sufficient amount is added for the slump and ease of handling. After the process of mixing, the mixture is added to the oiled or greased cylindrical moulds in layers tamping the each layer. Then the cylindrical moulds concreted is allowed for drying for 24h and the oiled moulds are demolded and are placed or immersed in water completely for the purpose of curing. The cured specimens of different ages are taken and are tested for strength. Here load is applied uniformly and the load the specimen takes ultimately is noted and strength aspect is determined using the formulae,

Split Tensile Strength= 2P/B Mpa

Where:

A= Load in kilo Newton

B= π DL

D= Diameter of cylinder, L= Length of cylinder

3.1. RESULS AND DISCUSSIONS ON SPLIT TENSILE STRENGTH

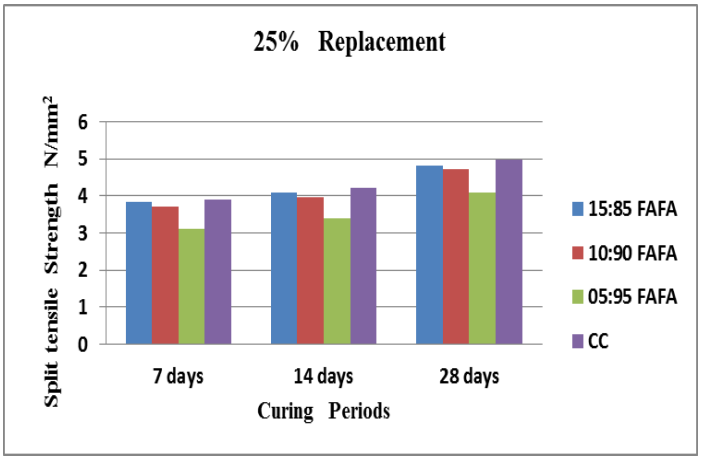

Chart 5 Bar Graph Showing Split Tensile Strength with 25% Replacement of FA with FAFA

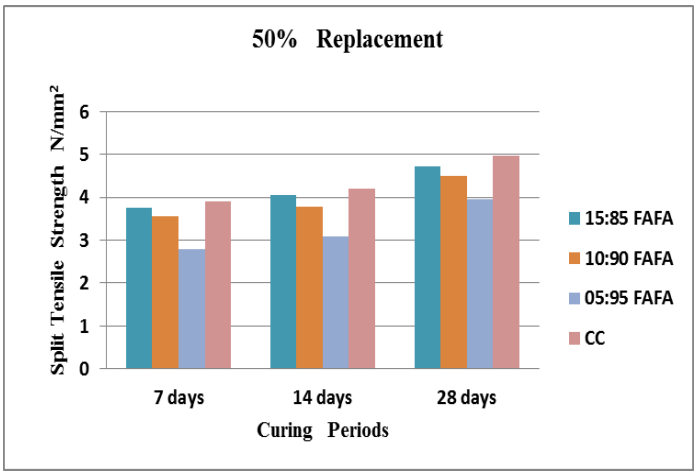

Chart 6: Bar Graph Showing Split Tensile Strength with 50% Replacement of FA with FAFA

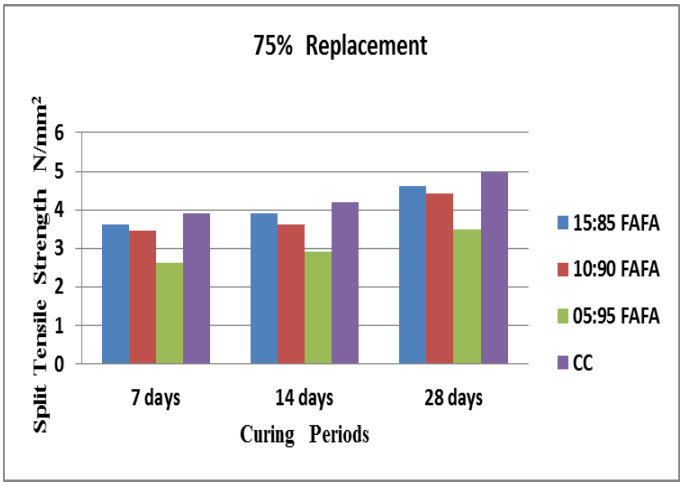

Chart 7: Bar Graph Showing Split Tensile Strength with 75% Replacement of FA with FAFA

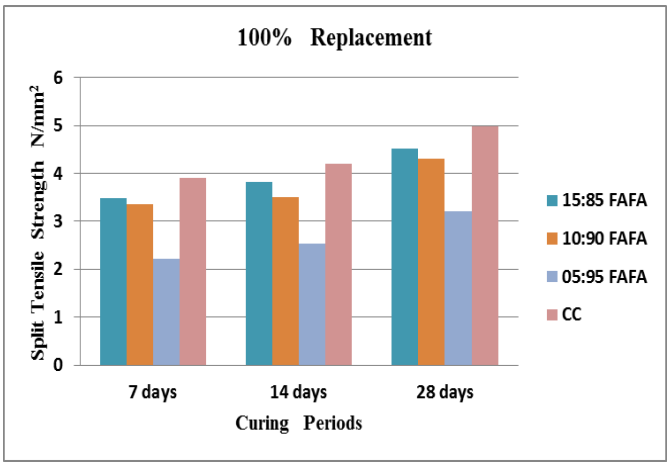

Chart 8: Bar Graph Showing Split Tensile Strength with 100% Replacement of FA with FAFA

From Chart. 5, the manufactured aggregate of 15:85 shows good tensile strength when compared to other ratios of aggregates prepared. 15:85 aggregates shows good tensile strength of 4.82 Mpa which is nearly equal to normal concrete of tensile strength 4.98 MPa. This shows a variation of 3.3% in tensile strength.

From Chart. 6, the manufactured aggregate of 15:85 shows good tensile strength when compared to other ratios of aggregates prepared. 15:85 aggregates shows good tensile strength of 4.72 M pa which is 2.12% less when compared to 25% replacement and also which is nearly equal to normal concrete of tensile strength 4.98 M pa with a variation of 5.5% in tensile strength.

From Chart. 7, the manufactured aggregate of 15:85 shows good tensile strength when compared to other ratios of aggregates prepared. 15:85 aggregates shows good tensile strength of 4.61 Mpa which is 2.4% less when compared to 50% replacement.

From Chart. 8, the manufactured aggregate of 15:85 shows good tensile strength when compared to other ratios of aggregates prepared. 15:85 aggregates shows good tensile strength of 4.52 Mpa which is 2% less when compared to 75% replacement

3.1.1 Discussions on Split Tensile Strength Results

The cylinder of dimension 0.15m diameter and 0.3m height are casted for both conventional as well as FAFA aggregate replacement of 25%, 50%, 75% and 100% respectively and are cured for the ages of 7days, 14days and 28days. The conventional concretes split tensile strength for M30 grade shows 4.98 Mpa but as the 15:85 proportion aggregates are replaced by 25%, 50%, 75% and 100% the split tensile strength slightly varied . But when 15:85 proportion aggregates are compared with the aggregates of proportion 10:90 and 05:95 the strength is high. Tensile strength of 15:85 aggregates are comparable with normal concrete hence this proportion aggregates are well suited and is optimum.

4. CONCLUSIONS

1. Various mix proportions of fly ash aggregates were manufactured in the ratio of 10:90 and 05:95, 15:85 respectively and were blended with concrete M30 grade to study the compressive strength behavior of fly ash aggregate addition.
2. After comparing results of all proportion, Compressive strength and Split tensile strength of 15:85 aggregates are comparable with normal concrete hence this proportion aggregates are well suited and is optimum.
3. Results showed that for 15:85 mix proportions with 25%, 50%, 75% and 100% replacement of natural aggregate showed compressive strength of 39.53 Mpa, 37.96 Mpa, 35.49 Mpa and 32.73 Mpa respectively.
4. Result of 15:85 shows a variation of 5.45%, 10.6%, 18.3% and 28.3% less compressive strength compared to conventional concrete.
5. Fly ash Aggregates of proportion 15:85 gave considerable split tensile strength of 4.82 Mpa, 4.72 Mpa, 4.61 Mpa and 4.52 Mpa for 25%, 50%, 75% and 100% respectively when compared with conventional concrete of tensile strength 4.98 M pa.
6. Result of 15:85 shows a variation of 3.3%, 5.5%, 8.3% and 9.24 % less split tensile strength compared to conventional concrete.
7. Result of 15:85 with 25% replacement shows a less variation in compressive strength and split tensile strength compared to conventional concrete .Hence it can be concluded as 25 % replacement as optimum .
8. The other replacements like 50%, 75% and 100% can be effectively replaced for the civil engineering application.

REFERENCES

[1] K. I. Harikrishnan, "Influence of Pelletisation process on the properties of flyash aggregates".
[2] K. Ramamurthy et. al. "Influence of binders on properties of sintered flyash aggregates", *Cement and Concrete Research*, Vol-28, 2006, PP. 33-38.
[3] R. Manikandan, "Swelling Characteristic of Bentonite on Pelletization and Properties of Flyash Aggregates".*Journal of Materials in Civil Engineering* [ASCE], October 2009.
[4] O. Kayali, "Flyash lightweight aggregates in high performance concrete", *Journal of Construction and Building Materials*, 22 (2008) 2393–2399.
[5] Kumuda V[1] , Nalina K[2] , Pradeep Kumar[3] , 'Effect of Thermal Power Plant Wastes on Compressive Strength of M_{25} Grade Fibre Reinforced Concrete' International Journal of Innovative Research in Science, Engineering and Technology, Vol. 7, Issue 4, April 2018
[6] Pradeep Kumar[1], Kumuda V[2] , ' Preparation of Fine Aggregate by Using Thermal Power Plant Waste by Pelletisation Technique' International Journal of Research and Scientific Innovation (IJRSI) , Volume V, Issue V, May 2018 , ISSN 2321–2705.