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Study on Composite Concrete by using Fly Ash, M-Sand and Fly Ash Aggregates

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Abstract:
Concrete is the most basic and the most essential building material which is used in any construction industry. It is plastic and mouldable when it is in crisp state. However gets solid and strong when solidified. Concrete is a building matter collectively composed of water, FA and CA embedded in a harden matrix of material called cement, which fills up the voids among aggregates and adheres them strongly. Concrete is good in compression but weak in tension, therefore the reinforcements are provided so that the required strength can be achieved in the tension zone. The usage of wastes such as fly ash are getting prioritized as additives, by using these wastes in concrete, The strength can be effectively achieved & the problem of disposal of these wastes can be greatly reduced. To meet the scarcity of fine aggregates these days M-Sand are used. In the present thesis work, the properties of concrete are thoroughly studied with addition of industrial wastes obtained from thermal power plants. Fly ash which is used in the preparation of pelletized coarse aggregates and also used as a supplement to cement. Various proportions of Fly ash and cement were adopted in the manufacture of aggregates of fly ash. The best proportion will be chosen as the final one for the preparation of FAA concrete based on the various test results such as impact, crushing and specific gravity tests after 28 days of curing. The prepared FAA will be used as a partial replacement for NCA at proportions 0%, 10%, 20%, 30%, 40% & 50% by volume of coarse aggregate. The parameters such as strength aspects are examined in this work. In this project the workability seems to decrease as the aggregates of fly ash is increased. Strength aspects such as compressive, Tensile and flexural strength tests are conducted. The compressive, tensile and flexural strengths are seem to increase for an optimum of 30% replacement of FAA with NCA, the strength later decreases further with increase in FAA percentages.

Key words: Fly ash, FAA, NCA, Tensile and flexural strength tests, etc..

I.INTRODUCTION

Concrete is the most basic material which is been used in construction industry since very long time in various fields of construction such as in buildings, bridges, pavements, dams, marine, sanitary structures and many others. Concrete is durable in nature. It is plastic and pliable in nature in its fresh state. Concreteis a building matter mainly composed of water, FA and CA embedded in a harden matrix of material called cement, which fills up the voids among aggregates and adheres them strongly. Concrete is good in compression but weak in tension, therefore the reinforcements are provided so that the required strength can be achieved in the tension zone. The most important component of a concrete is cement. The manufacture of cement causes various environmental and social consequences depending on considerations which are both harmful and are welcomed. Cement industries produce a huge amount of carbon dioxide. Various attempts have been made to reduce the carbon dioxide emission relating to concrete from both industrial and academicals sectors by substitution of conventional clinkers with industrial bi products such as fly ash. The use of industrial wastes gaining importance as additives, because they increase strength, decrease density and most importantly decrease environmental impacts. FLY ASH Fly ash is the byproduct from coal generating plant. Fly ash is the most important known commonly used pozzolanic ingredients in the world. It is one of the residues generated from that combustion of powdered coal and transported by flue gases and then collected by electrostatic precipitation. Ash which does not rise and settles down beneath is called as bottom ash. When the coal is burnt to produce heat, the residues contains 80% of fly ash and the remaining 20% contains bottom ash. The chemical components of fly ash contain SiO_2, Al_2O_3, Fe_2O_3,CaO, MgO and SO_3. However, the percentage of chemical components differs substantially, based upon the type of coal being burned.

FLY ASH AGGREGATES

Generally the light weight aggregate concrete are shown to be having adequate strength and durability and they have been started adopting in many structures of importance. The main objective of using fly ash aggregate is to reduce the self weight of concrete giving same strength compared to the natural aggregates. Aggregates of fly ash are generally produced by mixing fly ash with water and cement. The cement and fly ash of various proportions are tried with suitable water content to get the pelletized aggregates. The aggregate crushing and impact value were studied on these aggregates based on those test results the cement and fly ash proportion will be fixed to introduce it in concrete. These aggregates can be effectively used in the making of light weight concrete. The procedure of

preparation of these types of aggregates is called pelletisation. Pelletization process in which a suitable proportion of cement and fly ash selected and will be added into a mixing drum to get pellets of fly ash aggregate maintaining a suitable W/C ratio.

M SANDM Sand which are also known as factory sand or artificial sand is a type of sand used as a replacement for natural sand in every construction industry today, Since it has become very difficult to get natural sand cheaply, Because the construction of dams are taking place on every river hence these type of resources are washed away very quickly. Nowadays good quality sand is not very easily available, since it should be transported from very long distances making it very uneconomical. The artificial sands are manufactured using proper machines which have become a better substitute to river sand. Sand which are to be used in construction should be enough sharp, clean and course. The sand which is prepared by V.S.I crusher was found to be angular and cubical in shape. The sand manufactured in other type of crushers was found to be flaky, which is usually troublesome. M sand which is manufactured in other crushers usually contains large percentage of dusty matter and contains flaky particles. Because of the presence of flaky and angular particles the concrete may become harsh. And could result in spongy concrete.

II.HISTORICAL BACKGROUND

N.P. Rajmani and P.S. Ambilyi, 2006 [1]: In this study the usage of mortar for the aggregate of light weight concrete was made with aggregate based fly ash was examined and it was found that the aggregate of fly ash is technically viable and also found out to be having relatively less weight in nature as compared with natural aggregates. The aggregates of fly ash can be used for manufacturing of concrete blocks in masonry structures up to 20Mpa. However by using of less content aggregates of fly ash in concrete more than 40Mpa strength can be achieved.

S. Shanmugasundaram, et al, 2010 [2]: In this study utilization of fly ash aggregates in concrete was made. The coarse and fine aggregates were fully replaced by aggregates of fly ash in the fly ash concrete for M20 mix. The aggregates of fly ash were manufactured by mixing the fly ash with water and cement. The proportions of fly ash and cement were 90:10, 87.5:12.5, 85:15, 82.5:17.5, 80:20 and 77.5:22.5 were tried with W/C ratio as 0.3. The concrete cubes, beams and cylinders were and tested with the above 6 proportions of fly ash cement. It was found that the flexural, compressive, and split tensile strength was seem to be increased for the ratio 85:15 for 7 and 28 days compared with control concrete.

A. Sivakumar and P. Gomathi, 2012 [3]: This paper mainly focuses on usage of pelletized fly ash light weight aggregate in concrete. Fly ash is a material that can be mostly used as a cementitious material, replacement for fine aggregates and also as a light weight aggregate. Fly ash aggregate manufactured by pelletization is an effective aggregate in concrete. The pelletization efficiency depends on pelletizer speed, pelletizer angle and the binder type added with fly ash. In recent times, the usage of artificial aggregates such as fly lash aggregates reduces construction costs compared with conventional aggregates. In future the fly ash aggregate can be compensated by the nature resources for the aggregate.

Rahul Bansal and et al, 2015 [4]: This report reveals the experimental studies on the "Effect on Compressive Strength with Partial Replacement of Fly Ash". International Journal on Emerging Technologies 6(1): 2015. In this paper the fly ash is partially replaced with cement at 10%, 20% and 30. For all the above proportions three cubes of M-20 grade of size 150X150X150 mm were tested on compression testing machine and compressive strength of these cubes were noted at the age of 7 and 28 days. The result showed that the 10% replacement of fly ash gives 20% and 50% increase in the compressive strength at the age of 7 and 28 days respectively. It was observed with replacement of 20% fly ash concrete compressive strength was increased by 7% and 11% as compared to normal concrete cubes. It was seen that with 30% of fly ash 23% and 25% increase in compressive strength at 7 and 28 days period of curing. It was also observed that with increase in age the compressive strength also increases for fly ash replaced concrete.

Shwetha P C and et al, 2015 [5]: This paper reveals the "Experiment all Study on Partial Replacement of Cement by Fly Ash with Glass Fiber Reinforcement". IJERT Vol. 4 Issue 05, May-2015 In this study fly ash was used as a mineral admixture in cement for M-40 grade concrete. Glass fibers are used as additional reinforcement of constant 0.17% by weight of cement. Here fly ash has been partially replaced with cement at 5% to 30% in the interval of 5% for determining the mechanical properties at the age of 7, 28 and 56 days. The result showed that the workability increases for fly ash concrete mix and decreases for the fly ash and glass fiber combinational mix in the concrete. The compressive strength of fly ash concrete specimens is observed to be higher than the corresponding conventional concrete at 28 and 56 days. 10% FA and 0.17% GF seemed to give good flexural strength compared to the control mix and fly ash concrete mixes. 15% FA and 0.17% GF combination seemed to give good tensile strength compared to the control mix and fly ash concrete mixes.

Jayeshkumarpitroda and et al, 2012 [6] made an Experimental Investigation on Partial Replacement of Cement with Fly Ash in Design Mix Concrete. Here in this paper the cement is replaced by fly ash in various proportions of 0%, 10%, 20%, 30%& 40% by weight of cement for M-25 and M-40 mix. Concrete specimens were casted, tested and compared in terms of compression and split tensile strength with the normal concrete. The tests were carried out to determine the physical properties for the test results for compressive strength until 28 days and split tensile strength for 56 days are recorded. From the result it was seen that the compressive strength and split tensile strength decreases with increase in fly ash content in concrete.

AmanJatale and et al, 2013 [7]: In this paper they have studied the "Effects on Compressivel Strength When Cement Is Partially Replaced by Fly Ash". Here they have partially replaced with 20%, 40% and 60% by weight of cement. The effect of fly ash on workability, compressive strength, modulus of elasticity were studied and the concrete mix of grades M-15, M-20, M-25 with different fly ash proportions were studied, the result showed that

the use of fly ash improves with workability of concrete which reduces the use of admixture dosage in concrete. The modulus of elasticity of concrete using fly ash also decreases with the increase in fly ash percentage for a taken W/C ratio. The compressive strength of the concrete decreases with increase in fly ash content. The Rate of development of strength in concrete at various stages is related to the W/C ratio and fly ash percentages in the concrete mix.

T. Subramani and K.S. Ramesh, 2015 [8]:
Made an "Experimental Investigation on Partiall Replacement Of Fly Ash And Complete Replacement Of Sand With M-Sand". The fly ash is partially replaced with 25%, 30% and 35% by cement in concrete. The Cubes, lCylinders and beams were casted, cured and tested after 7, 14 and 28 days of water curing. The result showed that the compressive, flexural and split tensile strength increases with gradual increase in fly ash content for 7, 14 days compared to control concrete. For 28 days the compressive, flexure and split tensile strength increases and reaches maximum at 30% fly ash content compared to control concrete.

RafatSiddique, 2003 [9]: Studied the "Effect of fine aggregate replacement with Class F fly ash on the mechanical properties of concrete". Cement and Concrete Research 33, 2003. In this study the fine aggregates was replaced with 10%, 20%, 30%, 40% and 50% of class F fly ash by the weight of cement. Compressive, tensile, flexure strength and modulus of elasticity were found out at 7, 14, 28, 56, 91, and 365 days of curing. M-20 concrete mix proportion was adopted and the melamine based super plasticizer was used for all mix proportions. The result showed that compressive, split tensile, flexural strength and Elastic Modulus of natural FA replaced with fly ash concrete specimens were found to be more than the normal concrete specimens at all the ages and the strength increases with increase in ages. The maximum compressive strength occurs with 50% fly ash content at all ages. It is 40.0Mpa at 28 days, 51.4 Mpa at 91 days, and 54.9 Mpa at 365 days. The max tensile strength was observed at 50% of fly ash content at all ages. It is 3.6 Mpa at 28 days, 4.2 Mpa at 91 days, and 4.5 Mpa at 365 days. The maximum flexur all strength has been found to occur with 50% fly ash content at all ages. It is 4.3Mpa at 28 days, 5.3 Mpa at 91 days, and 5.4 Mpa at 365 days. At all ages, the maximum value of modulus of elasticity occurs with 50% fly ash content.

III.NEED FOR PRESENT STUDY

The main focus of this project is to investigate the strength characteristics of concrete with inclusion of fly ash aggregates as a partial replacement to natural aggregates at 0%, 10%, 20%, 30%, 40% and 50% respectively after selecting an optimum value of fly ash as a partial replacement of cement. And to achieve economy in construction and to utilize fly ash as an effective environmental friendly material. To actually meet the scarcity of material such as cement and coarse aggregate in future. To reduce the weight and to give high performance concrete by using sintered aggregates of fly ash. In this investigation following aspects such as compressive strength, Split tensile and flexural strength are studied. The use of these wastes such as fly ash as replacement of cement has given better results in previous research works.

IV.SUMMARY OFLITERATURE SURVEY

The Use of fly ash as a substitute to cement in concrete has been practiced since ancient times to reduce the cost of construction and also to enhance the strength characteristics of fly ash based concrete. Nowadays use of fly ash aggregate as a substitute to natural aggregates has become a new practice. The main aim of using the fly ash aggregate is to reduce the self weight of concrete and moreover reduce the cost of construction further more as we have concluded from literature review. The use of fly ash has lower strength at early stages but it has been observed that it builds strength increasingly at the later stages. By addition of fly ash light weight aggregates as partial replacement to normal coarse aggregates the concrete has achieved good strength over incremental ages.

V.PROBLEM DEFINITION

In the present experimental work the properties of concrete are thoroughly studied with addition of fly ash as a replacement for natural coarse aggregates and fly ash, which is obtained from thermal power plants having little cementitious properties are substituted with cement. The manufactured fly ash aggregates are replaced with natural coarse aggregates with following variations of 0%, 10%, 20%, 30%, 40% and 50% by volume of coarse aggregates. Following parameters such as strength aspects are studied in this work.

VI.OBJECTIVES

1.To use industrial waste fly ash as a stabilizing material and to solve the problem of waste disposal while finding the optimum replacement level.
2.To determine the behavior of concrete by using partial replacement of HVFA in cement and fly ash aggregates in coarse aggregates.
3.To investigate the strength parameters such as compressive, split tensile and flexural strength for fly ash and fly ash aggregate as a partial replacement for cement and coarse aggregates respectively.
4. To find out the optimum percentile value of fly ash and adopt that optimum value to produce fly ash aggregate concrete.

VII.METHODOLOGY

1.The materials like Cement, Fly Ash, M-Sand, Natural Coarse Aggregate, Fly Ash Aggregates and grade of concrete are selected and their characteristics has been thoroughly analyzed.
2.Usinglthese materials, Design mix is done with required w/c ratio for M25 concrete grade.
3.Optimum value for fly ash by partial replacement for cement will be determined.
4.Selection of best proportion of fly ash aggregate is made with various different proportions of cement and fly ash (20:80, 30:70, 40:60) by comparing the impact and crushing value with natural coarse aggregates.
5.The best proportion of fly ash aggregate is selected and partially replaced with natural coarse aggregate for different proportions.
6.The cubes, beams and cylinders are casted and tested for different mix proportions.

7. Finally with obtained results conclusions are given.

VIII.RESULT/TEST

1. Discussion on Workability

The slump test was usually conducted before casting the specimens for different variations and the results are put in the table.

Table.1. Workability Test Results

Replacement of Fly ash aggregates with normal aggregates	Slump values in mm
CC	105
0%	103
10%	92
20%	90
30%	85
40%	83
50%	79

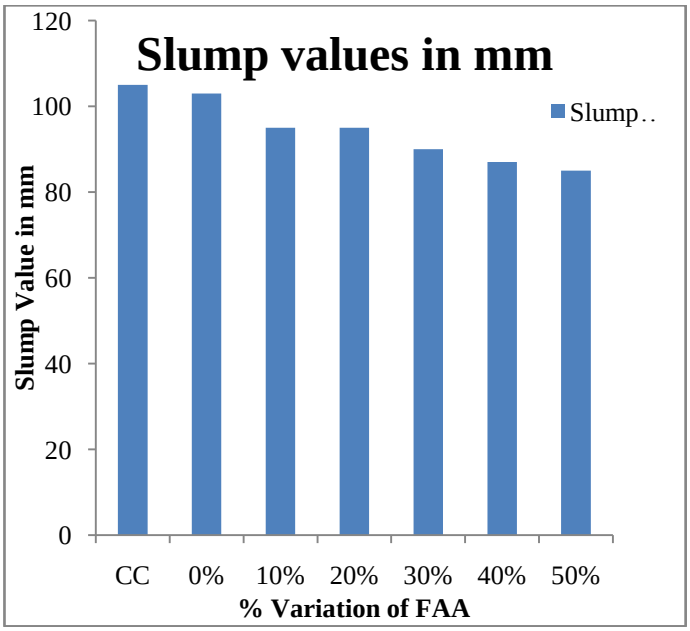

Figure.1. Slump values of FAA

Slump test was done for normal concrete by replacing fly ash aggregate at 0%, 10%, 20%, 30%, 40%, 50% with normal coarse aggregates keeping an optimum value for fly ash and cement proportion at 10%. Slump was in decreasing order; it might be due to the fact that addition of fly ash aggregate plays a role in workability of concrete.

2.COMPRESSIVEISTRENGTHITEST

➢ **For Concrete Using Fly Ash**

The compressive strength of normal concrete using fly ash was found out after 7 and 28 days of curing and the average of three specimens will be considered as the final compressive strength of the respective proportion. The cubes of standard size 150mm×150mm×150mm and then it was tested in Compression Testing Machine. The test is mainly done to determine the optimum values of fly ash and cement that can be used to produce concrete using fly ash aggregate the tests results are shown below are tabulated.

Table2. CompressivelStrength for M25 Grade Concrete Using Fly Ash 7 Dayslin N/mm^2

Sl. No.	% Fly Ash Replacement With Cement	Weight (Kg)	Ultimate Load (KN)	Compressive Strength For 7 Days (N/mm^2)
1	0%	8.50	490	21.77
		8.37	510	22.66
		8.36	480	21.33
		Average		**21.92**
2	10%	8.47	530	23.55
		8.32	540	24.00
		8.18	530	23.55
		Average		**23.70**
3	20%	8.00	520	23.11
		8.13	530	23.55
		8.16	500	22.22
		Average		**22.96**
4	30%	8.04	400	17.78
		8.10	410	18.22
		8.08	430	19.11
		Average		**18.37**

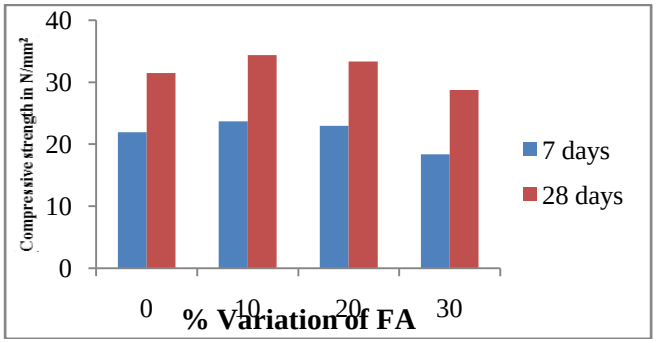

Figure.2. % Variation of Fly Ash With Respect To Cement for 7 And 28 Days in N/Mm^2

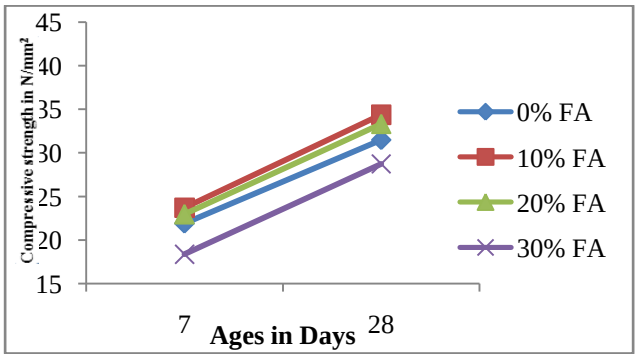

Figure.3. % Variation of Fly Ash With Respect To Cement for 7 And 28 Days in N/Mm^2

Discussion on Compressive Strength Result of Concrete Using Fly Ash

The compressive strength of concrete with fly ash as a replacement was determined. They were tested at 7 and 28 days. And the results are tabulated and figures are drawn to show comparison in strength variation. At 10% replacement of fly ash the strength was seem to reach maximum and the strength seem to decrease with increase in fly ash content this may be due the fact that as the cement content is reduced, the strength reduces too. Hence by above results 10% replacement of fly ash will be adopted as an optimum for preparation of fly ash aggregate concrete.

3. FLEXURAL STRENGTH TEST

➢ **For Concrete Using Fly Ash**

The Fly ash concrete beam mould specimen of 100×100×500 mm dimension was prepared and cured for 28 days and tested in a Universal Testing Machine(UTM). The test was done to determine the optimum value for fly ash

Table.3. FlexurallStrength of M25lConcrete Grade Using Fly Ash for 28lDays in N/Mm^2

Sl. No.	% Variation in FAA	Flexural strength in N/mm^2
1	0%	3.53
2	10%	3.80
3	20%	3.65
4	30%	3.14

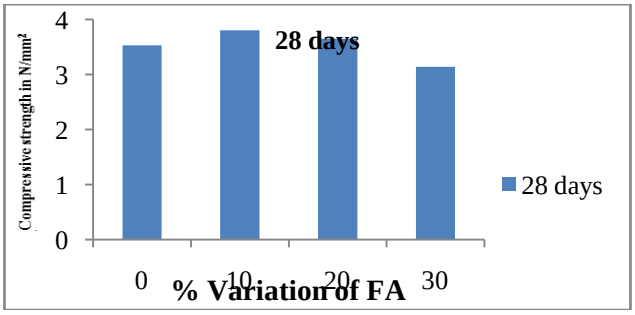

Figure.4. % Variation of Fly Ash With Respect To Cement for 28 Days in N/Mm^2

Discussion on FlexurallStrength Result of Concrete Using Fly Ash

The Flexural Strength of concrete with fly ash as a replacement to cement was determined. They were tested after 28 days of curing in a water tank. And the results are tabulated and figures are drawn to show comparison in strength variation. At 10% replacement of fly ash the strength was seem to reach maximum and the strength seem to decrease with increase in fly ash content this may be due the fact that as the cement content is reduced, the strength reduces too. Hence by above results 10% replacement of fly ash will be adopted as an optimum percent value for preparation of fly ash aggregate concrete.

4. COMPRESSIVE STRENGTH TEST

➢ **For Concrete Using Fly Ash Aggregate**

The test is carried out on concrete using fly ash aggregates. The cubic moulds of 150×150×150 mm dimension are prepared selecting an optimum value of 10% replacement of fly ash to cement and replacing natural fine aggregate with M-Sand and tested after 7, 28 and 56 days of curing and the results are tabulated as follows.

Table.4. CompressivelStrength of M25 Gradel Concretel Using Fly Ash aggregate for 7 Days in N/mm^2

Sl. No.	% Fly Ash Aggregate Replacement With NA	Weight (Kg)	Ultimate Load (KN)	Compressive Strength For 7 Days (N/mm^2)
1	CC	8.43	570	25.33
		8.23	530	23.55
		8.27	540	24.00
		Average		**24.29**
2	0% FAA	8.27	530	23.55
		8.32	540	24.00
		8.18	530	23.55
		Average		**23.70**
3	10% FAA	8.27	540	24.00
		8.33	570	25.33
		8.34	560	24.88
		Average		**24.74**
4	20% FAA	8.24	580	25.77
		8.21	560	24.88
		8.16	560	24.88
		Average		**25.17**
5	30% FAA	8.16	600	26.67
		8.13	610	27.11
		8.09	590	26.22
		Average		**26.67**
6	40% FAA	8.05	540	24.00
		8.12	510	22.67
		8.09	520	23.11
		Average		**23.16**
7	50% FAA	7.93	490	21.78
		7.84	470	20.88
		7.88	500	22.22
		Average		**21.63**

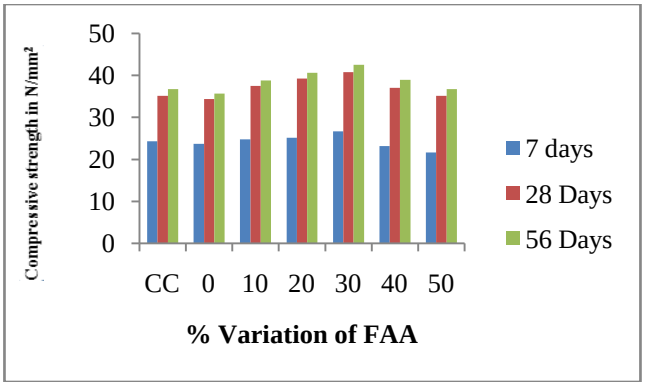

Figure.5. % Variation of FAA With Respect To NCA for 7 And 28 Days in N/Mm^2

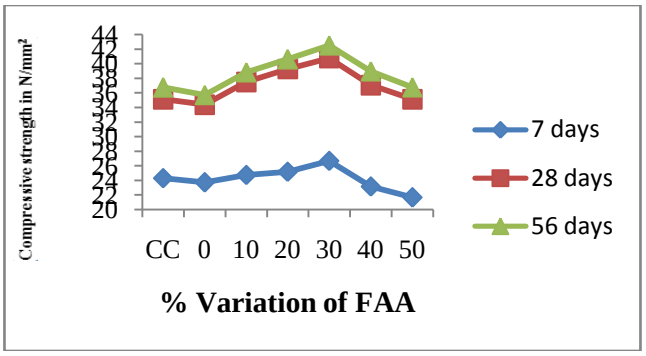

Figure.6. % Variation of FAA With Respect To NCA for 7 And 28 Days in N/Mm^2

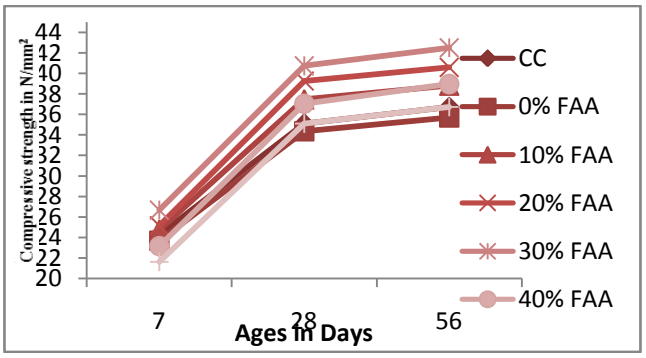

Figure.7.% Variation of FAA With Respect To NCA for 7 And 28 Days in N/Mm^2

Discussion on CompressivelStrength Result of Concrete Using Fly Aggregate

The compressive strength of concrete with FAA as a replacement to NCA was determined. They were tested at 7, 28 and 56 days. And the results are tabulated and figures are drawn to show comparison in strength variation. The compressive strength seemed to decrease slightly at 0% addition of FAA as compared to conventional concrete. At 10% replacement of FAA with normal aggregates, the concrete seemed to achieve good strength and is found to be increased by 6% compared to normal concrete. The replacement can continue till 30% and it was found to be the optimum percentage replacement of FAA with normal aggregates.

5. SPLITITENSILE STRENGTH TEST

The split tensile of normal concrete and using fly ash aggregate as a replacement was determined at 28 and 56 days of curing by considering the average of three specimens. The cylinders of standard size 300mm × 150mm were casted and then later tested in compression testing machine by keeping it horizontally.

Table. 5. SplitlTensile Strength of M25 GradelConcrete Using Fly Ash aggregates forl28 Days in N/mm^2

Sl. No.	% Fly Ash Aggregate Replacement With NCA	Weight (Kg)	Ultimate Load (KN)	Split TensileFor 28 Days (N/mm^2)
1	CC	13.29	240	3.39
		13.22	230	3.25
		13.35	250	3.54
		Average		**3.39**
2	0%	12.97	230	3.25
		13.04	250	3.53
		12.87	230	3.25
		Average		**3.34**
3	10%	12.88	280	3.96
		12.92	260	3.68
		12.62	240	3.39
		Average		**3.67**
4	20%	12.46	260	3.68
		12.40	270	3.82
		12.51	290	4.10
		Average		**3.86**
5	30%	12.28	310	4.38
		12.21	320	4.52
		12.35	290	4.10
		Average		**4.33**
6	40%	12.20	250	3.54
		12.16	230	3.25
		12.13	260	3.68
		Average		**3.49**
7	50%	12.03	260	3.68
		12.07	230	3.25
		12.15	240	3.39
		Average		**3.44**

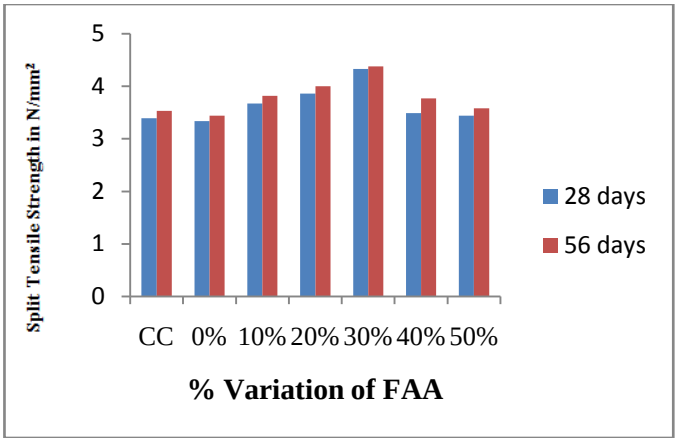

Figure.8. % Variation of FAA With Respect To NCA for 28 And 56 Days in N/Mm^2

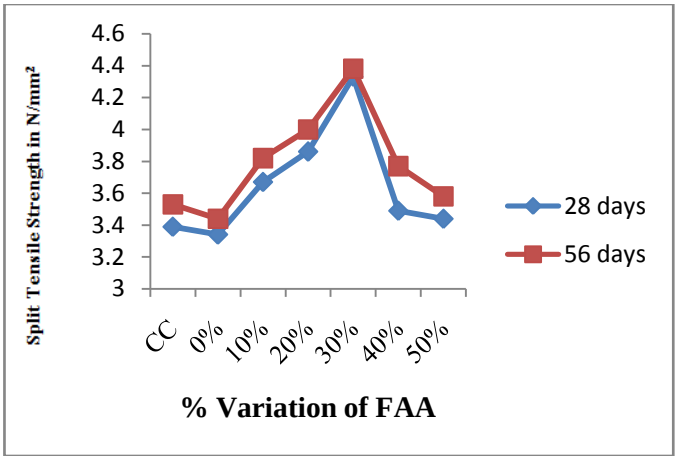

Figure.9. % Variation of FAA With Respect To NCA for 28 And 56 Days in N/Mm^2

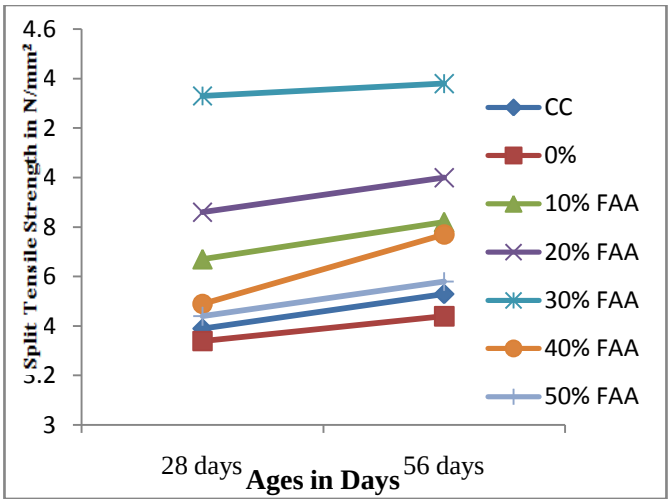

Figure. 10. % Variation of FAA With Respect To NCA for 28 And 56 Days in N/Mm^2

Discussion on SplitlTensile Strength

The addition of fly ash aggregates has improved the tensile strength of concrete. For conventional concrete at 28 and 56 days the tensile strength was found to be about 3.39 and 3.53N/mm^2. By addition 30% FAA, The tensile strength was increased up to a maximum of 4.33 and 4.38 N/mm^2 at 28 and 56 days respectively

FLEXURAL STRENGTH TEST

- **On Concrete Using Fly Ash Aggregate**

Table.6.FlexurallStrength of M25lConcrete Grade Using Fly Ash Aggregate for 28 and 56lDays in N/Mm^2

Sl. No.	% Variation in FAA	Flexural strength in N/mm^2	
		28 days	56 days
1	CC	3.86	4.07
2	0%	3.8	3.95
3	10%	4.05	4.33
4	20%	4.43	4.50
5	30%	4.51	4.66
6	40%	3.98	4.26
7	50%	3.90	4.14

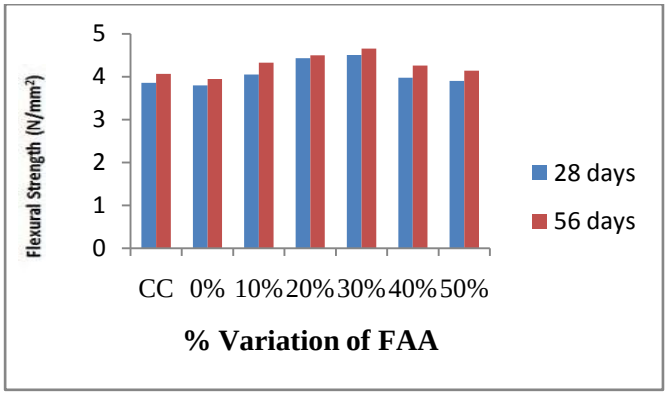

Figure.11. % Variation of FAA With Respect To NCA for 28 And 56 Days in N/Mm^2

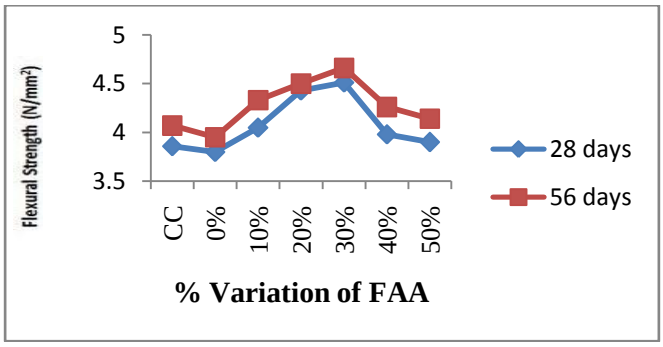

Figure.12. % Variation of FAA With Respect To NCA for 28 And 56 Days in N/Mm^2

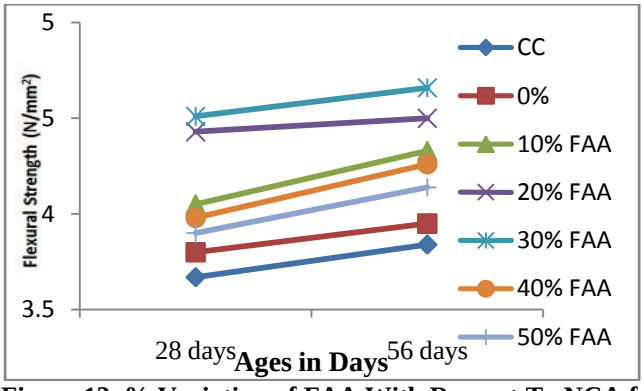

Figure.13. % Variation of FAA With Respect To NCA for 28 And 56 Days in N/Mm^2

Discussion on FlexurallStrength

The variation of flexure strength v/s percentage of light weight FAA as a replacement to natural aggregates for 28 & 56 days of curing are as shown in above figures. The flexural strength value was found to increase with addition of fly ash aggregates until an optimum of 30% replacement with natural coarse aggregates and decreasing gradually.

LIX.CONCLUSION

On the basis of the experimental investigations made and analysis of the results, following are the conclusions which are made.

1. From the experimental study it has been seen that the preparation of structural light weight aggregate concrete from cold bonded aggregates of fly ash is possible.
2.The pelletized aggregate of fly ash are seem to be lighter and porous in nature, has a bulk density less than that of plain concrete and that is why it is called light weight aggregate.
3.The cold bonded aggregates of fly ash are seem to be spherical in shape which play an important role in improving the workability of concrete even with less water content when compared with normal concrete.
4.The fly ash aggregates were first prepared adopting proportions 10:90, 20:80, 30:70, 40:60. And were cured for 28 days, after the curing is done the basic tests such as aggregate crushing, aggregate impact and specific gravity were conducted, based on the test results 30:70 proportion was adopted in production of fly ash aggregate concrete.
5.Before the preparation of fly ash aggregate concrete, the optimum value for fly ash as a partial replacement was found out by conducting various test results. It was observed that the 10% replacement of fly ash with cement seemed to give maximum strength and so it was adopted in the production of FAA concrete.
6.From experimental study on FAA concrete it is concluded that the compressive strength, Split tensile strength, and flexural strength are seemed to be increased continuously at some optimum value and then later decreased.

X.SCOPE FOR FURTHER INVESTIGTATIONS

1.The investigation can be carried out for other types of light weight aggregates with different grades of concrete.
2.The test on higher grade FAA concrete can be carried out for longer periods.
3.The study can be conducted by using other industrial waste products.
4.The replacement of FAA with NCA can be carried out for different proportions.

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