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A RREVIEW OF COMPRESSIVE STRENGTH OF MORTAR USING FLYASH AS A PARTIAL REPLACEMENT OF CEMENT

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Abstract—*Flyash is investigated for its used as a replacement for cement and fine aggregate. this paper represent the result of compressive strength of cement mortar using different proportion of fly ash(5%,10%,15%,20%,25%,30%,35%,40%,45%,50%)as per weight of cement. Test results indicate that the laterally improvement in the strength property of mortar as a partial replacement of flyash in cement mortar for different proportion.*

Keywords- *flyash, cement mortar, compressive strength,*

I. INTRODUCTION

Mortar is a plastic mixture of water and binding materials used to join concrete blocks, bricks or other masonry units. It is desirable for mortar to hold moisture, be plastic enough to stick to the trowel and the blocks or bricks and finally to develop adequate strength without cracking. Flyash is a fine powder recovered from coal-fires electric generation power plants. Flyash could be expensive replacement for Portland cement in concrete and using it, improves strength, segregation and ease of pumping concrete. Flyash could be added using a rate of 1 to 1.5 pounds of flyash of 1 pound of cement flyash could be used as prime material in Blocks, paving or bricks. It is mostly used for PCC pavements. PCC pavement use a large amount of concrete and using flyash provide great economic benefits. Coal fired power plants produce flyash, providing an excellent prime material used in blended cement, mosaic tiles and hollow blocks among other.

Class F: Fly ash normally produced by burning anthraciteor bituminouscoal, usually has a less than 5% Cao class F has a pozzolonic property only.

Class C: Fly ash normally produced by burning ligniteor sub-bituminouscoal, some class C fly ash has a Cao content excess of 10%

Fly ash (Class F) investigated for its use as a partial replacement for cement in cement mortar (1:3). The utilization of Fly Ash cement replacement material in mortar or as additive in cement introduces many benefits from economical, technical and environmental points of view.

II. LITERATURE REVIEW

A. MD. MOINUL ISLAM (2010) DEPARTMENT OF CIVIL ENGINEERING, CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY, BANLADESH "STRENGTH BEHAVIOR OF MORTAR USING FLYASH AS PARTIAL REPLACEMENT OF CEMENT"

In This Paper represent that the strength behavior of mortar using flyash of classF as partial replacement is observed for the replacement proportions of 10%, 20%, 30%, 40%, 50% and60% by weight of the cement for following time period: 3, 7, 14, 25, 60 and 90days

The ASTM type-1 Portland cement conforming to ASTM C-150 was used as a binding material. low calcium ASTM classFflyash used in this investigation. Locally available natural sand passing through 4.75mm sieve and retained on 0.015mm sieve was used for this investigation. All the specimens tested after specified curing period.in this paper for compressive test 50mm cube size are used.500gm cement plus flyash are used for mortar proportion 1:2.75 The results obtained are such as:

Table 1: COMPRESSIVESTRENGTH(MPa)OFCEMENT:FLYASHMORTARSFOR VARIOUS REPLACEMENTLEVEL

Replacement Level	***Ce:FA***	***Ce:FA***	***Ce:FA***	***Ce:FA***	***Ce:FA***	***Ce:FA***	***Ce:FA***
Curing period(Days)	100:0	90:10	80:20	70:30	60:40	50:50	40:60
3	14.3	13.0	12.2	11.5	10.6	7.0	3.7
7	20.3	19.1	18.4	17.0	16.2	13.0	7.2
14	23.6	22.7	22.1	21.5	20.8	17.7	10.5
25	28.0	27.2	26.9	27.0	27.7	26.5	20.2
60	30.9	30.5	31.1	31.8	33.2	30.4	28.1
90	33.3	33.9	35.0	36.5	38.0	34.9	31.7

*** Ce:Cement; FA:FlyAsh**

The results thus the shows a position correlation ship between the compressive strength with the increase of flyash proportion in mortar, but this position correlation ship is present only up to optimum value and that value was discovered as 40% by weight of cement.
Also this paper has discussed an limitation of the use of flyash of classF in a brief manner that the grade of increase of the strength is quite low as compared to that of normal mortar from OPC.

B. FREEDA CHRISTY (2010) SCHOOL OF CIVIL ENGINEERING, KARUNYA UNIVERSITY, COIMBATORE "EFFECT OF CLASS-F FLAYSH AS PARTIAL REPLACEMENT WITH CEMENT AND FINE AGGREGATE IN MORTAR"

The effect of classFflyash as partial replacement with cement and fine aggregate in mortar is a very fine study for the masonry construction. Four set of mixture proportion were made. First was without flyash and other mixes contained classF flyash.in first three set mortar were prepared with 1:3,1:4.5,1:6 binder to sand ratio. In the fourth set the cement mortar 1:6 the sand is replaced with flyash as various proportion and results were compared with the cement mortar with partial replacement of cement with the flyash. the paper has discussed the increment of strength of mortar when the partial amount of flyash is replaced with partial amount of cement as well as when partial amount of fine aggregate is replaced with flyash following results are generated.
Compressive strength tests were performed on compression testing machine using samples of cubes.

Figure 1: Set up of compressive testing machine

Three samples per each batch were tested with average strength valued result in this paper.

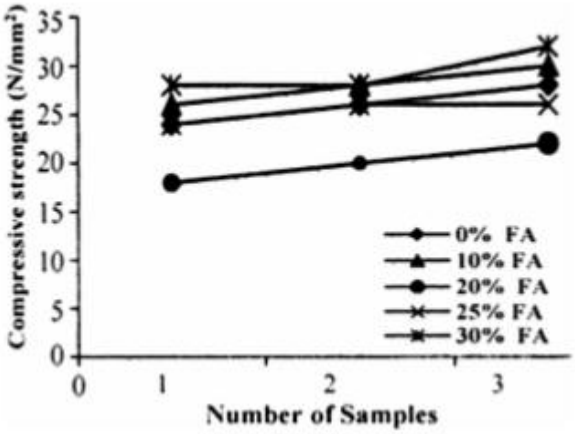

Fig.2-compressive strength of cement 1:3 partial Replacement of flyash with cement

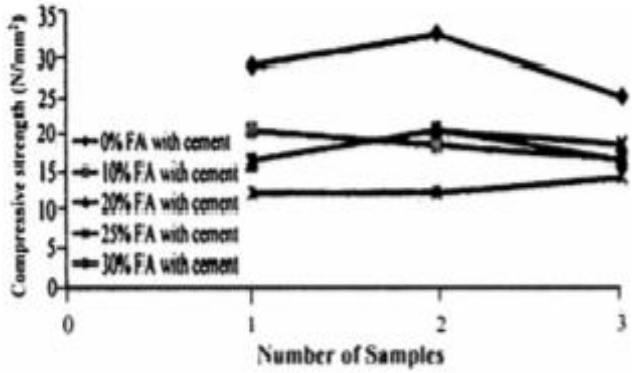

Fig.3- compressive strength of cement 1:4.5with partial Replacement of cement with flyash

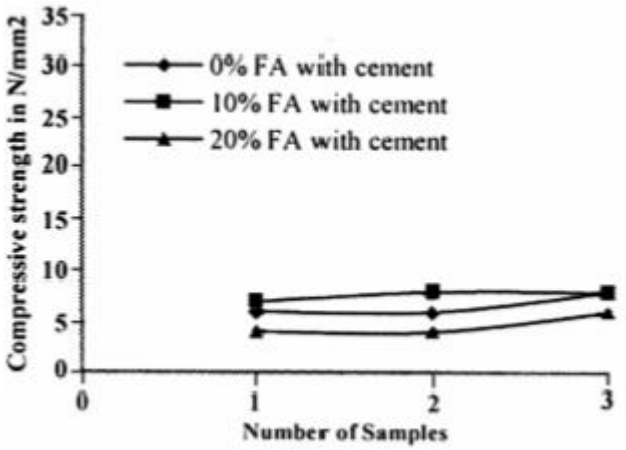

Fig.4-compressive strength of cement mortar 1:6 With partial replacement of cement with flyash

Flyash can be used in masonry mortar to improve the long term bond strength. Partial replacement of the Portland cement with class-F flyash literally improves the masonry bond strength. Mortar prepared using 20% flyash replacement with fine aggregate in 1:6 cement mortar yielding a higher compressive strength than the control mix.

C. YOGESH RAVICHANDRAN (AUGUST2014) NADAR COLLEGE OF ENGINEERING, CHENNAI, TAMIL NADU, INDIA. 2DEPARTMENT OF CIVIL ENGINEERING, SRI SIVASUBRAMANIYA NADAR COLLEGE OF ENGINEERING, KALAVAKKAM, CHENNAI, TAMIL NADU, INDIA. "EFFECT OF PROCESSED FLY ASH ON CEMENT MORTAR FOR STANDARD FINE AND NORMAL SAND"

In this paper represent that In cement mortar, flyash used as partial substitute for cement with normal sand available locally and standard fine sand and the replacement levels of fly ash to cement at 5%, 10%, 20%, 30%, 40%, 50 % and 70% for 1:3 mix proportions.

The cement use dint is research is ordinary Portland cement of grade53. Incaseofsand,readilyavailableriversand offinevarietyandstandard finegradesandisused andforfly ash,classF,fine gradeis used. Therearefourteenmixturesusedinthisinvestigation. Thereferencemixwasmadewitha cement-to-sand ratioof 1:3 withoutfly ash. Cementwasthen replacedwith processedfly ashat replacementlevelsof5, 10, 20, 30,40,50and70% by weight. The water-to-cementratio was keptat0.48forallmixtures. For 7, 14, 28, 56, 91 and 121 days the Mortar cubes are tested for compressive strength. When compared with the control mix for both types of sand the compressive strength increases up to 20 % replacement.

Table 2: The results of the Compressivestrengthofdifferentmixes

	StandardSand			NormalSand		
Mix/days	***7***	***14***	***28***	***56***	***91***	***121***
1	12.4	14.8	16.6	20.6	23	30
2	10.8	11.6	12.4	14	16	20
3	9.4	11	14	16.6	18.6	25
4	7.2	8.8	12	15.6	22	30
5	5.8	6.6	7.8	9.5	10.5	18.6
6	5.8	9.8	12	13.6	15	16.6
7	7	8.4	11.4	12.6	13.6	15
8	3.4	4.4	5.8	5.8	6.5	10
9	21.8					
10	18.4					
11	20					
12	20.4					
13	14.4					
14	17					
15	16					
16	8.6					

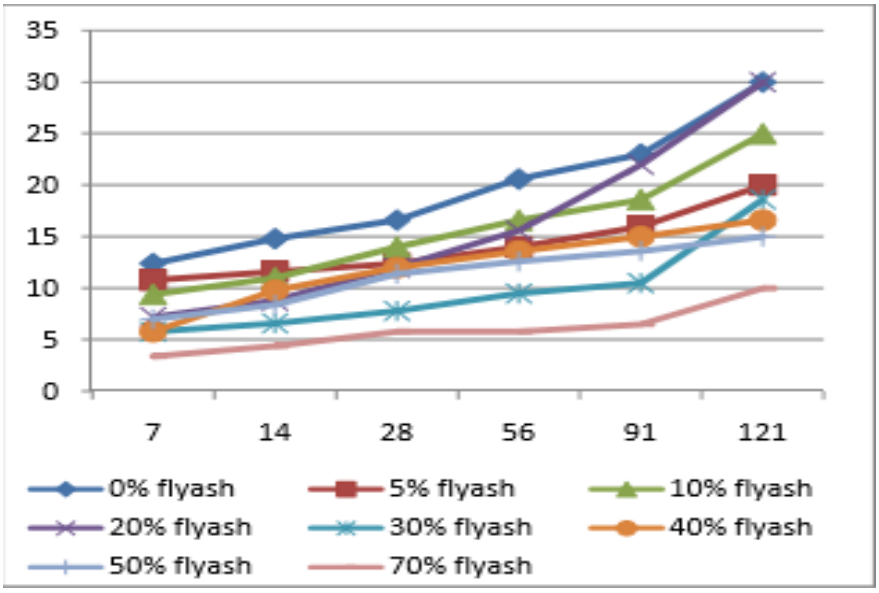

Figure 5- Graphicalrepresentationof compressivestrength

Byreadingthesurfacemorphology ofhardened specimensat30%,40% and 50%with referencemixitclearly indicatesthatsurfacetextureismoreuniform andpore diameterislessathigherreplacement level.
The strength is more at 7 days for mix 1 and the strength is the lowest for mix 8. Mix 1 has no fly ash content so it termed as reference mix and mix 8 has a maximum of 70% of fly ash. Hence, it is clear that the addition of fly ash reduces the compressive strength at early ages. It is also indicated from the graph that 7-day strength is lower when fly ash content is increased. The results of the test indicate that, the compressive strength increases with increase in fly ash content up to 20%. And the steady state of strength sustains between 30% to 50% mix. So it can be concluded that fly ash can be added up to 50% in case of compressive strength of the mortar and is comparable with reference mix. The situation is similar for standard sand, the only difference is that, with increase in fineness of the sand the strength increases but this is not practically possible because the sieving of large quantity of sand is very expensive.

III. CONCLUSION

- In first paper conclude that flyash mortar provides higher strength as compared with OPC mortar. Flyash mortar mix having different cement replacement level up to 50% represent satisfactory result for compressive strength. the maximum flyash content is observed to be 40% of cement. Flyash mortar with 40% cement replacement shows around 14% higher compressive strength than OPC mortar after 90days curing
- In first paper the compressive strength is measured for cement mortar 1:2.75,instead of this also used the different proportion like1:3,1:4.75 and1:6, also take a classCflyash instead of classFflyash then the strength measured for only 3,7 and 28 days but the cement replace with different proportion.
- In second paper conclude that the flyash as 10% partial replacement with cement can adopted for the strength range of 3-9 N/mm^2 and flyash as 20% partial replacement with fine aggregate can adopted for the strength range of 8-20N/mm^2 so the with the increasing of flyash content to get more compressive strength
- In second paper if take only one proportion 1:3 and measured the compressive strength for 3,7 and 28days with the cement partially replace by classFflyash as (0%, 5%, 10%, 15%, 20%, 25%, 30%)then also get sufficient and accurate result.
- In third paper the compressive strength increases up to 20 % replacement levels and marginal decrease in strength up to 50% when compared with the control mix for both types of sand. The hardened mixes shows that the silica content is less for lower replacement level and increasing more for higher replacement level.

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