Evaluation of Masonry Mortar in which Natural River Sand is varied by Pond Ash

Md Maaz Mujahid Chowdhary[1] S.M. Hashmi[2] Shaik Abdullah[3] Md. Faisaluddin[4] Md. Mansoor Ahmed[5]

[1]Student [2]Head of Dept. [3,4,5]Assistant Professor

[1,2,3,4,5]Department of Civil Engineering

[1,2,3,4,5]K.B.N College of Engineering, Kalaburagi, Karnataka

Abstract— The guideline goal of the present study is to examine the masonry mortar with various substitution level of sand by pond ash, so as to minimize the use of sand and to enhance the use of wastes products i.e., pond ash. To contemplate the quality advancement of brick work mortar containing different extents of pond ash under ordinary curing, To design mortar mix for 1:4, 1:6 and 1:8 accordance to the IS 2250-1981It was watched that Pond ash fulfills the physical and chemical prerequisites according to IS 2116-1980. We can finish up from the outcomes that addition of 40% to 50% of pond ash in production of bricks work leads to production of good quality brickwork. The compressive strength of mortar at different substitution level fulfill the minimum compressive strength prerequisites according to IS 1905-1987 for various evaluation of mortar. The compressive strength of stone masonry prism diminishes with increase in the substitution level of sand, however up to 25% substitution level the decline in strength is less contrasted with masonry prism with ordinary mortar. The Shear bond strength of masonry prism diminishes with increase in the substitution level of sand, however up to 25% substitution level the lessening is less contrasted with masonry prism with normal mortar. The shear bond strength of quadruplet masonry prism is less contrasted with triplet masonry prism because of increase in the surface range of masonry prism.

Key words: Evaluation of Masonry Mortar, Natural River Sand, Pond Ash

I. INTRODUCTION

Coal subordinate power plants are everywhere throughout the world and these plants are the principal wellspring of power production in India. These power plants are one of the significant source that are in charge of production of expansive measure of coal combustion residues as solid waste, which incorporates fly powder, slag, bottom ash alongside fluidized bed combustion ash.

In a dry base boiler when pulverized coal is smoldered around 80% of unburnt material is entered in the ignition gasses and caught and recouped as fly ash. The staying 20% ash is in dry base powder, a dim, permeable, granular material that assembled in water filled compartments at the base of the furnace. At the point when fly ash and bottom ash is conveyed to Capacity Lake as water slurry and ousted in extensive pond then it is alluded as Pond ash.

As pond ash is produced at an alarming rate thus the endeavors are required to securely dispose it and if conceivable discover methods of using it.

Characterization of pond ash helps in surveying the degree of its use and its appropriateness as fine aggregate as far as its physical, chemical and morphological properties.

Fig. 1: Pound Ash Sample

II. OBJECTIVES OF THE STUDY

- To minimize the utilization of Characteristic River sand to enhance the use of other waste items, for example, pond ash.
- To design mortar blend for 1:4, 1:6 and 1:8 agreement to the IS 2250-1981.
- To assess diverse strength properties of mortar blend with pond ash substituted in rate for sand in mortar, making to study the strength aspect of masonry mortar.
- To test the specimens like mortar cube of size 50mm*50mm*50mm and masonry prisms such as triplets and quadruplets by shifting the thickness of mortar layer.

III. PARAMETERS OF STUDY

- To conduct preliminary test on various ingredients used in masonry mortar.
- To vary the percentage of pond ash from 0% 25%, 50%, 75% and 100%.
- To study the workability of masonry mortar to obtain the corresponding flow for trail mixes and the flow kept is 110%-115% according to IS 2250-1981.
- To Study the strength properties such as compressive strength of mortar cube, compressive strength and shear bond strength of masonry prism.

IV. MATERIALS

A. Cement

43 Grade ordinary Portland cement is used confirming to the specification as per IS 8112-2013. The physical properties of the cement obtained are given in Table 1.

Sl. No	Properties	Results	Requirement as per IS 8112-2013
1	Consistency	28.4%	
2	Initial setting time	145 minutes	Should not be less than 30 min
3	Final setting time	330 minutes	Should not be more than 600 min
4	Soundness	0.5 mm	Shall not be more than 10mm
5	Compressive strength		
	72±1 h	33 mpa	Shall not be less than 23 mpa
	168±2 h	41.7 mpa	Shall not be less than 33 mpa
	672±4 h	55 mpa	Shall not be less than 43 mpa But not more than 58 mpa

Table 2: Physical properties of the cement

B. *Sand*

Natural River sand of zone II is used as fine aggregate.

Sl. No	Properties of sand	Obtained value
1	Fineness modulus	3.52
2	Specific Gravity	2.50
3	Zone	II
4	Water absorption (%)	1.9

Table 3: Sand

C. *Pond Ash*

Chemical and physical properties of typical sample of pond ash

1) Physical Properties of Pond Ash

Sl. No	Attributes	Results	Necessities	
1	Fineness-Specific surface in m^2/kg Blain's air by permeability method	265	320	200
2	Residue 45 micron sieve %,max	21	≤34	≤34
3	Compressive strength at 28days measured in N/mm^2, Min	30	Should not be less than 80% compared to Mortar without replacement	
4	Soundness, Max	0.028	≤0.8	≤0.8
5	Specific gravity	2.01	-	-
6	Moisture absorption	20%	-	-

Table 4: Physical Properties of Pond Ash

2) Chemical Properties of Pond Ash

Sl. no	Test performed	Results	Requirement as per IS: 3812:2013			
			Part 1		Part 2	
			Siliceous pulverized fuel ash	Calcareous pulverized fuel ash	Siliceous pulverized fuel ash	Calcareous pulverized fuel ash
1	SiO_2 plus Al_2O_3 plus Fe_2O_3percent by mass,(min)	91.04	70%	50%	70%	50%
2	SiO_2percent by mass,Min	67.24	35%	25%	35%	25%
3	MgO percent by mass, Max	0.74	5%	5%	5%	5%
4	Total SO_3 percent by mass, Max	0.19	3%	3%	5%	5%
5	Ignition loss in percent by mass,Max	3.19	5%	5%	7%	7%
6	Insoluble Residue, percent by mass	91.22	Not specified		Not specified	
7	CaOpercent by mass	3.53	Not specified		Not specified	

Table 5: Chemical Properties of Pond Ash

D. *Fly Ash Bricks*

The materials utilized for casting fly ash bricks are Fly ash, Cement, Pond ash, Quarry dust and water.

E. *Water*

Potable water or tap water is used.

V. DETAILS OF NUMBER OF SPECIMEN CASTED

Grade of mortar	Replacement level C:S:PA	No of specimens to be casted		
		Mortar	Masonry	
		Compressive strength	Compressive strength	Shear Bond strength
CM(1:4)	1:4:0	9	12	12
	1:3:1	9	12	12
	1:2:2	9	12	12
	1:1:3	9		
	1:0:4	9		
CM(1:6)	1:6:0	9	12	12
	1:4.5:1.5	9	12	12
	1:3:3	9	12	12
	1:1.5:4.5	9		
	1:0:6	9		
CM(1:8)	1:8:0	9	12	12
	1:6:2	9	12	12
	1:4:4	9	12	12
	1:2:6	9		
	1:0:8	9		

Table 6: Details of Number of Specimen Casted

VI. RESULTS

A. *Flow Table Test*

Grade of mortar	Sl. No	Designation	Water Cement Ratio	Flow (%)	Observation
CM(1:4)	1	$4A_0$	0.73	113	Mix was slightly harsh
	2	$4A_{25}$	1.02	110	
	3	$4A_{50}$	1.48	113	
	4	$4A_{75}$	1.73	115	
	5	$4A_{100}$	2.15	110	
CM(1:6)	1	$6A_0$	0.87	114	Mix was harsh with little amount of bleeding
	2	$6A_{25}$	1.51	112	

	3	$6A_{50}$	2.15	111	
	4	$6A_{75}$	2.9	114	
	5	$6A_{100}$	3.8	110	
CM(1:8)	1	$8A_0$	1.27	112	Mix was slightly harsh and bleeding take place at higher %
	2	$8A_{25}$	2.43	113	
	3	$8A_{50}$	3.49	112	
	4	$8A_{75}$	4.15	113	
	5	$8A_{100}$	5.6	112	

Table 7: Flow Table Test

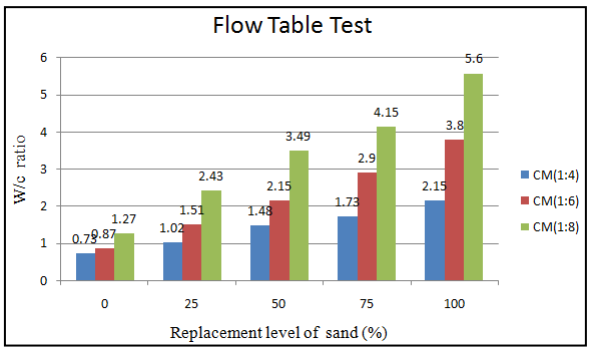

Fig. 2: Graph of Flow Table Test

B. Compressive Strength of Mortar

Grade of mortar	Sl. no	Designation	Compressive strength in N/mm²		
			7 Days	14 Days	28 Days
CM(1:4)	1	$4A_0$	7.15	12.95	22.20
	2	$4A_{25}$	4.65	8.97	15.28
	3	$4A_{50}$	2.73	3.85	8.13
	4	$4A_{75}$	1.86	2.40	4.35
	5	$4A_{100}$	0.92	1.27	2.95
CM(1:6)	1	$6A_0$	6.12	10.07	16.80
	2	$6A_{25}$	3.53	4.76	10.81
	3	$6A_{50}$	2.19	2.97	6.38
	4	$6A_{75}$	1.78	2.14	3.52
	5	$6A_{100}$	0.91	1.06	1.98
CM(1:8)	1	$8A_0$	3.59	5.20	11.90
	2	$8A_{25}$	2.23	3.68	6.90
	3	$8A_{50}$	1.13	1.85	3.73
	4	$8A_{75}$	0.90	1.50	1.50
	5	$8A_{100}$	0.50	0.87	0.90

Table 8: Compressive Strength of Mortar

C. Compressive Strength of Masonry Prism

Grade of mortar	Designation of Specimen with different thickness of mortar			Failure load (KN)	Compressive strength (N/mm²)	Corrected compressive strength (N/mm²)	Mode of failure
CM(1:4)	Triplet	8mm	$4A_0$	67	2.64	2.2	CF1
			$4A_{25}$	58	2.29	1.74	CF1
			$4A_{50}$	49	1.93	1.46	CF2
		10mm	$4A_0$	96	3.79	2.91	CF1
			$4A_{25}$	89	3.51	2.70	CF2
			$4A_{250}$	66	2.60	2.0	CF2
	Quadruplet	8mm	$4A_0$	77	3.04	2.58	CF1
			$4A_{25}$	71	2.80	2.38	CF2
			$4A_{50}$	67	2.64	2.24	CF2
		10mm	$4A_0$	113	4.46	3.83	CF1
			$4A_{25}$	95	3.75	3.22	CF1
			$4A_{50}$	78	3.08	2.64	CF2

Table 9: Results of compressive strength of masonry prism for CM (1:4)

Grade of mortar	Designation of Specimen with different thickness of mortar			Failure load (KN)	Compressive strength (N/mm²)	Corrected compressive strength (N/mm²)	Mode of failure
CM(1:6)	Triplet	8mm	$6A_0$	69	2.72	2.06	CF1
			$6A_{25}$	51	2.01	1.52	CF1
			$6A_{50}$	45	1.77	1.34	CF2
		10mm	$6A_0$	98	3.87	2.97	CF1
			$6A_{25}$	86	3.39	2.61	CF1
			$6A_{50}$	59	2.33	1.79	CF2
	Quadruplet	8mm	$6A_0$	85	3.35	2.84	CF1
			$6A_{25}$	64	2.52	2.12	CF2
			$6A_{50}$	57	2.25	1.91	CF2
		10mm	$6A_0$	105	4.15	3.56	CF1
			$6A_{25}$	98	3.87	3.32	CF2
			$6A_{50}$	76	3	2.58	CF2

Table 10: Results of compressive strength of masonry prism for CM (1:6)

D. Shear Bond Strength of Masonry

Grade of mortar	Designation of Specimen with different thickness of mortar			Failure load (KN)	Shear bond strength (N/mm²)	Mode of failure
CM(1:4)	Triplet	8mm	$4A_0$	17	0.63	SF2
			$4A_{25}$	12	0.45	SF2
			$4A_{50}$	8	0.30	SF1
		10mm	$4A_0$	22	0.79	SF1
			$4A_{25}$	17	0.61	SF1
			$4A_{50}$	10	0.36	SF1
	Quadruplet	8mm	$4A_0$	18	0.51	SF2
			$4A_{25}$	16	0.45	SF1
			$4A_{50}$	10	0.28	SF1
		10mm	$4A_0$	25	0.68	SF1
			$4A_{25}$	17	0.46	SF1
			$4A_{50}$	10	0.27	SF1

Table 11: Results of Shear Bond Strength of masonry prism with CM 1:4

Grade of mortar	Designation of Specimen with different thickness of mortar			Failure load (KN)	Shear bond strength (N/mm²)	Mode of failure
CM(1:6)	Triplet	8mm	$6A_0$	14	0.52	SF2
			$6A_{25}$	11	0.41	SF1
			$6A_{50}$	6	0.22	SF1
		10mm	$6A_0$	18	0.65	SF1
			$6A_{25}$	14	0.50	SF1
			$6A_{50}$	9	0.32	SF1
	Quadruplet	8mm	$6A_0$	14	0.39	SF1
			$6A_{25}$	13	0.36	SF1
			$6A_{50}$	10	0.28	SF1
		10mm	$6A_0$	21	0.57	SF1
			$6A_{25}$	16	0.44	SF1
			$6A_{50}$	8	0.22	SF1

Table 12: Results of Shear Bond Strength of masonry prism with CM 1:6

VII. CONCLUSIONS

- As the substitution level of pond ash builds, the interest of water likewise increments because of higher water retention by Pond ash.
- As grade of mortar increases the water cement proportion likewise increments, with the expansion in substitution level of pond ash in mortar, the workability as far as flow declines.
- It was watched that at higher supplanting levels of pond ash with sand, the mortar blend is somewhat harsh.
- The compressive strength of mortar at various substitution level fulfill the minimum compressive strength necessities according to IS 1905-1987 for various grade of mortar.
- The strength of mortar supplanted by pond ash increments with expansion in curing period, thus strength will improve with increment in the age of the mortar.
- With the substitution level of pond ash in mortar increments there will be diminishment in the compressive strength. The rate of decrease is distinctive for different grade of mortar. Most noteworthy diminishment is watched for 50% to 100% substitution level.
- The Shear bond strength of masonry prism diminishes with expansion in the substitution level sand, yet up to 25% substitution level the decrease in shear bond strength is less when contrasted with masonry prism with ordinary mortar.
- The shear bond strength of quadruplet masonry prism is less contrasted with triplet masonry prism because of expansion in the surface region of masonry prism.

REFERENCES

[1] Pond ash as an Alternative material to Fine aggregate in mortar. Bharathi Ganesh, Sharada Bai, Narendra B.K. National conference on "Beneficial use of fly Ash in Construction industry and Agriculture".23rd may and 24th may 2014.
[2] Influence of addition of pond ash as partial replacement with sand and cement on properties of mortar. Arunkumar Dwivedi, Dhiraj Kumar lal. International Journal of Innovative technology and exploring Engineering. ISSN: 2278-3075, Vol. 2, Issue 4, March 2013.
[3] Study of Pond ash (BTPS) use as a fine aggregate in cement concrete-Case study. Prof. P.P Bhangale, Prof P M Nemade. International journal of latest trends in engineering and technology.
[4] Effect of class-F fly ash as partial replacement with cement and fine aggregate in mortar. C. Freeda Christy and D.Tensing.
[5] Indian Journal of Engineering and material sciences. Vol 17, April 2010, pp. 140-144.
[6] Fly ash characteristics, utilization and government initiatives in India. Sharda Dhadse, Pramila kumara and L J Bhagia. Journal of scientific and industrial research.Vol.67, January 2008, pp.11-18.
[7] Use of fly ash as partial replacement of sand in cement mortar. Abhishek Jain, Nazrul Islam. International Journal of Innovative research in science, Engineering and Technology. Vol. 2, Issue 5, may 2013.
[8] Disposal and utilization of fly ash to protect the environment, Nawaz
[9] International Journal of Innovative research in science, Engineering and Technology. Vol. 2, Issue 10, October 2013.
[10] Study on flow properties and compressive strength properties of mortars using fly ash and lime Satish Chandra.c, Gyanen.Takhelmayum, Deepa.T

