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Review on Performance of Cement Sand Mortars Using Diverse Grades of Sand alongwith Pet Sand

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ABSTRACT

An attempt has been made to study the "PERFORMANCE OF CEMENT SAND MORTAR'S USING DIVERSE GRADES OF SAND" by taking different cement and sand ratio. The material used for the preparation of cement mortar with cement, sand and water. Neither admixture nor cement, sand substitute has been used in the task. The test result show that water : cement ratios increases with increase in cement and sand ratios as well as with decrease in the flexure modulus of sand as 1.45 and 1.25. It was also come in noticed that strength decreases with increases in the cement and sand ratios and with decreases in fineness modulus of sand with also the sand in A and B are with reach mortars.

Key Words: Different grades of Sand, Portland cement, bricks sand, Molds, Water, pit sand, fly ash.

INTRODUCTION

Aggregates and binding materials are mixed in proportions desired for work. Mixing of mortars is done thoroughly to ensure that every grain of aggregate is coated with binding material so that maximum strength is assured. There is no difference in strength of mortars if they are mixed thoroughly in both methods.

The proportions of material vary according to their nature, because they affect the quality of mortar. A fixed proportion cannot be wisely stated unless the nature of material is known, but it is accepted that proportions can be safely stated between certain limits in accordance with regulation. According to Ministry of Health Model Byelaws series IV (Buildings) has stated the requirement of various classes of mortars, for cement sand mortar, IC & $\leq$ 2S and $\geq$ 4S is measured by volume of the material when they are dry. According to wise craft man, Specification, mortars should be so compounded that its ultimate strength is practically equal to that of bricks to be used, usually slightly less.Mortar, containing moisture is affected by actin of frost before end after setting is computed, because moisture changes to ice on freezing. Weathering action caused by excessive rain, wind and high temperature can be harmful and precautionary measures should be taken and adequate proportion provided for materials and work in progress. So, according to work and weathering condition, quality of mortar is controlled by controlling ingredients proportions.

Quality of mortars depends upon the quality of cement, sand, water, admixture (if added) and so many other factors. Therefore, with availability of mortar materials, with different quality control, the mortars are prepared and tested. After test results we decide, the suitability of mortar and assign that for particular suitable construction. In other ways, for any structure or masonry first we decide what should be qualities and properties of mortars. Then we select the mortar materials and prepare the mortar of desired quality for that structure.In this Project, the work for study of cement and mortar, was carried out by taking different types of sands. The sand is designated as A, B, C and D on the basis of fineness of modulus. These sands have fineness modulus ranging from 1.20 to 1.97. The cement used for this project work is ordinary Portland cement. With different water cement ratios mortar was prepared taking each type of sand and their strength study was made in direct tension, compression and bending.

EXPERIMENTAL WORK

PIT SAND

Pit sands are obtained from pits dug into soils, consists sharp angular grains, free from salts. Clean pit sand is excellent material for mortars. River sands are derived from the banks or beds of rivers, consists of fine rounded grains, almost

pure and white in colour and is the best suited for making mortars. Sea sands are obtained from bed or bank of oceans, consists of fine rounded grains of light brown colour. It is contaminated by salts which causes atmospheric attack, dampness, efflorescence and disintegration of work.

Fig 1 Pit Sand

Function of Sand and Surkhi in mortar

Sand mortar does not add to its tensile strength, but it is used chiefly as an adulterant to save cost. It also prevents shrinkage and cracking of mortars in salting. Surkhi is generally made by powdering (beating into powder) old bricks, brick-bats or powdering clay balls burnt in kilns. Like sand it is used as adulterant but unlike sand, surkhi imparts strength and hydraulic property to mortar. For good hydraulic property, surkhi should be made from well burnt hash, ground into very fine powder, and the mortar mixed well in mortar mill.

Fig 2 Sand and Surkhi

Composition of mortar affects the properties and its uses. Fat lime mortar does not set hard and has no hydraulic property, suitable only for brick work joints. For heavy engineering wok, foundation, external plastering and pointing work cement mortar or hydraulic lime mortar should be used. For special important work with great strength, pure hydraulic lime may be used with sand without admixture. Mortars made from one part fat lime 2 part surkhi or one part surkhi and 1 parts and is used for foundation and super structure of ordinary buildings. 10.P.C: 8 S is strong enough for building purposes.

Role of Admixture

$CaCl_2$, NaCl, NaOH, Na_2SiO_3 (sodium silicate) etc. are examples as accelerating admixtures which accelerate the setting time of cements. Sugar, glucose etc. are retarding agents for cement. If more than 0.05% sugar by weight of cement is used, it will act as cement killing agent. Lignosulphonic acids and their salts, hydroxylated carboxylic acids and their salts act as water reducing admixtures. Addition of these compounds lubricates the concrete mix or mortar and workability is increased. Lime also increases the workability of mortar or concrete mix. Animal and vegetable oils and their fatty acids (beef tallow), natural wood resins pre neutralised with NaOH (vinsol resins), wetting agents such as alkali salts of sulphated and sulphonated organic compound (i.e. Darex) are known as air entraining admixtures. Air entrained mortars or concrete is made for frost-resistance. Freezing and thawing effect is controlled by air entertainment and workability is also improved. Air entrainment reduces the density of mortar or concrete and voids

increases. So 5.55 average loss of strength is achieved due to air entrainment Mortar is efficient in lime. There should be a matrix of some kind in the mortar such as lime or O.P.C., the mortar is to be capable of its proper function. If the lime age is more, poorer mortar is achieved.

Organic hydroxyl acids or salts as ester, ether and lactones, tartaric acid etc. if mixed with hydraulic cement, they have retarding effect. Alkali permagments, chromates, dichromate's, chlorates, phosphates, fluorine, oxalic acid, potassium-iron oxalate etc. have accelerating affect. Sugar amounting 6% of quick lime in lime mortar increases about 60% of tensile strength.

RESULTS

It has been shown that the compressive strength, water retentively and workability of cement lime mortars can be raised over wide range by changing the proportions of cement and lime in the mortar.

As noted previously, the cement is the main contributor to the strength of mortar. But at the same time, the cement contributes to rapid setting, low water retentively and poor workability.

On the other hand, lime in the mix contributes very little towards strength, but it does improve the workability and makes for better retentivity.

Mortar type		**Tasted at 7 days / Tasted at 28 days**	
		Compressive strength MPa(PSI) Average of six 50mm(2") cubes	
Laboratory prepared	**P**	11.6(1700)	17.52(2640)
	Q	7.9(1098)	12.52(1713)
	R	3.2(436)	5.01(735)
	T	3.3	2.51(383)
	U	1.6(250)	0.56(83)
Job prepared	**P**	0.4(45)	14.2(2130)
	Q	10.0(1400)	10.1(1550)
	R	8.0(870)	4.2(590)
	T	3.5(363)	2.1(390)
	U	2.0(145)	0.6(68)

The results of tests made on the strength and water retentivity of mortar types P, Q, R, T and U.

Sand A (Obtained from library construction site)

i) Loose unit Weight = 1.415 t/m^3
ii) Compacted unit weight = 1.514 t/m^3
iii) Specific gravity = 2.501
iv) Bulking of Sand = 6.318%
v) Fineness modulus = 1.414

Table 1: Grading and fineness modulus of sand C (Weight of sand taken = 100 grams)

Indian standard sieve No.	**Weight retained(gram)**	**Cumulative weight(gram)**	**percentage cumulative weight retained**	**Percentage passing**
4.75mm	0.0	0	0	100
2.36mm	2.1	2.1	0.2	99.8
1.18mm	4.1	6.1	0.6	99.6
600micron	32.1	38.1	3.8	99.4
300micron	445.1	483.1	48.3	57.9
150micron	435.1	918.1	91.8	8.4
	Total :	**1441**	**144.1**	

Fineness modulus = 144.1 / 100 = 1.441 i.e. Fineness modulus = 1.44

Sand B (Obtained from library construction site)

i) Loose unit Weight = 1.43 t/m^3
ii) Compacted unit weight = 1.58 t/m^3
iii) Specific gravity = 2.33
iv) Bulking of Sand = 9.89%
v) Fineness modulus = 1.20

Table 2: Grading and fineness modulus of sand D (Weight of sand taken = 100 grams)

Indian standard sieve No.	Weight retained(gram)	Cumulative weight(gram)	percentage cumulative weight retained	Percentage passing
4.75mm	0.0	0	0	100
2.36mm	0	0	0	100
1.18mm	4	4	0.4	99.6
600micron	5	9	0.9	99.1
300micron	240	249	24.9	75.1
150micron	685	934	93.4	6.4
	Total :	**1196**	**119.6**	

Fineness modulus = 119.6 / 100 = 1.196 i.e. Fineness modulus = 1.20

Moulding of specimens for project work:

This project work two types of compression specimen one type of tensile specimen and flexure specimen had been casted. In structure laboratory 9 cast iron cubes of size 7.07 cm cube, cross sectional area 50 cm^2, were available. Also #cast iron and 6 wooden cubes of size 5 cm, cross sectional area 25 cm^2 were available. Nine briquettes of 6.45cm^2 and 6 cast iron prisms (beams) of size 4cmx4cmx16cm were available. These moulds were used for making specimen of compression, tensile and flexure strength test of mortar. Flow table, tampering rod tampering specula were available. All cubes briquettes prism and flow table were oiled and their nuts were tightened to get proper shape. Volume of cement sand to fill all specimen was worked out. Now take sand A and mix 1:3 cement sand properly in mixing pans with shovel or trowel. Now add about 60% of water by weiht of cement all fill flow table in 3 layers with tampering rod and give 20 blow in 6 sec-find workability as per IS 2386-63VI. Make a trail with different amount of water to get workability as 95 to 105% (Workability is measured as %age of average increase in diameter of flow table mould).

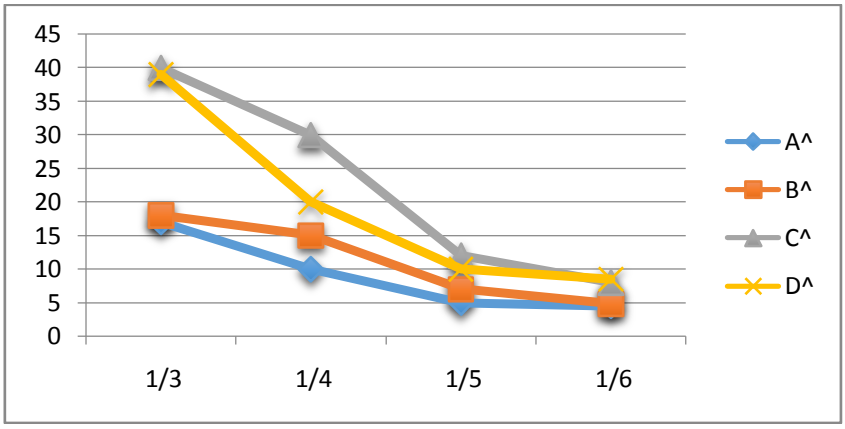
Table 3: test results

Sand type	F.M	Mortar type	C : S ratio	W/C ratio	Flow percentage	Compressive strength				Tensile strength		Flexure strength	
						7 days		28 days		7days	28 days	7 days	28 days
A	1.44	C_1	1:3.5	100	98	11	24.4	8	22	21.15	6.68	7.50	20.2
		C_2	1:4.5	124	100	8.5	20.8	7	10.4	3.6	6.0	6.0	18.9
		C_3	1:5.5	164	100	5.5	14.0	3	9.6	2.01	4.86	4.33	12.8
		C_4	1:6.5	194	100	2.5	6.4	0	4.0	.85	4.40	3.2	11.6
B	1.20	D_1	1:3.5	104	102	9.0	27.2	14	20.8	2.8	7.75	7.75	20.8
		D_2	1:4.5	124	98	8.4	22.0	8.6	12.0	2.00	7.44	6.50	17.99
		D_3	1:5.5	164	100	3.2	16	6	7.2	1.67	5.8	3.9	16.45
		D_4	1:6.5	205	97	1.4	10	4	4.2	1.50	5.0	3.2	14.99

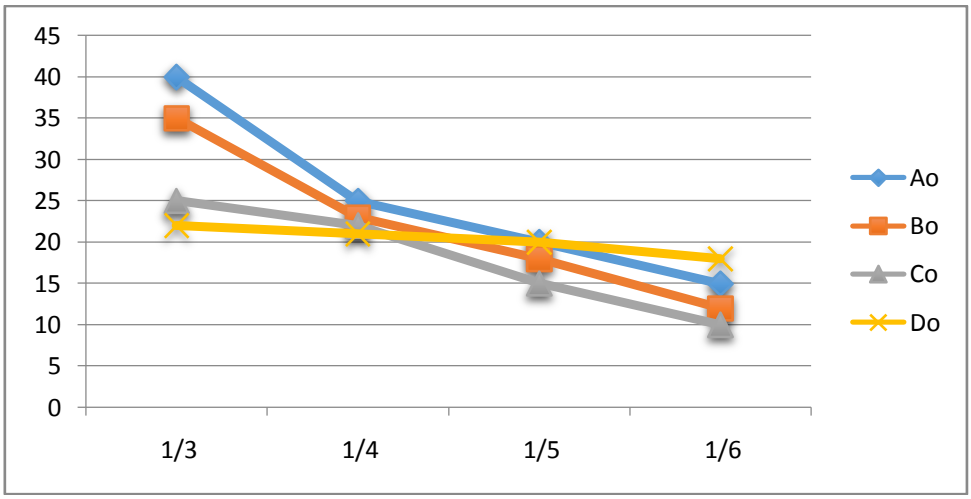
The Description of Graphs

Curve Ao Stands for7 days strength for sand C (f.m. = 1.44)
Curve A^ Stands for 28days strength for sand C (f.m. = 1.44)
Curve Bo Stands for 7days strength for sand D (f.m. = 1.20)
Curve B^ Stands for 28days strength for sand D(f.m. = 1.20)

Specimens: 4cm x 4cm x 16cm Size Beam

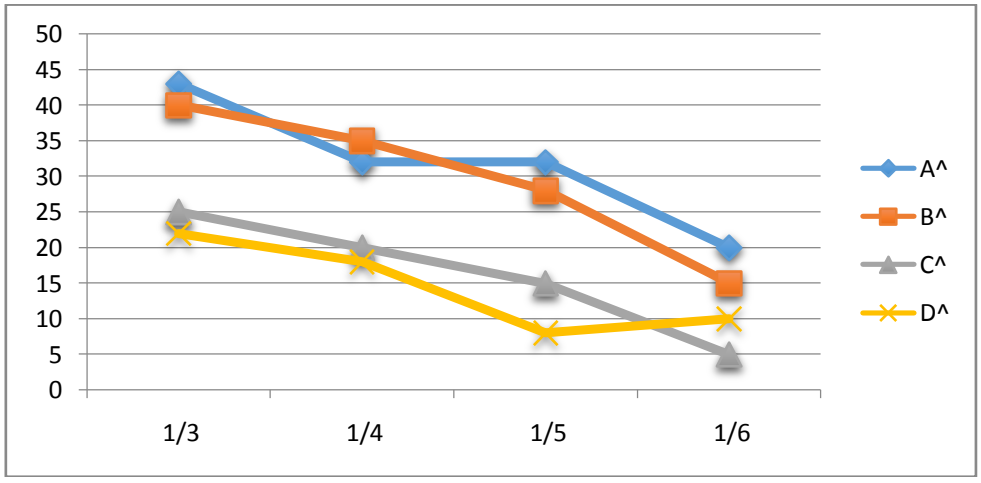


Graph Ao-7 days Cement: Sand ratio v/s Compressive Strength graphs

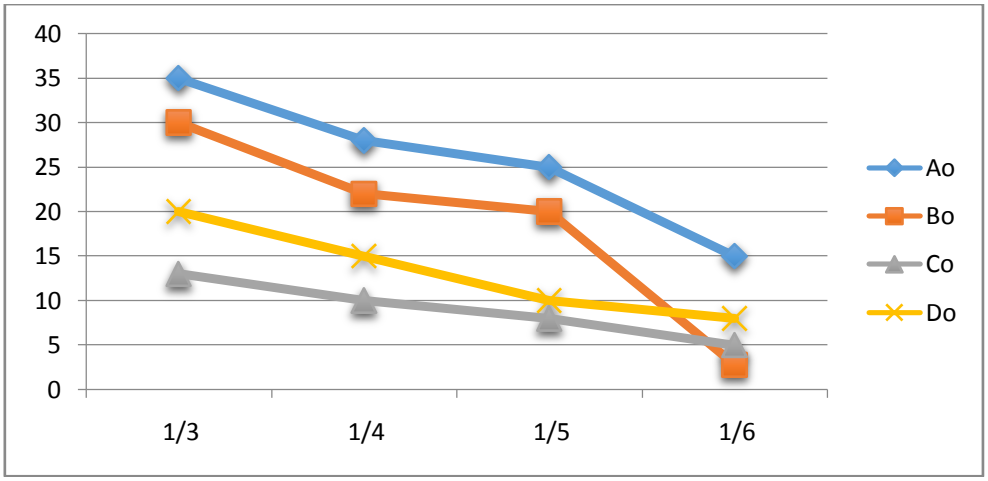


Graph A^ -28 days Cement: Sand ratio v/s Compressive Strength graphs

Specimen: Briquette



Graph Bo-7 days Cement: Sand ratio v/s Compressive Strength graphs



Graph B^-28 days Cement: Sand ratio v/s Compressive Strength graphs

CONCLUSION

On the basis of above observations, following conclusions are recorded:-

1. For constant flow, W/C ratio increases with increase in C/S ratios (here increasing order of C/S ratio is taken as 1/3,1/4, 1/5 and 1/6).
2. For constant workability, W/C ratio increases with decrease in fineness modulus of sands (here decreasing in order of f.m. is taken as 1.97, 1.78, 1.44 & 1.20).
3. Observation no.(3) concludes that failure of poor mortars is sudden by crushing as they have low strength. The failure of rich mortars gives sufficient warning showing cracks.
4. From observation no.(4), it is concluded that mortars made by coarser sand attains its strength at 28 days whereas mortars with finer sand does not. It simply indicates that strength variation with age is low for coarse sand and high for finer sand.
5. Mortar strength depends upon several parameters such as W/C ratio, f.m. of sands etc. Observation no.(5) concludes that each parameter will affect the strength of different mortars in similar fashion.

FUTURE SCOPE

The work carried on cement sand mortar in this Projects may be further scopes:-

1. Cements sands mortars can be studied with fly ash as additional ingredient or cements substitute. Only care should be taken in the sense that the fly-ashs is pozzolanic in nature.
2. In India, about 8 million fly-ash is being produced per year by thermal plants. India fly-ash contains pozzolanic material, and they may be used in mortars and concretes. It is expected that mortar may be produced economically with fly-ash.
3. Cements sands mortar can be also studied with lime. The mortars is deficient in lime, so optimum use of lime may be worked out for cement sand lime mortar.
4. Cements sands mortars can be extended for further study by using surkhis and brick-Ballast.
5. Cements sands mortars can be extended for further study using different types of admixture.

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