CDC

Construction Diagnostic Centre

Non Destructive Testing, Testing Lab, Quality Control / Audit, Repair & Rehab. Consultants

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Director - **Ravi Ranade**

Date: - 21st January, 2013

To,
M/S A.N. Pandde & Sons
Plot Survey No – 86 / 3 (PT) , At – Pise , Post – Amne
Tal – Bhiwandi , Thane

Sub : - Report of Comparison of Crush Sand Plaster & Natural Sand Plaster.

Dear Sir,

With reference to discussions with you, we have carried out a comparison of Plaster using Crush Sand and Natural Sand. Our Observations & Test results are as below –

A) Laboratory tests :-

1. Various laboratory tests as mentioned below were conducted on Crush sand & Natural Sand.

i) Sieve analysis
ii) Specific gravity
iii) Water absorption,
iv) Bulk density.
v) Compressive strength of plaster mortar

Source of Material –

Natural Sand - River sand collected at Kalegao, Tal Karad, Dist, - Satara

Crush Sand - Rock Source – Padaga, Bhivandi, Crush Sand Manufactured at Akash Ganga factory, Old M.I.D.C., Satara, Maharastra using VSI crushing machine of M/S Akadsh Ganga

Cement – Ultratech – PPC

Sr. no.	Description	Crushed Sand	Natural Sand
1	Fineness Modulus	1.09	1.48
2	Specific gravity	2.82	2.78
3	water absorption	0.62%	0.50%
4	Bulk density	1.792 (Kg / Lit)	1.794 (Kg / Lit)
IS Code References - IS - 2386-(Part 3) – 1963 METHODS OF TEST FOR			

SEIVE ANALYSIS – GRADIATION			
	Crushed Sand	**Natural Sand**	**Acceptance Criteria As per IS 1542 – 1992**
Sieve Size	**% Passing**	**% Passing**	**% passing**
10 mm	**100.0**	**100.0**	**100**
4.75mm	**100.0**	**100.0**	**100**
2.36 mm	**100.0**	**100.0**	**95 – 100**
1.18 mm	**91.7**	**83.1**	**95 – 100**
600 Mic	**66.8**	**50.6**	**90 – 100**
300 Mic	**32.6**	**18.4**	**80 – 100**
150 Mic	**14.7**	**7.0**	**20 – 65**
pan	**0.0**	**0.0**	**0 – 15**
F.M. =	**1.09**	**1.48**	The fineness modulus of sand shall not be less than 1.4 in case of crushed stones sands and crushed gravel sands and not less than 1.5 in case of naturally occurring sands.
IS Code for specifications - IS - 1542 - 1992 (Sand For Plaster - Specifications)			

COMPRESSIVE STRENGTH OF PLASTER MORTAR				
Sr. No.	**Description**	**Crushed Sand**	**Natural Sand**	**Acceptance Criteria**
1	**Water for gauging to give a flow between 110 to 115 with 25 drops in 15 seconds**	**114.94 ML**	**102.97 ML**	----
2	**Compressive Strength at 7 Days**	**2.97 N/mm^2**	**3.01 N/mm2**	----
3	**Compressive Strength at 28 Days**	**6.04 N/mm2**	**6.53 N/mm2**	Not less than 3 N/mm^2 at 28 days
IS Code References - IS - 1542 – 1992 (Sand For Plaster - Specifications) ,IS-1727-1967 (Methods of test for Pozzolanic Material), IS - 2550 – 1981 (Code for practice for preparation & use of Masonry Mortars)				

B) Field tests :-

Comparative study of Plaster using Crush sand & Natural Sand

Two different grades of mortars were used viz. 1:4 and 1:6 for both, plaster with natural sand mortar plaster . The walls for plastering were selected for plaster in such a way , that, they will have same area, same exposure condition so as to have a common base for comparison. Thus total four internal walls and four external walls were selected for plaster.

Following field tests were conducted on site of Akash Ganga factory, Old M.I.D.C., Satara, Maharastra.
Following are the photographs during plastering & testing.

During Internal River sand & Crush sand Plastering

Measurement of flow during the plaster


During the external Crush sand & River sand plastering


During the* Scratch *test on plaster


1. Rebound Ratio of plaster -

Rebound ratio is a ratio of weight of plaster mortar material fall after finishing of first layer of plaster to the total weight of plaster mortar used.

Waste material is a percent material remaining after the entire plaster is complete and which can not be reused.

i) Internal Plastering in CM 1: 6

Description	Crush Sand	Natural Sand
Rebound ratio	28%	24%
Wastage of material	2.4%	2.4%

ii) Internal Plastering in CM 1: 4

Description	Crush Sand	Natural Sand
Rebound ratio	7.5%	15%
Wastage of material	2.5%	5%

iii) External Plastering in CM 1: 6

Description	Crush Sand	Natural Sand
Rebound ratio	11.2%	11.75%
Wastage of material	5.33%	5.33%

iv) External Plastering in CM 1: 4

Description	Crush Sand	Natural Sand
Rebound ratio	4%	4.1%
Wastage of material	6.6%	6.6%

2. Measurement of the cracks on plaster

Number of cracks, cracks – width we re measured on 7th day, 10th day, after 1 month after plastering.

Cracks recorded on Internal Plaster surfaces

Description	**Crush Sand**	**Natural Sand**
Plaster in 1:4 - After 7 days	No cracks found	No cracks found
Plaster in 1:4 - After 30 days	No cracks found	No cracks found
Plaster in 1:6 - After 7 days	No cracks found	No cracks found
Plaster in 1:6 - After 30 days	No cracks found	No cracks found

Cracks recorded on External Plaster surfaces

Description	**Crush Sand**		**Natural Sand**	
	Crack length below width 0.25 mm	**Crack length of width 025 to 0.50 mm**	**Crack length below width 0.25 mm**	**Crack length of width 025 to 0.50 mm**

Plaster in 1:4 - After 7days	1 Crack of 160 mm	Nil	1Crack of 50mm & 1 crack of 60mm	1Crack of 50mm & 1 crack of 50mm
	Total Length of Crack – 160 mm		**Total Length of Crack – 210 mm**	
Plaster in 1:4 - After 30 days	1 Crack of 160 mm, 2 cracks of 30 mm & 40 mm	Nil	1Crack of 50mm & 1 crack of 60mm	1Crack of 50mm & 1 crack of 50mm
	Total Length of Crack – 230 mm		**Total Length of Crack – 210 mm**	
Plaster in 1:6 - After 7 days	**No cracks found**	**No cracks found**	**No cracks found**	**No cracks found**
Plaster in 1:6 - After 30 days	Total length of crack = 100mm	---	Total length of crack – 120mm	---
	Total Length of Crack – 100 mm		**Total Length of Crack – 120 mm**	

3. Nail tests on plaster

Penetration depth was measured for hammering of nails of different diameters at different locations. This nail test was conducted on walls after 1 month. For Internal plaster 10 blows of 0.5 kg hammer given and that for external plaster 15 blows were given

Description	**Crush Sand – Plaster surface**			**Natural Sand – plaster surface**		
	3.2 mm Dia	**2.7 mm Dia**	**1.5 mm Dia**	**3.2 mm Dia**	**2.7 mm Dia**	**1.5 mm Dia**
Internal Plaster in 1:4 CM	No penetration	No penetration	No penetration	No penetration	No penetration	No penetration
Internal Plaster in 1:6 CM	Depth of penetration = 5 mm	Depth of penetration = 5 mm	Depth of penetration is 5 mm	Depth of penetration is 5 mm	Depth of penetration is 5 mm	Depth of penetration is 5 mm
External Plaster in 1:4 CM	Depth of penetration is 3 mm	Depth of penetration is 3 mm	Depth of penetration is 3 mm	Depth of penetration is 3 mm	Depth of penetration is 3 mm	Depth of penetration is 3 mm
External Plaster in 1:6 CM	Depth of penetration is 8-10 mm	Depth of penetration is 8-10 mm	Depth of penetration is 8-10 mm	Depth of penetration is 15 mm	Depth of penetration is 15 mm	Depth of penetration is 15 mm

4. Scratch tests on plaster

The scratch resistance of the plaster was measured after 45 days by making the scratches on the plaster using kitchen knife at various locations.

Description	**Plaster by Crush Sand**	**Plaster by Natural Sand**
Internal Plaster in 1:4 CM	No scratch was found on surface.	No scratch was found on surface.
Internal Plaster in 1:6 CM	No scratch was found on surface.	No scratch was found on surface.
External Plaster in 1:4 CM	Groove was found but it was not deeper than natural sand plaster surface.	Groove was deeper than the groove on crush sand plaster.
External Plaster in 1:6 CM	Groove impression & the depth was same as on natural sand plaster surface.	Groove impression & the depth was same as on Crush sand plaster surface.

5. Rebound hammer (Surface Hardness) tests on plaster

Rebound hammer test is a Non Destructive test to assess the surface hardness & surface strength. This Rebound Hammer test was conducted at three locations after 45 days.

Description	**Crush Sand Plaster – Avg. Rebound Index**				**Natural Sand Plaster – Avg. Rebound Index**			
	Loc.- 1	**Loc.- 2**	**Loc.- 3**	**Avg.**	**Loc.- 1**	**Loc.- 2**	**Loc.- 3**	**Avg.**
Internal Plaster in 1:4 CM	18.75	18.10	20.37	**19.07**	19.07	21.66	19.40	**20.04**
Internal Plaster in 1:6 CM	18.75	18.10	20.37	**19.07**	19.40	15.84	17.46	**17.56**
External Plaster in 1:4 CM	23.28	24.89	24.89	**24.35**	25.86	22.31	19.07	**22.41**
External Plaster in 1:6 CM	18.43	18.10	16.81	**17.78**	21.01	22.31	18.75	**20.69**

Observations & Conclusion –

Based on the above lab and field test, it can be seen that, in almost all tests, the results of crush sand & natural sand as material and the test results of Crush sand and Natural sand Plaster are at par and no significant difference is noticed in both the materials.

For **Construction Diagnostic Centre**

Ravi Ranade
(Chartered Civil Engineer & NDT Consultant)