



East Central Railway

Office of the
General Manager (Engg)/Hajipur

PCE's CIRCULAR No- 28/2008/WORKS

Sub- WALL FINISHING WITH TILES/STONES

1) **General-** Wall tiles/stones provide a wide range of aesthetic and architectural treatment to external facing. Due to scarcity of suitable stones in abundance and also due to difficulties in dressing of faces, wall tiles are now a days widely used as because wide range of patterns, shapes and colours are available in the market. Since exterior finishing is exposed to weather and liable to dimensional changes, such finishing with these tiles require better workmanship than the interior finishing.

2) **Functional Requirements-** The functions of external wall finishings are as under:

- a) To obtain an overall architectural expression or to achieve a particular degree of aesthetic effect.
- b) To increase the durability and reduce the maintainance of a structure, and
- c) To assist in protecting the structure against rain penetration and other weather conditions.

3) **Choice of Stones & Tiles -** The factors which govern the choice of using stones & tiles include following.

- a) The appearance or effect desired,
- b) Exposure conditions and the degree of protection needed,
- c) The nature of background on which tiles are to be fixed.
- d) Cost of the finishing work with stones vis-à-vis tiles.

Depending upon the functional requirement following types of stones/tiles are commonly being used for wall finishing.

i) The tiles normally being used are cement concrete plain/terrazzo tiles requiring polishing after fixing as well as pre-polished designer CC tiles (both conforming to IS: 1237-1980) and Ceramic tiles (Conforming to IS:13712 -2006). Stones generally being used are Granite, Marble, Dholpur or Gwalior sand stone, Lime stone, slate etc.

ii) **Size & Thickness of the Tiles/stones-**

- (a) Generally size of the tiles/stones shall be so selected that area of a unit should not exceed 900 Sq.Cm i.e max size of the tiles/stones being used should be 300 mm x 300 mm.
- (b) The thickness of CC tiles shall vary from 12 mm - 25 mm and that of ceramic tiles shall vary from 6-10 mm depending upon the size and manufacturer's specification.

- (c) Thickness of granite, marble & slate for normal residential & service buildings varies from 10 mm to 20 mm and thickness of limestones & sand stones should preferably be not less than 20 mm. However for multistoried buildings the thickness of stones used for tiling work depends on the architectural effect desired and it should not be less than 40 mm.

iii) Comparative cost of various materials used in wall finishing is as under

S.No	Material	Approx Cost (Per Sq.M)
1	General Ceramic Tiles (6.5 to 8 mm thick)	Rs 550- 750/-
2	Cement Concrete Mosaic Tiles (20 mm thick)	Rs 700-750/-
3	Cement Concrete Art/Design pattern Tiles (12 mm to 20 mm thick)	Rs 800-850/-
4	12 mm thick Pre polished designer CC tiles	Rs 1100/-
5	Different types of Stones	
(i)	10 mm thick pink granite tiles	Rs 1050/-
(ii)	10 mm thick gray coloured granite tiles	Rs 990/-
(iii)	10 mm thick black granite tiles	Rs 1175/-
(iv)	10 mm thick superior quality (RBI Red) granite tiles	Rs 1500/-
(v)	8 mm thick marble tiles	Rs 850/-
(vi)	Sand/Lime Stone (20 mm to 40 mm thick)	Rs 1000/-
6	Imported Ceramic Tiles (8 mm thick) of AZULEJOS MIJARES make or similar	Rs 2500/-

Before selecting the material for wall finishing, cost aspect should also be looked into depending upon the importance of the structure. It is seen from the above table that the imported ceramic tiles are very costly, therefore, these tiles should be used very scarcely that too with the written approval of THOD.

4) Acceptance Criteria for wall finishing materials

a) For normal & pre polished CC tiles

Properties	Physical Requirements	Relevant Code
Abrasion/Wear resistance (Loss in thickness in mm)	Max 3.5	IS 1237:1980
Water Absorption	Max 10 %	
Wet transverse/Flexural Strength	Min 30 N/mm ²	

b) For Ceramic Tiles

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Properties	Physical Requirements	Relevant Code
Scratch resistance (Moh's Scale)	Min 3	IS: 13630 Part -2
Water Absorption	Max 20 %	IS: 13630 Part -16
Wet transverse/Flexural Strength	Min 30 N/mm ²	IS: 13630 Part -6

c) For common stones

Type of Stone	IS Code	Specific Gravity (Minimum)	Minimum Compressive strength (Kg/Cm ²)	Maximum water absorption % by weight
Granite	3316-1974	2.60	1000	0.50
Lime Stone	1128-1974	2.00 -2.75	200	0.15
Sand Stone	3622-1977	2.65-2.95	300	2.50
Marble	1130-1969	2.50	500	0.40
Slate	6250-1981	2.00	800	2.00

For first 400 Nos of tiles/stone or less minimum one sample of the tiles/stone to be randomly selected and tested for physical properties in accordance with the test methods as detailed above. Further testing is required @ one sample for every additional 2000 Nos or part there of. While framing special condition and or specification to be included in the tender/contract agreement for such works, a Para with caption "**Sampling, Testing and Acceptance of Materials**" should invariably be included in which reference of relevant IS codes and other standard specifications should be made. All the field Supervisors and Officers associated with execution should also be well conversant with provisions of these codes and specifications and should check/test-check the works following the codal provisions.

- 5) Durability**-Excessive temperature variations in surroundings will cause cracks and bulges in the tiling work. Dark coloured tiles absorb heat readily. Where such effects are envisaged, an adequate width of joints should be provided around each tiles to accommodate thermal movements. Resistance to water penetration is very important for durability. Water has access into the facing mainly through the joints and the tiles themselves are impermeable unless the glaze is damaged and the tile body is permeable. To prevent access of water, the joint filling shall be impermeable, complete and without cracks. Once water has entered through the gaps of joints, it may affect the tile fixing and cause loss of adhesion apart from seepage through walls.
- 6) Surface Preparation**-The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence, if any, shall be removed by brushing and scraping. In case of concrete

surface back ground, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off. In case background is unsuitable for direct fixing then floated coat or rendering is to be done by applying 13 mm thick cement mortar 1:3 along with suitable water proofing compound. The final floated coat shall be true to plumb.

7) Fixing of Tiles & Stones-

a) Fixing of CC/Ceramic Tiles-

- i) The mix for bedding mortar shall be 1:4 cement sand mortar. Before tiling is commenced, it shall be ensured that there is proper adhesion between the floated coat and the background and no part of the rendering has a hollow ring. The floated coat shall be completed at least one week before the fixing begins and shall be free from visible moisture.
- ii) The non porous tiles need not be soaked; whereas porous tiles should be completely immersed in clean water for at least one hour before using. After soaking, the tiles shall be fixed as soon as the surface water has drained away.
- iii) Before tiling begins and bedding mix applied on it, the dry floated coat shall be wetted just sufficiently to prevent it from absorbing water from the bedding mix.
- iv) It is not sufficient to place the tile on wall rather the tiles shall be evenly placed and tapped back firmly into position in order to ensure that the bed is soiled over the whole of the back of the tile including corners. The resultant thickness of the bed behind the tile should generally be 6 mm, but not more than 12 mm thick.
- v) Grouting or Pointing of Tiles- Grouting of joints are being done for joints up to 5 mm wide whereas for joint more than 5mm width pointing of joints are being done. Grouting or pointing should not be carried out, until the day after the tiles have been fixed. Grouting or pointing mix of grey or white cement (1 cement, 2 stone dust) mixed with clean water to the required consistency is satisfactory. A water proofing agent may be added to the grouting mix. In pointing mortar, small quantity of fine sand should be added to the mix to facilitate application of pointing mortar properly.

b) Fixing of Pre polished designer CC tiles-

- i) Plaster the surface to be tiled with cement sand mortar 1:3
- ii) Wet the back side of the tile with water. Complete immersion of tile in water is not required.
- iii) Spread cement mortar on the back side of the tile after wetting the tile.
- iv) If tiles are square or rectangular in shape, set the right angles for the area and place the first tile along the right angle lines and place it on base mortar. Tap gently with a rubber or wooden mallet to obtain perfect levels.

- v) Clean the surface of the tile with clean water immediately after laying with wet sponge. Ensure the base of mortar cement which squeezes through the joints does not settle on the tile.
- vi) Do not use the area laid for at least 24 hours.
- vii) Fill in the joints with pointing material which is a mixture of white cement and desired colour pigment. For higher quality of finishing if required, a polymer based cementitious tiling joint filler like Roffe rainbow or similar to be used. Do not apply pointing material all over the surface.
- viii) Allow pointing material to set for 15 minutes and then clean the surface of the tile with a clean wet sponge, removing the excess pigment on the tile surface.
- ix) Wash the surface with soap water or mild detergent to obtain a clean surface and wipe it.

c) Fixing of stones-

- i) **Dressing-** Sand stones and Lime stones face tiles shall be cut to required size and shape, so as to be free from waviness and to give truly vertical and horizontal joints with adjoining units. Dressing at the back of the stone should not be done so as to ensure good grip with the backing.
- ii) **Methods of attachment-** Special fixing techniques are employed making use of cramps, dowels, etc for fixing any stone tiles of thickness 40 mm or more. Method of attachment of the stone face tiles are as under.
 - (a) Using cramp to hold the stone in position only, in this case the weight of the unit being transferred to the unit beneath
 - (b) When cramps are used to hold the unit in position only the facing shall be provided on a continuous support on which they rest at ground level. At other storey levels, the support may be in the form of projection from or recess into the concrete floor slab or a beam between the columns or metal angle attached to the floor slab or beams. The support shall preferably be at vertical intervals not more than 3.5 m apart and also over the heads of all openings.
 - (c) Using cramp to hold the units in position and in addition to support the units thus transferring the weight of the units to the backing.
 - (d) Gun metal cramps shall be of 25 mm x 6 mm and 150 mm long for one brick and 115 mm long for half brick thick wall. These shall be 300 mm long for stone masonry walls and brick masonry walls thicker than 230 mm. Spacing of cramps would depend on size of stone but it is necessary to ensure that each slab is properly secured to the backing as well as adjoining slabs. Cramps shall not be spaced more than 600 mm apart horizontally.
 - (e) The adjoining stones shall be secured to each other by copper pins of 75 mm long and 6 mm dia.

(f) Cramps and pins are generally fixed in cement mortar 1:2 using fine sand.

iii) Laying and Fixing-

(a) Stones tiles having thickness up to 25 mm are fixed with backing in mortar like any other wall tile material as described in (a) above. However stone having thickness of 40 mm or more should generally be fixed with the backing with metal cramps only.

(b) Stone tiles should be wetted before laying. They shall then be fixed with cement sand mortar 1:3 or 1:4. As far as possible the backing shall be carried up simultaneously with the face work.

d) **Joints-** The joints shall be done with composite cement lime mortar 1:1:6 (1 cement, 1 lime putty, 6 fine sand) and it is to be ensured that all joints shall be full of mortar. The thickness of joints shall be as small as possible, not exceeding 5 mm. For a close butt jointed facing, the thickness shall not exceed 1.5 mm. The face joints shall be uniform throughout. It is preferable to use joint sealing compound where the facing may be exposed to heavy rain.

e) **Pointing-** All exposed joints in facing should be pointed with mortar to match the colour of the facing. Pointing should be sunk from the face by 5 mm and depth of pointing should not be less than 15 mm. The mortar used for pointing shall be 1:2 (1 white cement, 2 stone dust) with an admixture of pigment to match the shade of the stone.

Docket No- W-2/118/09/Works Policy
Copy-

1. CAO/Con/N, CAO/Con/S/MHX for information PI.
2. DRM/DNR, DHN, MGS, SPJ & SEE for information PI.
3. Sr.DEN/ (Co-ord)/DNR, DHN, MGS, SPJ & SEE for information and necessary action.
4. All HODs, Dy HODs/Engg Deptt/ECR

Date-17.07.08
29

Chief Engineer/Works

Dy Chief Engineer/Works

Accepted
29.7.08