cement & concrete institute

Plastering

squash-court walls

1. General requirements

Plaster
The plaster on playing walls of squash courts has to be hard and strong and its surface must be a true plane with a fine matt texture.

Background
The masonry background must be true so that the plaster can be as uniform and thin as practicable.

Sand
The sand must be suitable: it must produce a mortar of good plasticity with a relatively low water content.

Curing
The plaster must be damp cured as described below.

Workmanship
A high standard of workmanship is essential.

Supervision
Good supervision is needed at all stages of the work.

Trials
The suitability of the materials, methods and personnel must be established before the work is started.

Stockpiles
The full quantities of materials, and especially of sand, must be on site before the work is started. Sand should be kept covered to prevent contamination.

Access
Scaffolding must be erected to provide easy access to all parts of the walls.

Control of suction
To control suction, the background (ie brickwork) should be wetted the day before any slush, spatterdash or plaster coat is applied.

2. Construction requirements

The faces to be plastered must be hard, strong, clean and free of dust and other loose material. They should be as plane as possible: within ± 3 mm of planeness and verticality. This is best achieved by using accurately and rigidly fixed profiles, between which string lines are stretched as guides for bricklaying.

The bricks should have moderate suction and a surface texture that will provide a good mechanical key. The horizontal joints should be raked out 5 mm deep.

The exterior walls must be watertight because any moisture penetration may damage the paintwork to their interior surfaces. A cavity wall is best, but expensive because the inner leaf, if it is the front playing wall, should be at least 210 mm thick to avoid resonance.

Exterior surfaces of solid exterior walls should be plastered (1 bag cement: 200 ℓ sand), then decorated and weather-proofed with a coat of coarsely textured plaster and/or a cement-based or thick emulsion paint formulated for exterior use.

A playing wall should not have any changes of material or thickness or construction or movement joints in it and should not incorporate any part of an existing building.

Walls that are partly above and partly below ground level should be of cavity construction for waterproofing and to minimize stresses in the playing wall that may arise from differences of temperature within them.

3. The use of polymer emulsion admixtures

A polymer emulsion, based either on styrene butadiene rubber or acrylic, may be included in mixes for the bonding coat, undercoat and finishing coat. Such admixtures:

- Reduce water requirement of the mix
- Improve workability of the undercoat and finishing coat mixes
- Reduce drying shrinkage
- Improve adhesion
- Increase toughness of the hardened material
- Reduce the tendency to crack

The successful use of polymer emulsion admixtures has been reported by specialist contractors. The following points concerning their use should be borne in mind:

- Obtain specially formulated admixtures only from reputable manufacturers.
- Dosage should be as advised by the manufacturer.

- A trial section should be done in order to accustom workmen to the use of modified mixes.

4. Plastering system

The thickness of the system should be less than 20 mm. Because it may be difficult to obtain a reliable bond between coats of plaster, it is recommended that the plaster system should consist of:

- a bonding coat
- a single finish coat of 12 mm nominal thickness

If a plane finish is to be obtained with a single, thin coat of plaster, the brickwork must be accurate. When replastering existing walls, the finish coat may vary in thickness from 7 mm to 25 mm provided that the thickened parts are limited in area and that the extra thickness is carefully built up to ensure full compaction throughout.

Bonding coats

There are three types of bonding coats: slush coats, proprietary bonding agents and spatterdash coats. A slush coat may be used if the brickwork provides a good mechanical key for the plaster, but a spatterdash coat is preferred and should always be used where the surface of the brickwork is rather smooth.

1. **Slush coats**
   This is a slurry of one part fine sand to two parts cement and sufficient water to produce a paint-like consistence. The slurry should be kept stirred and be used within an hour of mixing.
2. **Proprietary bonding agents**
   These must be used in strict accordance with the manufacturer's instructions.
3. **Spatterdash coat**
   This is a mixture of one part cement, one and a half parts coarse sand and enough water to make the mix just pourable.

   The mixture is thrown forcibly onto the wall with a brush with long, stiff bristles, or with a scoop, and should form shining nodules 2 to 3 mm high. The finish must not be worked but be left rough and should extend over the whole wall. It should be damp cured, as described below, for three to five days and then tested. Only if it is hard and adhering strongly, should plaster coats be applied.

Undercoats

If an undercoat is necessary, it should be of the same materials and proportions as the finish coat. Undercoats should be 6 to 13 mm thick and be screeded off and woodfloated to a true and plane surface. One or two hours after it has been applied, the undercoat should be scratched with wavy, horizontal lines about 5 mm deep and 25 mm apart.

The finish coat should be applied the next day, immediately after a slush coat has been applied.

Finish coats of sand-cement mixes

Mix proportions are discussed later. The amount of water in each batch must be closely controlled to ensure that the quality of the batches is uniform. The mix should contain enough water to allow proper compaction without sagging on the wall. Mixes that are too dry cannot be compacted fully and this will seriously reduce the strength of the plaster.

After mixing, batches should be used within about half an hour. During this period they should be covered with wet sacks or plastic sheeting and be remixed at intervals without the addition of more water.

The plaster must be screeded off, compacted and floated to a true surface with wooden tools. Final smoothing with a steel float should be delayed as long as possible and then be done with heavy pressure with just enough polishing to obtain the required texture.

Joints

No plaster coat should have any joints within the area of the wall. A neat, narrow, vertical joint should be provided at each corner to isolate the plaster on one wall from that on the adjoining wall.

Reinforcing sand-cement finishes

Reinforcement may be incorporated in the plaster on the front wall if:

- the finish coat is substantially thicker than 12 mm;
- the water requirement of the sand exceeds the recommended limits (see *Mix proportions for plaster*, below);
- a richer mix than that recommended is used;
- some movement of the walls is expected, eg earth tremors or ground movements (in this case the main precaution should be to reinforce the walls themselves).

Reinforcement in plaster does not prevent shrinkage, but ensures micro- rather than macro-cracking.

The reinforcement is usually 0,71 mm diameter (22 SWG) woven mesh wire with 13,2 mm openings. A single layer is provided *at mid-depth* of the plaster coat, fixed with steel nails at 300 mm centres. The wire is pulled taut during fixing and must not extend from the front into the side walls.

The reinforcement should be fixed after the spatterdash coat has hardened and the finish coat should be applied as soon as possible after fixing the wire.

If galvanized mesh is used, add a soluble chromate to the mixing water of the plaster to prevent possible chemical reactions between the zinc galvanizing and the alkalis of the cement.

Use:
either chromium trioxide (CrO_3)
at 0,7 g/ℓ mixing water

or potassium chromate (K_2CrO_4)
at 0,14 g/ℓ mixing water

or potassium dichromate ($K_2Cr_2O_7$)
at 0,20 g/ℓ mixing water

Moist curing

All plaster should be kept continuously moist for at least seven days after being applied. This allows the cement in the plaster to hydrate thoroughly and for the plaster to develop strength.

Drying period

The plaster must be allowed to dry out before it is painted.

5. Materials

Cement

Cement should comply with SABS ENV 197-1; type CEM I or CEM II A. Do not use masonry cement. Note that it is illegal to sell cement not bearing the SABS mark.

Sand

The quality of the sand is of critical importance. Not only must it produce a mix of suitable consistence for plastering (ie with adequate plasticity, cohesiveness, etc) but the mix must require as little water as possible to attain this consistence.

The sand should be markedly coarser than normal plaster sand and is best described as “a high-quality, natural (ie pit or river), concrete sand, rather on the fine side”. Each grain should consist of a sound piece of quartz or of the parent rock, have fairly smooth surfaces and be rounded or chunky rather than elongated or flaky. Crusher sands alone are seldom suitable.

Sands produced from partly decomposed granite or granite-like rock are also seldom suitable. The size of the grains should vary from about 3 mm to dust and the clay content should be negligible. An excess of coarse particles can be removed by sieving on site, but it is impracticable to wash out an excess of fines on site. All sand should be passed through a sieve with 2,36 mm openings. The sieve should be approximately horizontal and be shaken or rotated about a horizontal axis.

Throwing sand against a steeply sloping sieve gives an unacceptably variable product and is wasteful.

Sands with grading within the limits given in Table 1 are likely to be satisfactory.

Table 1: Recommended grading of sand for squash-court plaster.

Sieve size, mm	Percentage passing
4,750	100
2,360	90–100
1,180	60–100
0,600	35–85
0,300	25–35
0,150	10–20
0,075	4–7

Note

1. Sands with gradings outside these limits may prove suitable when tested.
2. An excess of coarse particles, or excessively angular particles, inhibits the smooth flow of plaster when it is applied and may cause the surface to tear when it is trowelled.

It may be necessary to mix two sands to obtain the necessary range of particle sizes and grading. If a coarse natural sand is not available for blending, a crusher sand with well shaped particles can sometimes be used.

The amount of water needed to bring a given mix to the right consistence is called the water requirement of the sand. It is an important characteristic because the total water in the fresh mix determines not only the potential physical strength of the plaster, but also the amount by which it shrinks on drying. Different sands may have different water requirements.

It is recommended that sand should be assessed for suitability by a concrete technologist. The sand properties should be such that it is possible to produce a workable mortar with a 28-day cube strength of at least 25 MPa using a mixture of 2,5 parts of dry sand to 1 part of cement by mass. (This is based on a relative density of 2,65 for the sand.) Water requirement should not exceed 320 l/m^3 and preferably be less than 300 l/m^3.

Any sample of sand that is sent to a laboratory for testing must be truly representative of the bulk supply. Samples must be taken from a number of places on stockpiles, thoroughly mixed, and the volume reduced by quartering. The minimum size of sample for laboratory testing is 5 kg or 4 ℓ of each sand, but samples twice this size are recommended.

6. Batching and mixing

Mix proportions for plaster

If batching is by mass:

125 kg dry sand to 1 bag (50 kg) cement

If batching is by volume:

110 ℓ sand in a loose, moist state to 1 bag cement

Batching by mass is more accurate than batching by volume and is therefore preferred. Small changes in mix proportions in these relatively rich mixes have a substantial effect on the strength of the plaster. If volume batching is used, each batch should consist of one or more whole bags of cement and the appropriate volume of sand, measured with calibrated containers.

The containers should always be overfilled and then struck off level with the brim. Part-filling of containers should not be permitted.

Mixing must be thorough as poor mixing can lead to localized failures.

7. Quantities of materials

The total area of playing surface of a standard squash court is 109 m^2. The net volume of plaster required, assuming an average thickness of 12 mm, is 1,31 m^3. A cubic metre of the suggested mix contains 11 bags of cement and approximately 1,25 m^3 sand. An allowance for wastage – say 10 to 20% – should be included in the quantities of materials provided for the job.

8. Repair of localized failures

Localized failures may occur because of impurities in the sand or because of improper mixing of the plaster. The affected areas are seldom more than 75 mm square. Cut out the affected area until sound plaster is reached. Remove all dust from the hole with a vacuum cleaner. Use a soft bristle brush to paint the exposed surfaces with a cement-water slurry and immediately afterwards fill the hole in layers with a 3:1 mix of coarse sand and cement with just enough water added to make a crumbly consistence. Ram the material home with a piece of wood. Bring the repair plaster proud of the plaster surface and compact it by using a board and hammer. Dress the surface to match the texture of the existing plaster.

Coat the patch with an acrylic emulsion paint after 24 hours. The wall can be put into use as soon as the paint is dry.

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