THE CONCRETE INSTITUTE

concrete tennis courts

1. site and drainage

The most suitable site is one that is situated on well-drained gently sloping ground which will permit surface water to drain away quickly. Sites hemmed in by trees should be avoided because their roots may disturb and crack the the concrete.

Where the site permits, the court should be positioned with its longitudinal axis in a north-south direction, or up to 25 degrees counterclockwise of it.

If a concrete surface is to remain true and free of cracks, it must rest on thoroughly stable material, but no soil or earth is likely to be stable enough if it is liable to prolonged, or even periodic, saturation.

Where the normal slope of the ground does not permit natural drainage, or where the ground is clayey, it will be found advantageous to lay a line of agricultural drain pipes around the site. These should be placed in a small trench about 250 mm wide and packed around with gravel or broken stone. This pipe line should have a fall of about 1 in 50 and the outlet should be connected either to a sump filled with broken stone or gravel, or to the nearest ditch.

If the area is seasonally damp, the site of the court should also be drained in a similar manner by laying a line of piping diagonally across the whole area into which other smaller lengths of pipe line are connected. (See figure 1.)

2. preparation of site

The site should be stripped of turf until firm ground is reached. All soft or spongy areas should be excavated and the holes filled with well-tamped sand, gravel or cinders. Roots of trees and other vegetation should be removed.

At this stage the holes for the net posts should be dug. The excavations should be 450 mm square, 750 mm deep and 12,80 m apart centre-to-centre on the net line.

Another hole, about 250 mm by 250 mm by 250 mm should be dug under the centre of the net to take the anchor block for the strap which holds down the centre of the net.

If the clearing of the site has uncovered a sandy or gravelly sub-soil, and this is at a suitable level, the concrete surfacing can be laid directly on it; otherwise a layer of compacted sand, gravel or hard well-burned cinders should be laid over the whole area of the court to provide a sub-base. This layer should be not less than 100 mm thick, but if it has to be thicker, it should be built up in layers each not more than 100 mm thick. Each layer must be fully compacted by watering and rolling or tamping.

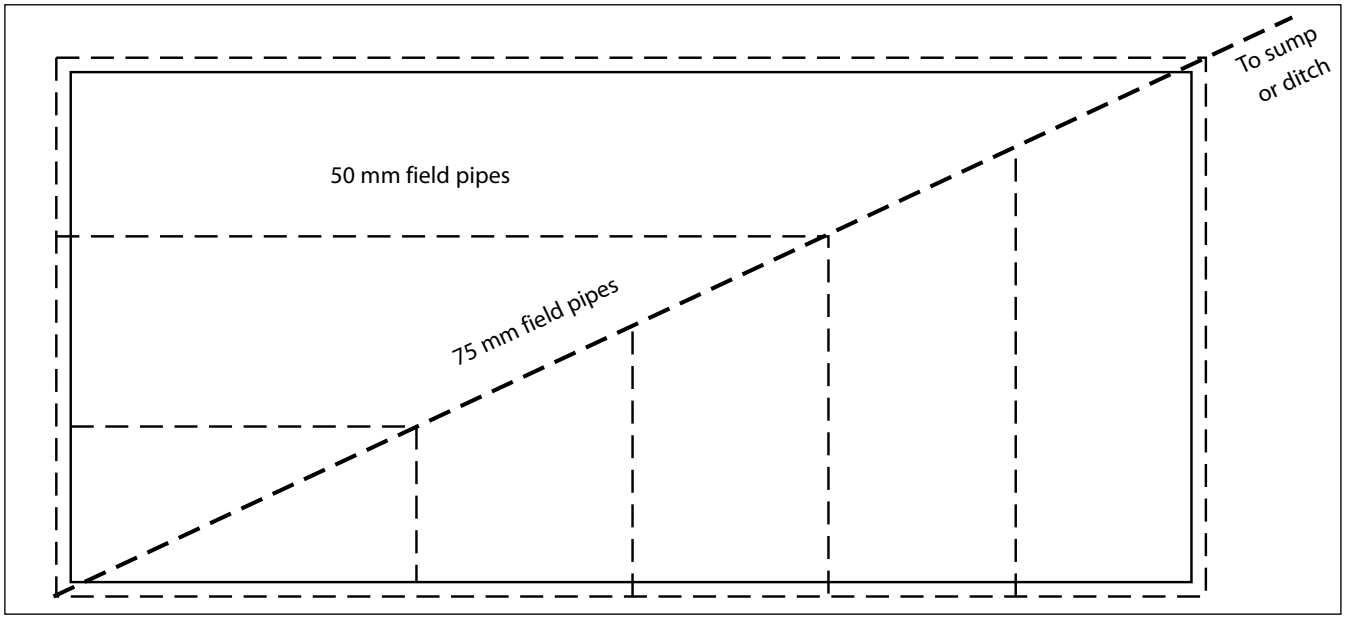

Figure1: Drainage plan

It is important that the sub-base on which the concrete rests be uniform and consist of materials which will not change or deteriorate with time, otherwise uneven settlement or cracking of the concrete will occur.

An old gravel, ant-heap or bituminised court usually makes a good sub-base.

The sub-base should be trimmed true to give an even fall of 100 mm from one side of the court to the other, so that no water can accumulate and the sub-base is kept firm and solid.

The finished surface of the court should be given the same crossfall to permit rain water to drain away quickly. The court should not be drained from the centre outwards.

3. size and setting out of court and surround

The size of the playing area of the court is 23,77 m x 10,97 m measured to the outside of the lines. If the court is truly rectangular, the diagonals of this area will each be 26,179 m long. The diagonals of a half-court will be 16,174 m. Other dimensions are given in Figure 3.

The width of the surround is a matter of choice. Generally speaking, 4,5 m to 5,5 m at each end and 1,8 m to 2,75 m at the sides will be sufficient for ordinary play. In the case of championship size courts, these dimensions should be increased to 6,40 m and 3,66 m respectively. Since these paved areas should be truly rectangular, tabulated below are the lengths of the diagonals of the paved areas for three typical classes of court, and for the corresponding half-court.

Class of court		Dimensions of paved area, m	Lengths of diagonals, m
Minimum	full court	31,2 x 14,6	34,447
	half court	15,6 x 14,6	21,336
Medium	full court	34 x 16	37,578
	half court	17 x 16	23,345
Championship			
	full court	36,6 x 18,4	40,965
	half court	18,3 x 18,4	25,953

4. concrete surfacing

The concrete surfacing described below has been designed (a) to be as low in first cost as is consistent with providing a surface which will remain suitable for good club-standard play over many years; and (b) to be easy to lay, using only labour and equipment easily available.

4.1 Thickness

The slab should be laid in two courses, namely a base course 85 mm thick followed by a top course 15 mm thick, the total thickness being 100 mm.

4.2 Joints

The court area should be divided into bays of convenient size, each of which should be concreted in one operation. The bays should be laid alternately, checkerboard fashion, with joints between adjacent bays. Two types of joint are used.

An expansion joint is provided across the court under the net. This consists of a 20 mm wide gap containing a strip of closed cell expanded polyethylene.

All the other joints are keyed contraction joints. These are designed to allow for some shrinkage in the concrete and to prevent relative vertical movement of the concrete on either side. Provided these joints are properly made, they do not in any way affect the bounce of the ball. Figures 4 and 5 show joint details. Figure 3 shows suggested positions of the joints. Placing them near to the court markings makes them less conspicuous.

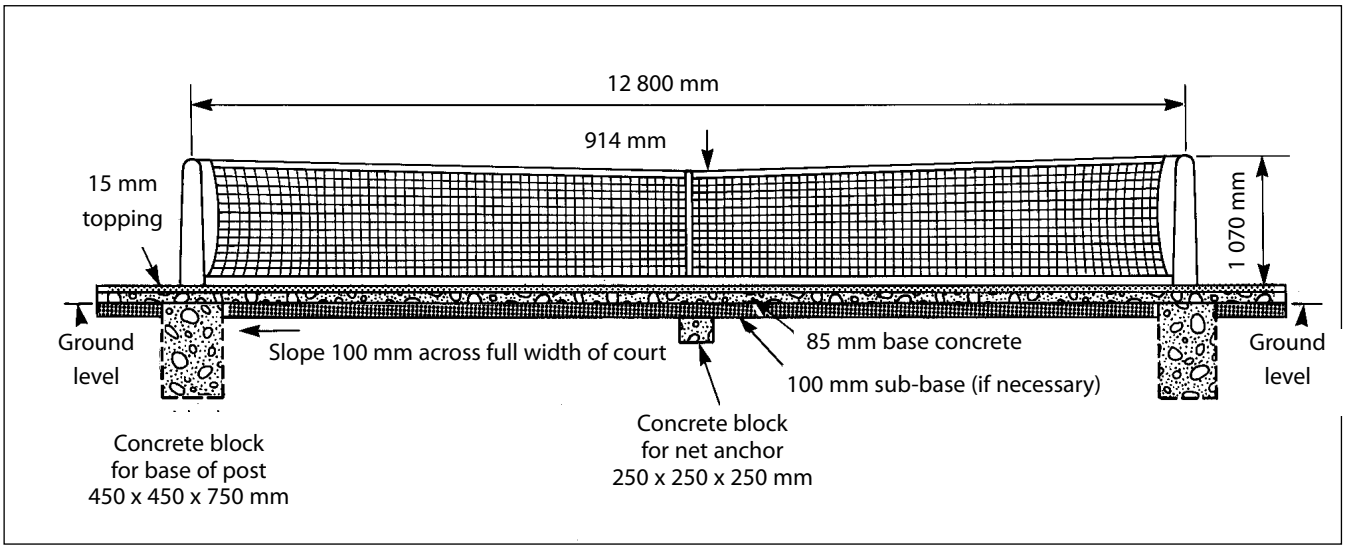

Figure 2: Cross section

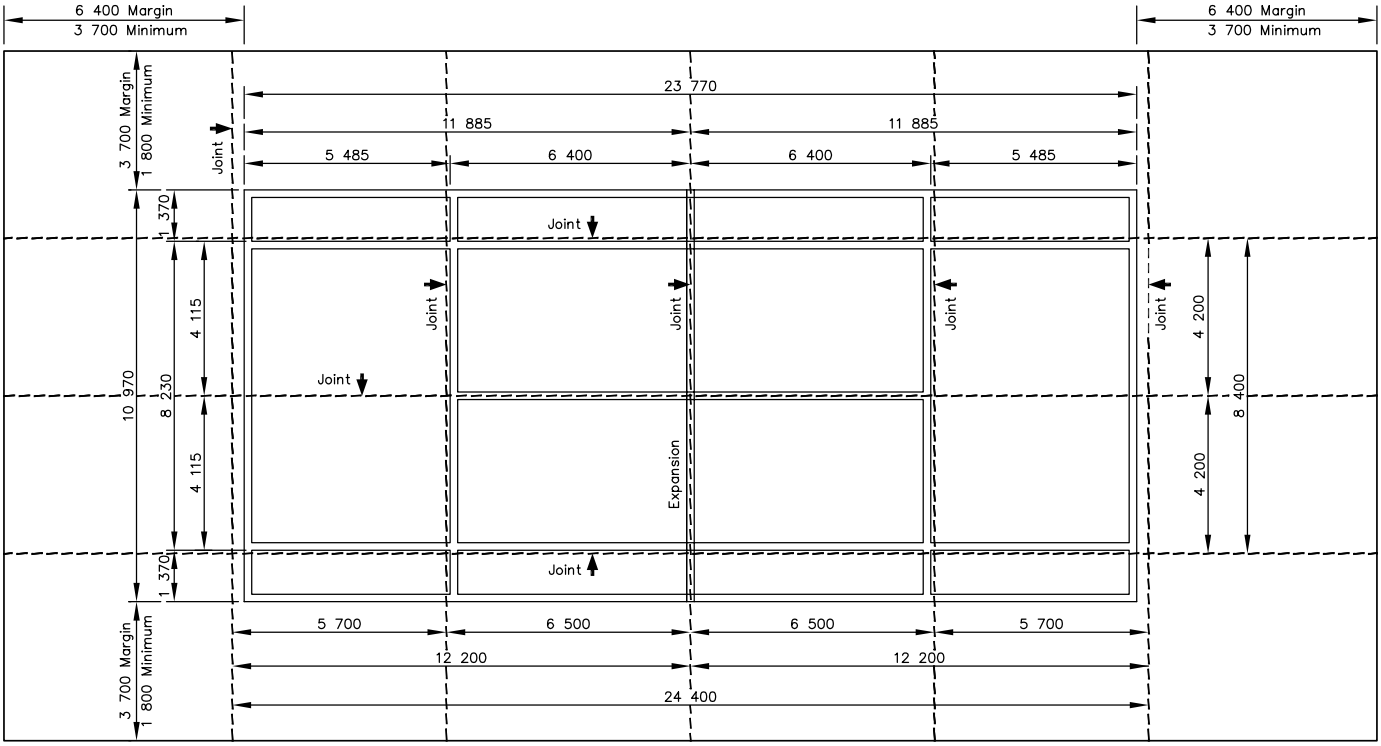

Figure 3: Layout of joints and markings

5. forms and strike-off boards

The side forms for the bays should be of 100 x 50 mm timber and should be straight and free from twist. They should be set true to line and level in order to give the required fall of 100 mm across the surface of the court and should be held firmly in position by stakes driven into the ground. Keyed joints between adjacent bays are formed by fixing suitably shaped strips of timber to the side forms. (See Figure 5).

The forms should not be removed until the concrete is at least 12 hours old, and should be cleaned and oiled before each use.

The strike-off board should be 225 mm x 50 mm timber, 4,8 m long, and planed on both edges. For bays of 4,2 m width, a 50 mm x 15 mm strip, 3,8 m long should be tacked along the bottom edge to provide 15 mm rebates at the ends of the board. For bays of other widths, the length of the board should be 600 mm more than, and the length of the tacked-on strip 400 mm less than, the width of the bay.

A round steel bar or tube about 300 mm long should be driven through a drilled hole at each end of the board to permit easy handling.

For finishing of the concrete a working platform of some kind will be required to enable the workmen to trowel and finish the surface without marking the work already completed. The platform should span the bay without touching the concrete.

6. concrete mixes

All concrete for tennis courts should be made with cement complying with SANS 50197-1 strength class 42,5 N or higher. Other cements may be used in consultation with The Concrete Institute. Bags should be clearly marked with the strength grade, e.g. 42,5 N, and a Letter of Authority (LOA) number issued by the National Regulator for Compulsory Standards.

Concrete for the 85 mm thick base course should be mixed in batches each of which contains 50 kg of cement, 100 litres of sand, 100 litres of crushed stone, and enough mixing water to produce a workable mix. (If the concrete is being purchased ready-mixed, the specified crushing strength at 28 days should be 20 MPa and, since it will be compacted by hand, the slump should be 100 mm).

The stone should be 19 mm nominal size.

The sand should be clean and rather coarse with particles ranging in size from about 5 mm down. It should contain a wide variety of sizes of particle, with no one size predominating, and with only a limited amount of dust or other very fine materials.

Both the stone and the sand should be free of clay, loam, organic matter and of other impurities.

Advice on the suitability of sand and stone for concrete may be obtained from the Cement & Concrete Institute.

The water used for mixing should be clean and fit to drink.

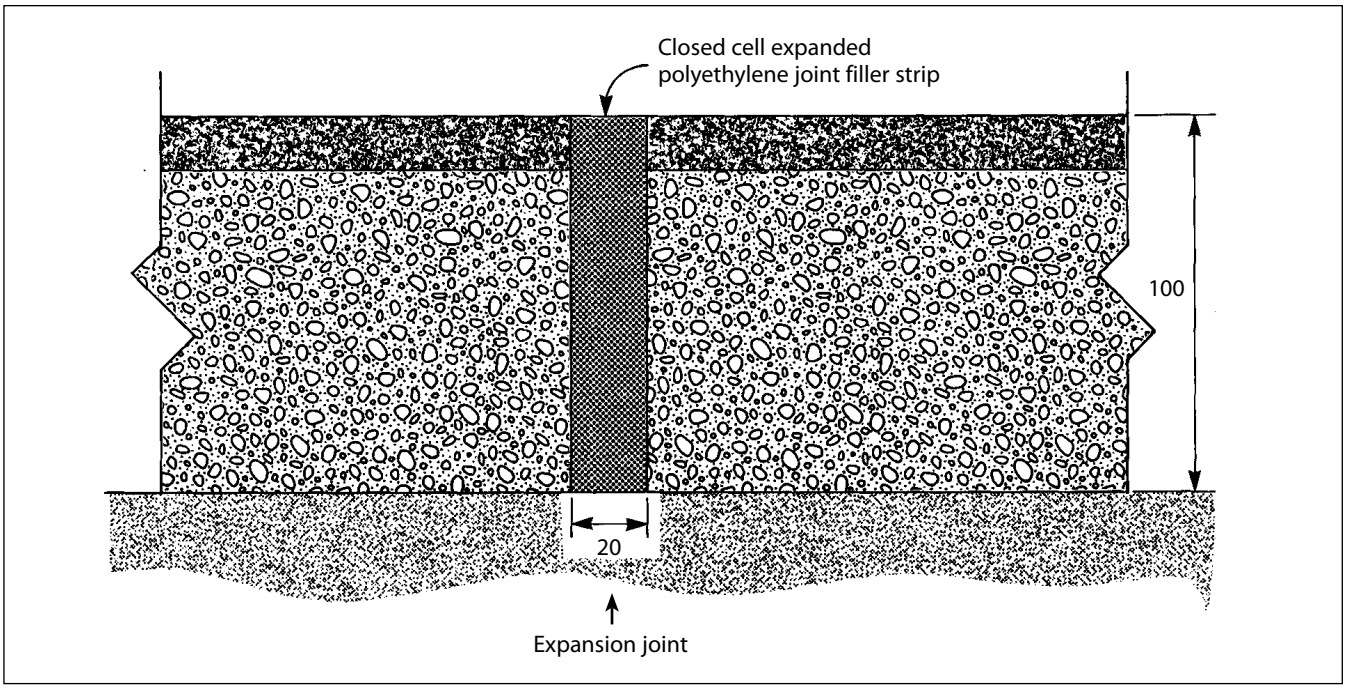

Figure 4: Joint under net

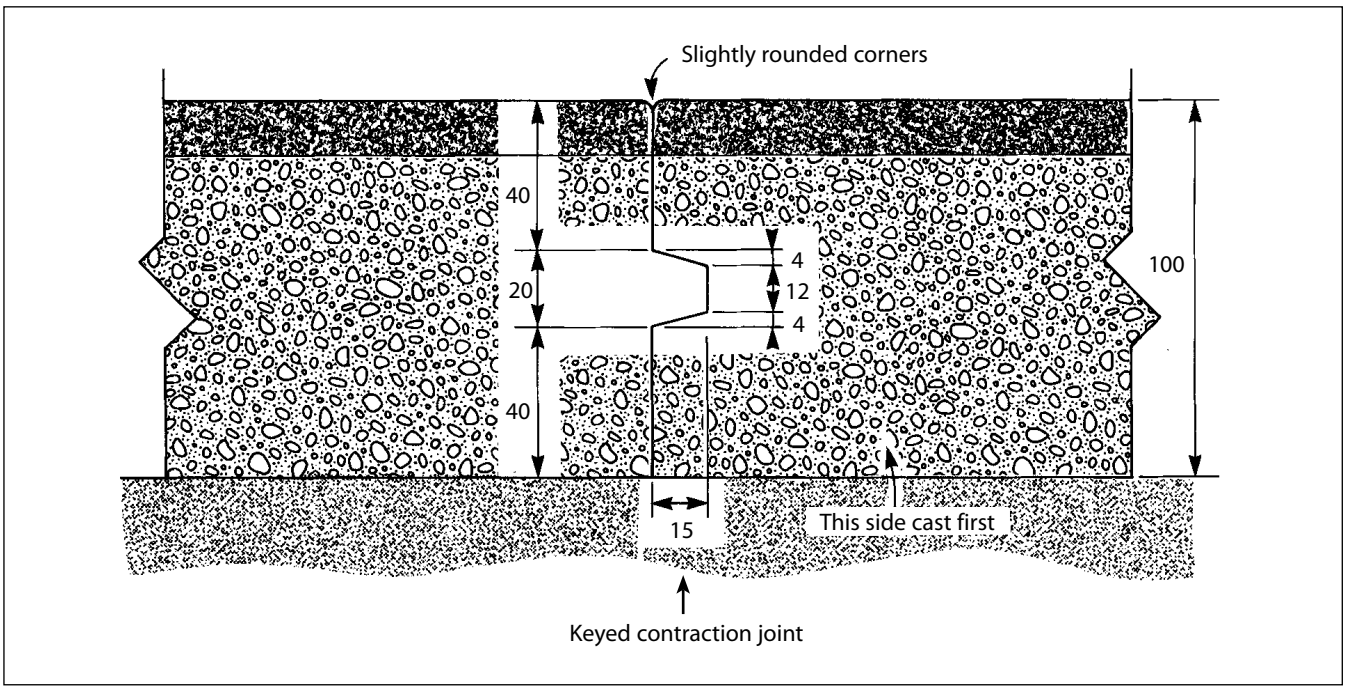

Figure 5: Joint between bays

Mortar for the 15 mm thick top course should be made in batches each of which consists of 50 kg of cement and 100 litres of sand, using the same sand as for the base course concrete, mixed with just sufficient water to give a plastic consistency similar to that used for plastering.

7. mixing concrete

The materials should be mixed together with the least amount of water that will give a workable, plastic and cohesive concrete. The final mix should have a consistency such that if dumped from a shovel, it remains in a heap; but if then rodded, settles down easily and smoothly, without either stones or watery liquid separating from the mass.

8. placing concrete

The first step is to set the net posts plumb and to the correct levels in concrete bases, using the same mix as specified for the base course. The post holes should only be filled to the level of the bottom of the slab.

At the same time a block of the same concrete should be cast under the centre of the net to take the net anchor. The block should be a cube of about 250 mm, with its top surface at the level of the bottom of the slab. The anchor should be a length of 8 mm diameter rod – preferably corrosion-resistant – about 700 mm long bent to a hairpin shape. The legs are cast in the concrete with the loop projecting 25 mm to 30 mm above the finished level of the slab.

Before placing the base course concrete, the sub-base should be dampened to prevent loss of moisture from the mix. Throughout the placing of the concrete, over-wet and over-dry mixes must be avoided. When placing the concrete, the mortar in the mix should come to the surface with rodding and tamping and with the levelling done with the strike-off board. The latter should be handled by two men, using both a chopping and sawing motion. The correct level is obtained by allowing the board to ride on the side forms, thereby automatically fixing the level of the finished surface 15 mm below that of the forms.

The mortar for the topping course should be placed directly on the surface within one to four hours of completing the bottom course. It should be spread and levelled with the strike-off board, but with the straight edge of the board riding on the side forms to bring the surface to the final level, flush with the tops of the forms. Again, the strike-off board should be used initially with a chopping movement to ensure that the full thickness of the topping is compacted.

After the mortar has been struck off a wood float should be used to smooth out any board marks left on the surface.

Finishing to a non-abrasive (but not glassy) texture is done with a steel trowel, but this finish trowelling should not, in any circumstances, be done on wet mortar. It should only start when the water sheen has disappeared from the surface and as the mortar is starting to stiffen, that is about 1 to 2 hours after placing. Comparatively heavy pressure on the trowel will be required. If the timing of this operation is corrrect, the effect of the steel trowel will be to push down into the mass of the material those projecting particles which cause it to be abrasive. This will give extra density and toughness to the surface. Conversely, if the steel trowel is used too often or too soon, so that moisture is drawn up to the surface, the surface will be weakened.

Too smooth a finish should be avoided as it gives little spin to the ball and makes footing less sure.

Alternatively a suitable texture may be achieved by heavy steel trowelling followed by very light brushing with a hair broom.

It may be useful to remeber that rough spots can always be rubbed down, when the concrete has hardened, with a carborundum stone and water to produce as fine a finish as may be desired.

To prevent spalling of the edges of the slab, the last operation should be to round off the corners adjacent to the forms very slightly with a steel trowel. This rounding should be only just sufficient to give a clean edge to the concrete, as excessive rounding will affect the bounce of the ball.

9. joints

When a bay is to be cast against completed work, the new concrete should be placed to butt directly against the edge of the older concrete. The strike-off board should then ride on the surface of the completed bay so as to ensure that adjacent slabs are level across the joints.

The expansion joint along the line of the net is formed by casting the edge of the concrete on one side vertically, and then placing a 100 mm x 20 mm strip of closed cell expanded polyethylene expansion joint filler against the concrete before the next bay is cast. This strip is left in place. The expansion joint should be carried round the net posts and the net strap anchor. (See Figures 4 and 5 for joint details).

10. curing

It is extremely important that the newly-laid slab be properly cured, that is, it must be kept continuously and visibly damp for at least 7 days and preferably for much longer. In cold weather the minimum curing period is 10 days.

Concrete and mortar must not be allowed to dry out soon after laying. To this end, immediately the surface has stiffened sufficiently, it should be covered, preferably with plastic sheeting held down with pipes, planks, poles, stones or other weights. This sheeting is also valuable for protecting newly-finished surfaces from damage by rain.

While the plastic is in place, it is good practice to hose water in under it each day.

If it is not possible to keep the plastic in place for the full curing period, it can be replaced by hessian, empty cement bags, sand, or similar material which will retain moisture on the surface.

When frost is expected, the concrete should be covered with plastic over which sacks, or straw, etc, is placed.

Under no circumstances should curing be neglected as the quality and durability of the court are dependent on it.

11. marking

Satisfactory lines can be painted on the court surface with a white concrete paint which can be renewed every few years.

Permanent lines that need no painting can be obtained by fixing 15 mm thick x 50 mm wide timber lathing on to the bottom course and filling the top course around these. The timber is then removed and the space thus formed filled with a white mortar composed of white cement and white sand. The timber laths should be slightly bevelled on each side to permit easy removal.

All lines should be 50 mm wide.

12. coloured finishes

12.1 Pigments

The top course may be coloured by mixing a mineral pigment with the cement.

Mineral pigments are available in two main types: natural and synthetic. Generally, the latter are more expensive, but have a high colouring power, are more uniform and reliable, are available in, and are colour-fast in, a wider range of colours. Reds, browns, and buffs are the cheapest and the most durable, and are recommended. Blues and greens are expensive and susceptible to fading and mottling in the open; only the most expensive synthetic pigments are claimed to be light-fast. Black pigments produce only grey to slate-grey concrete which tends to show up any defects, and to suffer from fading and mottling (often due to lime bloom).

The proportion of pigment to use depends upon the shade of colour desired and the quality of the pigment and is best decided by trial. Make up a few small pats of the topping mixture using 2, 5 and 8% of pigment by mass of the cement. When these have thoroughly dried out, the percentage corresponding to the desired shade can be chosen.

The pigment must be carefully weighed for each batch and must be thoroughly mixed with the dry cement first before adding aggregates, and water. No more than 8% of pigment should be added to the cement. A bag of cement weighs 50 kg. Mixing can be done by passing through a fine (say 3 mm) mesh sieve until the colour is uniform.

It is recommended that pigments be obtained from a recognized manufacturer of high quality products.

Do not attempt to colour concrete by sprinkling on and trowelling into the surface a mixture of neat cement and pigment as this makes for a very poor wearing surface.

12.2 Coatings

Paint-like coatings, which can be applied by brush, roller or spray, and which are claimed to last for several years on surfaces such as tennis courts, are available. They normally incorporate a fine mineral filler to give a textured surface to the coating. Before purchase, however, it should be established that the product gives a coarse enough texture.

12.3 Stains

Shades of buff may be obtained by brushing the concrete surface with a solution of commercial ferrous sulphate, which is obtainable in the form of a green powder or crystals.

A 10% solution (1 kg of sulphate to 10 ℓ of water) should be prepared by dissolving the sulphate in boiling water and then diluting with water to produce the strength required.

A stronger solution or more than one coat will give deeper shades. The concrete should be washed and should be slightly damp before applying the stain.

For best effects the stain should be applied within 24 hours of placing the concrete; the older the concrete the less will be the staining effect.

Uneven suction may result in a mottled effect rather than an even distribution of colour.

13. quantities of materials

For a court of the minimum recognised size, overall 31,2 m x 14,6 m, the main materials required are:

cement	330 bags
sand	33 cubic metres
stone 19 mm	25 cubic metres

These quantities are net and should be increased by about 5% for wastage, post-hole concrete, etc.

A medium size court, 34 m x 16 m would require 19% more materials, while a championship size court 36,6 m x 18,4 m would need 48% more materials.

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