

# Concrete at home and on the farm

There are many small concrete projects that the home-owner can confidently take on.

Concrete is made by mixing portland cement, sand, stone and water. The potential strength of concrete depends largely on the proportion of each ingredient in the mix.

Concrete hardens as a result of the chemical reaction between the cement and water; if concrete is allowed to dry out too rapidly it will not develop its full strength. This is why concrete should be “cured”.

## 1. What materials do I need?

All cement sold in South Africa must meet the requirements of SANS 50197 for Common cement or SANS 50413 for Masonry cement and the National Regulator for Compulsory Standards (NRCS) requirements as detailed in NRCS VC9085. Bags should be clearly marked with the strength grade, notation indicating composition and a Letter of Authority (LOA) number issued by the NRCS. An LOA is issued for each cement type from each source. To verify valid LOA numbers contact the NRCS on 012 428 5199 or [www.nrccs.org.za](http://www.nrccs.org.za).

**Note** that Masonry cements complying with SANS 50413 are not permitted to be used in concrete.

The sand and stone must be free of leaves, grass, compost, clay lumps, etc. Sand should be fairly coarse, with particles ranging from about 5 mm to dust.

Mix proportions are given for stone sizes of 26,5 mm or 19 mm. These sizes are most commonly available and are the most economical.

Any water that is fit to drink is suitable.

**Note** that fertilizer, sugar, oil, etc., are harmful to fresh concrete.

## 2. How thick should the concrete be?

**Minimum thicknesses are:**

Paths, patios, floors, driveways – 80 mm.

Footings for garden walls – 200 mm (width should be 600 mm).

## 3. How much concrete do I need?

Calculate the volume of concrete required.

For rectangular shapes

volume = length × width × thickness.

For circular shapes

volume = diameter × diameter × 0,08.

## 4. What mix proportions should I use?

The strength of the concrete depends on mix proportions and should suit the work being done. Mix proportions and quantities are given in the table overleaf. These proportions are based on the use of grade 32,5 cement. Higher grades will produce higher strengths; lower grades should not be used.

**High-strength** concrete should be used for precast items such as flagstones, and heavy-duty floors such as workshops.

**Medium-strength** concrete is suitable for light-duty floors, paths, patios and steps, driveways and carport floors.

**Low-strength** concrete is suitable for footings for walls.

## 5. How should I measure the ingredients?

Use a bucket or tin of convenient size for batching all the solid ingredients. Check that the container is clean before you start. Fill the container accurately each time so that the quality of concrete does not vary from one batch to the next.

## 6. How should I mix the concrete?

Concrete can be mixed by hand if quantities are small, or in a concrete mixer powered by electricity or a petrol engine. Machine mixing is highly recommended for important work.

## 7. Mixing by hand

Very small batches of up to about 25 ℓ of mixed concrete can be mixed in a wheelbarrow.

Bigger batches should be mixed on a concrete slab or steel plate. Do not mix directly on the ground as water may be drawn out of the concrete, or soil mixed into it.

Measure and mix batches of a convenient size (as much as can be mixed and placed in about 15 minutes).

Spread the sand in a layer about 100 mm thick. Spread the cement on top of this and mix the two thoroughly.

						quantities for 1 m <sup>3**</sup> of concrete (approx.)		
	stone size mm	mix proportions by volume			approx.* yield of batch	cement 50 kg bags	sand m³	stone m³
		cement	sand	stone				
High-strength concrete	26,5 or 19	1	2	2	3	9,25	0,6	0,6
Medium-strength concrete	26,5 or 19	1	2,5	2,5	4	7,7	0,64	0,64
Low-strength concrete	26,5 or 19	1	3,5	3,5	5,25	5,8	0,67	0,67

\* Batching container units (for example, a 1:2:2 mix batched in a 10 ℓ bucket will yield 30 ℓ of concrete per batch).

\*\* 1 m<sup>3</sup> = 1 000 ℓ

Now make a heap with the mix and make a hollow in the middle. Add water in small quantities and mix it in. Keep on adding and mixing in water until the consistence of the mortar is rather like that of thin porridge.

Next measure the right amount of stone and mix this well into the mortar until each particle of stone is well coated with mortar. If the mix is too stiff to be placed easily, add a little more water and mix it in thoroughly.

If too much water is added, the mix will be slushy and the concrete will be weak.

If not enough water has been added, the concrete will be difficult to place and compact, which will also reduce its strength.

## 8. Using a concrete mixer

The batch size should suit the mixer – under-filling the mixer wastes time while overfilling results in spillage and poor mixing.

Measured quantities of materials are added in the following order: first the stone and about half a measure of water, then the cement, then the sand, and finally more water until the right consistence is reached.

When all the materials have been added, continue to mix until colour and consistence are uniform. Discharge each batch completely.

## 9. Moving the concrete to the job

The concrete can be moved in buckets or wheelbarrows. If it is jolted too much the stone will settle at the bottom. If this happens, remix the concrete before placing it.

Don't let the concrete stand so long that it stiffens before it is placed. Cover concrete with plastic sheets or wet sacking so that it does not dry out in the sun or wind.

## 10. Placing the concrete

Dump/place the concrete as close to its final position as possible. If concrete is placed on the ground, the soil should be thoroughly damp, but without any standing water, when the concrete is placed.

The concrete should be well compacted. Work the concrete right into the corners and along the edges with a spade or trowel. To compact concrete slabs, use a wooden beam that spans the width of the slab. First use a chopping action and then a sawing action. Next, wood-float the concrete to obtain an even, but rough surface. Very smooth, steel-trowelled surfaces on outdoor paving may be slippery and dangerous.

## 11. How do I cure the concrete?

By keeping the concrete damp. Once it has stiffened, either cover it with plastic sheeting that is held down firmly along its edges, or cover it with hessian or sacking that is kept wet. Curing should continue for 7 days. Good curing also helps to limit cracking of the concrete.

## 12. Joints and panel sizes

Concrete slabs should be divided into panels to limit random cracking. The distance between joints should be about 2,5 m in concrete 80 mm thick, and 3,0 m in concrete 100 mm thick.

Panels should be more or less square and each panel must be completed in one operation.

**Important note:** Suspended slabs, beams and support columns should never be built without being designed and specified by a professional structural engineer.