

Mortar mixes for masonry

Mortar binds bricks and blocks together to give strength and stability to a wall.

Freshly mixed mortar must be soft and plastic so that it spreads easily and makes good contact without becoming too strong. Mortar that is too strong may crack and is wasteful and expensive.

1. Materials

1.1 Cement

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.

Preferred cement types are:

- Common cement complying with SANS 50197-1
- Masonry cement complying with SANS 50413-1; strength class 22,5X.

Cement must be kept in dry storage. If there are hard lumps in the cement that cannot be crumbled by hand, it is not fresh and should not be used.

1.2 Lime

Use only type A2P or A3P building lime complying with SANS 523. Do **not** use quick-lime, lime wash or agricultural lime.

Lime should be used if the sand lacks fine material or is single sized, as such sands tend to produce mortar with poor workability unless lime is included in the mix.

Lime also helps the fresh mortar to retain water when it is placed against dry masonry units and helps to prevent cracking of the hardened mortar.

For Class I mortar, a maximum of 10 kg of lime is permitted per 50 kg of cement. For Class II mortar, a maximum of 25 kg of lime is permitted per 50 kg of cement.

Do **not** use lime with masonry cement.

1.3 Sand

Sand shall either comply with all of the following requirements or, if required in terms of the specification, the requirements of SANS 1090 for mortar sand (natural or manufactured):

- a) sand shall contain no organic material (material produced by animal or plant activities);
- b) sand shall not contain any particles which are retained on a sieve of nominal aperture size 5 mm;
- c) when 2,5 kg of cement is mixed with 12,5 kg of air-dry sand, the mixture shall not require more than 3,0 ℓ of water to be added to reach a consistency suitable for the laying of masonry units; and
- d) when mixed with the cement in accordance with the mix proportions, the sand shall have workability suitable for the laying of masonry units.

NOTE: Sands which require the addition of more than 3,0 ℓ of water in terms of (c) to reach a consistency suitable for the laying of masonry units, can in some instances be blended with a coarse sand (for example, river sand with a particle size of less than 4 mm) to make them comply with the requirements of this test. The proportion of the blended sand can be determined by trials.

Some pit sands are suitable. River, dune and beach sands are often too uniform in size (single-sized) or too fine to give good results without being blended with another suitable sand.

2. Mix proportions

The proportion of each material in the mix should suit the type of work being done. Strength requirements and mix proportions, recommended by Cement & Concrete SA, are given in Table 1.

In general terms the classes of mortar may be used as follows:

Class I

Highly stressed masonry incorporating high-strength structural units such as might be used in multi-storey loadbearing buildings or reinforced masonry.

Class II

Normal loadbearing applications, as well as parapets, balustrades, retaining structures, and freestanding and garden walls, and other walls exposed to possible severe dampness.

Table 1: Mortar strength requirements and mix proportions (complying with SANS 2001-CM1:2012)

mortar class	minimum required compressive strength at 28 days, MPa		quantity of sand ¹ per 50 kg bag of cement, ℓ		quantities of materials required per m ³ of mortar (not including wastage)			
	preliminary laboratory tests	works test	common ² cement 32,5 42,5	masonry ³ cement 22,5X	common ² 50kg cement bags 32,5 42,5	sand m ³	masonry ³ 50kg cement bags 22,5x	sand m ³
I	14,5	10	130 ℓ	80 ℓ	10,0	1,25	13,5	1,15
II	7	5	200 ℓ	130 ℓ	7	1,35	10	1,25

1. Sand is estimated at a 5% moisture content.
2. Common cement complying with SANS 50197-1, strength class 32,5 or 42,5.
3. Masonry cement complying with SANS 50413-1, strength class 22,5X.

NOTE: For 90 - 110 mm thick single leaf walls, 1 m³ of mortar will be sufficient to lay about 3 700 bricks (190 x 90 x 90 mm) without wastage. See note in section 6.

Other proportions may be used if these can be shown by test to be satisfactory.

3. Batching the materials

A builder's wheelbarrow is a convenient measure for large batches; the capacity is 65-ℓ. Steel drums of 20 ℓ or 25 ℓ capacity and buckets are useful for small batches. Check the capacity of drums and buckets when filled to the brim as this is often more than the nominal capacity. To batch, shovel material into the measure and then strike off level with the brim.

4. Mixing

Mixing should be done on a clean hard surface such as a smooth concrete floor or a steel sheet. Small batches may be mixed in a wheelbarrow provided that the volume of the batch is no more than half the capacity of the barrow.

If you are working on your own or with one assistant, it is better to mix a number of small batches as they are required than to mix a one-bag batch.

One man – particularly if he is a weekend builder – can probably lay a little more than 60 bricks an hour.

Sand and cement, and lime if used, should be mixed dry until the colour of the mix is uniform. Then add water in small quantities, mixing after each addition, until the mix is soft and plastic.

5. Handling

If mortar is left in the sun before being used, it should be covered with plastic sheeting or a wet sack. Discard mortar that has stiffened so much that it is impossible to restore workability without adding more water.

6. Use of mortar

Mortar must not be used after it has started to set, which usually occurs about two hours after it has been mixed.

Do not use too thick a layer of mortar between bricks or blocks; this is wasteful and may lead to cracking.

7. Quantities of materials

Quantities of cement and sand required per 50 kg bag of cement and to produce 1 m³ of mortar are given in Table 1. Quantities required for block laying depend on block size and are outside the scope of this leaflet (See Cement & Concrete SA leaflet Quantities for ordering building materials.)

The addition of lime is optional. A maximum of 25 kg is permitted per 50 kg bag of cement when Class II mortar is used and 10 kg, maximum, is permitted per 50 kg bag when Class I mortar is being used. Mix proportions do not need to be adjusted. Only yield will increase by 5%.

Do **not** use lime with masonry cement.

Note that quantities in the table are approximate and do not allow for wastage, which could typically range from 10 - 20%.

Note: Concrete bricks and blocks should not be wetted before being laid. Burnt clay bricks should be wetted before being laid.