Quantities for ordering building materials

1. Introduction

The quantities given in this pamphlet are approximate. They form a basis for a first estimate of quantities to be used on site.

The following notes apply generally.

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.nrcs.org.za.

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

- Mix proportions in the tables are based on materials being batched in a loose state, i.e. poured into the batching container without being compacted
- "Common cement" complies with SANS 50197-1. "Masonry cement" complies with SANS 50413-1 strength class 22,5X.
- A bag of cement contains 50 kg of cement.
- It is recommended that cement is only batched in whole bags.
- The capacity of a builder's type 5 wheelbarrow complying with SANS 795 is about 65 ℓ. Volumes of 130 ℓ and 200 ℓ are therefore equivalent to two and three barrowsful respectively.
- The selection of good quality sand and stone is important.
- Only sufficient water should be used to produce a workable mix of 60-100 mm slump. Too much mixing water will reduce the strength of the concrete.
- The importance of curing cannot be overemphasised. For hardening to occur, cement must have access to water. Once the concrete is allowed to dry, no further strength development will take place. Preventing excessive loss of water is also important to avoid cracking and crazing and the possibility of a weak dusty surface. Cure for at least 7 days, and longer in cold weather when strength development slows down.

2. Materials quantities for concrete

The volume of concrete, for rectangular shapes such as foundation strips, floor slabs, etc. is: thickness x length x breadth.

If each of these dimensions is measured in metres, the volume will be in cubic metres.

Quantities of materials for concrete suitable for hand compaction (i.e. without the use of poker vibrators) are shown in Tables 1a-d and **do not include allowance for wastage**. **(The strengths stated are typical strengths only and for actual strengths, trial mixes should be performed using accurate measurements of water content)**

Table 1a: 32,5N or R Common cement, 19 mm stone

Strength at 28 days	Material quantities for 2-bag mixes				Quantities per m³ of concrete		
	Cement 50 kg bags	Sand wheelbarrows / litres	Stone wheelbarrows / litres	Yield m³	Cement 50 kg bag	Sand m³	Stone m³
LOW 15 MPa	2	3,5 230 ℓ	3,5 230 ℓ	0,35	5,8	0,65	0,65
MEDIUM 25 MPa	2	2,5 160 ℓ	2,5 160 ℓ	0,26	7,7	0,62	0,62
HIGH 30 MPa	2	2,0 130 ℓ	2,0 130 ℓ	0,22	9,2	0,60	0,60

Table 1b: 32,5N or R Common cement, 13,2 mm stone

Strength at 28 days	Material quantities for 2-bag mixes				Quantities per m^3 of concrete		
	Cement 50 kg bag	Sand	Stone	Yield m^3	Cement 50 kg bag	Sand m^3	Stone m^3
		wheelbarrows / litres					
LOW 15 MPa	2	4,0 260 ℓ	3,5 160 ℓ	0,33	6,1	0,80	0,50
MEDIUM 25 MPa	2	2,5 160 ℓ	2,0 130 ℓ	0,24	8,4	0,68	0,54
HIGH 30 MPa	2	2,0 130 ℓ	1,5 100 ℓ	0,20	10,2	0,66	0,50

Table 1c: 42,5N or R Common cement, 19 mm stone

Strength at 28 days	Material quantities for 2-bag mixes				Quantities per m^3 of concrete		
	Cement 50 kg bag	Sand	Stone	Yield m^3	Cement 50 kg bag	Sand m^3	Stone m^3
		wheelbarrows / litres					
LOW 15 MPa	2	4,0 260 ℓ	4,0 160 ℓ	0,39	5,1	0,67	0,67
MEDIUM 25 MPa	2	3,0 200 ℓ	3,0 200 ℓ	0,30	6,6	0,64	0,64
HIGH 30 MPa	2	2,5 160 ℓ	2,5 160 ℓ	0,26	7,8	0,62	0,62

Table 1d: 42,5N or R Common cement, 13,2 mm stone

Strength at 28 days	Material quantities for 2-bag mixes				Quantities per m^3 of concrete		
	Cement 50 kg bag	Sand	Stone	Yield m^3	Cement 50 kg bag	Sand m^3	Stone m^3
		wheelbarrows / litres					
LOW 15 MPa	2	4,5 300 ℓ	3,0 200 ℓ	0,37	5,4	0,79	0,53
MEDIUM 25 MPa	2	3,0 200 ℓ	2,5 160 ℓ	0,28	7,1	0,69	0,58
HIGH 30 MPa	2	2,5 160 ℓ	2,0 130 ℓ	0,24	8,4	0,67	0,55

Notes on mixes in Tables 1a – 1d:

1. Low-strength (15 MPa) concrete is suitable for unreinforced foundations (single storey only); mass fill, infill concrete in masonry (only with 13,2 mm stone).
2. Medium-strength (25 MPa) concrete is suitable for unreinforced slabs, reinforced slabs and foundations, infill concrete in masonry (only with 13,2 mm stone).
3. High-strength (30 MPa) concrete is suitable for reinforced concrete members and precast items such as concrete flagstones.
4. Trial mixes should be done to get actual concrete strengths.
5. All concrete structures must be designed by a professional structural engineer.

3. Mortar 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 2. These strengths should be confirmed by a professional structural engineer before building commences.

In general, the classes of mortars 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; and reinforced masonry.

Class II

Normal loadbearing applications, including parapets, balustrades, retaining structures; freestanding and garden walls; and other walls exposed to possible severe dampness. In practice, Class II mortars are used for most applications.

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

Table 2: 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 m³ of mortar (not including wastage)			
	Preliminary laboratory tests	Works test	Common[2] cement 32,5 & 42,5	Masonry[3] cement 22,5X	Common[2] 50 kg cement bags 32,5 & 42,5	Sand m³	Masonry[3] cement bags 22,5x	Sand m³
I	14,5	10	130 ℓ	80 ℓ	10	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: The addition of lime is optional. A maximum of 10 kg is permitted per 50 kg bag of Common cement for Class I mortar.
A maximum of 25 kg is permitted per 50 kg bag of Common cement for Class II mortar.
Mix proportions do not need to be adjusted. Only yield will increase by about 5%.
Do NOT use lime with masonry cement.

4. Quantities of masonry units and mortar

The dimensions of units given in Table 3 are those of the commonly manufactured sizes.

Notes:

- The table is based on exact sizes of solid masonry units, with 10 mm thick bedding and vertical joints, and no wastage. For 15 mm thick joints, multiply the quantity of mortar required by 1,5; for 20 mm thick joints, multiply by 2.

- Since no allowance is made for a number of factors which could influence mortar quantities, the following adjustments should be made:

1. Allow for wastage which could typically range from 20 % to 50 %. This could be more without good supervision.

2. For hollow units reduce mortar quantities by:

Width of units, mm	% reduction
90 - 110 mm	20
140 mm	30
190 - 220 mm	40

3. For units with perforations or holes increase mortar quantities by 15%.

4. For units with frogs; frog laid face up (as required for structural walls), increase mortar quantities by 15%.

5. Once the above adjustments have been made for mortar ready-mixed and delivered into watertight containers on site, reduce quantities by 20% as against site-mixed mortars

6. For under- or oversized units:
Measure dimensions of 10 units and use the average for calculating the number of units per m².

Table 3: Approximate quantities of masonry units and mortar

masonry unit size, mm			masonry units per m²	mortar m³ per	
length	width	height		1000 units	100 m² walling
190	90	90	50	0,27	1,35
190	190	90	50	0,57	2,85
222	90	73	52	0,29	1,51
222	16	73	52	0,34	1,77
290	90	90	34	0,36	1,21
290	90	140	23	0,41	0,92
290	140	90	34	0,56	1,87
290	140	140	23	0,63	1,41
390	90	90	25	0,45	1,13
390	90	190	13	0,54	0,68
390	140	90	25	0,70	1,75
390	140	140	17	0,77	1,29
390	140	190	13	0,84	1,05
390	190	90	25	0,95	2,38
390	190	190	13	1,14	1,43
440	90	190	12	0,59	0,67
440	140	190	12	0,90	1,01
440	190	190	10	1,24	1,37
440	110	220	10	0,75	0,75
440	220	220	10	1,50	1,50

5. Materials for plaster (complying with SANS 2001-EM1:2007)

Quantities depend on the mix proportions, thickness of plaster and roughness of the background surface.

Exposure Conditions	Common[1] cement, kg	Sand[2] ℓ	Yield per batch, ℓ	Masonry[3] cement, kg	Sand ℓ	Yield per batch, ℓ
External plaster	50	150	120	50	130	108
Internal plaster	50	200	150	50	150	120

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

NOTE: The addition of lime is optional. A maximum of 25 kg's is permitted per 50 kg of Common cement.
Mix proportions do not need to be adjusted. Only yield will increase by about 5%.
Do NOT use lime with masonry cement.

To calculate the approximate area that can be covered by a batch of plaster, use the following example:

Common cement using a 1:6 mix,
i.e. 50 kg cement to 200 ℓ sand.
From the table above, the yield = 150 ℓ
For 15 mm plaster thickness and 20% wastage
= 150 ÷ 15 ÷ 1,2
= 8,3 m^2

6. Materials for sand-cement floor screeds

Sand-cement screeds are essentially light-duty flooring elements and are suitable for:

- Wearing surfaces of floors of utility rooms in domestic premises (e.g. store rooms, garages)
- Floors covered with carpets, plastic tiles or linoleum, etc. and subjected to relatively light traffic such as in offices, shops and hospitals.

Sand-cement screeds are not suitable for industrial premises.

Quantities of materials depend on the thickness of the screed. Using a mix consisting of 1 bag of cement and 130 ℓ of coarse sand, and assuming a screed thickness of 25 mm, quantities for 100 m^2 of screed are 23 bags of cement and 3,0 m^3 of sand.

The suggested wastage factor is 10%.

For sand-cement floor screeds refer to Cement & Concrete SA's *"Sand-cement screeds and concrete toppings for floors''* leaflet.

Appendix

Field test for quality of sand for mortar and plaster.
This simple field test can be used to confirm that the sand yields a smooth, plastic and cohesive mix which does not require excessive amounts of water to reach a brick-laying or plastering consistence.

Where possible, the test should be carried out on a sample of sand before placing a final order.

The quantities used should be weighed out on a scale which is in good order, and the test carried out on a smooth impervious surface. It is also important that the sample used is fairly representative of the bulk supply.

Procedure

i) Weigh out the following amounts of material:

5 kg cement
25 kg of dry sand
5 kg (ℓ) of water
1 kg (ℓ) of water

ii) Mix the cement and sand to a uniform colour on a non-absorbent surface.

iii) Mix, in succession, each of the amounts of water (5 ℓ and 1 ℓ):

If 5 ℓ is enough, the sand is of good quality
If 5 ℓ +1 ℓ is enough, the mix is of average quality

Only "good" sands are recommended for exterior plasters. "Average" sands may be used for mortar and interior plaster.

Cement & Concrete SA
P O Box 168, Halfway House, 1685
Block D, Lone Creek, Waterfall Park, Bekker Road, Midrand
T 011 315 0300
E-mail: info@cemcon-sa.org.za
Website: www.cemcon-sa.org.za

Published by: Cement & Concrete SA, Midrand, 2021