You also need to assess the surface texture of the blocks. If the texture is too smooth, reduce the amount of fine material in the mixture. If it is too coarse, increase the amount of fine material. AfriSam can advise on the most appropriate mix designs to suit available materials.

Production:

Ordering and stockpiling materials:

Aggregates and cement should be ordered in good time. Stocks should be sufficient to prevent stoppages due to lack of material.

As a rough guide, using aggregate cement ratio of 8:1 by loose volume, three and a half bags of cement and a cubic metre of aggregate will be enough to make about 400 standard bricks. The number of blocks produced from the same quantity depends on the size of the blocks and whether they are solid or hollow.

Batching:

Bagged cement should be batched by the full bag. Cement supplied in bulk may be weighed (preferable) or batched by loose volume.

It is important to batch all materials accurately. Batching containers such as wheelbarrows, buckets, drums and wooden boxes, should be loosely filled to the brim and struck off flush. To avoid errors, there should be enough containers for a full batch to be made without using any container more than once. Dented or broken containers must not be used. Mix proportions may be adjusted once all properties are understood.

Water content:

Water content is critical. The mixture must be wet enough to bind together when compacted, but should not be so wet that the blocks slump or sag when the mould is removed. A common mistake is the use of mixes that are too dry, resulting in incomplete compaction. Moisture content is approximately right when ripple marks form on a steel rod or the back of a shovel when it is rubbed against some of the mixture. The water content is just optimum when ripple marks start appearing on blocks when they are removed from the mould.

Mixing:

Hand mixing using shovels should be done on a level concrete slab or steel plate.

First spread the aggregate out 50mm to 100mm thick, then distribute the cement and stone, if any, evenly over the sand. Mix aggregate and cement until the colour is uniform. Spread the mixture out, sprinkle water over the surface and mix. Continue with this process until the right amount of water has been mixed in.

For machine mixing, first mix aggregate and cement, then add water gradually while mixing until the water content is correct.

Retempering:

The concrete mix should be used within two hours of mixing and must never be retempered by mixing in additional water, as this reduces the resultant strength of the mix.

Moulding:

Adequate care must be taken when compacting the concrete in the moulds of the block-making machine. Too little or poor compaction will result in greatly reduced strengths.

The moulds should be removed carefully so that the fresh blocks are not damaged. Fresh blocks should be protected from the rain and from the drying effects of the sun and wind during the first day with plastic sheets or any suitable covering.

In some cases, it may be necessary to protect blocks from frost damage. Covering with plastic sheeting with the edges held down is normally sufficient.

To minimise breakages in cold weather, increase the cement content of the mix or the curing period before moving blocks.

Curing:

The day after production, blocks should be removed from the production slab and stored in the stacking area, ready for curing. Stacks should be carefully built to avoid chipping edges and corners.

Curing is the process of maintaining satisfactory moisture content and a favourable temperature in the blocks to ensure hydration of the cement and development of optimum strength.

In the South African climate, it is normally sufficient to cover blocks with plastic sheeting to prevent moisture loss, or to spray blocks with water.

Blocks should be cured for at least seven days.

Quality Control:

Three aspects should be monitored to ensure quality masonry units, namely: strength, dimensions and shrinkage.

Strength:

The quality of blocks should be controlled so that the strengths are adequate to avoid breakages or rejection by customers and the mixes are as economical as possible.

Ideally, blocks should be regularly tested for strength and mixes, and production processes modified if necessary. If testing is not practical or unaffordable, block strength should be continually assessed by looking to see if the corners and edges, or even the whole bricks, tend to break in handling. Knocking two bricks together can also be used to assess strength.

Dimensions:

The length and width of the units are determined by the mould and will not vary greatly. However, the height can vary and should be monitored using a simple gauge. Units of inconsistent height will lead to difficulties during building and possibly cause rain penetration.

Shrinkage:

Concrete masonry units shrink slightly after manufacture. In order to avoid this from happening in the wall, cured blocks should be allowed to dry out for at least seven days before being used for construction.

Conclusion:

We hope that this guide is useful in establishing and maintaining a successful brick- or block-making business and producing units of the highest quality that will enable your business to grow. For further assistance, please contact the AfriSam customer service.

A detailed Safety Data Sheet and a guide to the use of cement and concrete are available on request.

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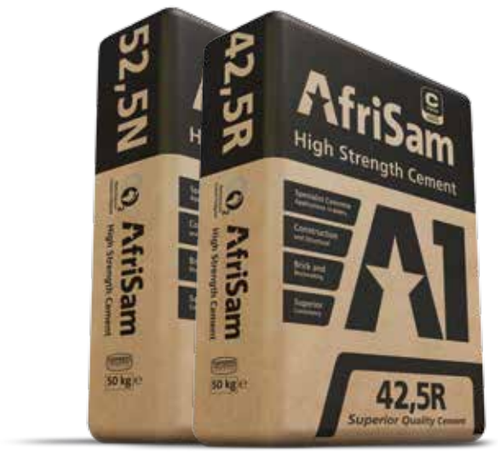
Your guide to CONCRETE BRICK & BLOCK-MAKING



OUR QUALITY PROMISE

AfriSam's commitment to superior performance gives customers the peace of mind that comes with guaranteed technical excellence, top quality products, sustainability and continuous innovation.

www.afrisam.com

Building our Future Together

AfriSam

11/06/2014

Reducing our Carbon Footprint

With the planet as one of our core values, we assess the carbon footprint of each and every one of our operations and products while actively striving to drive down our impact on the environment.

The small-scale manufacture of concrete bricks and blocks for masonry is well suited to small businesses. Production can be done in the open, the process is simple and the equipment is relatively inexpensive.

The aim of this publication is to provide information that is needed in setting up and running a block-yard to manufacture concrete bricks and blocks on a small scale.

Aspects dealt with include: selecting and establishing a site, selection of equipment, materials for block-making, trial mixes and production.

Bricks and blocks are masonry units and are referred to as such in SABS standards. Units may be solid or hollow. The difference between bricks and blocks is size. In this brochure, we refer to blocks throughout, but the same principle applies to bricks.

Selecting a site:

In selecting a site, consider the following:

Location:

This should be considered in relation to the supply of raw materials, market for blocks, location of the labour force, security and availability of services such as roads, water, sewerage, electricity.

Access:

The site must be accessible to trucks delivering materials and collecting finished blocks.

Ground slope:

Ideally, the site should be as level as possible. Steep slopes make handling and production difficult. Terracing a steep slope is expensive.

Size:

The site should be big enough for aggregate stockpiles, cement storage, production, block stacking, staff facilities, offices and on-site access. The details are as below:

Aggregate stockpiles:

- Aggregates must be stockpiled in such a way that they do not become contaminated by soil, leaves, or any other foreign material.
- Different aggregates must be kept separate and rainwater must be able to drain away.
- Ideally, aggregates should be stockpiled on a concrete slab. If this is not possible, the layer of aggregate in contact with the soil should not be used for production.
- Aggregates must not be stockpiled under trees.

Cement:

The best way to store cement is in a silo. However, for most small-scale block-yards, cement is usually delivered in bags. The bags should be stored as follows:

- Store in a weatherproof room.
- Stack on a tarpaulin or on closely spaced wooded strips so that the cement does not absorb moisture.
- The storeroom must be big enough to hold at least a week's supply of cement.

Production area:

The size of the production area depends on the method of producing blocks.

- A stationary machine which forms blocks on pallets, needs a relatively small area, with a space around it for the operator.
- A mobile 'egg-layer' machine needs a fairly large space on which blocks are made.

Stacking area:

This area, which should be big enough to stack at least two weeks' worth of production, is necessary for curing and drying the blocks. It is normally not necessary to pave this area. To avoid muddy conditions, a layer of aggregate about 100mm thick should be placed over the stacking area.

Staff facilities:

These should include toilets, ablution facilities and, possibly, change rooms. Facilities should meet minimum requirements of local authorities, if applicable.

Offices:

It may be necessary to have an office or area where the administration work is done.

On-site access:

Pathways and roadways between the different parts of the yard should be wide enough for barrows, trolleys or trucks and may have to be paved or covered with aggregate to make them usable in wet weather. Paving will be necessary where trolleys are to be used to move blocks.

Construction of a slab (where blocks are made):

Area:

A flat concrete slab, big enough for at least one day's production, is required. As a guideline, a 50m² area is suitable for the production of 1 000 bricks or 200 blocks.

Slope:

Normally, block production is carried out in the open and the concrete slab should have a minimum slope of 1 in 100 to ensure proper drainage.

Thickness:

The minimum thickness of the slab is normally 125mm. However, in the case of temporary works or works using a small hand machine, a thickness of 100mm could be used. Large production machines may require a minimum slab thickness of 150mm.

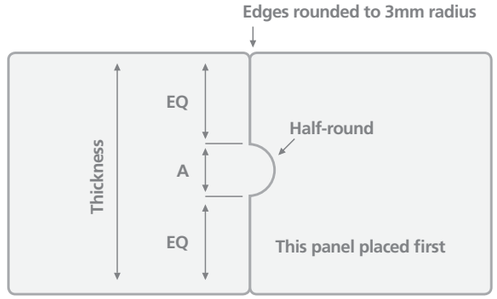
Concrete:

For concrete ordered from a readymix supplier such as AfriSam, specify a strength of 30MPa at 28 days and 19mm stone. Slump should be 100mm if the concrete is to be compacted by machine vibration and 125mm for hand compaction. A wood-floated finish permits easier removal of blocks.

If you mix the concrete yourself, you should use a mix design that yields a 30MPa concrete strength. Details of the mix design for this strength are contained in the AfriSam Cement product brochure for the particular type of cement you are using.

Joints:

To prevent uncontrolled cracking of the slab, it should be divided into panels. These panels should be square or as close to square as possible. A construction joint is shown below. The half-round keyway prevents differential settlement of adjacent slabs. The dimension "A" of the half-round is indicated in the table below.



The maximum jointing space depends on the thickness of the slab. The joint spacing for different slab thicknesses is given in the table below.

Slab thickness (mm)	Joint spacing (mm)	Dimension A (mm)
100	3,00	20
125	3,75	25
150	4,50	30
200	6,00	40

It is not necessary to reinforce the slab panels with steel rods or mesh. The soil beneath the slab should be well compacted before placing the concrete.

Equipment:

Block-yard equipment consists essentially of a means of moulding blocks, a concrete mixer and various general purpose tools and equipment. These are discussed below:

Block-making equipment:

There are two basic types of equipment, depending on the method of moulding the blocks. For both types, equipment includes small hand-operated devices which have limited output and a range of electrically-powered machines of high output:

- Stationary machines that mould blocks, one or more at a time on pallets.
- Egg-layer machines that mould blocks on a concrete slab.

The following table gives some advantages and disadvantages of both:

Type of machine	Factors
Stationary	A relatively small space is needed for production.
	Block machine can be under cover.
	Pallets are necessary. For most systems, enough pallets for a day's production are needed. Pallets are therefore an expensive item initially. They also involve ongoing expense as damaged (or stolen) pallets have to be replaced.
	Some hand-operated machines for making bricks need only a few pallets because bricks are removed from the pallet directly after moulding.
'Egg-layer'	A fairly large slab is needed for the production of blocks. The slab is expensive and increases the size of the site necessary for a blockyard.
	Pallets are not necessary.

For both types, equipment available includes small hand-operated devices (which have limited output) and a range of electrically-powered machines of high output.

Concrete mixer:

It is possible to make blocks on a small scale without a concrete mixer. Hand mixing has the advantages of reducing the amount of capital required and providing employment, but it may limit output and is not always thorough. Hand mixing should be done with shovels on a concrete slab or flat steel sheet. Never mix directly on the ground because this results in contamination of the mix.

A pan mixer is the only type of machine mixer suitable for block-yards. Pan mixers, with a forced mixing action, can cope with semi-dry mixes used for making blocks. Drum mixers do not work because they cannot mix semi-dry concrete.

The output of the mixer should match that of the block-making machine. A mixer of adequate capacity for making hollow units may have sufficient capacity for solid units.

Miscellaneous equipment:

This includes wheelbarrows, batching containers and trolleys for moving blocks, shovels, hosepipes and plastic sheeting for covering the blocks while curing.

Materials:

Cement:

AfriSam's High Strength Cement complies with SANS 50197-1 and can be used successfully for block-making, provided the correct mix proportions are used.

Aggregates:

Sand and stone are used for most block production. Clinker or hard-burnt ash often contain harmful impurities and should not be used as aggregate unless they are found to be acceptable from laboratory tests. Good quality clinker can be used instead of sand and stone, but blending with sand or stone may be necessary as well.

The following aggregates may be considered:

- Fine sand with particles mainly smaller than 1mm; pit, fine or dune sand.
- Coarse sand with the biggest particles approximately 5mm in size; crusher, pit or coarse river sand.
- Stone with a maximum size of 13mm for bricks or solid blocks or 10mm for hollow blocks.

It is possible to make blocks with coarse sand on its own. Alternatively, combinations of aggregates may be used:

- A blend of coarse and fine sand.
- A blend of fine sand and stone.
- A blend of fine sand, coarse sand and stone.

For small-scale production, the best aggregate or combination of aggregates is normally found by trial and error. Where needed, AfriSam can provide assistance.

Water:

Water that is fit for drinking may be used. Most river and borehole water may be used.

Trial mixes:

The aim is to find a mix that will produce blocks that have an acceptable texture and are strong enough, yet as cheap as possible. Because cement is more expensive than aggregates, the lower the cement content, the cheaper the block. However, cement content influences the strength and, therefore, optimum cement content should be found by trial and error.

Look out for breakages to corners and edges of cured blocks. If blocks break when they are handled, they are clearly too weak. You can also assess strength by knocking two blocks together after they have been cured and dried out.

A ringing sound indicates good strength, while a hollow thud probably means the blocks are too weak. Ideally, blocks should be tested in a laboratory for strength.

The National Building Regulations require nominal strengths of 7MPa for solid units and 3,5MPa for hollow units for single-storey houses and buildings.