



EXPECT THE BEST
RETAINING WALLS

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Installation guidelines

The strength of a wall comes from the design – not the blocks. It is therefore critical to consult an engineer when a wall is higher than 1.4m. Bear in mind that a retaining wall must resist the lateral pressures generated by the soils behind it or, in some cases water pressure too. Every retaining wall supports a “wedge” of soil. As the setback of the wall increases, the size of the sliding “wedge” is reduced. This reduction lowers the pressure on the retaining wall.

The most important consideration in proper design and installation of retaining walls is to recognise and counteract the tendency of the retained soil to move downslope due to gravity. This creates lateral earth pressure behind the wall which depends on the angle of internal friction and the cohesive strength of the retained material.

Lateral earth pressures are zero at the top of the wall and - in homogenous soil - increase proportionally to a maximum value at the lowest depth. Earth pressures will push the wall forward or overturn it if not properly designed. Also, any groundwater behind the wall that is not dissipated by a drainage system causes further hydrostatic pressure on the wall.

It is critical to have proper drainage behind the wall in order to limit the pressure to the wall's design. Drainage materials will reduce or eliminate the hydrostatic pressure and improve the stability of the material behind the wall.

When the weight of blocks alone is not enough to resist soil loads (walls higher than 1m), horizontal layers of geotextiles are used to reinforce soil behind walls. With proper soil reinforcement and design, retaining walls can be constructed to heights in excess of 20m.

Why retaining walls fail:

- Insufficient drainage
- Incorrect or non-use of Geotextiles
- Insufficient compaction of soil behind the wall
- Inadequate foundations

CRITICAL CONSIDERATIONS:

- The NHBRC stipulation is that a wall of up to 1.4m doesn't need an engineer's approval if the soil is good compactible soil without excessive storm water and there is no load pressure on the wall such as vehicular traffic or buildings. Retaining walls which are higher than 1.4m need an engineer's approval.
- You cannot build a retaining wall where clay and non-compactible sand conditions exist.
- For a wall which is higher than 3m the common rule is to use Geotextile in every third layer (we recommend that with a Bosun Robust Block that a Geotextile is used in every second layer).
- Consider available space, drainage and water management.

FOUNDATION:

All retaining walls should have a foundation, even if the wall isn't high.

- After excavating and digging the foundation the soil must be levelled and compacted.
- Foundation dimensions are custom designed.
- For walls which are more than 6 layers high, construct a concrete foundation. If walls are less than 6 layers high the soil needs to be compacted and cement can be added.
- Wet your concrete foundation regularly for 24 hours for better curing and to prevent cracking.

SOIL COMPACTION:

- Inadequate soil compaction is the most common reason for retaining wall failures according to engineers.
- The wall blocks are merely the 'skin'. Compaction is what determines structural integrity.
- Compaction needs to be done layer by layer behind the blocks. Lay one row of blocks and compact behind and inside the blocks using a mechanical compactor or roller and a hand tamper respectively before laying the next row.
- Every layer must be moist when compacted (neither dry nor muddy).
- Make sure to obtain the compaction density as per design. Normally 90-95% MOD ASSHTO.

Retaining Walls

Bosun VFC Retaining Wall System

The VFC (Vertical Fixed Connection) retaining wall system producing a vertical wall.



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Robust Block

The Robust block is a cost-effective solution for large, engineered solutions.



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Versoblock

The Versoblock - a standard retaining wall block, cost effective for both small installations and larger engineered installations.



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Bosun VFC Retaining Wall System

90-Degree Segmental Concrete Block Retaining Wall Solution



The VFC (Vertical Fixed Connection) retaining wall system is designed to construct 90° concrete block retaining walls. In addition, the VFC system meets SANRAL's requirements for vertical retaining walls outlined in South Africa COTO specification for roads 2019.

The system uses a positive mechanical interlock connection between the geogrid and the block through an oval shaped interlocking pin. In addition to the fixed connection, the VFC uses a double nib system, resulting in increased shear resistance than what a single nib system can offer.

The innovativeness of this system is evident in the fact that the company holds two direct patents and one indirect patent on various aspects of its design.

A positive mechanical connection and double nib system:

- The VFC block features a specially shaped channel that enables the connection of geogrid to a custom-designed concrete pin (locking mechanism). The system mechanically secures geogrid to the block, enabling the building of vertical, 90 degree retaining walls. Patent: ZA 2018/04934
- Vertical walls are required on various infrastructure projects with space constraints. The VFC creates more usable ground space.
- The VFC further boasts a double nib system, resulting in increased shear resistance than what a single nib system could offer.
- The VFC block is compliant with SANS8006-1 and tests have been conducted in accordance with ASTM D6638 and ASTM D6916 to verify the local facing stability.
- The VFC block has been designed for use with a variety of both imported and locally manufactured geotextiles available in South Africa.

Easy to use and install:

As with the patented Bosun Castle Bottom kerbs (Patent ZA: 2012\09544), the VFC Base Block has cavities on its bottom surface. These cavities make the base block much quicker and easier to install. Where an imperfect bedding layer forced installers to uplift, fill up and re-lay conventional blocks it is easier to manoeuvre the Castellated block into place, with the bedding layer/levelling pad material being displaced into the cavities in the base block.

- The castellated base block simplifies bedding and sets the levels for all succeeding layers.
- The base block comes with a simple jig which enables the placement of a spirit level across both axes. This, in turn, facilitates accuracy and ease of setting out.
- The base block can be inverted and used as capping on the top of the wall.
- The locking of the geogrid into the VFC block is quick and simple.
- The weight of the standard VFC block is approximately 24kg, making it light enough for one man to handle, in turn promoting hand labour.
- The VFC block complies with SANS 508 and block heights in particular, are guaranteed to be consistent.

VFC block

Dimensions	300mm x 300mm
Height	140mm
Mass per Block	± 26kg
Blocks per m ²	23.8



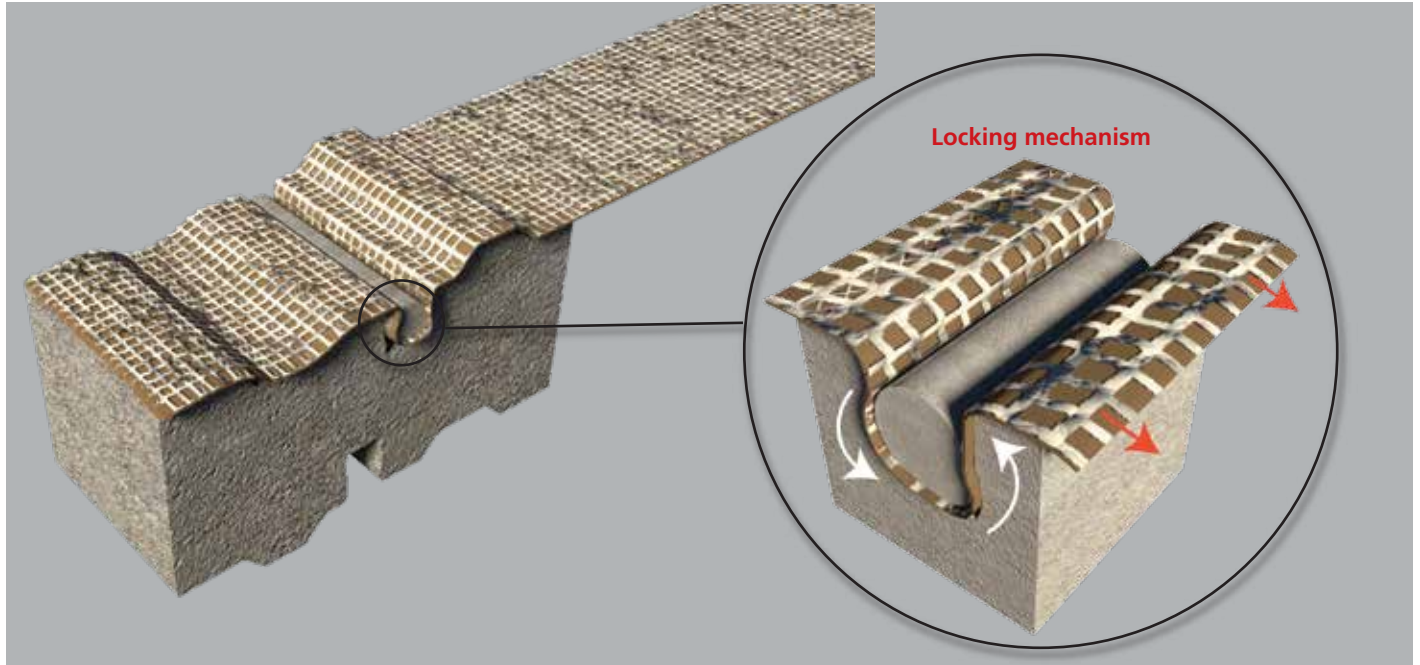
VFC base block

Dimensions	300mm x 250mm
Height	80mm
Mass per Block	± 13kg
Blocks per LM	4

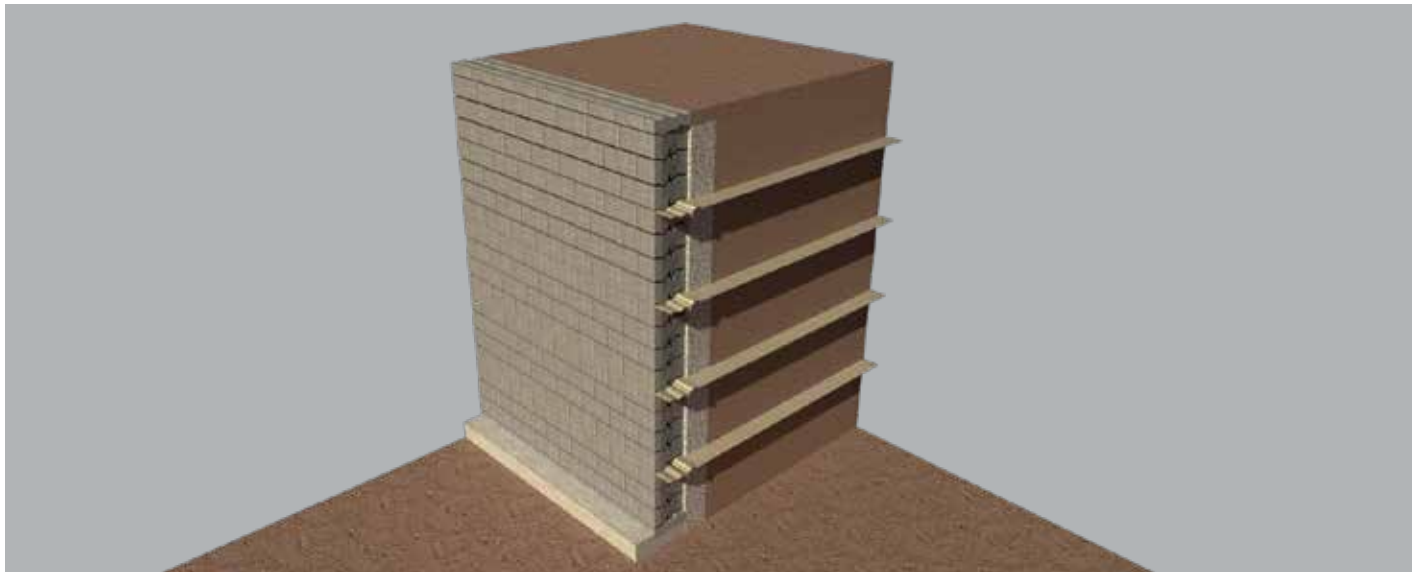


Retaining Walls: VFC Retaining Wall System

Positive mechanical connection (locking mechanism):



Design concept:



Retaining Walls: VFC Retaining Wall System

Interchangeable face:

The VFC features an interchangeable face. This means that it can be used to construct linear, concave and convex wall geometries with a 2m radius. No concrete infill or cutting of blocks is required when constructing curves.

The larger block face is used by default, while concave curves can be achieved by simply flipping the VFC block over from front to back. (Patent: ZA 2017/08449).

Convex curves can be achieved by shifting the rear parts of the blocks towards each other. This will result in less cutting on site.

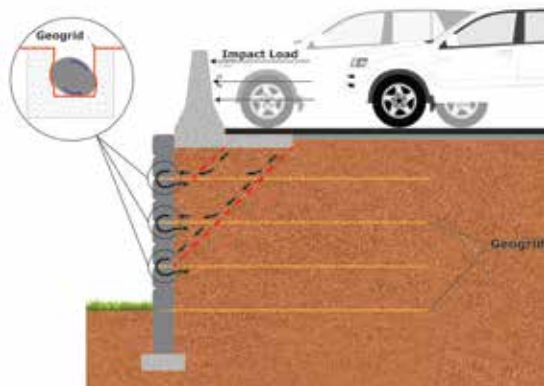


Retaining Walls: VFC Retaining Wall System

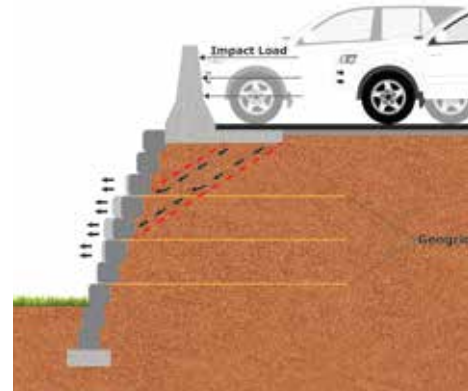
Practical advantages:

Roads built on the VFC system are better equipped to handle potential impacts on barriers. Conventional retaining wall systems using friction principles may fail as opposed to the fixed connection system used with the VFC.

VFC System

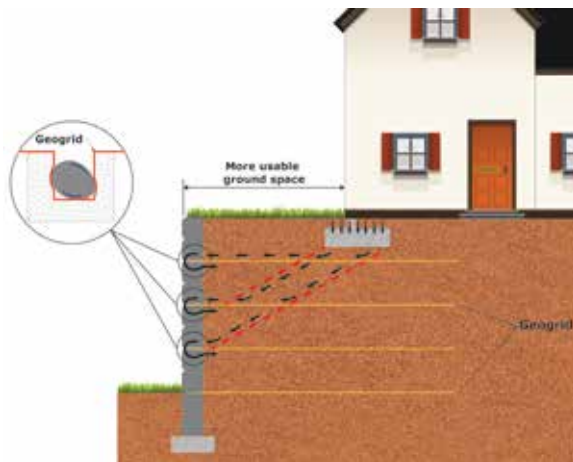


Conventional System

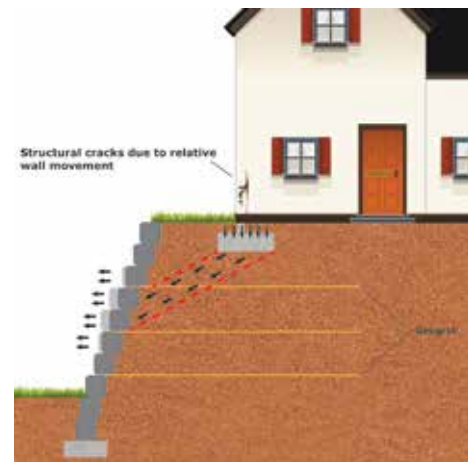


Due to the fixed connection and strong nibs, zero relative displacement occurs between blocks experiencing building surcharge.

VFC System



Conventional System



Retaining Walls: VFC Retaining Wall System



Robust Block

The Robust Retaining Wall Block, developed and manufactured by Bosun, is an innovation in the retaining wall market. The block features new patented design elements with better weight distribution and height tolerances compared to standard retaining wall blocks. The specially designed nib also offers excellent shear resistance. The Robust Block is a cost-effective solution for large, engineered solutions.

The Robust Block can be used in either a closed or open face formation, with the open face being extremely popular due to the economic advantage of using less blocks and saving on costs. At 5.1 blocks/m² using an open formation, it is one of the most competitive in the market.

An open face formation can be transformed into a closed face by using a cost-effective slider between the blocks. The slider prevents soil erosion between the blocks and most importantly on the top row – regardless of formation.

Robust block

Dimensions	440mm x 300mm
Height	250mm
Mass per Block	±47kg
Blocks per m ² (Open)	5.1
Blocks per m ² (Closed)	9.1



Retaining Walls: Robust Block

Bosun Robust Block Advantages

100% consistent block heights

A critical aspect with retaining wall blocks is consistency in block heights. SANS 508, (the official South African specification for retaining wall blocks) **specifies dimensional differences of not more than $\pm 3\text{mm}$. The Bosun Robust Block guarantees these height tolerances or your money back.** If there are any dimensional inaccuracies, it is at the back of the block that can't be seen and it doesn't have any structural influence.

Why are blocks of consistent heights important?

- The layer on top of irregular blocks will rock back and forth.
 - There will be uneven weight distribution of blocks placed on top of an uneven layer, leading to stress points and, ultimately, block failure.
 - Geotextiles placed between uneven rows of blocks might tear or rip out.
 - It wastes a lot of time to level blocks on site with little stones, etc.
- (Patent: ZA 2016/00519)

Special V-shaped stiffeners

The Bosun Robust Block has a superior crushing strength compared to most standard concrete retaining blocks. The crushing strength is derived from various design elements, including the unique V-shape stiffeners in the block. Because of the Bosun Robust Block's superior crushing strength, the construction of retaining walls which are 10m high is possible it.

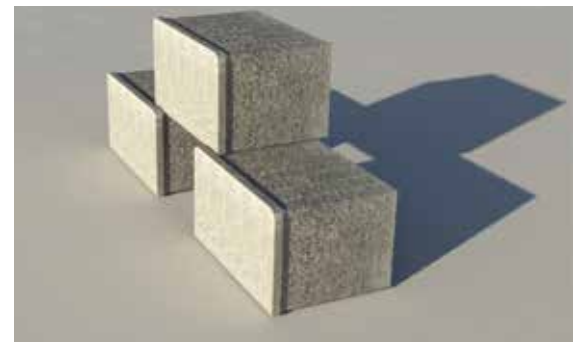
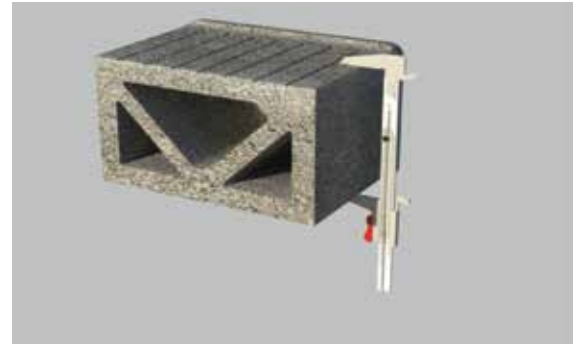
The V-shaped stiffeners also offers a better distribution of force and, in combination with the flat top of the block, offers better resistance to deflection on the sides and top of the block.

Flat surface

Because this block has a flat surface, vertical pressure from above is displaced more evenly and point loads are more widely spread than with conventional retaining blocks.

Nib

The Bosun Robust Block offers excellent horizontal shear (sliding from the back) resistance because of its specially designed nib.



Retaining Walls: Robust Block

Other advantages of the nib are:

- Fewer blocks are used in closed laying method.
- Gaps between the blocks are smaller in the open laying method.
- There is less chance of soil falling through gaps in the open installation method.
- It is possible to build steep walls at angles of up to 80°.

Open blocks

Soil erodes into the block at the back (open side) of the Robust Block. This means that soil doesn't leave the retaining structure when it erodes.

Installation guides

The Robust Block offers installation guides on the top part of the block. These lines will ensure consistent overlapping of blocks on site.

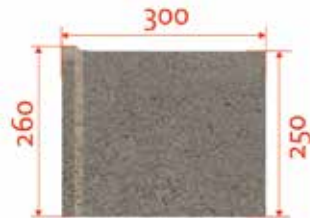
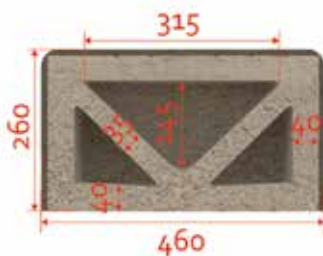
Handling

The blocks is easy to pick up and handle on site. It is possible to carry six blocks with a gravity clamp.

Slider for closed face installations

The use of the slider allows for a more cost-effective closed face option which prevents soil erosion between the blocks and most importantly on the top row, regardless of formation. In addition, the slider can improve the aesthetics of the wall as it promotes plant growth within the retained soil.

Dimensions	320mm x 60mm
Height	230mm
Mass	±9kg
Blocks per m ²	5.1



Retaining Walls: Robust Block

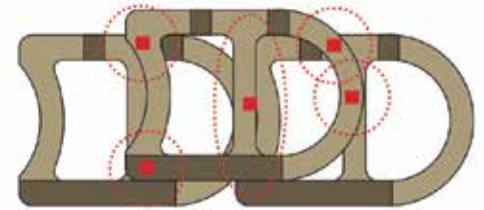


Versoblock

The Versoblock offers superb versatility – a standard retaining wall block, cost effective for both small installations and larger engineered installations. The lip helps to ensure that the blocks above keep their position behind the blocks below.

- Versoblocks could be used with either the front, back or side exposed, to create different finishes.
- Versoblock could be installed closed, creating a solid retaining feature – or open in order to create a living wall of plant life.
- The load is carried on five points on the block, compared to three points on similar systems – thereby increasing the stability of the wall.
- Versoblocks are available with a lip which simplifies installation and increases stability.

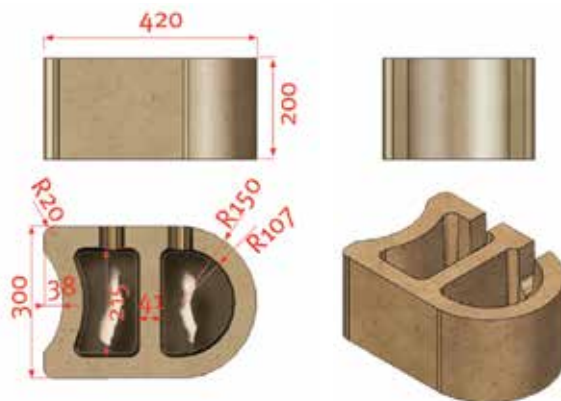
Dimensions	420mm x 300mm
Height	200mm
Mass per Block	± 28kg
Blocks per m ² (side on open)	8.33
Blocks per m ² (side on closed)	13.09
Blocks per m ² (front/back open)	9.56
Blocks per m ² (front/back closed)	16.67



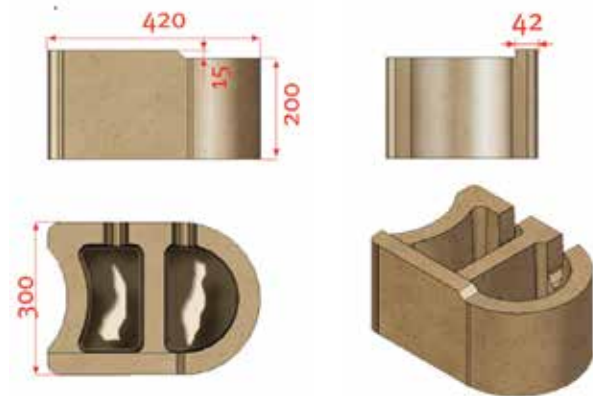
The load is carried on five points on the block, compared with three points on similar systems. This increases the stability of the retaining wall.

Profile without lip

Unit of measurement: mm



Profile with lip







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