



TERRACRETE DRY CAST SPECIFICATION GUIDELINE



Dry Cast - machine pressed

Terracrete permeable concrete block pavers are versatile units used in a wide range of applications, ranging from light erosion control on exposed earth slopes, for reinforced, grassed waterways, or for installing permeable, paved road/parking surfaces (to differing levels of sophistication).

The blocks are made in various parts of the world, using a variety of raw materials (cement, sand, crushed rock, and a selection of recycled waste products such as concrete rubble, glass, over-burn clay bricks and ash). The manufacturing process also varies, - mostly the blocks are machine-made (dry-cast) in specialist block plants, but to a lesser

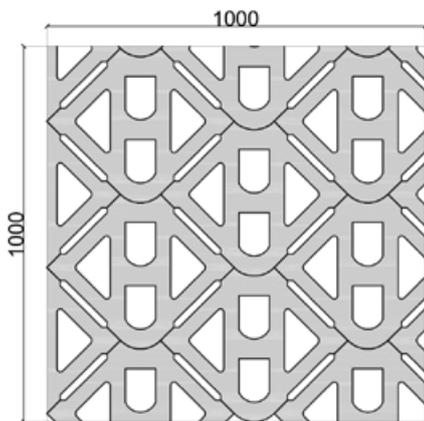
degree are also made semi-manually, using plastic moulds, a process that was developed to enable start-up operators with a small-scale production method, without investing in expensive machinery.

No particular specification can cover all aforementioned variations and applications. The recommended specifications and case studies listed below will cover dry cast blocks which are machine made in various factories. In the absence of directly applicable statutory standards in respect of similar products in some countries, **it is indispensable for the designer to declare site specific requirements and to determine a suitable standard with the local supplier.**

Testing procedures for crushing tests

Dry-cast blocks should be tested by crushing them under a full platen test. For that purpose, pre-soaked blocks should be allowed to surface dry before rubbing bed surfaces down to remove high points/protrusions before being positioned between two 4mm 3-plywood sheets. Force to be applied at not more than 15MPa per minute. Crushing strength to be calculated using the net block area and crushing force, according to routine calculations (Refer to the Report on Laboratory Tests – Guide to the Design of Terraforce Retaining walls of 1992 and to SANS 508: 2008).

Commonly Applied Patterns

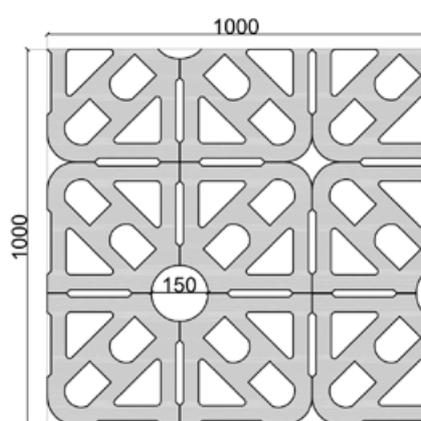


Unidirectional Formation

36,3% open/m²

±9,09 Blocks/m²

Allow for small variations.

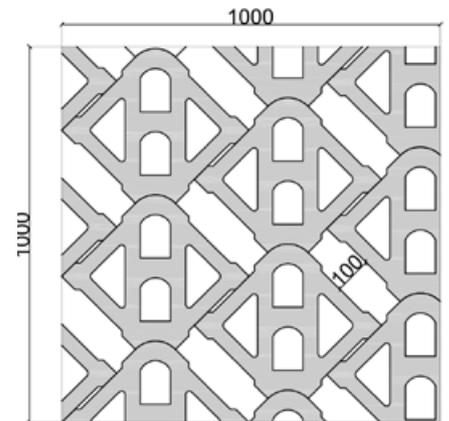


Circular Formation

40,2% open/m²

±8,2 Blocks/m²

Allow for small variations.



Unidirectional Formation, Extended

45,6% open/m²

±7,4 Blocks/m²

Allow for small variations.



Typical TERRACRETE Applications

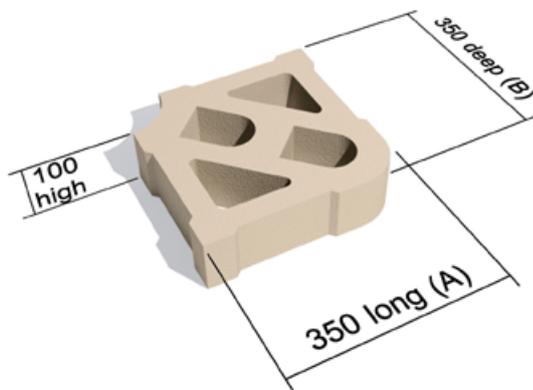
Erosion Control Blocks; (ECB) to combat erosion caused by wind or random water flow over vulnerable slopes and sand dunes. Also used to build effective roadways, sometimes in the form of two narrow strips, to prevent gullies and potholes on farms and in nature reserves. Refer Terranews 12/2002 – 2005, 2/2005, 10/2006, 8/2008, 1/2012, 5/2012 - downloadable online: <http://www.terraforce.com/downloads/>

Water Sensitive Urban Design; (WSUD) covers reinforced grassed waterways, or water infiltrating parking areas and storm water attenuation ponds. Refer Terranews 12/2002 – 2005, 2/2005, 10/2007, 1/2015, 10/2015, 2/2017, 10/2017- downloadable online: <http://www.terraforce.com/downloads/>

Permeable Concrete Block Pavements; (PCBP) are to be planned in close consultation with the manufacturer to ensure that blocks of adequate strength are produced for the particular application. May also include Hard Lawn Pavers (HLP) which are generally understood to disallow water penetration into the subbase. Refer Terranews 21/2003, 31/2004, 1/2006, 3/2007, 2/2008, 10/2008, 2/2009, 8/2011, 9/2013, 4/2014, 4/2015 - downloadable online: <http://www.terraforce.com/downloads/>

Articulated Concrete Block Mats; (ACBM) can be supplied when specifying wet-cast Terracrete blocks. It should be noted that according to the U.S. based N.C.M.A.; (Ref. Tec 11- 9A, Articulated Concrete Blocks for Erosion Control) – Cabled systems can facilitate machine placement. Cables don't increase hydraulic or structural values however. Refer Terranews 12/2002 – 2005, 7/2014 - downloadable online: <http://www.terraforce.com/downloads/>

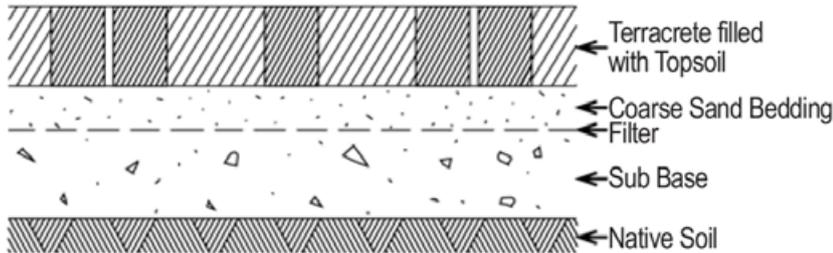
TERRACRETE Permeable Concrete Paving - machine pressed



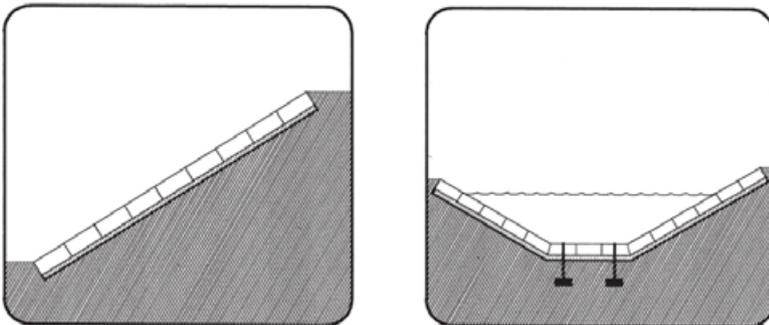
1. **Description:** Permeable Paving Block with two triangular and two arrow shaped openings as shown
2. **Nominal Size:** 350mm long x 350mm deep x 100mm high
3. **Dimensional Tolerances:** Length, depth and thickness ± 4 mm
4. **Dry Mass:** Average of six samples 16kg/unit, with no block less than 15.2kg
5. **Block Concrete Volume & Density:** $0,00747\text{m}^3 \times 2100\text{kg/m}^3$
6. **Nett Load Area:** 0.0746m^2
7. **Compressive Strength:** Average of six samples 14MPa, with no block less than 11.2MPa (full platen)
8. **Effective Plan Area:** $8,7 \text{ units/m}^2$ (9 units/m^2 max) dep. on pattern chosen
9. **Block Wall (Web) thickness:** 40 - 50mm
10. **Open Surface Area:** 36% min. - dep. on pattern chosen
11. **Infill Volume of Openings:** $0,033 - 0,037\text{m}^3/\text{m}^2$
12. **Unit Mass:** 175kg/m^2 min. infill included
13. **Surface Finish:** Surfaces to be dense and free from chips, cracks and other surface defects excluding core bar feathers
14. **Aggregate/Binder Ratio:** 6:1



TYPICAL APPLICATIONS

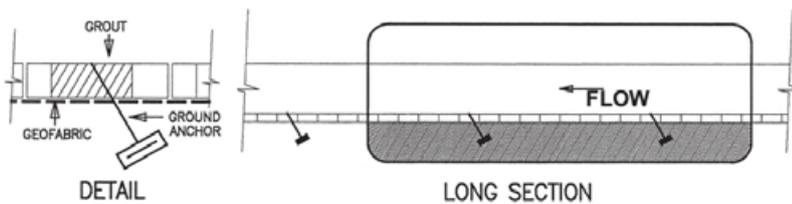


DRIVE OVER HARD LAWN Roads • Parking Areas
 Eco-surfaces are capable of infiltrating large amounts of stormwater. The design of bedding layer and sub-base as short term storage reservoir depends on the ability of in-situ native soil to absorb this water.

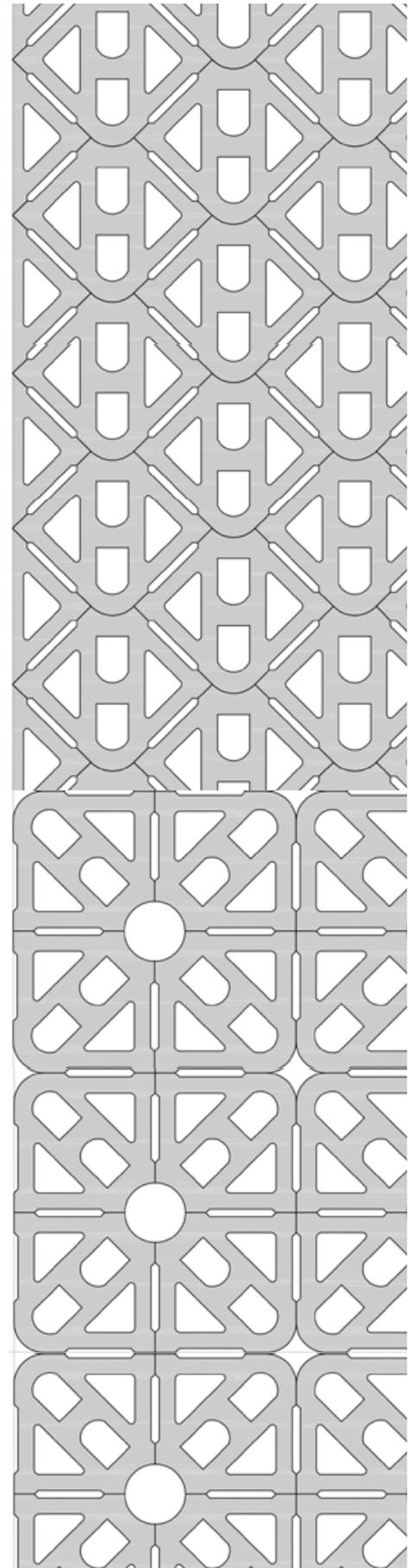


EMBANKMENTS AND SHORELINES

Sand Dunes • Abutments • Spillways • Channels • Streams • River Banks • Dykes - Dams • Lakeshores

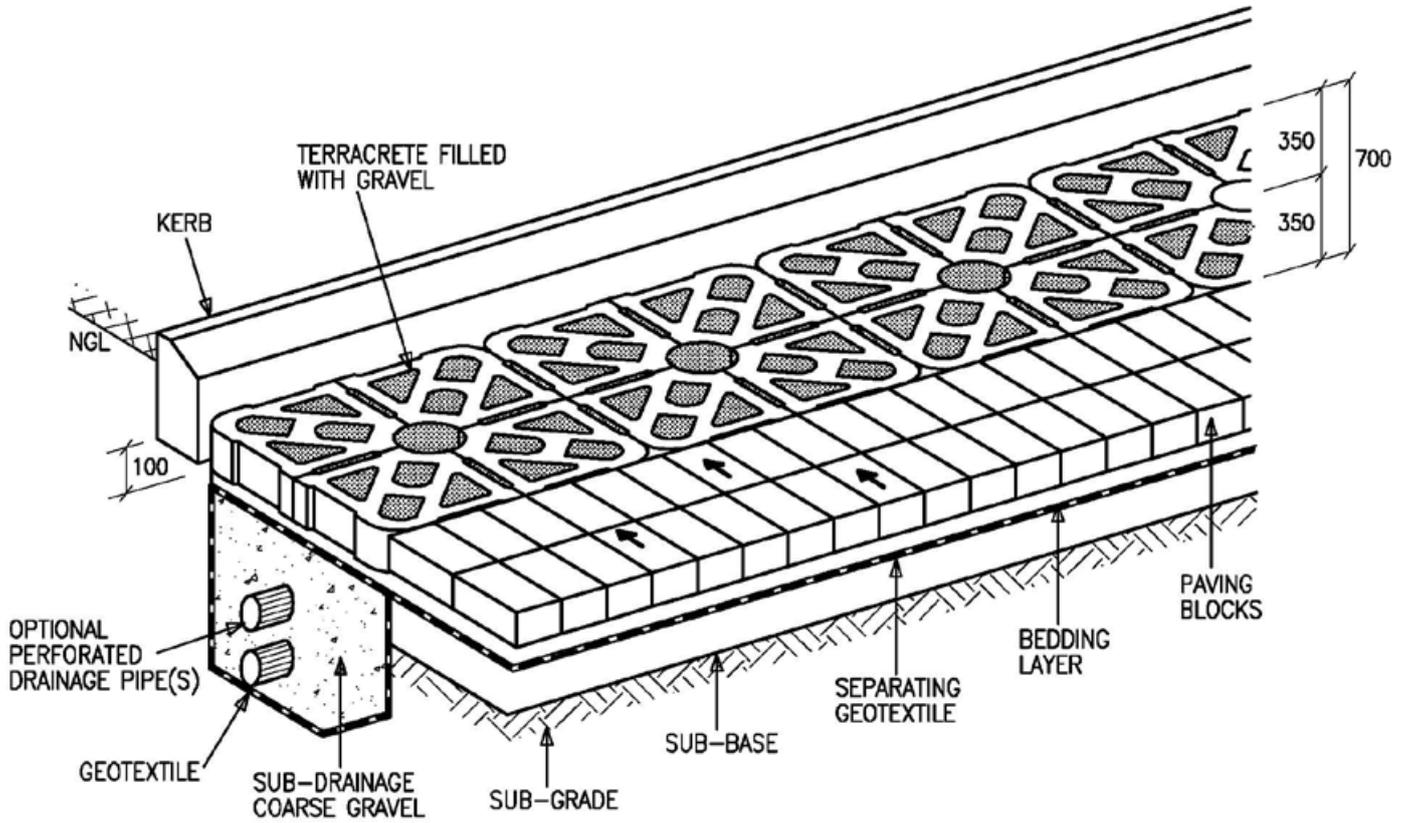


The units can be laid in different patterns and may be used with or without ground anchors for the lining of riverbanks and other areas subject to soil erosion. The paving of grassed roads and parking areas, as well as the stabilising of steep embankments such as bridge abutments can be undertaken with these versatile blocks.



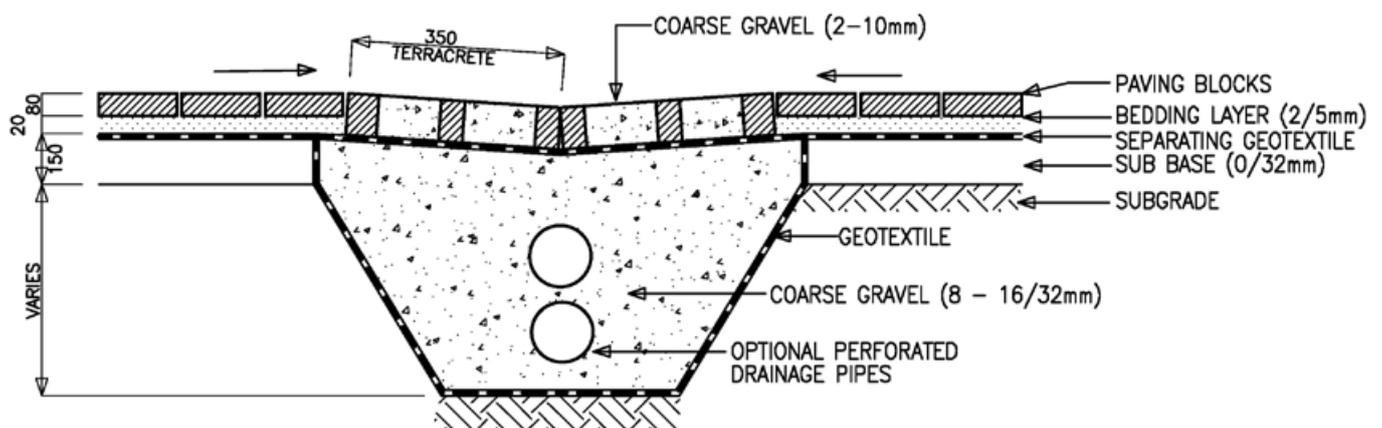


TERRACRETE Perimeter drainage channel



TERRACRETE Intermediate drainage channel

The incorporation of drainage lines along edges, around perimeters and at predetermined centers across parking/storage areas or roadways makes it possible to up-grade existing ones or enhance drainage/infiltration of new installations.





Installation of TERRACRETE Blocks

- It is suggested that the contractor carefully plans and identifies the drop-off or delivery areas along the construction route prior to delivery. Double handling of blocks may result in blocks being damaged unnecessarily. Blocks should be carefully off-loaded from the delivery vehicle and be stored on a level area on the delivery pallets.
- For safety reasons, the public should be kept away from these areas to prevent injury.
- Prepare site profile to line and level as specified by the designer, before placing non-woven geome membrane (recommended) with at least 200mm overlap. Placing and compaction of the sand bed shall be spread evenly over the membrane, in order to achieve a “compacted” thickness of approximately 20mm thick. The sand bed shall be laid in advance of placement of the blocks, but only to the extent that the particular section can be completed on the same day.
- Blocks shall be pressed into its bed in the specified formation, close fitting, to present a flat surface without protrusions and as directed by the designer.
- All blocks shall be filled with the material as specified by the designer, lightly tamped. Suitable grass seeds may be mixed into the growing medium before placement, if so desired.
- Cutting of blocks should preferably be avoided, but where cutting of blocks is required, (bends and junctions) blocks must be neatly cut with an angle grinder.
- Blocks shall be laid in the chosen pattern if the conditions on site permit it, except where curves or junctions occur. Here it may be necessary to insert triangular shaped panels of blocks neatly cut to shape with an angle grinder. The line of the packed units shall both be visually straight and parallel with the edge of the installation.
- To protect against undermining during times of high flood, at least one row of blocks shall be packed horizontally along all edges of canals, filled and seeded as required.

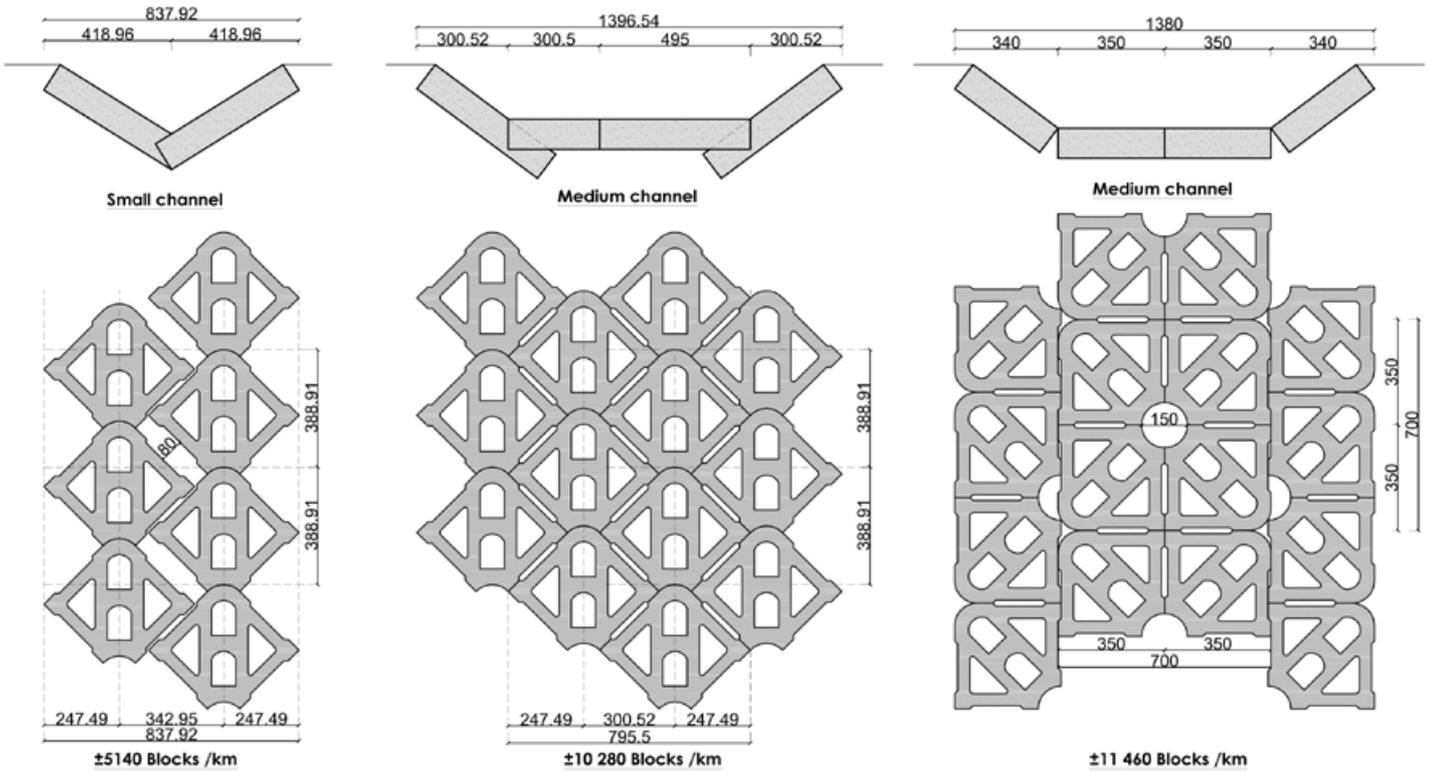
Optional Notes

- The above guidelines are intended for the person supervising the installation. Prior professional design input cannot be waived.
- The designer will consider gradient, soil conditions, expected storm water flow velocity and volume, velocity reducing measures (drop structures, weirs and stilling basins). For roads and parking areas, he will analyse natural soil, designated loading and possible storm water attenuation / detention / infiltration, to design the required layer work.
- The resulting design will describe cross section, gradient, laying pattern, base course / filter / bedding / drainage layer, weirs or buffers, attenuation ponds or ground anchors where required.
- When in doubt, contact Terrasafe at www.terraforce.com

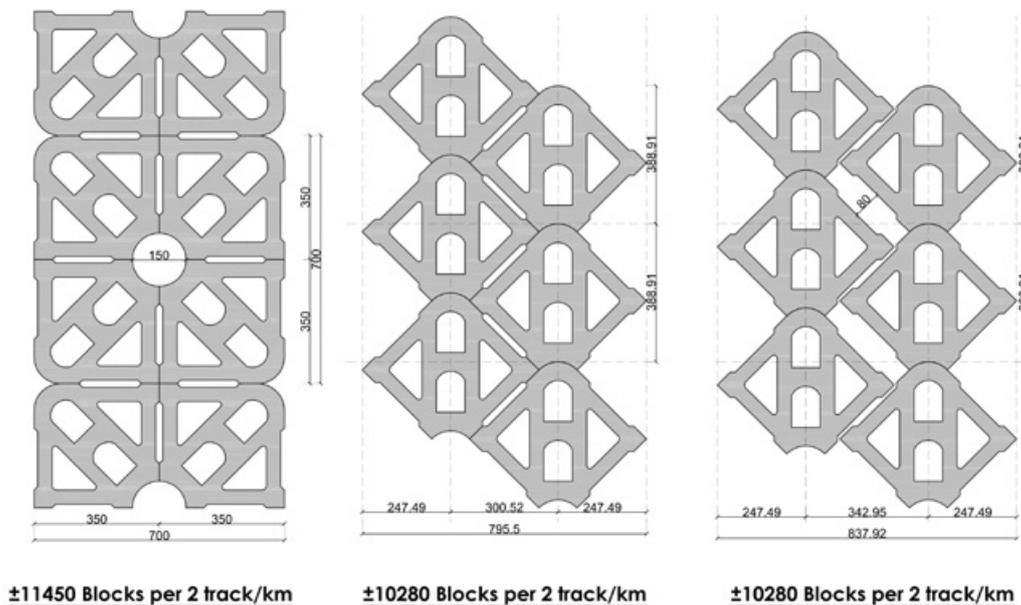


TERRACRETE Storm Water Channel

Terracrete dry cast
Variations for storm water channels



TERRACRETE Wheel Tracks



Variations of single wheel tracks
Dry cast



Cautionary Note

- Terracrete blocks are not intended to replace hard wearing concrete or fired clay paving bricks, unless produced with a special mix design to be negotiated in advance.
Terranews 10/2008 - downloadable online: <http://www.terraforce.com/downloads/>
- Under normal loading stress, or during the construction phase, some blocks may crack without compromising the integrity of the installation. Cracked blocks may be left in place, while still performing as intended. Alternatively, for aesthetic reasons, they may be removed and replaced.
Construction vehicles with ribbed tires, should not drive over such installations.

Maintenance

- Like all installations of a similar nature, a maintenance plan should be in place before a completion certificate is issued.

Particular Specification

PA FLEXIBLE AND PERMEABLE HARD LAWN CONCRETE PAVER

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- PA 06 GEOTECHNICAL REPORT
- PA 07 GENERAL REQUIREMENTS AND TOLERANCES
- PA 08 MEASUREMENT AND PAYMENT

PA 01 SCOPE

- This is a Particular Specification and covers the construction of flexible and permeable hard lawn concrete paver sections, laid closely together, the joints and open areas between the units filled with jointing sand or other material as specified by the responsible person; SANS 1200 MJ.

PA 02 SPECIFICATIONS

- The block shall comply with the minimum specifications as stated in the table below and in the SANS 1200 MJ: Segmented paving section, and shall also be erected in accordance with the dimensions shown on the design drawings.



21 day crushing strength of dry cast blocks:

- Under full platen contact: Avg. 14MPa with a minimum of 11MPa
- Block dimensional variations: Approx. 4mm (Length, width and height)
- Block mass variation: Not less than 95% of specified mass.
- Tests and associated results, as conducted by an approved authority / laboratory, shall be made available to the Employer or his Agent for approval, e.g.:
- 21 day crushing strength (As specified above)

Other supporting specifications

- Where this specification is required for a project, the following specifications shall, inter alia, form part of the contract document:

SANS 1200 A, D, DM, G, M and ME

PA 03 MATERIALS

- Apart from the specification of concrete mentioned above, all materials shall comply with minimum SABS 1200 specifications.

PA 03.1 CONCRETE

- Concrete used for flexible and permeable hard lawn concrete pavers shall comply with the requirements of SABS 1200 G.

PA 04 CLEARING OF PRECAST LAWN PAVER AREA

- Strip clearing for the flexible and permeable hard lawn concrete paver shall be carried out in accordance with SANS 1200 C.

PA 05 PROFESSIONAL ENGINEER /REGISTERED PERSON / TECHNOLOGIST

- It is suggested that all proposed flexible and permeable hard lawn concrete paver areas, are designed, and overseen by a professional registered engineer or technologist for quality purposes.
- Proof of valid Professional Indemnity Insurance shall be submitted with the design for approval by the Employer or his Agent / Engineer.



PA 06 GEOTECHNICAL REPORT

- The Employer shall be responsible to provide Tenderers with a suitable geotechnical report during the design period and the cost thereof shall be borne by the Employer or his Agent.

PA 07 GENERAL REQUIREMENTS AND TOLERANCES

- The completed flexible and permeable hard lawn area shall be true to the setting outline.
- The Contractor shall, on completion of each section of paved area, remove all debris and other loose material so as to leave the paved area with a neat and finished appearance.

PA 08 MEASUREMENT AND PAYMENT

- Various items shall be listed. The unit of measurement shall be as specified.
- Various items shall be listed as given below. The tendered rates shall include full compensation for the necessary plant, labour and material to execute the works as listed, including the spoil of surplus material on site and control density testing. The tenderer shall submit a design of the paved area for approval by a Registered Person (Professional Engineer and /or Technologist).
- Approved flexible and permeable hard lawn concrete paver (Complete as per the approved detail drawings as supplied by the Registered Person (Professional Engineer/Technologist) including sand or gravel under layers, geotextile, concrete paver blocks, concrete, sand or gravel infill blocks, or any other item, deemed necessary or specified by the Contractor's engineer, to successfully complete the operation.....Unit: m²

Disclaimer

- Although every reasonable effort has been made to ensure that the technical information and the design procedures presented in this Guide are correct, neither Terraforce CC and any manufacturer of the product, nor their consultants, who have contributed to the preparation of these guidelines, will be held liable for any loss or damage, either direct or consequential, arising from any failure of installations constructed with Terracrete precast concrete blocks.
- As with any structure, the design of Terracrete projects should only be undertaken by suitably qualified and experienced designers with due cognisance being taken of the specific geotechnical conditions and vital soil parameters pertaining to the site.



@TerraforceRetainingWalls

TERRAFORCE®

The original, reversible, hollow core retaining block



10.



PLANTABLE WIND EROSION CONTROL



STORM WATER ATTENUATION



PLANTABLE STORM WATER CONTROL



AFTER RAINS



STORM WATER CONTROL & ATTENUATION



STORM WATER CHANNEL

TERRAFORCE®

The original, reversible, hollow core retaining block



11.



PERMEABLE PAVING FOR 300 TON BOAT LIFTER OPERATION



PERMEABLE PARKING



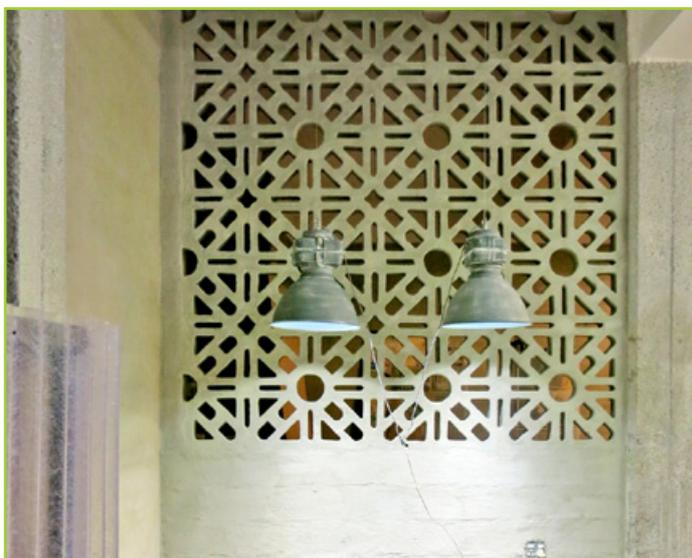
PERMEABLE TRACK BETWEEN PADDOCKS



ECO-FRIENDLY ROAD & EROSION CONTROL



TERRACRETE EROSION CONTROL



TERRACRETE INDOOR SCREEN

TERRAFORCE®

The original, reversible, hollow core retaining block



12.



STORM WATER CONTROL AT BRIDGE



ECO-FRIENDLY ROAD & EROSION CONTROL



ECO-FRIENDLY ROAD & EROSION CONTROL



PERMEABLE PARKING



PERMEABLE PARKING



ECO-FRIENDLY EROSION CONTROL