

2019

Citygreen Stratavault Specification V2.8



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0245 LANDSCAPE – STRATAVAULT MODULE**1 GENERAL****1.1 RESPONSIBILITIES****General**

This work section, when read in conjunction with the Drawings, provides particular requirements with respect to the following:

- Stratavault.
- FilterGrid.
- Reroot linear root barrier.
- Aeration pipe.
- Filler soil.
- Granular base course.

Ensure that all interfaces are fully coordinated prior to commencement.

1.2 INTERPRETATION**Definitions**

General: For the purposes of this worksection the following definitions apply:

- Stratavault: Patented, load-bearing engineered plastic module with vertical and lateral interlocks, for creating void space beneath pavements.
- Stratavault Matrix: Assembled and interconnected volume of Stratavault modules
- Lateral Pipe System: Perforated pipe system for circulation of air, and distribution of water and nutrients, connected to surface grating.
- Vertical Pipe System: Large diameter plastic pipe system for inspection, circulation of air, and connection to surface grate.
- Rootstop Root/Moisture Barriers: Linear membranes to prevent root or moisture Penetration.
- ReRoot Barrier: Linear root barriers with vertical integral root training ribs.
- Filler Soil: Correctly balanced soil mix to provide optimum growth conditions for tree root systems within Stratavault matrix.
- Filtergrid ®: High strength geogrid bonded to filter fabric for reinforcement of granular road base.
- Tree Pit Opening: The pavement opening within which the tree is planted.
- Granular Base Course: Compacted granular material to approved regional standards for support of pavement to relevant Pavement Load design.
- Tree Pit: Excavated space filled with quality soil media for tree planting.
- Reinforcing Collar: A trench between Stratavault matrix and surrounding soil, lined with Filtergrid, filled with granular base course and compacted. This may be filled with Cement Stabilised Sand – refer to section 3.4 - Granular collar.

1.3 SUBMISSIONS**Products**

Documentation: Submit copies of product manufacturer's:

- Product technical data sheets, verifying product properties;
 - Manufactured in Australia.
 - Manufactured from 100% recycled material.
 - Void space greater than 90% per volume.
 - Warranted by Australian entity for 20 Years.

- Achieve open apertures throughout all axis for advanced tree root growth; 300mm unrestricted openings vertically and 285mm unrestricted openings laterally.
- System must be able to fully connect, laterally and vertically, for structural integrity.

Quality Benchmarks

- Supply Certificate - showing date of supply, delivery location, and project reference.
- Accredited Installer Certification - completed within last 6 months of submission.

Tests

Submit results from supplier as follows:

Stratavault 45/ 30 Series:

- Laboratory crush tests to verify the ultimate load strengths as specified in Part 2 of this Specification. Testing must have been completed physically in Australia by registered local engineers, from produced product (not FEA).

Citygreen Academy - Installer Training & Accreditation

Online training and accreditation is mandatory for project managers and installation teams to complete prior to commencing works onsite, as part of construction certificate signoff and product warranty.

- Access to the training platform can be registered online via - www.citygreen.com/training
- Applicants then receive an approval and login email, inviting them to the Litmos training platform to complete the training - <https://citygreenacademy.litmos.com/account/login>

Upon completion of the training, installers will receive a training certificate as verification of their course completion. This must be ready and available onsite anytime at request by Contract Administrator and/or Citygreen representative.

1.4 SUPPLY CERTIFICATE

Nominated contractor will be provided a Supply Certificate, which may be in the form of an Invoice, to be provided to the registered landscape architect/project administrator as confirmation of goods supplied for project as specified.

1.5 SMARTCERTIFY ITP PLATFORM

The **SmartCertify** is a new technology holdpoint platform has been developed to make the QA phases of the projects around the world faster and easier.

The site managers take photos on their smartphone/tablet at the relevant witness /hold-points throughout install, and uploaded in realtime. This platform captures the geo-coordinates of each photo, as well as treepit ID, holdpoint/witnesspoint stage, and comments at time of install.

The **Citygreen Tree Pit Hold Point Sign-off Checklist** is saved within the documents section of each project portal for download and completion for each tree pit.

The construction drawings are also uploaded to this platform, showing tree pit ID tags, to give a central reference point.

Then once all ITP checklists are successfully completed, uploaded and compliant, and the photos uploaded realtime via smart devices throughout installation phases, the construction certificate is issued, along with the 20 year warranty.

This platform is available to all project partners (the client, project administrators, principle and sub contractors, project engineers) to give live realtime updates on progress.

To register for project, follow the link - <https://citygreen.com/compliance>

1.6 CONSTRUCTION CERTIFICATE

Nominated contractor to onforward to registered landscape architect/engineer the Certificate of Install provided by and signed off by Citygreen. The supply of Construction Certificate is contingent on above sections 1.3, 1.4, 1.5 being completed satisfactorily.

1.7 WARRANTIES

- Citygreen's standard 20 year warranty is applicable from date of install, if above sections 1.3, 1.4, 1.5, 1.6 are completed satisfactorily.

1.8 INSPECTION

Notice

- Project installation schedule to be shared with Citygreen prior to commencing works. Changes to schedule must be updated to Citygreen within 24 hours of change actioned.
- Minimum of 72hours notice to be given to Citygreen prior required onsite.

2 PRODUCTS

2.1 STRATAVAULT

Proprietary item

- **Select from the following Stratavault 45/ 30 Series: [complete/delete]**

Stratavault 45 Series *

- Engineered plastic module designed to assemble together to create a matrix beneath pavements. The interconnected skeletal matrix provides in excess of 94% void space for filling with soil media, or storing/ detaining storm water. Due to the high structural integrity of the modules, these matrixes can be incorporated beneath trafficable pavement surfaces - subject to correct pavement design, certified by project engineer.
- 100% recycled Polypropylene (PP) reinforced with fiberglass.
- No steel components- corrosive free.
- Australian manufactured
- Ultimate Load Strength 550 kPa (79.8 psi), verified by laboratory crush tests.
- 60 cm (23.6 inch) x 60cm (23.6 inch) x 40cm (15.7 inches) in height

Stratavault 30 Series *

- Engineered plastic module designed to assemble together to create a matrix beneath pavements. The interconnected skeletal matrix provides in excess of 94% void space for filling with soil media, or storing/detaining storm water. Due to the high structural integrity of the modules, these matrixes can be incorporated beneath trafficable pavement surfaces - subject to correct pavement design, certified by project engineer.
- 100% recycled Polypropylene (PP)
- No steel components- corrosive free.
- Australian manufactured
- Ultimate Load Strength 306 kPa (44.38 psi), verified by laboratory crush tests.
- 60 cm (23.6 inch) x 60cm (23.6 inch) x 40cm (15.7 inches) in height

*** NOTE:**– Stratavault 30 & 45 Series systems are made up of five components, for increased efficiencies;

- **Stratavault Foot Plate:** sits on the base of excavated pit, with Stratavault module legs placed within, for load dispersion.
- **Stratavault Module:** the high-strength load bearing module, four legs, eight lateral connection points, eight vertical connection points.
- **Stratavault Bridge:** locates and connects all modules laterally.
- **Stratavault Connector:** locates and connects all modules vertically (round plug-looking item).
- **Stratavault Grate:** placed on top layer only, in a tile-like placement, providing additional structural support for overlying pavement.

Refer technical sheets and online training for more information.

2.2 FILTER GRID 3030**Proprietary item**

- Composite of a laid geogrid made of stretched, polypropylene (PP) or Polyester (PET) bars with fused junctions and a mechanical bonded filter geotextile attached to the geogrid structure, used for the reinforcement in many fields of civil engineering including road construction, landfill and Hydraulic Engineering.

Table 1: Nominal Physical Properties

Property	Unit	30/30 Q1 151 GRK 3
Geogrid		30/30 Q1
Raw material	-	Polypropylene (PP), or Polyester (PET)
Max. tensile strength, md / cmd**	kN/m	≥ 30/ ≥ 30
Elongation at nominal strength, md / cmd**	%	13
Aperture size, md x cmd**	mm x mm	Approx. 25 x 25
Geotextile		151 GRK 3
Raw material	-	Polypropylene (PP), white
Mass per unit area	g/m ²	≥150
Max. tensile strength, md / cmd**	kN/m	7.5 / 11.0
Elongation at max. tensile strength, md / cmd**	%	40-80
Puncture force	N	1,670 min
Displacement at static puncture strength	mm	30
Vertical Permeability Coefficient	Cm/s	(1.0~9.9)*(10 ⁻¹ ~10 ⁻³)

* based on, ** md = machine direction, cmd = cross machine direction

2.3 REROOT LINEAR ROOT BARRIER

Proprietary item

- Linear root deflecting barriers to be used in proximity to tree root ball, to protect all pavement layers. Vertical, integral ribs guide tree roots down into Stratavault matrix beneath pavement.
- Continuous rolls to minimize joins and possible penetration.
- Widths to suit application and pavement depth.
- 100um thickness.
- 100% High density Polyethylene. This resin meets FDA regulation 177.1520 for food packaging.

Table 2: Nominal Physical Properties

PROPERTY*	ASTM D	UNIT	VALUE
Density	1505	g/cm ³	0.952
Melt Index	1238	g/10 min	0.35
ESCR, F ₅₀ Condition B	1693	h	50
Tensile Yield Strength	638 @ 50mm/min	MPa	27
Elongation at Break	638 @ 50mm/min	%	>600
Brittleness Temperature	746	°C	<-90
Flexural Modulus	790	MPa	1310
Shore Hardness D	2240	-	66
Thermoforming**		cm	18-23
Sheet sag		h	>700

* Physical properties reported herein were determined on compression molded specimens prepared in accordance with Procedure C of ASTM D 1928.

** 0.61 x 1.22 x 3.2mm thick blank heated to forming temperature.

*** Test conditions: 296ml, 23g bottle, 10% fill, Orvus K detergent.

2.4 AERATION PIPES

Proprietary item

- Flexible, perforated pipe system for optimizing oxygen exchange within the tree pit soil. This lateral pipe system is connected to the surface by tee fittings and riser pipes, and also forms of distributing for harvested storm water, and supplementary irrigation or nutrient dosing.
- 100% High density Polyethylene pipe
- Moulded tee fittings
- Cast aluminium ventilation grilles with tamper-resistant grating.

2.5 FILLER SOILS

Refer addendum: Filler soil for Citygreen Soil Cell Treepits.doc

2.6 GRANULAR BASE COURSE

Granular material meeting the standard below, or equivalent (approved by specifying Landscape Architect in consultation with qualified Civil or Geotechnical Engineer):

- ASTM D1241-07, Type 1, Gradation B Standard Specification for Materials for Soil-Aggregate Sub base, Base, and Surface Courses.

Type I mixtures shall consist of stone, gravel, or slag with natural or crushed sand and fine mineral particles passing a No. 200 sieve. 100% High density Polyethylene pipe.

Table 4: Nominal Physical Properties:

Sieve	Percent Passing
37.5mm (1.5")	100
25mm (1")	75-95
9.5mm (3/8")	40-75
4.75mm (No 4)	30-60
2.0mm (No 10)	20-45
425µm (No 40)	15-30
75µm (No 200)	5-15

3 EXECUTION

3.1 GENERAL

Product Storage

- Stratavault modules shall be transported and stored on Citygreen pallets, with pallet wrap intact until required for installation. Pallets shall be positioned on firm level base, so as not to impede traffic or work flow.

Services

- Installer must obtain accurate service locations from all providers, and discuss potential conflicts with tree pit location prior to commencement. Any amendments to tree pit numbers, dimensions or location to be approved by the principal Landscape Architect in writing.
- Statutory clearance and cover measurements for service pipes and conduits to be observed by Installer.

Tree Pit Layout

- Tree pit locations and dimensions shall be accurately surveyed, and marked using string lines, survey pegs and marking paint. Landscape Architect to inspect and approve the tree pit layout, relative to project details, including granular collar detail.

Tree Pit Depths

- Installer to confirm excavation depths from finished pavement elevations, including provision for drainage and base course layers.

Soil Analysis

- Site soil analysis to be conducted by soil analyst and submitted to Landscape Architect to ensure adequate drainage of surplus water from base of tree pit. Where drainage is inadequate, provision shall be made using land drains connected to main storm-water pipe, or grade to soakage pits.
- Design of soakage pits to be approved by Landscape Architect, prior to commencement of works.

3.2 TREE PIT EXCAVATION AND DRAINAGE

Description: Excavating the pit, providing adequate drainage, and meeting required load capacity at floor of tree pit.

Excavation

- Tree pit to be excavated accurately to dimensions of detail plans, allowing 200mm (8") additional clearance in length and width. Side walls of excavated pit to be clean, straight, and within 15° of vertical. Measure tree pit length, width and diagonals at base of pit to ensure that correct dimensions are being obtained (measurements shown on tree pit detail plus 200mm). Confirm that correct depth has been provided, measuring from finished pavement level, including any drainage layers. Base of tree pit should be flat, and have a grade of 5%.

Reinforcing Collar

- The top perimeter of the tree pit shall be further excavated to a depth of 300mm (12"), and to a width of 200mm (8"), or of sufficient width to permit a narrow foot compacting plate to be utilized.
- Sides and base of this excavation to be clean and straight.

Drainage

- Positive drainage to main storm-water service from base of tree pit is mandatory if the design incorporates water harvesting, and strongly recommended if the site soil is not well drained. The base of tree pit must be graded at 5% to the perforated collection pipe in trench. Collection pipe to be wrapped in filter sock, and connected to storm-water system.
- A 100mm (4") layer of clean aggregate to be placed in base of tree pit, and levelled.

Sub-grade Preparation

- Base of tree pit must be free of debris and level. Check CBR of the subgrade below the proposed granular pavement layers to ensure it meets the documented pavement design criteria. Confirm the subgrade surface below the Stratavault matrix is compacted to a minimum of 95% of maximum dry density at optimum moisture content in accordance with Standard Proctor Method (and has a minimum allowable bearing pressure of 100kpa.) Proof compact the subgrade in natural ground with
- a minimum of three passes of a suitable vibrating compacting machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.
- Apply additional compaction forces at optimum water levels.

Installation of Aggregate Sub-base below Stratavault Matrix

- Install aggregate sub-base to the depths indicated in the drawings, under the first layer of Stratavault modules. A 100mm layer of clean aggregate 5-10mm screening to be placed in base of tree pit and levelled.

Compact aggregate sub-base layer to a minimum of 95% of maximum dry density at optimum moisture content in accordance with Standard Proctor Method. Compact the sub-base with a minimum of three passes of a suitable vibrating machine or apply other compaction forces as needed to achieve the required subgrade compaction rate.

3.3 MATRIX INSTALLATION AND SOIL FILLING**Assembling the matrix and associated components, filling with soil.****Stratavault Assembly**

- (Refer Citygreen Academy online training – see above Section 1.4)
- Check and confirm all tree pit dimensions, and mark location of tree with surveyor pegs before commencing assembly of Stratavault matrix. Rectify any discrepancies or errors.
- Ensure base of pit is level and free of debris. Place first Stratavault Foot Plate in left corner of tree pit.
- Place Stratavault Modules in the pit connected to Foot Plates. Attach the Bridge Connectors between the Modules and press into place until a firm 'click' is felt. Continue laying out Foot Plates, placing modules on Foot Plates, and connecting with Bridge Connectors, until the first layer of the matrix is complete.
- If additional layers are specified, place Vertical Connectors in the top of the module columns; then lay out the Modules, connecting the feet firmly to the Vertical Connectors. Use Bridge Connectors as previous to connect modules laterally.
- When the desired number of layers has been achieved, place the Top Grates firmly into all apertures in the top of the matrix.

Lateral Pipes

- Perforated aeration pipes must be installed within the top layer of modules, as per tree pit design details. The pipe must be laid in a complete connected circuit, within 600mm (24") of outer edge of matrix. Junctions and risers to be fitted at spacings of no more than 3.6 metres (12'). Riser pipes to be trimmed to 150mm (6") above finished pavement level, and supported in vertical position by temporary staking. Open ends of pipe to be sealed with caps or weather-proof tape.

Vertical Pipes

- Where vertical aeration or inspection pipes are specified, they should be placed within the large central opening of the Stratavault modules, in correct locations. Pipes should be trimmed to length 150mm (6") above finished pavement level. Open ends of pipes to be sealed with caps or weatherproof tape.
- In any instance where the vertical aeration pipes conflict with the overlying hardstand pavement (ie deemed unsightly, conflicts with pavement construction, or finished pavement function) the contractor is free to bend this vertical slotted piping to come up within nearest soft surface such as a gardenbed or tree surround. This deviation of vertical piping may be relocated no greater than 4 meters in any direction from the initial design.

Root/Moisture Barriers

- Where detailed on the tree pit plans, a linear Rootstop Barrier shall be installed. Typically this will be placed between the Stratavault matrix, and the side wall of the pit. Ensure the barrier is inserted to the full depth of the pit, and is not in contact with any sharp debris or stones what may cause a puncture in the barrier. Any joins shall be overlapped by 150mm (6") and taped both sides using Rootstop tape over clean dry surfaces. The top edge of the Rootstop barrier shall be trimmed with a sharp knife to level with the top of the Stratavault matrix.

Loading Matrix with Filler Soil

- Ensure that all required filler soil testing and certification is complete to satisfaction of Landscape Architect prior to loading into tree pit.
- When matrix is fully assembled, with all specified piping and barriers in place, the filler soil can be loaded into the matrix.
- Soil should be placed using an excavator bucket, and spread with rakes or shovels until the void spaces are filled. Ensure the outer trench for granular collar is kept clean and free of filler soil. Matrix to be vibrated using plate vibration or needle vibration equipment, to shake soil into all voids.
- Continue loading dry soil, and raking out and vibrating, until matrix is filled.
- Note: Depending on the chosen soil blend, and the percentage of loam, installers may water in the soil to give greater filling of the matrix volume.
- In some instances an air layer is detailed in the top of the matrix. In this case, soil is loaded, spread and vibrated in smaller amounts, to ensure an even distribution of soil beneath the air layer.

Filtergrid Separation/Reinforcement

- The outer trench for provision of granular collar shall be cleaned, and all filler soil and debris removed. Place the Filtergrid layer to top of matrix, and cut to length, ensuring that the material covers the top of the matrix, the upper side walls of the matrix, and the bottom of the adjacent trench for granular collar. Any material joins must be straight, free of debris, and over-lapped 150mm (6"). Pipe penetrations to be provided by means of two intersecting slits cut with a sharp knife to form a cross.

3.4 COMPACTION AND PAVEMENT LAYERS**Enclosing the tree pit, and placing pavement layers, to comply with design loads.****Granular Collar**

- Load the granular base course material into the base of the collar trench, ensuring the Filtergrid layer is not displaced from the base of the trench. Compact the granular material in 150mm (6") lifts until the collar is level with the top of the matrix.
- For pits located back-of-kerb, or immediately adjacent/beneath roadways; use Cement Stabilised Sand (5% cement, applied with light compaction and moisture) in the zone of the Granular Collar/over excavation.

Tree Pit Opening

- Confirm the exact required position of the tree pit opening from project details and with reference to survey markers. Cut Filter grid layer and fold back to expose the tree pit opening. Position formwork.

Position formwork to provide for poured concrete system, or other method as specified on project details.

- Place ReRoot linear ribbed root barrier within the tree pit opening, with vertical ribs facing inwards.
- Ensure bottom edge of ReRoot barrier is placed on the Stratavault matrix, and upper edge is at finished pavement level. Trim to suit with sharp knife. Ensure any joins are overlapped a minimum of 150mm (6"), are clean and dry, and taped both sides with Root Stop tape.

Granular Base Course

- Load and spread granular base course material (screening smaller than 25mm or 1 inch), onto the Filtergrid layer, in an even depth of 150mm (6 inches). Compact this layer with a vibrating plate compactor with a mass of up to 1400kg/m² or 270 lb/sq ft of base plate, to specified compaction levels.
 - Continue building compacted granular layers to required levels, including the reinforcing collar.
 - A lightweight smooth drum roller (mass 2 tonne) may only be used on static setting after 300mm layer of granular is placed over the matrix.
 - Compaction equipment with mass above 7 tonne should only be introduced when pavement layers have a minimum cover of 400mm (15 inches), and on low vibration.
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This is a generic and non-specific specification to assist designers/engineers in appropriate design. The supplier/ manufacturer takes no responsibility with regards to its application for any project. It is suggested that the site engineer be engaged to prepare designs and specifications for any project utilising the Stratavault.