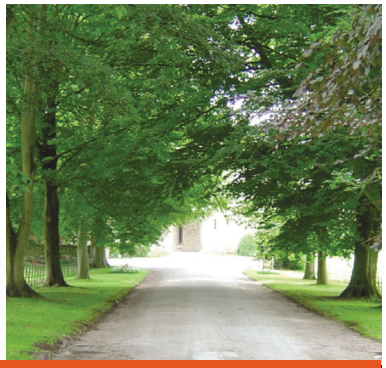
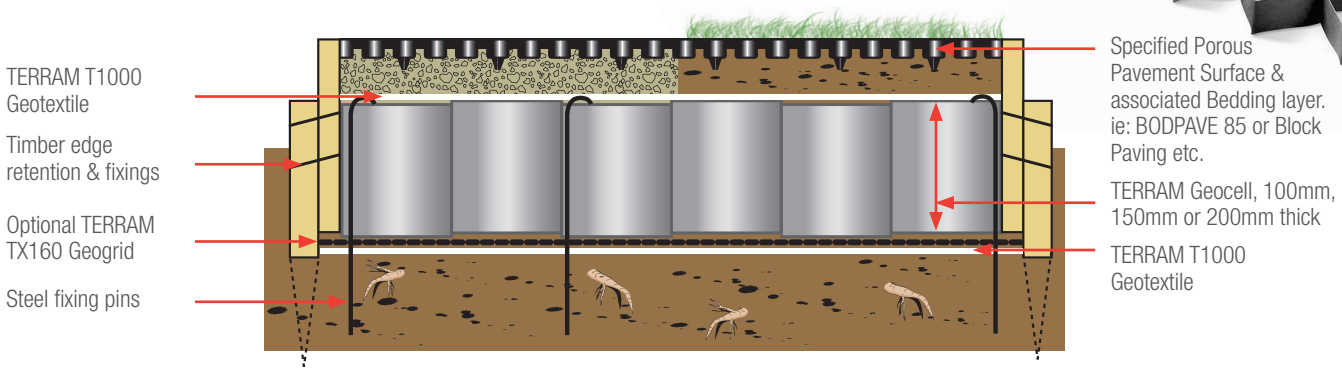
TERRAM GEOCELL

SPECIFICATION, DESIGN & INSTALLATION GUIDANCE

For Tree Root Protection (TRP)



Typical Construction Profile



Installation method for Geocells TRP for permanent access routes and car parks

1. Obtain the approval of the Local Planning Department and Arboricultural Officer for the method of construction proposed and any imposed limitations on the use of mechanical equipment.
2. Remove all debris and reduce surface levels to the allowable reduced dig whilst strictly avoiding soil compaction and tree root damage. Build-up directly on the existing surface levels may be necessary.
3. Ensure that the prepared surface is reasonably even and fill any localised depressions with sharp sand to achieve an even surface profile. Do not roll or consolidate the area.
4. Install tanalised timber edging boards or other approved edge retention to the perimeter of the construction zone as appropriate to the total layer profile thickness. Avoid damage to tree roots when placing fixing posts and pegs.
5. Install a layer of Terram T1000 geotextile across the site, over lapping adjacent rolls by a minimum of 150mm. Lightly pin the geotextile in place until the overlying layers are installed as required.
6. A layer of TERRAM TX160 geogrid may be required depending upon the site soil strength, traffic loading intensity/frequency and any restrictions on build-up depth. Place the geogrid layer over the T1000 geotextile layer and fix down using steel pins to hold flat. Overlap adjacent rolls by minimum 150mm. Avoid tree root damage and soil compaction.
7. Open out the TERRAM Geocell layer and pin in place using steel fixing pins or similar approved between the edging boards. The pins hold the cells in an open and fully expanded position during the filling process. Pin spacing will vary according to the site conditions, generally 1m –2m centres on flat surfaces around the perimeter and where panels join. Drive the pins in so that they are just touching the top of the cells but do not compress the fabric and avoid tree root damage. Cut the TERRAM Geocell to suit using a sharp knife/scissors or alternatively fold up against the edgings.
8. Fill the TERRAM Geocell with a clean, open graded angular aggregate (5mm - 45mm) working towards the tree from the furthest point away and using the filled TERRAM Geocell as a platform. (Single sized, rounded aggregate or DoT Type 1 should not be used). Do not roll the surface, a light vibratory compaction plate may be permitted to settle the stone into the cells; seek advice from the specifier or Arboricultural Officer. Do not contaminate the filled cells with site debris, soil or mud.
9. Install the permeable surface layer such as TERRAM BODPAVE 85, TERRAM Truckpave, permeable concrete block paving or porous asphalt on top of the TERRAM Geocell according to the manufacturer's recommendations. The type of bedding layer will depend upon the specification of the porous surface, an additional layer of TERRAM T1000 geotextile may be required over the filled Geocell to prevent loss of the bedding layer material into the voids. Please refer to Specification, Design and Installation Guidance for BODPAVE 85 and TERRAM Truckpave, or refer to the specific manufacturers' guidance for other surfacing materials.

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Installation method for Geocells TRP for temporary haul road

In some applications a TERRAM Geocell may be installed as a temporary haul road base and completely removed after use. Alternatively a sacrificial stone layer may be installed on the filled Geocell which is removed and replaced with a permanent permeable pavement solution when use of the haul road is complete.

1. Apply all construction detail as for items 1 to 8 above for 'Permanent Access Routes'.
3. Place a separation layer of TERRAM geotextile onto the TERRAM Geocell surface. The geotextile grade will be determined by the specific site design criteria and degree of haul road traffic proposed. E.g. TERRAM T1000 or TERRAM T2000.
4. Place a minimum 100mm thick layer of either clean graded stone or DoT Type 1 sub-base stone onto the TERRAM geotextile.
5. Routinely check for erosion of the surface and repair with additional stone as required to avoid exposure of the separation geotextile.
6. After the haul road use is completed, remove the sacrificial layer of stone and geotextile and follow item 9 above for 'Permanent Access Routes'. Avoid contamination of the open-graded stone within the TERRAM Geocell during removal of the sacrificial stone layer. Alternatively remove the entire construction profile and return the site to its original status. At all times avoid damage to tree roots and soil compaction during removal and disposal of the construction layers.
7. Seek the specifiers' advice on renovation and restoration of the landscaped surfaces within the tree protection zone upon removal of the Geocell TRP system.

General Design Overview for TERRAM Geocell TRP

TERRAM Geocell TRP is a three dimensional geocellular sub-base confinement system designed for the protection of tree roots where the construction of roads, car parks and access routes are required in the vicinity of trees and where Tree Preservation Orders (TPO) may be enforced. The structure confines and stabilises the sub-base stone ensuring that vehicle loads are dissipated, rutting and soil compaction is prevented and damage to tree roots is avoided. When installed as advised, TERRAM Geocell will also allow the continued passage and circulation of air, water and nutrients to tree roots to sustain a healthy growing environment as recommended by the following 2 documents:

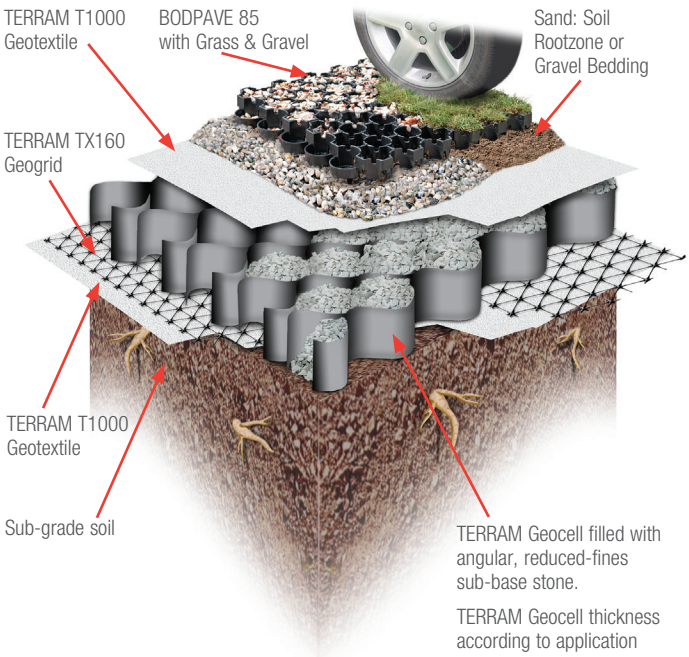
- British Standard BS5837: 'Trees in Relation to Construction' (2012).
- Arboricultural Advisory and Information Services APN12– Driveways Close to Trees.

TERRAM Geocells are supplied flat packed and open to form a strong three dimensional geocellular structure. In this type of 'Reduced-Dig' or 'No-Dig' TRP application, TERRAM Geocell is intended for use in conjunction with a water and gas permeable SuDS (Sustainable Drainage System) compliant pavement surface product such as BODPAVE 85 or Truckpave cellular plastic paving, permeable concrete block paving or porous asphalt surfaces. Although TERRAM Geocell can be used by traffic in isolation for a very limited period when filled; it is not advised that TERRAM Geocell is used as the permanent surface finish for vehicle access routes. Exceptions may arise where TERRAM Geocell is installed as a temporary haul road for example as a site access route and may be removed and disposed of or fully re-surfaced after use.

Design Notes for Geocell TRP

1. BS5837 advises that any new permanent hard surfacing should not exceed 20% of any existing unsurfaced ground within the TRP area.
2. Geocells must be filled with clean, open graded angular aggregate, normally in the particle size range of 5mm - 45mm. Clean 4/20 or 4/40 stone or a reduced-fines DoT Type 1X or Type 3 may be acceptable. Single sized, rounded aggregate or DoT Type 1 should not be used.
3. TERRAM Geocell layer thickness and inclusion of a geogrid will depend upon subgrade soil strength and proposed traffic loadings. See table 1 for further guidance.
4. Specific advice on CBR% strengths, ground conditions and construction over weak ground with a CBR less than 1% is available from TERRAM. CBR% = California Bearing Ratio, a measurement of subgrade soil strength.
5. Soil compaction will severely affect the trees ability to take up water and oxygen; similarly, raising soil levels around trees will deprive roots of oxygen and cause stress and dieback.
6. In most cases 80% - 90% of a trees root system are in the upper 1m of soil and the small fibrous tree roots are the most important to a tree's health. The fine roots enable transport of oxygen, water and nutrient to the tree via the larger roots which also anchor the tree and provide stability. Severing only a small proportion of the fine sur face root structure can severely affect the tree, causing stress, die back and loss of stability.

Typical Profile



Typical Profile showing various product layers. Not all layers will apply to every application.

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Table 1 Geocell TRP thickness

APPLICATION/LOAD	CBR (%) STRENGTH OF SUBGRADE SOIL (see Chart 1)	GEOCELL/Sub-base thickness (mm) (see notes 2-4)	GEOCELL GRADE	TERRAM GEOGRID reinforcement layer	TERRAM GEOTEXTILE filter/separator layer
Pedestrian/Cycles	3≤ 1<3	100 100	25/10 25/10	TX160	T1000 T1000
Cars/Light vehicle	3≤ 2<3 1<2	150 150 200	25/15 25/15 22/20	TX160	T1000 T1000 T2000
HGV's	3≤ 2<3 1<2	200 200 300	22/20 22/20 25/15 25/15 (2 Layers)	TX160 TX160	T1000 T1000 T2000

Table 2 – Geocell specifications

GEOCELL GRADE	PANEL SIZE	CELL DIAMETER AND DEPTH	PANEL WEIGHT	MATERIAL	WALL PERMEABILITY (Li/m²s)	JOINT BOND
25/10	5m x 7m	250mm x 100mm	17kg	Non-woven polyproplylene	20	Chemical
25/15	5m x 7m	250mm x 150mm	25kg	Non-woven polyproplylene	20	Chemical
22/20	6m x 3m	220mm x 200mm	20kg	Non-woven polyproplylene	20	Chemical

Supplementary information

DESCRIPTION	DATA
GEOCELL fill material	4/40mm coarse graded aggregate (BS EN 13242 and 7533-13:2009)
Geotextile filter/separator layer(s)	TERRAM T1000 or T2000 (see table 1) geotextile
Geogrid reinforcement layer	TERRAM TX160 geogrid

Chart 1: Field guidance for estimating sub-grade strengths

CONSISTENCY	INDICATOR			STRENGTH	
	TACTILE (feel)	VISUAL (observation)	MECHANICAL (test) SRT	CBR (%)	CU (kN/sqm)
Very Soft	Hand sample squeezes through fingers	Man standing will sink >75mm	<2	<1	<25
Soft	Easily moulded by finger pressure	Man walking sinks 50-70mm	2-4	Around 1	Around 25
Medium	Moulded by moderate finger pressure	Man walking sinks 25mm	4-8	1-2	25-40
Firm	Moulded by strong finger pressure	Utility truck ruts 10-25mm	8-15	2-4	40-75
Stiff	Cannot be moulded but can be indented by thumb	Loaded construction vehicle ruts by 25mm	15-30	4-6	75-150

Further Reading

- British Standard: BS5837 (2012) – Trees in Relation to Construction - Recommendations.
- Arboricultural Advisory and Information Services Services APN12 (2007)– Driveways Close to Trees.
- 'Tree Root Systems'. (M. Dobson 1995) – Arboricultural Research Information Note 130/ARB/95.
- 'Driveways Close to Trees' (M. Dobson / D. Patch 1996). Arboricultural Practice Note 1.
- 'Guidance for Trees: Conflict or Compliment?'. (R. Nicholson 2001). Arboricultural Journal No. 25.

This field guide is provided as an aid to assessing the mechanical stabilisation requirements in commonly encountered site conditions. TERRAM accepts no responsibility for any loss or damage resulting from the use of this guide.

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Berry

A Berry Global Company
Fiberweb Geosynthetics Ltd
Blackwater Trading Estate
The Causeway, Maldon, CM9 4GG
United Kingdom

Tel: +44 (0)1621 874200
Fax: +44 (0)1621 874299
Email: info@terram.com
www.terram.com

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