Cellweb® TRP

Tree Root Protection

Cellweb® TRP is a 3D cellular confinement tree root protection system. The system provides a 'no dig' solution for the construction of new hard surfaces within root protection areas (RPAs). Cellweb® TRP has been designed and independently tested to comply with recommendations made in Arboricultural Practice Note 12 and BS 5837 2012 – Trees in relation to design, demolition and construction.

Cellweb® TRP Key Functions

Cellweb® is a 'no dig' solution which is constructed directly on the existing ground surface. This eliminates the requirement for excavation, preventing root severance.

Cellweb® is a completely porous system allowing continued water permeation and gas exchange between the rooting environment and atmosphere.

Cellweb® spreads point loads, minimising increases in soil compaction within the rooting environment. This maintains an open graded soil structure allowing continued root growth, water, gas and nutrient migration.

The Cellweb® TRP system comprises the following three components

Treetex™ Geotextile. Following minimal ground preparation the Treetex™ is laid onto the existing ground and top soil. This acts as a separation layer, separating the system above from the soil and rooting environment below. Treetex™ performs as a hydrocarbon pollution control measure in accordance with BS5837, holding 1.7lt of oil per square meter.

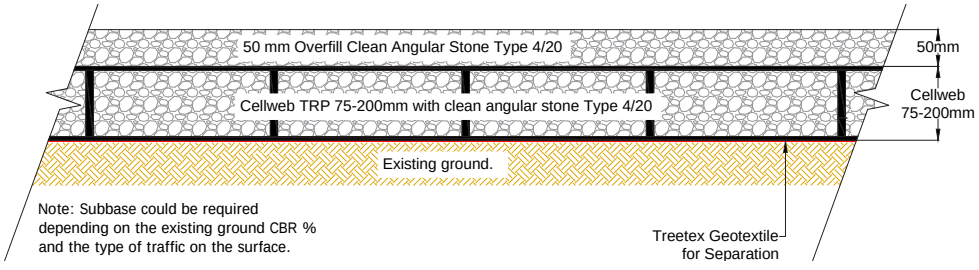
Cellweb® 3D Cellular Confinement. The Cellweb® is installed on top of the Treetex™ layer. This is fixed to the ground using ten steel J pins per panel. The panels can be cut to the required shape and adjoining panels can be connected using heavy duty staples or cell ties.

4-20mm Clean Angular Stone. The expanded Cellweb® is infilled with a 4-20mm clean angular stone. The confined angular stone locks together to produce a rigid stone mattress, while maintaining air pockets for continued water permeation and gas exchange. The low fines content of the stone prevents the Treetex™ layer from becoming blocked over time.

Which depth of Cellweb® TRP?

The Cellweb® System is provided in four different depths; 200mm, 150mm, 100mm and 75mm. The depth required is determined by the proposed traffic loadings and the site ground conditions. Geosynthetics in house engineering department can provide a free site specific technical recommendation. For free technical and engineering support please contact Geosynthetics Ltd 01455 617139 or the full installation guide can be found on our website www.geosyn.co.uk.

Indicative Cellweb with overfill



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Tree Root Protection Using Cellweb TRP®

Fact Sheet 1: Use of Cellweb TRP® in Root Protection Areas (RPA's)

Introduction

Cellweb TRP® is a cellular confinement system that confines aggregate materials and makes them stronger. This behaviour allows the depth of pavement construction to be reduced. It also minimises compaction of soils below road pavements constructed using the Cellweb TRP® tree root protection system. Cellweb TRP® is used around the world to provide cost effective road and railway construction, as well as Tree Root Protection.

Cellular confinement was developed by the US Army Corps of Engineers during the 1970s to allow construction of roads for military equipment quickly and easily using whatever local soil material was available (especially across beaches). Since then the method has been developed and it is now routinely used in road and rail construction as well as in tree root protection. There is an extensive research base that demonstrates the performance of cellular confinement and it is a method of pavement construction that is recognised by the US Federal Highways Administration.

Characteristics of Cellweb TRP®

Pokharel et al (2009) stated that about one fifth of pavement failures in the US occur due to either weak subgrades or inefficient load transfer from the sub-base. Cellweb TRP® can improve the strength of road pavement construction to deal with these problems. It is a three dimensional interconnected honeycomb of cells made from HDPE. The cells are filled with aggregate sub-base and laterally confine the material when it is loaded, thus increasing the bearing capacity of the layer. This results in a thinner layer of aggregate being required to achieve the same performance.

It also allows uncompacted open graded aggregate to be used in the sub-base construction which is a vital part of any tree root protection system.

Cellweb TRP® is available in a range of height and aspect ratios to suit different load applications.

Use of Cellweb TRP® in RPAs

The use of Cellweb TRP® tree root protection system for building roads, car parks and other vehicular pathways includes a sub-base infill material of clean angular stone which does not need to be compacted. This immediately provides a layer of material that will absorb compaction energy applied to the top of materials placed over it. Compaction of soils by construction machinery does not extend to a great depth. This is the reason why earthworks materials are normally placed in thin layers because compaction only occurs in the top few hundred mm at most. With the lightweight compaction plant used on most development sites the maximum depth that compaction will extend to is between 150mm and 200mm. Thus, if an 80mm layer of asphalt is placed over a 150mm deep Cellweb TRP® system the compaction reaching the base of the construction and the natural soil will be minimal. This effect was demonstrated by Lichter and Lindsey (1994) where a trial area was trafficked by a front-end loader and only suffered significant compaction of the soil to a depth of 100mm.

The use of Cellweb TRP® also spreads the wheel loads from traffic. There has been extensive research published on the performance of these systems from the original work by the US Army Corps of Engineers (Webster 1981) to more recent studies such as that by Emersleben and Meyer (2008).

Figure 1 - In situ density test prior to construction of pavement

The research shows that Cellweb TRP® acts as a stiff raft to distribute wheel loads and reduce their magnitude at the base of the construction by 30% to 36% (without any asphalt or other surfacing). Once the surface is taken into account, the pressure applied by traffic to soil below roads or pavements constructed using no-dig methods will be significantly reduced and thus compaction will also be reduced. Note, compaction is not prevented but it is reduced, thus maintaining the soil bulk density at levels that are suitable for tree root growth.

The effectiveness of the Cellweb TRP® no-dig construction in reducing soil compaction has been demonstrated in trials carried out by the Environmental Protection Group Limited. Two parking bays were constructed over a fine sand soil, one with a Cellweb TRP® cellular confinement sub-base. The parking bays were surfaced with asphalt and then used by cars for four weeks on a daily basis. It is well known that compaction of soils occurs in the first few passes of a vehicle, so the maximum adverse effects on compaction of soil below the pavement should have been achieved. In situ density tests were carried out on the sand below the pavement before and after construction (Figure 1).

Tree Root Protection Using Cellweb TRP®

Fact Sheet 1: Use of Cellweb TRP® in Root Protection Areas (RPA's)

Figure 2 - Cellweb TRP® in construction.

Figure 3 - In situ density tests post-trafficking.

The results in Figure 4 show that compaction of the soil below the Cellweb TRP® pavement was noticeably lower than that below the normal pavement. The increase in compaction below the normal pavement is similar to the increase found on a number of construction sites by Alberty et al (1984).

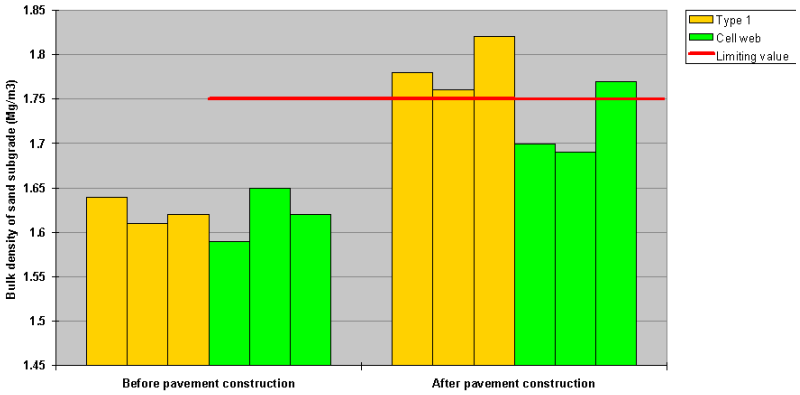

Figure 4 Comparison of soil compaction below pavements

The use of layers of uncompacted material has also been shown by others to reduce compaction of natural soil by construction plant (Lichter and Lindsay 2004). However, these were temporary layers intended to be removed after construction was finished and they are not suitable for incorporation into a permanent car park surface. Nonetheless, it does demonstrate the effectiveness of no-dig techniques using Cellweb TRP®. It is important to note that the specific properties of cellular confinement systems (eg material type, strength, welding at joints, perforations, etc) will affect how each one behaves in trials such as this. Therefore the results are only applicable to the Cellweb TRP® system.

Note

So called tree root protection systems that use Type 1 sub-base or any similar material that requires compaction will not prevent compaction of soils around the tree roots. Type 1 is also not very permeable to air and water and will limit the availability to roots. Therefore geogrid reinforced Type 1 is not suitable for tree root protection.

References

Alberty CA, Pellet HM and Taaylor DH (1984). Characterisation of soil compaction at construction sites and woody plant response. Journal of Environmental Horticulture, 2, 48-53.

Lichter J M and Lindsay P A (1994). The use of surface treatments for the prevention of soil compaction during site construction. Journal of Arboriculture 20 (4) July 1994.

Pokharel SK, Han R, Parsons RL, Qian Y, Leshchinsky D and Halahmi I (2009). Experimental study on bearing capacity of geocell-reinforced bases.
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Tree Root Protection Using Cellweb TRP®

Fact Sheet 2: Water and Oxygen Transfer Through the Cellweb TRP® System

Water and Oxygen Transfer Through the System

Water and oxygen are the lifeblood of trees without which they will wither and die. It is important to design developments in and around the root protection area (RPA) of existing trees to maximise the availability of water and oxygen to the roots. This can be achieved in a number of ways using the Cellweb TRP® tree root protection system.

The main causes of reduced water and oxygen availability for tree roots are:

- Compaction of the soil around the roots
- Covering the ground surface with impermeable cover which prevents water infiltration.

Both of these effects can be reduced or prevented by using Cellweb TRP® tree root protection within an appropriately designed road or car park surface.

Compaction of Soil

The use of Cellweb TRP® tree root protection system for building roads, car parks and other vehicular pathways includes a sub-base infill material of 20mm to 40mm or 4mm to 20mm clean angular stone which does not need to be compacted. This immediately provides a layer of material that will absorb compaction energy applied to the top of materials placed over it. Cellweb TRP® also spreads the wheel loads from traffic which reduces compaction, thus maintaining the soil bulk density at levels that are suitable for tree root growth.

The effectiveness of the Cellweb TRP® no-dig construction in reducing soil compaction has been demonstrated in trials carried out by the Environmental Protection Group Limited (See Fact Sheet 1).

Water and Oxygen Availability

The Cellweb TRP® tree root protection system is constructed using 20mm to 40mm or 4mm to 20mm gravel infill and has perforated cell walls. The pore spaces between the aggregate particles are greater than 0.1mm in diameter and are therefore defined as macropores (Roberts 2006). This open structure is far more permeable than typical soils and allows the free movement of water and oxygen within it so that supplies to trees are maintained as shown in Figure 1. The use of continuous permeable surfacing and intermittent gaps in impermeable surfacing are recognised ways of providing water and air infiltration pathways through a pavement surface into the tree root zone (Ferguson 2005).

The Cellweb TRP® system incorporates the Treetex® geotextile at the base. This is a very robust geotextile that is resistant to puncturing. Crucially for tree root protection it does not have a water breakthrough head that other geotextiles may have. Therefore it will always be free draining and will not limit oxygen availability to the roots.

Breakthrough Head

All geotextiles are by their nature permeable, however in order to develop optimum water-flow performance, some types of geotextiles (eg, thermally bonded types) require a minimum depth of water to develop over them.

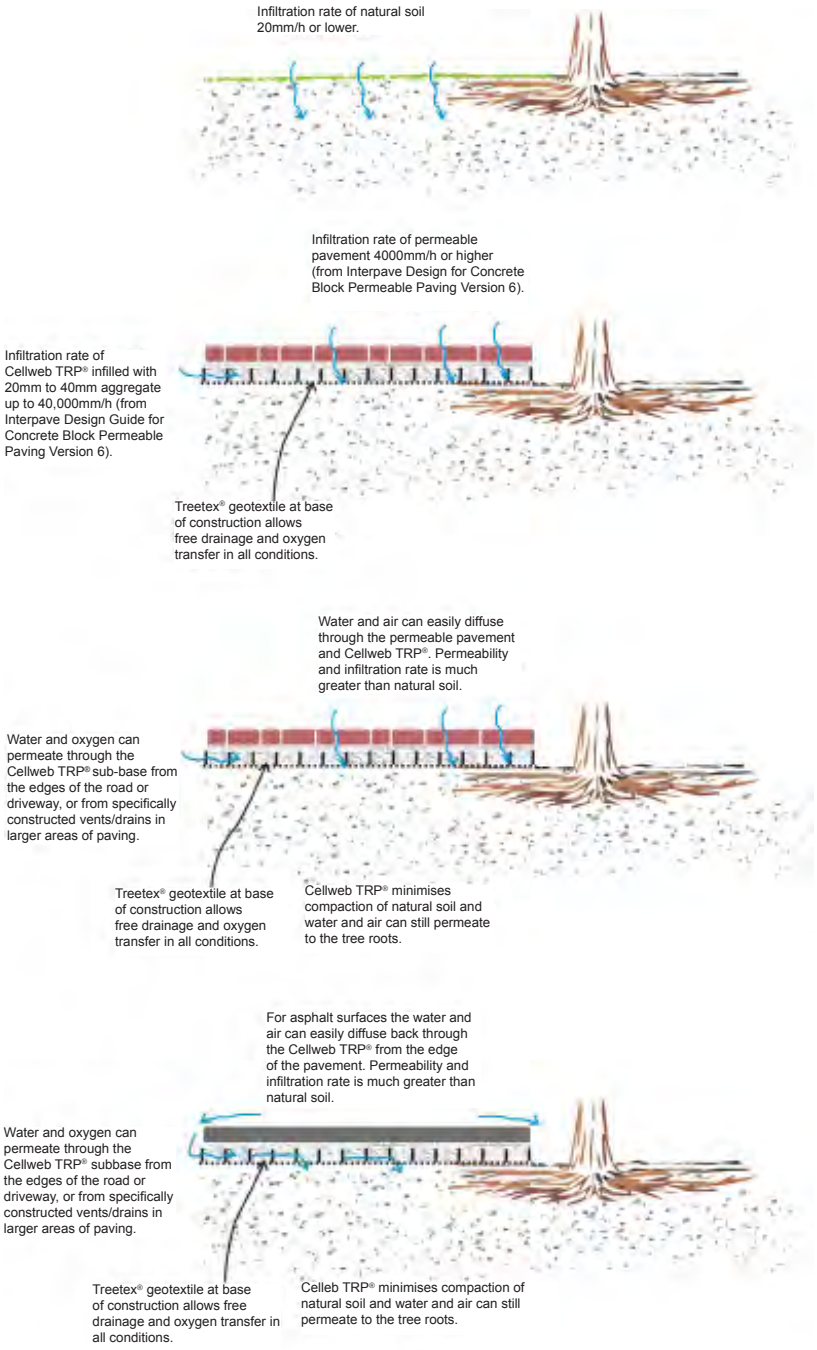
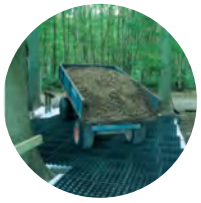


Figure 1 Water and oxygen availability in Cellweb TRP® tree root protection pavements

Therefore a layer of up to 50mm of water can build-up over some geotextiles after rainfall. Treetex® needle punched geotextiles however remains free draining at all times as it has "zero breakthrough head" which means it does not require a build up of water to permeate.

Tree Root Protection Using Cellweb TRP®

Fact Sheet 2: Water and Oxygen Transfer Through the Cellweb TRP® System



If the Cellweb TRP® sub-base layer is covered by a layer of permeable block paving the rate of oxygen transfer through the system is estimated to be around 1 x 10-4 g/s/m² using simple diffusion theory. For a natural sandy soil the rate of transfer to the same depth is around 7 x 10-5 g/s/m². Therefore even on the most aerated of natural soils the Cellweb TRP® tree root protection system does not restrict oxygen supply to tree roots.

Water ingress will also be maintained at the levels similar to a natural sites as water simply passes through the pavement. Permeable block paving and porous asphalt have infiltration rates that are very large (typically > 2500mm/h) in comparison with most rainfall events. The infiltration rate is also far higher than natural soils (infiltration rate for sand is quoted as >20mm/h by Hillel 1998). Thus the pavement allows rainfall to soak into the soil as it would naturally (there will be some reduction as some water soaks into the blocks and gravel as the rainfall passes through).

TABLE 1 - CHARACTERISTICS OF ROOT SYSTEMS OF MATURE EUROPEAN BROADLEAVED AND CONIFEROUS TREE SPECIES GROWING ON WELL AERATED, SANDY SOILS

Species	Tolerance to Oxygen Deficiency	Species	Tolerance to Oxygen Deficiency
Ash	Medium-high	Japanese Larch	Medium
Aspen	High	Lime	Low
Birch	Low	Norway Maple	Medium
Beech	Low	Norway Spruce	Very low
Common Alder	High	Red Oak	Medium-high
Corsican Pine	--	Scots Pine	Medium
Douglas Fir	Medium-low	Sessile Oak	High
English Oak	High	Silver Fir	High
European Larch	Medium	Sycamore	Low
Hornbeam	Medium	White pine	Very low

From Roberts et al (2006)

If the Cellweb TRP® is covered by impermeable asphalt or similar materials the aeration of the sub-base can be promoted from the side of a paved area. This is achieved using gravel filled conduits to connect the sub-base to the surface, allowing oxygen into the layer from where it can freely travel to the root area. Open areas that are normally provided immediately around the tree will also be beneficial in allowing oxygen into the Cellweb TRP® layer. Oxygen can flow horizontally through the Cellweb TRP® because of the perforated walls.

Notwithstanding the above, some trees are more tolerant than others to a deficit of oxygen (Table 1). The use of permeable surfaces over the Cellweb TRP® is advisable where pavements are to be constructed over trees with a low tolerance to oxygen deficit.

References

Alberty CA, Pellet HM and Taaylor DH (1984). Characterisation of soil compaction at construction sites and woody plant response. Journal of Environmental Horticulture, 2, 48-53.

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Lichter, J M and Lindsay, P A (1994). The use of surface treatments for the prevention of soil compaction during site construction. Journal of Arboriculture 20 (4) July 1994.

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Tree Root Protection Using Cellweb TRP®

Fact Sheet 3: How the Cellweb TRP® System Deals With Oil and Other Pollution

Pollution in Urban Runoff

It has been suggested that pollution from run-off could damage tree health in certain concentrations. Pollution is present in runoff from car parks, roads and even roofs. There are a wide variety of pollutants including heavy metals, oil, fertilisers, pesticides, salts, pathogens and sediment that can cause environmental damage if discharged into rivers or groundwater (CIRIA 2007).

Where permeable pavements are constructed over the Cellweb TRP® the pavement construction will filter out and retain most pollutants. This fact sheet will discuss the extensive evidence base that demonstrates how effective permeable surfaces are at removing pollution. It will explain how they remove pollution from runoff before it reaches the soil below and how robust trees are to the levels of pollution found in runoff.

The effects of de-icing salt on trees are discussed in a separate Fact Sheet No 5.

There is research available which reveals that the pollutant loads from small areas of car park or small roads, where the majority of no-dig installations are used, are much less than for main roads or larger car parks (CIRIA 2003). Such low levels are unlikely to damage tree health. Sustainable drainage systems positively encourage the use of trees and other plants to treat the pollution that is present in run-off from hard surfaces.

Pollution Removal in Permeable Pavements

The effective removal of pollution from runoff by permeable surfaces has been well known since the late 1990s. This early work is summarised in CIRIA Report C582 (CIRIA 2002) and it showed that permeable pavements filter out sediment and act as bio reactors to degrade oil based pollutants. The sediment is filtered as it passes through the fine pores in the surface (either in porous asphalt or in the grit jointing material between blocks) which is where the majority of pollution is trapped (Legret and Colandini 1999, Shackel and Pearson 2005). If it passes this surface filtration layer it will be trapped on geotextiles either within or at the base of the construction. The Cellweb TRP® system will always have a Treetex™ geotextile at the base over the subgrade. This has properties that make it robust enough to survive in contact with the clean angular aggregate.

Worldwide research has generally shown that runoff that has passed through permeable pavements has low concentrations of pollutants, especially metals, oils and bacteria (Wilson 2007). This includes research in countries where the geotextile is generally only provided at the base of the construction. The percentage removal of various contaminants from a permeable pavement is shown in Figure 1. In this case the pavement was sealed and the water collected from a manhole at the outfall. It did not have an upper geotextile in the pavement. Similar findings have been reported by Mullaney and Jefferies (2011).

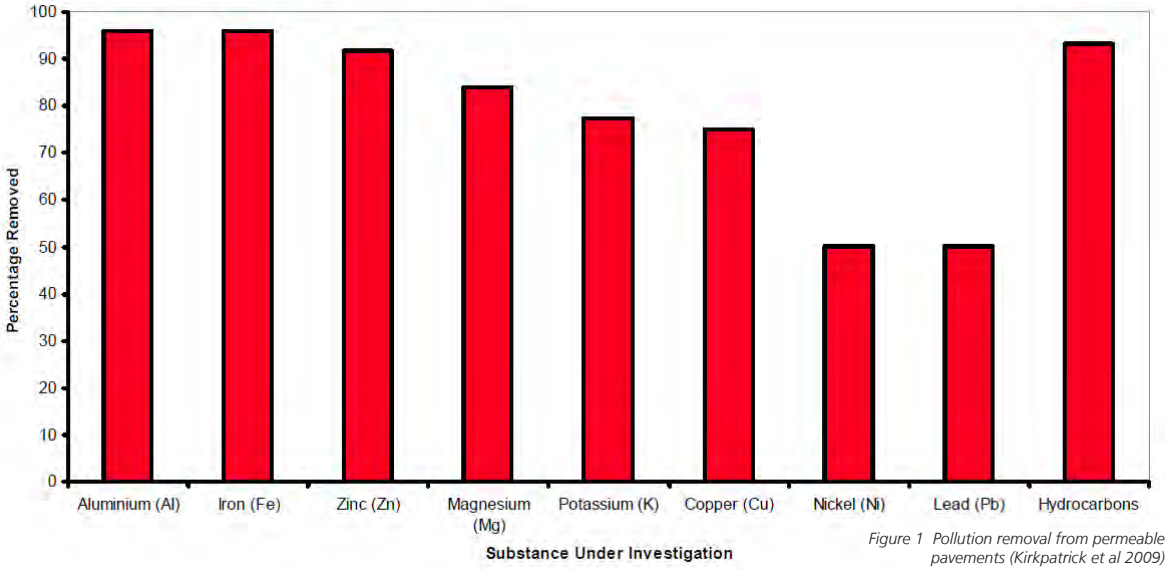

Figure 1 Pollution removal from permeable pavements (Kirkpatrick et al 2009)

All permeable pavements tend to use an open graded sub-base that is similar to the clean angular aggregate used in the Cellweb TRP®and therefore this material will help remove pollution in a similar manner. More recent research has confirmed that day to day pollution removal does not depend on a geotextile at high level in the pavement (Mullaney and Jefferies 2011) but that geotextiles in the construction can be beneficial if there are larger spills of oil (Puehmeier and Newman 2008). The Treetex™ geotextile provided at the base of Cellweb TRP® pavements will reduce the risk of any excessive pollution passing through the system into the soil below. Because of the pollution load and treatment that clearly occurs within the pavement there will not be a significant build up of pollutants within the soil below it.

Tree Root Protection Using Cellweb TRP®

Fact Sheet 3: How the Cellweb TRP® System Deals With Oil and Other Pollution

Ability of Trees to Deal with Pollution

Many trees are able to remove a wide variety of pollutants from soil. One of the more recent developments is stormwater forestry (United States Department of Agriculture (USDA) 2006). The USDA states that 'Trees also show enormous potential to remove other pollutants, such as metals, pesticides, and organic compounds.' The report does go on to suggest that some tree species may be damaged by pollutants in stormwater and this will require consideration on a site-by-site basis. However, these adverse effects can be minimised by careful design of the pavement drainage; for example, by using no-dig permeable pavements that filter out most pollutants before they reach natural soils.

Contaminates in runoff are typically not at concentrations that can adversely affect most riparian tree species. Excess nitrogen and phosphorus in soils are quickly taken up by trees with oxygen rich rhizospheres, because osmosis can happen freely. When nutrients are available trees take advantage of the windfall. Additionally, robust resilient trees are able to metabolize contaminates (heavy metals, inorganic and organic compounds) into their carbon rich heartwoods.

Bioretention areas are widely used in North America to collect and treat runoff in landscaped areas. A study by Toronto and Region Conservation (2009) involved extracting and testing soil cores extracted from three bioretention facilities in the Greater Toronto Area. These varied in age from 2 to 5 years and showed metal and PAH levels comparable to nearby reference sites that were not affected by runoff. The pollution concentrations were below Ontario background concentrations. The testing was repeated at one facility after two years which showed no change in contamination levels. This tends to suggest that pollutant loads from small paved areas will not significantly affect trees.

Benefits of Permeable Paving with Cellweb TRP® Tree Root Protection

Research has clearly shown that the majority of pollution is removed from runoff within the permeable pavement structure (which will include the Cellweb TRP® tree root protection system). Thus the low levels of pollution that are realised from the base of a Cellweb TRP® tree root protection system are unlikely to damage tree health.

The reduced compaction and highly permeable nature of the Cellweb TRP® tree root protection system (see Fact Sheet 1) will help to preserve the health of trees within developments. In addition there are clear benefits in attenuating and treating rainfall runoff using permeable pavements combined with the Cellweb TRP®.

References

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Tree Root Protection Using Cellweb TRP®

Fact Sheet 4: Treetex™ Geotextile and Oil Pollution

Introduction

The Cellweb TRP® tree root protection system traps pollution in a number of different locations. This makes it robust and minimises the risk of pollution passing into the ground below when it is used as part of a permeable pavement. The Treetex™ geotextile is one part of this system that helps trap and treat oil pollution, especially when an unexpected larger oil spill occurs.

Treetex™

Treetex™ is a heavy duty needle punched non-woven geotextile fleece manufactured from polypropylene. Treetex™ is ideal for use in the tree root protection system as it is easily moulded to the shape of the aggregates used in the pavement and does not form a plane of weakness in the pavement construction. Elvidege and Raymond (1999) found that the greater the mass per unit area of a geotextile the less it is likely to be damaged. The Treetex™ is unlikely to be damaged by the traffic loads it will be subjected to.

Oil Pollution

Day to day small drips of oil pollution in permeable pavements generally trapped and treated in the joints and in the aggregate. However larger spills of oil can overcome this element of the system and the oil retaining capability of these systems has been shown to fail under certain circumstances (e.g. Puehmeier et al. 2004). This is where the Treetex™ geotextile can help trap the excess oil and allow it to degrade aerobically within the pavement construction. Tests have shown that Treetex™ will absorb 1.7 litres of oil per m^2. It provides a substrate on which bacteria necessary for oil degradation can survive.

Product Testing

Tests undertaken at Coventry University have concluded that the Treetex™ will absorb 1.7 litres of oil per m^2, which is four times more effective than standard geotextiles.

References

Elvidge CB and Raymond GP (1999). Laboratory survivability of non woven geotextiles on open graded crushed aggregate. Geosynthetics International 1999, Vol 6, No 2.

Puehmeier T, Coupe SJ, Newman AP, Shuttleworth A and Pratt CJ (2004). Recent Developments in Oil Degrading Pervious Pavement Systems-Improving Sustainability. In: Proc 5th Int. Conf. Sustainable Techniques and Strategies in Urban Water Management,6-10 June 2004, Lyon, France, 811-818

Tree Root Protection Using Cellweb TRP®

Fact Sheet 5: Cellweb TRP® and Road Salt Pollution

Introduction

Road salt is applied to roads and pavements to help manage ice and snow and maintain safe access. It is commonly referred to as "gritting" and has been used in increasing quantities since the late 1940's. Although it provides safety benefits and minimises disruption to travel, the adverse impact that road salt can have on trees in some situations is well known (Transportation Research Board 1991 and Forest Research 2011). Road salt is the most commonly used de-icing chemical in the UK. It is crushed rock salt and the main component is sodium chloride. Both sodium and chloride ions can be harmful to some trees if there are excessive quantities in the soil.

The amount of salt applied to roads has reduced over recent years. This is due to generally milder winters (although severe winters can still occur as in 2010/2011) and better management of where and when gritting is carried out.

Salt damage occurs to trees through contamination of the soil around roots or by salt spray. Salt spray is much more likely on roads with fast moving traffic such as motorways and trunk roads. It is likely to be less of a problem where vehicles are moving at low speeds. These low speed areas are where the majority of Cellweb TRP® is installed. Damage to trees occurs most frequently where large volumes of salt are used to de-ice the roads and pavements (Forest Research 2011).

Where the Cellweb TRP® system is used below a permeable surface rainfall will carry the sodium chloride into soil around the roots. The same will happen on traditional impermeable surfaces if the water is allowed to flow off the edge of pavement, for example into a swale. Permeable surfaces (and swales) will not remove sodium or chloride ions from surface water runoff (SPU, 2009). Neither will any other form of sustainable drainage system (swales, etc). However, the difference is that permeable surfaces and the Cellweb TRP® system do not concentrate the polluted water around tree roots. This dissolved pollution is therefore spread out over a wider surface so the load of sodium and chloride ions per m² of soil is reduced. This effect reduces the risk of salt damaging trees.

For example assume that salt is applied to a 10m by 10m area (100m²) at the rate of 20/gm² and this is washed off an impermeable area towards a tree root zone that has 1m² of exposed soil (1m by 1m). The load of salt being washed into the tree root zone will be 2000g/m². If th same area is constructed using permeable pavement the salt load into the soil below the pavement is only 20g/m² (Figure 1).

There is also evidence that permeable paving systems have the capacity to store and then distribute the chloride load over a longer time period than would be observed on a standard, impermeable asphalt pavement, therefore reducing acute levels at trees (Houle 2006).

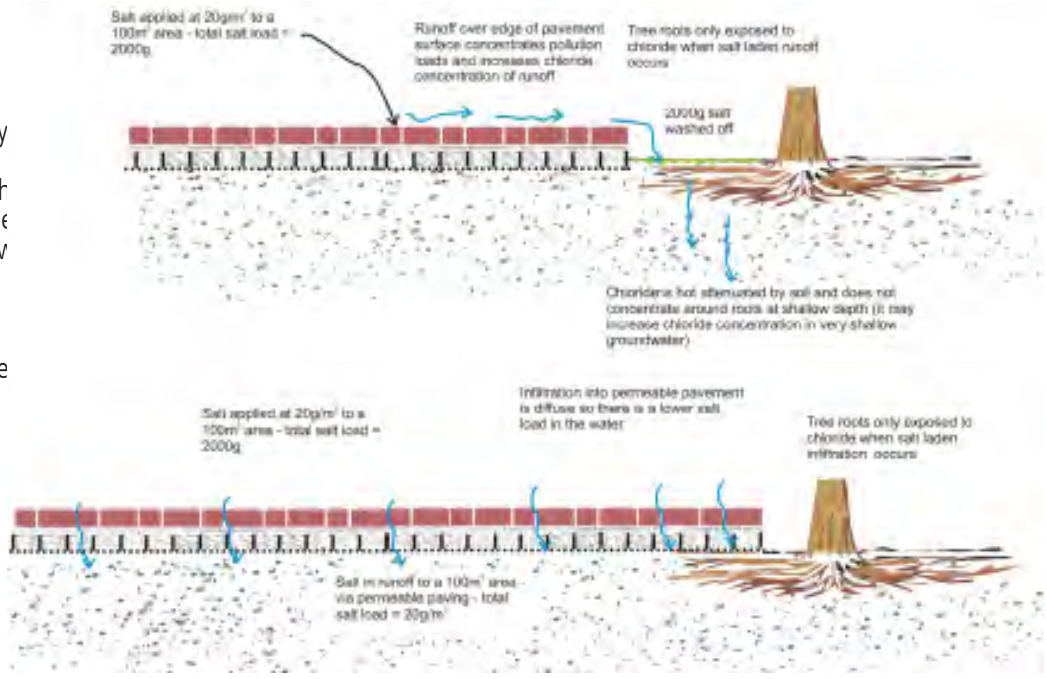

Figure 1: Use of permeable paving over Cellweb TRP® to reduce salt load to trees

Behaviour of Chloride in the Ground

Sodium chloride in runoff is a dissolved contaminant and is not removed by filtration or absorption in the pavement or soil. It does not accumulate in sediments or soils around infiltration systems (Datry 2003) and will pass straight through the vadose zone to the groundwater table (Pitt 1994). Having said that a study in Pennsylvania, USA (where there is frequent salting of pavements in winter) found that the level of chloride in infiltrating groundwater reduces rapidly when salt is not applied. The study concluded that it should not pose a risk to groundwater because of dilution.

Therefore chloride will not accumulate in soil around trees and shallow roots will only be exposed to chlorides during runoff events. The less frequently salt is applied the lower the exposure of trees to chloride.

Trees generally take up less water in winter and therefore if exposed to only a few instances of chloride contaminated water the effects may be minimal, for example in a small car park in the south of the UK. Greater exposure may be expected in a large supermarket car park in a more northerly location such as Scotland where salt treatment may be more frequent. In such instances the salt tolerance of the trees being protected should be considered (Table 1).

Tree Root Protection Using Cellweb TRP®

Fact Sheet 5: Cellweb TRP® and Road Salt Pollution

Icing on Permeable Surfaces

The nature of permeable surfaces means that hoar frosts occur more frequently on permeable surfaces but ice layers are thinner (CIRIA 2002). Snow also settles earlier and stays longer. More frequent hoar frost has also been observed in trial areas of various types of surface constructed as part of a Highways Agency research project. However because surfaces are well drained and generally do not have standing water more recent experience indicates that ice forms less frequently on the surface (Houle 2006).

Pervious concrete has been found to reduce the occurrence of freezing puddles and black ice. Melting snow and ice infiltrates straight down into the pavement facilitating faster melting which will reduce the number of salt applications required (Gunderson, 2008).

De-icing on Permeable Surfaces

Permeable surfacing and tree root protection is used in many cases where surfaces will have much lower levels of salt application than the main road network (e.g. car parks, courtyards, tertiary roads). A study in New Hampshire, USA, found that overall less salt was used on permeable surfaces. When compared to salt application on traditional pavements there was a 75% reduction in annual use on a porous asphalt car park (Houle 2006).

TABLE 1 - TOLERANCE OF COMMON TREE SPECIES TO SALT (FOREST RESEARCH 2011)

Tolerance	Species	Tolerance	Species	Tolerance	Species
Tolerant	Alnus Glutinosa	Intermediate	Acer Campestris	Sensitive	Acer Pseudoplatanus
Tolerant	Elaeagnus Angustifolia	Intermediate	Alnus Incana	Sensitive	Aesculus Species
Tolerant	Gleditsia Triacanthos	Intermediate	Crataegus Monogyna	Sensitive	Betula Pubescens
Tolerant	Pinus Nigra (all varieties/subspecies)	Intermediate	Carpinus Betulus	Sensitive	Cornus Species
		Intermediate	Fagus Sylvatica	Sensitive	Corylus Species
Tolerant	Picea Pungens	Intermediate	Fraxinus Excelsior	Sensitive	Larix Decidua
Tolerant	Quercus Robur	Intermediate	Picea Abies	Sensitive	Platanus X Hispanica
Tolerant	Robinia Pseudoacacia	Intermediate	Pinus Contorta	Sensitive	Prunus Avium
Tolerant	Salix Alba	Intermediate	Pseudotsuga Menziesii	Sensitive	Tilia Cordata
Tolerant	Ulmus Glabra	Intermediate	Sorbus Aucuparia	Sensitive	Tilia Platyphyllos
		Intermediate	Thuja Occidentalis		

Conclusion

Although permeable surfaces and the Cellweb TRP® tree root protection system do not prevent chloride and sodium ions reaching the soil around trees the evidence indicates that they will reduce the load of chloride that tree roots are exposed to. This is due to less frequent applications of salt and the fact that water infiltration from the pavement is diffuse and does not concentrate the chloride load.

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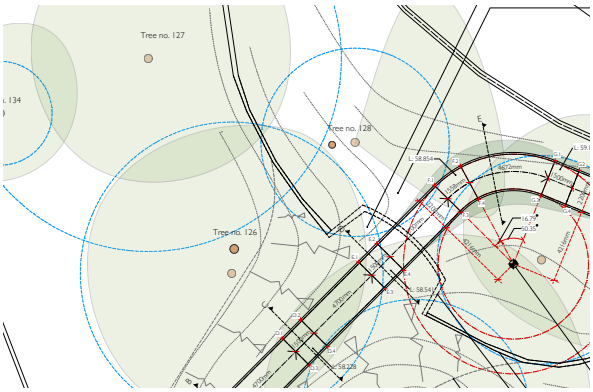
Cellweb® TRP

The Contractors Guide

Complies with BS:5837 | No Dig Solution | Adopted by Councils | 100% Success Rate | Cellweb®TRP Guaranteed | Independently Tested

What is Cellweb®TRP?

Cellweb®TRP is a cellular confinement system specifically designed for tree root protection. The system creates a stable load bearing surface for traffic or footfall whilst eliminating damage to roots through compaction and desiccation. The Cellweb®TRP system comprises of three specific elements; Cellweb® TRP, Treetex pollution control geotextile and an infill of clean angular stone. The system has been designed to combine the best possible products to create an unparalleled solution for tree root protection applications.



What is a Root Protection Area (RPA)?

The Root Protection Area is the minimum area around a tree which is deemed to contain sufficient roots and soil to maintain the trees viability. The RPA is calculated as 12 times the diameter of the tree trunk and 1.5m off the ground; for example a tree has a trunk that is 500mm in diameter and is measured 1.5m above the ground. This calculates that the RPA will have a radius of 6m (500mm x 12 = 6,000mm). The RPA is a radius relative to the tree trunk, but the calculation is based on the trunk diameter. This is used to protect all of the retained trees within and around the development.

What is a Tree Preservation Order (TPO)?

Tree Preservation Orders are put in place by local planing authorities in England to protect specific trees and woodlands in the interest of amenity. Preservation orders prohibit; cutting down, topping, lopping, uprooting, wilful damage and wilful destruction of trees as per The Town And Country Planning (Tree Preservation, England) regulations 1990 and 2012. If found guilty of tree cutting offences in the UK, the court can fine up to £20,000. In serious circumstances, a person can face unlimited fines if found guilty by the Crown Court.

How Cellular Confinement Works?

By confining the infill material, 3D Cellular Confinement Systems work by altering the angle of load distribution, reducing the load on the soil and increasing its bearing capacity. This ultimately minimises soil compaction and maintains an open soil structure. This is crucial for continued water permeation and gas exchange in the rooting environment.

What makes Cellweb®TRP the best solution?

- Cellweb®TRP is the only established guaranteed tree root protection system on the market in the UK.
- It Complies with BS 5837: 2012, Trees in relation to design and demolition/construction recommendations.
- It is the only independently tested system, ensuring compliance with recommendations made in BS 5837: 2012.
- Cellweb®TRP has had a 100% success rate on thousands of projects.
- Our in house tree root protection team will provide technical support both over the phone and on site.
- Our in house qualified civil engineers will provide site specific technical recommendations.
- An extensive bank of case studies is available to download for free.
- We offer free educational tree root protection seminars across the UK.
- Cellweb®TRP has been adopted by a number of local authorities throughout the United Kingdom.

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What the Guarantee covers and how to get your project guaranteed?
The guarantee covers the replacement of the dead tree(s) up to the value of £10,000 per tree. In the unlikely event the Cellweb®TRP System fails, the guarantee will also cover the replacement of the system up to £50,000.

To obtain the guarantee you will need to provide a copy of the arb report. Geosynthetics Ltd will then send a complementary technical recommendation. A scoping agreement will then be signed to clarify what tree(s) are guaranteed.

For more information please contact the team on 01455 617 139.

Why is stone so important, how can I source it and how much will I need?
In conjunction with Cellweb®TRP we recommend using 4-20mm of clean angular stone. Having an angular stone allows the stone to bind together providing rigidity throughout the cells and also allows pore spaces for the diffusion of water and gasses. Having a clean stone will ensure that fines do not clog the Treetex layer.

If you would like more information on the stone specification, please contact the team on 01455 617 139 however this can be sourced from your local quarry.

What is Treetex and what does it do?
Treetex is a pollution control geotextile developed to work in harmony with the Cellweb®TRP System. The heavy duty needle punched geotextile fleece is manufactured from polyproplyene. Treetex is ideal for use in a Tree Root Protection system as it is easily moulded to the shape of the aggregate and has been independently tested by Coventry University. The product has been proven to absorb 1.7 litres of oil per m^2 ensuring that the roots are not damaged by pollutants from the surface.

Do I need any specialist equipment for installation?
The system is very easy to install and simply requires a stapler, staples and pins to hold the panels down during installation. Please note on larger scale projects for speed of installation, a hydraulic stapler may be used.

What applications can Cellweb®TRP be used for?
Cellweb TRP is likely to be required in the following scenarios:

- For the construction of any new hard surface within the RPA of any retained tree on or bordering the site.
- For the construction of temporary ground protection where construction and foot traffic must pass through the RPA during construction. BS 5837 2012 – Trees in relation to design, demolition and construction recommendations states that: “New temporary ground protection should be capable of supporting any traffic entering or using the site without being distorted or causing compaction of underlying soil.”
- Where the use of ‘No Dig’ construction has been specified by an arboricultural consultant within the tree protection plan.
- Where Cellweb TRP has been specified in the architects or engineers plans and drawings.

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Free technical support from Geosynthetics Ltd is available

Our tree root protection team can offer support and advice in the following areas.

- Installation
- Overcoming changes in levels and other site specific challenges
- The Cellweb infill material – 'What stone and how much'
- Surfacing options for the Cellweb®TRP system
- Edging the Cellweb system
- Quantifying and pricing

All of the above services are free of charge and have been developed to ensure that you are provided with the required levels of tree root protection for your site. The advice and services have been given to ensure that you are able to provide an excellent service to your clients and do not fall foul to the tree protection law or planning conditions.

What is the delivery turn around time as standard?

Delivery turn around for the Cellweb®TRP system is 24-48 hours* dependent on location and volume purchased.

Which depth of Cellweb®TRP do I need?

Depth of Cellweb®TRP	Unit	Gross Vehicle Weight (GVW)	Application
200 mm	Kg	< 60,000	HGV & Unusual - Crane / piling rig
200 mm	Kg	< 50,000	Heavy Construction Traffic
150-200 mm	Kg	< 30,000	Standard Construction Traffic & Refuse vehicle
150 mm	Kg	< 16,000	Emergency Access & Tractors
100-150 mm	Kg	< 9,000	Delivery Vans
100-150 mm	Kg	< 6,000	Car Park: Cars & Light van
100mm	Kg	< 3,000	Domestic Traffics: Cars
75mm	Kg	< 1,000	Pedestrians (with cyclist) path

Can I use an alternative system?

Cellweb® TRP has a number of unique attributes and once this has been specified by architects and designers, please be aware that no other system can comply. For guidance on ascertaining if another system is suitable, please contact our team for assistance. A system failure can ultimately bring about the demise of the protected tree(s) and could lead to prosecution and unlimited fines.

Please be aware that if Geosynthetics Ltd have completed site specific calculations and provided a full technical recommendation, use of another product will void our engineered solution and the guarantee will no longer be applicable.

For further information and assistance with Cellweb Tree Root Protection, please contact Geosynthetics Ltd on 01455 617 139.

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Reinforcement with Cellweb® TRP

Application [11 RUR-CEL] Information For Calculation

Geosynthetics

Date:	
Client / End user:	
Designer / Specifier:	
Planning Authority:	
Project Title:	
Location:	
Application (or any additional information):	

Traffic information	
Vehicle Type (nb of axles)	
Axle Load: P (kN/axle)	
Wheel load: (kN/wheel)	
Vehicle Weight:(kg or Ton)	
Number of traffic passages:	

Area	
Area approx (m2) and/or Dimensions (m x m)	

Traffic (Please Tick)	
Regular HGV use	
Occasional HGV use	
No HGV use	
Unusual load e.g. crane or piling rig	
Occasional fire engines	
Bin lorries	

Existing Ground	
CBR (%)	

Existing ground	
Type of soil	
Granular Soil	
Cohesive Soil	
Peat Soil	

Type of Surfacing (Porous surface always recommended for TRPA)	**Surface to be used**	
	during construction	**after construction**
Block Paving+Sand Bedding		
Porous Tarmac		
Resin bound gravel + Porous Binder course Asphalt		
Loose Gravel		
Golpla System infill gravel		
Golpla System infill grass		
Sudscape		
Other		
Depth of Surface *		

*See drawing below