

FERGUSON
PLANNING



APPENDIX 2 – CONSTRUCTION TECHNIQUES



**Main Office: Shiel
House**
54 Island Street
Galashiels
TD1 1NU

T 01896 668 744
M 07960 003 358
E tim@fergusonplanning.co.uk **W**
www.fergusonplanning.co.uk

Glasgow Office:
69 Buchanan Street
Glasgow
G1 3HL

M 07586 807 973
E sarah@fergusonplanning.co.uk
W www.fergusonplanning.co.uk

NI Office:
61 Moyle Road
Ballycastle
Co. Antrim BT54
6LG



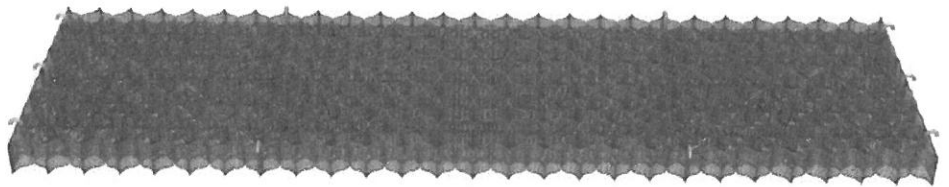
Cellweb®TRP

Why protect trees?

Trees provide a wealth of benefits within the urban environment including cleaning the air, prevention of flooding and moderation of the climate.

As a result, within the UK it is an offence to cut down, lop, uproot, top, wilfully damage or destroy a protected tree without authorisation. Fines, if the defendant is found guilty in a Crown Court, are unlimited.

To minimise the environmental impact and avoid legal proceedings, we offer the independently tested Cellweb®TRP system.



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 create an unparalleled solution to tree root protection applications.

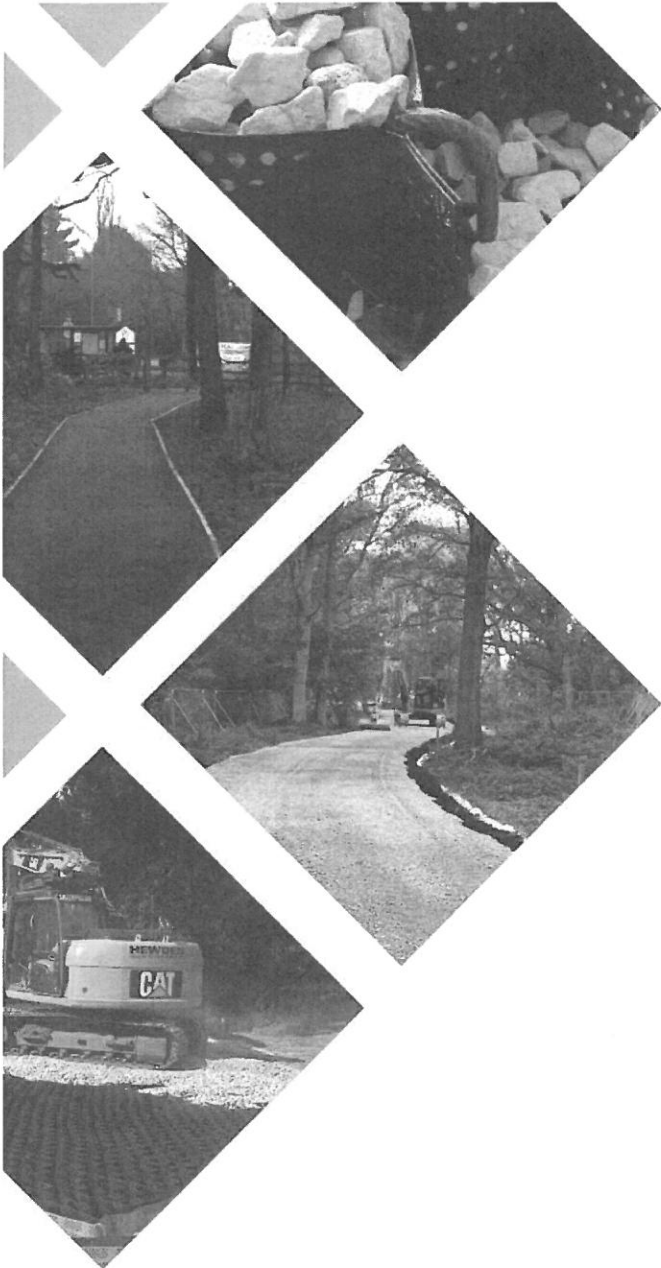
Cellweb®TRP is a no-dig solution that ensures that the load placed upon it is laterally dissipated rather than transferred to the soil and roots below. The use of Treetex™ pollution control geotextile allows for drainage and separation whilst preventing contaminants from reaching the roots.

The walls of the cells are perforated and when combined with the infill of clean angular stone, enables free movement of water and oxygen, ensuring that supplies to the tree roots are maintained.



Geosynthetics
Engineered Solutions

“Creating Innovative Solutions with Outstanding Products”



What makes Cellweb®TRP different?

With over 15 years of captured data and thousands of installations, the Cellweb®TRP system has developed a reputation for excellence.

We are so confident in our system, we offer a guarantee that covers the replacement of the trees and of the system itself. With Cellweb®TRP being quick to install and having a 100% success rate it is clear to see why the Cellweb®TRP is regularly specified by tree officers and arboriculturalists across the country.

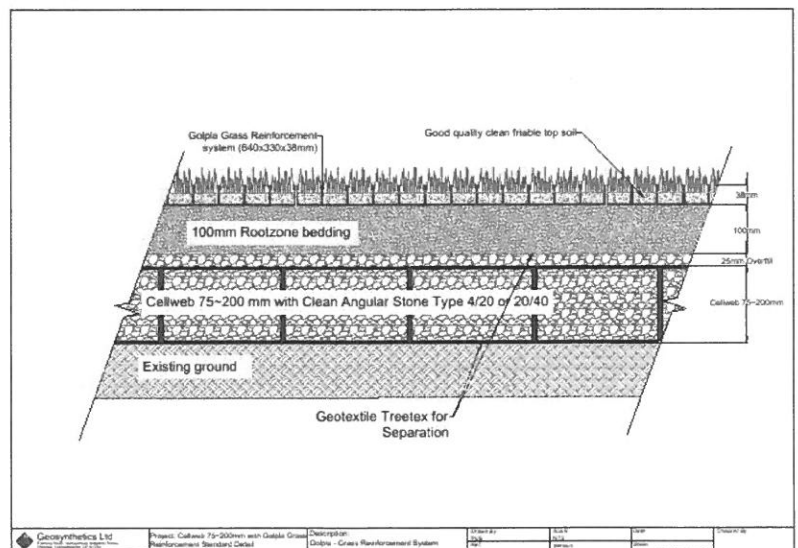
From the drawing board to installation, we are here to help.

We have been supplying the Cellweb®TRP system since 1998 and our technical team have vast experience with tree root protection and the associated legislation.

Delivering complete peace of mind to customers is our number one priority. As part of this customer care package we offer free on site consultations, technical recommendations and on site installation guidance on all projects.

Our in-house engineering team provide site specific recommendations to ensure the solution used is cost effective and environmentally sound.

For more information on Cellweb®TRP or Geosynthetics Limited please contact our sales office on 01455 617139 or visit www.geosyn.co.uk.



Introduction

Trees are an essential component of our built environment; they make for better places to live, play and work.

Retaining trees successfully requires their sympathetic treatment to respect the stem and crown we see above ground and also the roots we don't see but exist below ground to sustain the tree.

Innovation in construction methods and materials enables society to make efficient and effective buildings whilst respecting the natural environment around them. Innovation in foundation techniques has enabled buildings to be installed closer to trees than conventional foundations permit.

This note considers innovation in foundations, particularly screw piles that have a very low impact on trees.

Tree root systems

It is first important to better understand tree root systems. Trees do not have root systems like a carrot; rather than sending a root directly downwards trees send roots out horizontally from their stem. The best analogy is the foot on a wine glass. The wider the foot, or base, of that glass the more stable it is – the less likely it is to be knocked over.

The same is true of trees – a broad spreading root system provides the tree with stability and allows it to explore the soil for nutrients and water.

Tree roots therefore spread out radially from the tree trunk and most are contained within the upper 600mm of soil. It is also possible for trees to send roots to greater depth and some species of tree are better at doing this. Generally though, tree roots are found in the upper layers of soil where they can exploit the nutrients and moisture whilst having access to air.

Roots do not spread radially in a simple, wheel-spoke arrangement but in a random and irregular pattern subject to what they encounter in the ground. Roots tend to be thickest near the stem and then quickly taper in diameter to eventually form fine threads. Along the length of the root they continually divide in to many roots so making a network to maximise the resources.

Tree roots do not stop at the edge of the canopy either. Roots can grow to 2.5 to 3 times the height of the tree. But trees can tolerate the loss of some roots as the crown can tolerate the loss of some branches. The basic premise is that the further from the tree that loss occurs the less harmful it is to the tree.

The impact of conventional foundations

Conventional mass-filled concrete foundations tend to result in considerable root loss as they are installed in continuous trench excavations. These excavations sever roots that they encounter.

Conventional foundations tend only to be used where they are sufficiently remote from the trees. *BS5837:2012:Trees in relation to design, demolition and construction – Recommendations* gives guidance on how close that excavation can occur. In very simple terms that guidance says such foundations should not be used within a radius of the trees equivalent to 12 times the trunk diameter – a 1 metre diameter trunk therefore dictates excavation should be further than 12 metres from the tree.

But that doesn't mean that structures cannot be placed closer to the tree, it just means that an alternative foundation type should be used that does not result in so much root loss.

Alternative foundation types

There are a variety of foundation types that BS5837 recognises as suitable for use closer to trees.

Pad, or pile, and beam are the usual options as these require only small holes to be placed in the ground. To avoid harm to tree roots the beam must be what is referred to as 'non-intrusive'. That is to say that the beam that supports the superstructure should not be set in to the ground. This avoids the root loss that would be caused from the excavations required to set it in to the ground.

Another option is a series of mini-piles supporting a reinforced, and suspended, ground floor slab. There are specialist engineers and suppliers that can design these foundation systems. They are very effective as they elevate the floor slab above the existing ground level and require very little excavation – the root system remains intact and viable if installed correctly.

Innovation in foundation design

Building on the mini-pile principle is the use of what are commonly called 'screw piles'. These helical threaded steel tubes are, as the name suggests, screwed in to the ground by a specialist machine. The advantage they have over other foundation systems is that they require no excavation and nor do they place concrete near roots (concrete can harm roots if it comes in to contact with them).

Screw piles are inserted in to the ground by either a hand operated portable rig or by a machine mounted rig. Protecting the ground near to the trees can enable access for machines and avoid compaction and contamination of the soil.

The screw pile is of very narrow diameter so can pass between tree roots without disturbing them. In very sensitive locations, for instance within 1m or 2m of a large tree, it is feasible to undertake some pilot excavations to locate roots or, alternatively, a ground penetrating radar system can be used to locate roots. Pre-locating them ensures they are not damaged during installation.

The installation operation is very quick so the amount of time machines and construction staff are working in the rooting area is reduced to a minimum. Having supervised installation I can confirm that these screw piles can be installed within hours rather than the days it takes to install conventional foundations.

Once the screw pile is installed a load bearing framework is fitted to the pile heads. The framework is set above ground level and therefore avoids further excavation. The superstructure is supported by the framework. The open framework that supports the superstructure can also permit the suspension of services and drainage so avoiding the need for it to be installed in open trenches.

Keys to the success in using screw piles include:

1. Locate tree roots in advance of piling
2. Protect the ground to avoid compaction and contamination of root-bearing soil
3. Locate the load bearing structure above existing soil levels
4. Suspend services and drainage from the support framework
5. Continue to protect the ground around the foundations and continue to build the superstructure

Experience with screw piles

I have been involved in thousands of construction projects where foundations of varying types are needed near trees.

I have witnessed the installation of a variety of foundation types from the conventional continuous strip foundations, pad and beam, pile and beam, contiguous piling, and pile and suspended floor slab. All of these have their place.

As well as smaller projects, I have also been involved in a large project where we used screw piles as foundations for lodges, restaurant and facilities building at a major tourist attraction in the UK. These buildings were nestled amongst a mature, tree'd landscape where tree roots were present throughout the soil. The client wanted to ensure no harm to the trees so we sought out the least intrusive system, screw piles.

The planning consent was contingent on supervision of the pile installation so I experienced first-hand what is involved in that installation. It helped that we had a sympathetic installer (www.abcanchors.co.uk/) of the piles who understood the need to safeguard the trees.

At this project we observed the following:

1. The ground was protected by robust timber sheeting so the mini-excavator could operate on the soil.
2. Small trial pits were dug by hand at each pile location and confirmed the absence of roots (pile locations could have been altered to accommodate roots if found).
3. Each screw pile was inserted to the required depth
4. Measurements were taken to guide the final design of the load-bearing beams
5. The load-bearing beams were fitted
6. Services and drainage were suspended from the structure (and further suspended under timber boardwalks to take them out of tree'd zones)
7. The ground protection was uplifted from below the load-bearing structure, a geotextile membrane was laid and covered with 100mm of gravel.
8. Ground protection was extended around the building footprint for the superstructure build
9. The superstructure was built and services connected
10. All protective measures around the building were removed and the landscape restored.

That project was completed around 3 years ago and no adverse effects on adjoining trees are apparent. Given the proximity of the foundations to the trees the adverse effects would have revealed themselves very early. The trees continue to be monitored but the expectation of adverse effects revealing themselves is zero.

Conclusions

Conventional foundations close to trees can result in harm to roots and that is why guidance directs us to seek alternative foundation design.

There are several options available but the least harmful, based on experience of its use and monitoring of after effects, is the use of screw piles.

Screw piles avoid the use of concrete, can avoid roots, provide for an above-ground platform and are quick and clean to install.

Screw piles enable us to achieve structures near trees that ensure the long-term sustainability of those trees. I frequently recommend them where we need to safeguard trees.

Jago Keen, MSc, Dip.Arb., MArborA, MICFor.

25 August 2017

About the author:

Jago Keen has spent over 30 years in arboriculture, following his father in to the profession. Jago has experience of thousands of construction projects across the UK and Europe where trees need to be safeguarded. With a focus on finding solutions to ensure trees can be retained, but society continues to develop, Jago identified the use of screw piles for use to achieve foundations near trees. Jago was Chairman of the Arboricultural Association, the UK's professional body for arboriculture, from 2013 to 2016, is a Registered Consultant of the Institute of Chartered Foresters. He advises a wide range of clients including national housebuilders, NHS Trusts, private landowners, British institutions and Russian regional government.





www.carpenteroakandwoodland.co.uk

Carpenter Oak & Woodland
The Framing Yard
Loch of Lintrathen
Kirriemuir DD8 5JA

28th August 2017

Reference: proposed dwelling at Peel Wood

Carpenter Oak & Woodland were founded in 1987 with the purpose of conserving the historic timber framed buildings in the UK, learning about the ancient craft that formed them and promoting the use of green timber as a sustainable modern construction material. We have worked on some of the most prestigious and sensitive conservation projects over the last 30 years: the fire damaged roof at Windsor Castle, and the replacement roof at the Great Hall of Stirling Castle. Our experience in conserving informs our ethos and methodology in all aspects of our work.

We are accustomed to and expert at working in sensitive environments, none more so than the work our team undertook at Shackleton and Scott's huts in Antarctica. Working alongside conservationists, archaeologists and ecologists as part of a team is a field we have unrivalled experience in, within our industry. On home soil, our work is carried out in full respect of the relevant British Standards – in this specific case, BS5837.

In recent years, our Scottish team have undertaken work at Inverewe Gardens, Wester Ross, erecting an outdoor shelter nestled amongst ancient woodland with the use of a gin-pole. Limited and sensitive access are challenges we tackle on a weekly basis – our team transferred 80T of green oak to the 4th floor of the Brixton Department Store in 2016, without use of a tower or conventional crane. We relish these challenges.

Our company has a deep rooted appreciation for the natural materials which allow us to create our award winning buildings. We have a re-planting scheme, whereby for every tree harvested for our frames we replant 10. Our timber only comes from sustainable plantations. We use trees in their natural form, typified in the design of the proposed dwelling at Peel Wood - a cruck frame; formed with curved timber, following the natural growth of the tree - timber rejected by all but a few in the construction industry.



www.carpenteroakandwoodland.co.uk

Our team have erected frames with virtually every means possible; hand-erect; gin-pole; ropes and pulleys; manual lifting devices (Genie lifts, Roustabouts); telehandler; spider cranes; cranes; dual cranes; helicopters. We're constantly adaptable to the surroundings in which our frames are built, with safety paramount.

We commend all aspects of this project – the sensitive design, the use of timber in its natural form, and the intentions of the patron to nurture and respect the long term future of this woodland. Carpenter Oak & Woodland are well placed to bring this project to fruition, alongside Adam Elder, with the sensitivity it demands.

Yours faithfully,



Fergus Stuart
Sales Designer
Carpenter Oak & Woodland