Optera Structural Solutions

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Arboricultural method statement to install a root barrier

CLIENT ADDRESS: Crawford & Co., 1st Floor, Cassiobury House, 11-19 Station Rd, Watford, WD17 1AP

POLICY HOLDER ADDRESS: Heath Farm, The Dramway, Coalpit Heath, Bristol,

CLIENT REFERENCE: SU2204195

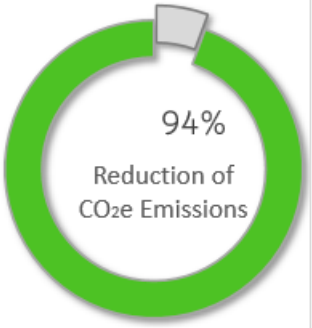
OUR REFERENCE: OPT-7799

PROJECT MANAGER: Steve Wiseman

DATE 11 September 2023

ETSIMATED DURATION: 3 weeks

Specifications of Barrier					
Barrier Type	**Length (m)**	**Max Root Depth from SI (m)**	**Minimum depth to be achieved with barrier (m)**	**Shortest distance between vegetation and barrier (m)**	**Shortest distance between barrier and foundation (m)**
Copper	25	N/A	3	8	2.5



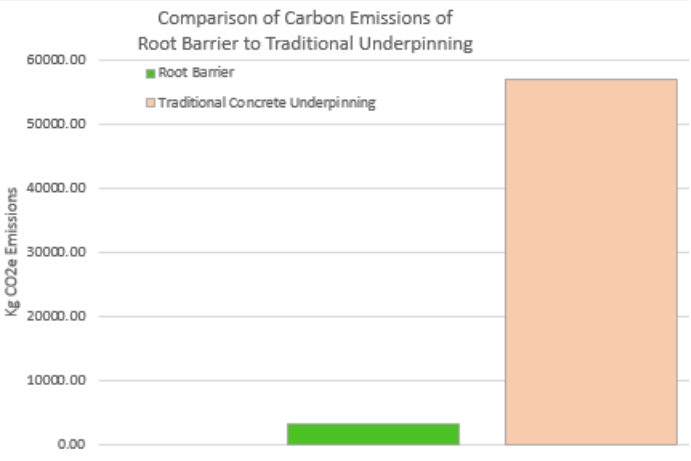


Figure 1 - Aerial plan indicating proposed length and alignment of barrier

Carbon Emissions

The installation of a copper impregnated geotextile fabric is the most carbon neutral option available to the insurance repair marketplace. The average tree absorbs 21 kg of CO_2 per annum based upon a mature species. Felling trees releases carbon and replanting saplings takes many tens if not hundreds of years to offset the effect of felling the original species.

Traditional engineering solutions consume vast quantities of carbon, both in their execution with plant, spoil to landfill and the vehicle movements to and from site. In addition, the manufacture of concrete generates in the region of 72kg of CO_2 per ton and contributes 8% of all manmade carbon output in the world today.

From Optera's own investigations and research, we estimate:

- The average underpinning scheme omits 12 tons of CO_2.
- The average piled raft scheme omits 44 tons of CO_2.
- PU injection treatment omits 3 tons of CO_2.
- By contrast, a 10m root barrier omits just 1 ton of CO_2.

Not only is the root barrier installation both less disruptive and much quicker to install then traditional engineered techniques, but it offers carbon savings of between 88 and 95% and is still 67% more carbon friendly than our closest innovative competitor.

Method Statement

- Set up site including compound area to be agreed with the client. This will be boarded, protected and secured with site fencing.
- Take down the side fence for access to the rear garden and board and protect along the barrier line.
- CAT scan the barrier line and any services are to be hand dug and exposed prior to machine excavation.

- Working from, the right-hand side, form a trench 400mm wide to the target depth and place arisings on boards. Excavation in the top metre of soil will be under supervision; any significant tree roots (Diameter >25mm) will be cut with a clean sharp saw on the side of the trench closest to the trees.
- Typically, once the first five metres has been dug and formed, line the trench with the copper impregnated bio barrier and backfill in layers, compacting with a hydraulic compactor attachment to the excavator to within 200mm of the surface.
- Repeat this exercise until all of the barrier is dug and installed.
- As the site requires, top up the trench with 200mm of clean graded topsoil and spread grass seed
- Off hire and clear plant and equipment from site.
- Reinstate fences, gates, etc. as agreed or specified and clean down the site.

Notes and Assumptions

i. It is assumed that the excavations will be undertaken in virgin ground with no requirement for trench support or additional protections.

ii. No allowance has been made for the temporary disconnection or relocation of services or drainage.

iii. No allowance has been made for replacement of any plants, trees, shrubs, etc. that may be necessarily damaged or destroyed during the installation of the root barrier, or gaining access to the work area – it is assumed that this will be dealt with by means of a direct payment by the Insurance company after assessment by the loss adjuster.

Intervention Explained

Clay-shrinkage subsidence is typically related to the encroachment of tree roots into the clay soils beneath the foundations of the property.

To ameliorate tree-root induced clay-shrinkage subsidence, the first option is generally removal of the implicated tree(s). However, where the tree(s) cannot be felled, for whatever reason, the next option would be to sever the roots between the tree and the property and form a barrier to prevent reestablishment of the roots.

The barrier will be positioned between the offending tree(s) and the affected part of the building, and will be installed to a depth designed to cut the tree(s) roots between the tree and the foundations; the act of excavation severs the roots, causing any roots beneath the foundations to wither and die. This prevents the tree(s) from extracting moisture from the clay supporting the foundations, allowing the clay to rehydrate and recover their natural moisture levels. Naturally, there is a period of time required for the recovery process to take place, but repairs can typically be undertaken shortly after the installation is complete.

The root barrier material favoured by Optera is a tough, copper impregnated geotextile membrane. This is normally installed using an excavator measuring no more than 2m in width. A trench is formed with the excavator and the arisings are either disposed of off-site or are stored on-site for use as backfill material.

The barrier is typically formed in 5m sections. Once the first 5m of the trench is excavated, the leading edge is bunded with a trench-sheet and the copper impregnated bio-barrier is installed, before backfilling with free-draining stone, or excavated arisings as appropriate to the site. Where 'as-dug' material is used, the backfill is placed in layers and consolidated with a compactor plate attached to the excavator. The process is then repeated until all of the designated barrier has been installed. If reinstatement works are to be undertaken by another contractor, Optera will fill the trench to the surrounding surface as a temporary measure to allow consolidation and avoid a trip-hazard until the permanent reinstatement can be completed. Any excess spoil will be cleared from site along with the plant, welfare, and protections.

How do Copper Root Barriers work?

In the UK the shrinking and swelling of clay soils, particularly when influenced by trees, is the single most common cause of foundation movement that damages domestic buildings.

Trees are known to cause clay soils to shrink by drawing water through their roots, predominantly during the Spring and Summer months. The shrinkage results in both vertical and horizontal ground movement that, when transmitted to a building's foundations, cause damage to the building's structure. The amount of shrinkage depends on the type of clay soil, the type and size of vegetation, and on weather patterns.

The moisture content of a clay soil tends to vary with depth. Closer to the surface there can be relatively large changes in soil moisture content between summer and winter as a result of evaporation from the ground surface, the drying effect of the Sun and general vegetation, including grasses. Such variations are normally confined to the upper 1m of the ground. However, where trees are growing within influencing distance of a building, then the soil moisture profiles will fluctuate much more widely through the seasons and to a much greater depth; in response, soil volume changes are amplified, and consequential building movements will be far greater.

It is quite possible that a building will coexist with nearby trees for many years without any noticeable damage, so what is the trigger for the onset of damaging levels of movement? The answer is usually a combination of the tree(s) getting bigger and developing larger leaf areas, but very often it is linked with a particularly hot, dry period of weather.

The process of clay-shrinkage subsidence is a reversable one and buildings experiencing damage in response to a period of hot, dry weather will typically see an improvement (crack widths will reduce) following a corresponding period of cooler, wetter weather when the clay is able to recover its moisture levels and swell back to its former volume.

The intention of the Bio-root barrier is to divorce the building (or more specifically the clay soils supporting the building's foundations) from the influence of the trees and thereby stop the seasonal soil moisture fluctuations, allowing the building to remain stable throughout the year.

The bio-root barrier is strong and flexible, with very high tear resistance, as well as being water-permeable, thus allowing the natural movement of water through the ground without impediment. The Copper contained within the core of the membrane also acts as a chemical repellent to the roots without constituting a hazard to plants or animals. The Copper foil securely bonded within the porous geotextile membrane, releases Copper ions into the adjacent soil by forming Copper Carbonate (verdigris); these signal adverse conditions to any roots growing towards the barrier, preventing a proliferation of roots close to the barrier. The levels of Copper generated do not constitute a burden on the eco-system or impact groundwater quality.

Outdated, impervious barriers divert rather stop roots and may prevent the movement of groundwater causing unintended consequences. The use of Optera's permeable barrier stops roots both by forming a physical impenetrable obstacle and by acting as a chemical inhibitor to the reestablishment of roots.

The multi layered membrane is welded together, retaining its flexible qualities, allowing it to be cut and effectively resealed to fit round buried services. The barrier material itself has a 60 year service life expectancy.

The chemical inhibitor effect prevents the proliferation of root against the barrier face, which was often a problem associated with conventional barriers, where increased moisture levels could encourage root growth.

Following installation of the root barrier, the trench may be backfilled with 20mm single sized stone, alternatively, and dependent upon site conditions, backfilling could be done with as-dug material, which would be placed and compacted with a plate-compactor mounted on the excavator arm. In specific circumstances, we may also use no-fines concrete on the structure side of the shield.

Some degree of surface settlement can be experienced following completion, where this happens, Optera will return to top-up the trench; typically this occurs within the first six months of installation.