Statement of Work

Optera Structural Solutions

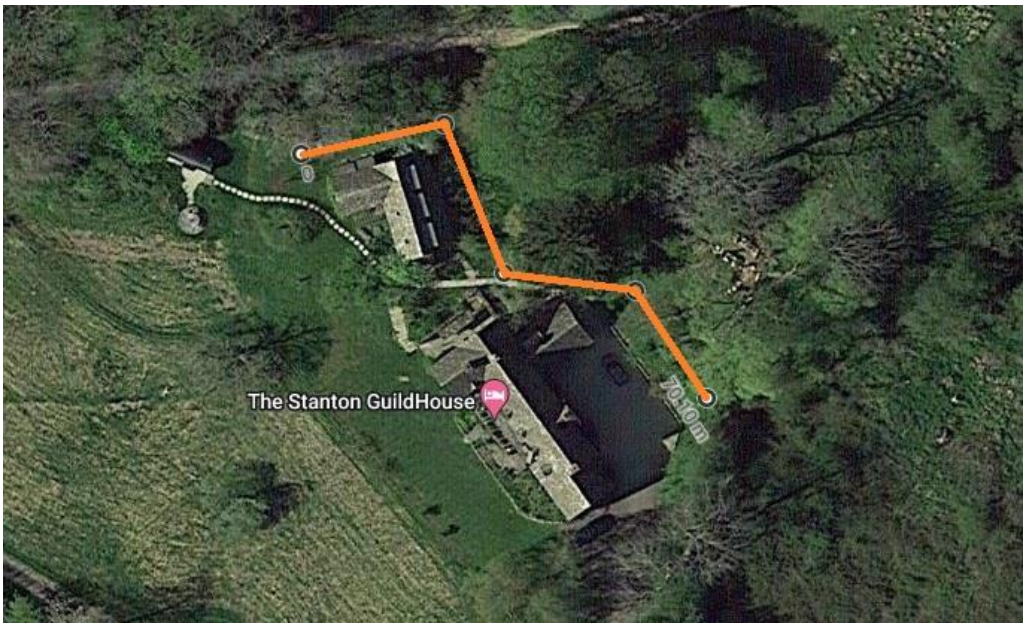
The Barn, Oxburgh, Fosse Way,
Stretton on Dunsmore, Rugby, Warwickshire, CV23 9JF
Telephone: 02476 553 776. Email info@optera,co.uk.

SOW OPT-7829 Agreement to install a root barrier for Crawfords

CLIENT ADDRESS:	**Cartwright House, Tottle Road, Nottingham, NG2 1RT**
POLICYHOLDER:	**Stanton Guildhouse Ltd.**
POLICYHOLDER ADDRESS:	**The Stanton Guildhouse, Broadway, Worcestershire, WR12 7NE**
CLIENT REFERENCE:	**SU2206126**
OUR REFERENCE:	**OPT-7829**
PROJECT MANAGER:	**Steve Wiseman**
DATE	**24 November 2023**
ETSIMATED DURATION:	**3 weeks**

Specifications of Barrier					
Barrier Type	length	Max Root Depth from SI	Minimum depth to be achieved with barrier	Distance between tree / Vegetation and barrier	shortest distance between barrier and foundation
Copper	**70m**	**3.0m***	**3.5m**	**Varies**	**Approx. 2.0m**

** - See comments below*



Aerial plan indicating proposed alignment of barrier

This scheme quotation is strictly confidential and for the sole benefit of Optera's client. The intellectual property contained within this document is Optera's alone and this document must not be passed in full or in part to another person, party, or organisation without the express written agreement of Optera, other than the Policyholder and insurance company responsible for the respective claim.

Proposed Works

The existing foundation on the main building is indicated to be set between 1.0m and 1.1m deep[1], with tree roots recorded to a depth of 2.5m.

The existing foundation on the Workshop building is indicated to be set between 0.81m and 1.9m deep[2], with tree roots recorded to the full depth of the boreholes at a depth of 3.0m.

The Plasticity Index of the clay soils is reported to be in the High, or upper Medium Volume Change Potential[3] range.

Reference to the NHBC tables will not help in this instance as these tables only provide foundation depths up to 2.5m deep. It is therefore recommended that the barrier design is based on the empirical root depth data and a barrier depth of 3.5m is used.

Since the barrier is within 5m of the implicated trees, we would recommend that the tree owners are notified of the works and they are advised to seek their own independent advice regarding the effect of the barrier on the stability of their trees. Where the affected trees are protected by Tree Preservation Order (TPO) it will be necessary to gain consent via a Tree Works Application prior to commencement of the proposed works.

Method Statement

- Set up site including compound area to be agreed with the client; this will be boarded, protected and secured with site fencing
- 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
- Form a trench 450mm wide to the target depth and place arisings on boards
- 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

[1] *CET Site Investigation – TPs 1 and 2*
[2] *CET Site Investigation – TPs 3 and 4*
[3] *NHBC Chapter 4.2*

Notes and Assumptions

i. No site visit has been undertaken and if instructed, then Optera reserve the right to visit the property to confirm the assumptions made within this report and amend the scheme accordingly

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

iii. **Notify the tree owners of the proposed Works and that they are advised to seek their own independent advice regarding the effect of the barrier on the stability of their trees – by Others**

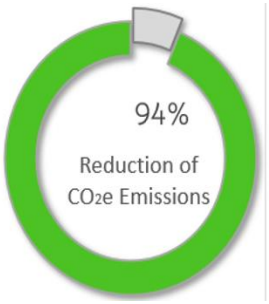
Carbon Emissions

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.

Warranty Details

All Optera whole life scheme designed barriers are issued with a 10 year company warranty, the details of which are seen below:

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STRUCTURAL SOLUTIONS

Warranty Note

Building Repair Warranty

Contractor	Optera Ltd.
Warranty Reference Number	xxxx
Supplier Registered Office Address	Seven Stars House, 1 Wheler Road, Coventry, England, CV3 4LB
Supplier Company Number	07468088
Supplier Job Reference Number	xxxx
Commencement Date	xxxx
Expiry Date	xxxx
Homeowner's Name	xxxx
Location of Works	xxxxx
Description of works undertaken and Warranted the "Works"	Works completed pertaining to Optera's Statement of Work. Dated xxxxx

Signed for and on behalf of Optera Ltd:-

Name:	Spencer Caizley
Sign:	Spencer Caizley
Position:	Director
Date:	xxxxx

Warranty

The Contractor warrants that for a period of 10 years from the date of completion of the Works detailed above, the Works undertaken and/or the materials installed shall be free from defect. In the event of a failure, proven to be due to faulty workmanship by the Contractor, or materials supplied and installed by the Contractor, the Contractor will make or cause to be made, all repairs necessary to enable performance in accordance with this warranty

Any dispute as to whether any defect or failure is attributable to faulty or sub-standard workmanship or materials shall be referred to an arbitrator, who should be a suitably qualified and experienced Chartered Engineer, or Chartered Surveyor (i.e. a chartered civil, or structural engineer (MICE/IStructE), or a chartered building surveyor (RICS))

This warranty is specific to the location and Works as detailed above and is subject to the following qualifications and conditions:

Qualifications

The Homeowner acknowledges that the Contractor shall not be responsible for remediation of any of, or any combination of the following causes:

1. The cost of routine maintenance, overhaul or modifications or loss or damage arising therefrom, or for which compensation/recourse is provided by legislation such as the Consumer Credit Act 1974;
2. Any wilful acts or wilful omissions of the Homeowner or persons acting on their behalf
3. Any loss of use, any consequential or economic loss of any kind or description whatsoever including, but not limited to loss, costs, damages, expenses or penalties for any reason;
4. Any damage caused by war risks, sonic booms or nuclear radiations;
5. Any damage or defect caused by wear and tear, sunlight, normal deterioration, neglect in maintenance, any change in colour, texture, opacity or discolouration or staining or superficial deterioration or marring of finishings or surface appearance or aging process;
6. Any claims first notified outside the period of this warranty or any claims for any defects that the Homeowner should reasonably have been aware of any defects for which the Homeowner receives a discount/reduction in the cost of the Works;
7. The use of the Works for any purpose other than that for which they were originally intended and as stated in this document;
8. Any claim, loss or damage caused by or consequent upon a peril that can be insured under a Household or Commercial Buildings or Property Owners Insurance policy whether insured or not, other than in respect of subsidence, heave or landslip as a direct result of defective workmanship or materials in the Works herein warranted;
9. Placement, erection or construction of anything on or through the Works without the written permission of the contractor;
10. Any costs, losses, expenses or damages for death, bodily injury, disease, illness or injury to mental health;
11. Any abnormal use of the Works or the imposition of any load greater than that for which the Works were designed in whole or in part, structural alterations, repairs, modifications to the Works during the period of this warranty unless agreed in writing by the Contractor;
12. Any claim, loss, destruction or damage caused by pollution or contamination;
13. Any claim involving cosmetic cracking or blemishes that do not affect the performance of the Works;
14. Any claim, loss, destruction or damage due to defective design;
15. Any issues caused by the materials after expiry of the manufacturers product guarantee.

Conditions

A. The Homeowner shall notify the Contractor in writing of any defect within 21 days of discovery and give the Contractor reasonable opportunity to inspect the alleged defect and the area affected. During such an inspection, the Contractor shall be permitted to take such notes, photographs and/or samples as he deems necessary

B. In the event of a failure attributable to workmanship, the Contractor's sole responsibility shall be limited to the costs of making good such repairs as necessary to enable the Works to perform as originally warranted.

C. Any work carried out to rectify any failure or deterioration covered by this warranty shall not extend the duration of this warranty.

D. If an alleged failure or deterioration is proven to not be the responsibility of the Contractor, then all costs associated with the investigation of such failure shall be borne by the Homeowner.

E. This warranty does not become valid or enforceable until such time as payment in full for the Works has been received by the Contractor.

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.