



## ULTIMATE SCREW PILING SOLUTION – FOR THE CONSTRUCTION INDUSTRY

### Arboriculture Support Document for Screw Pile Installation

*“Much of the damage that can be done to trees by construction occurs below the ground, and so if you are planning to build within an RPA (Root Protection Area) foundation design is critical. One of the most significant issues of building around trees is severing roots. In extreme cases this can cause the tree to fall over (the issues this might create for a new building are clear) but will more likely cause the tree to die slowly as its nutrient supply is cut off. Essentially this means that traditional trench foundations in RPAs are out, unless they will only clip a small area.”*  
Archio (2017)

The preferred alternative to traditional foundations when building in RPAs is to use small diameter piles. Piled foundations limit potential damage to roots during installation, and ensure no part of the tree bears the loads from the structure.

#### **Micro Piling vs Screw Piling**

Local Planning Authorities will often allow buildings or structures to be built within an RPA if they are supported by Micro Piles or Screw Piles.

There are many different forms of Micro Piles in use in the UK, mainly manufactured from steel or concrete or a combination of the two. They are typically pre-fabricated and driven in (using a percussion rig or vibratory action), or preaugured and cast in situ. Micro piles provide an excellent foundation system in the correct situation. Installing virtually any type of micro pile will create a hole up to 300mm diameter to the required depth which involves fully displacing or removing soil or tree roots in the intended pile location. This creates a suitable hole to allow a pile to be driven in or cast into place but at the expense of root damage.

Screw piles are a far less invasive foundation system. A screw pile consists of a slender, hollow steel shaft with a small number of steel helices (or screw threads) welded to it. As an indication, the largest screw pile offered by Ultimate Screw Piling Ltd – the 76R - has a pile shaft outer diameter of 76mm, a maximum helix diameter of 350mm, a maximum helix thickness of 20mm but can support 20 tonnes as standard.

Installing screw piles is a smooth and steady process whereby screw piles are rotated into the ground using a handheld or excavator mounted torque head. Installation occurs at a constant speed, inducing no vibration and requiring no pre-auguring.

A screw pile displaces a comparatively small amount of soil & tree roots compared to a traditional micro pile. The helices attached to the screw pile shaft are deliberately made from thin steel plate, with a blunt protruding edge to ensure that where possible, roots are moved out of the way during installation rather than severing them. The pile shaft is considerably smaller than that of a micro pile so again, displacement of soil and tree roots is minimised.

Screw Piles: **Keeping root damage to an absolute minimum**

Clearly there is no way that a pile can be installed through an existing root system without causing some damage, however it is key to the health of the tree to minimise this effect as much as possible. As previously discussed, micro piling requires the removal of all material in the position of the pile, including any tree roots encountered. Based on experience from years of pile installation, screw piling has been found to leave a good proportion of the tree roots intact following installation. It has been argued that screw pile installation acts to aerate the soil in which it penetrates, which has the added benefit of increasing oxygen supply to the root system. Compression of soil containing tree roots by traditional foundations has been shown to have a detrimental effect on the continued health of the tree. Compaction of soil reduces the passage of oxygen to roots during wet weather, and can cause the soil to become so dense that roots are no longer able to penetrate through it. Screw piles overcome this by supporting load directly on their constituent helices. These are placed well below the tree roots to ensure the root ball does not experience any loading influence or disturbance as a result of development.

### **Additional benefits of using screw piles**

When installed as a deep foundation (4m+), screw piles are resistant to water movement in the soil (heave/shrinkage) experienced as a result of water uptake from the soil by the tree and therefore are ideally situated for use in high volume potential clays. Installing screw piles as an alternative to deep footings in such soils is often considerably cheaper.

Screw Piles are installed to a predetermined torque during the installation process. A well-established relationship exists between installation torque achieved and the final load capacity of the pile, so the final capacity of the pile can be calculated quickly on site. As no further pile testing is required once the pile is in the ground, there is no need to place the tree at further risk of damage through the use of testing equipment.

No heavy plant is needed to install a screw pile (unlike the equipment required for concrete driven piles or similar where large rigs are required). Our excavator mounted torque head (capable of installing piles with a SWL of 250kN (factored)) can be operated from a long reach excavator, which ensures that the root ball experiences no loading as a result of pile installation.

Typically screw piles are used in combination with a cast concrete ground beam system / Steel ring beam and Block and Beam System. This system is generally flexible enough to allow pile to be adjusted on site if any large tree roots are encountered and need to be avoided.

### **Screw Pile Installation Method**

The typical screw pile installation method is described briefly below for reference.

1. Clear away vegetation in the area to be piled and check for underground cables, drains, pipes using appropriate equipment. Identify any major tree roots to be avoided in the intended pile locations.
2. Mount the powerhead to the excavator, remembering to connect the auxiliary hydraulics to the powerhead as per the detailed instructions supplied. Check for correct operation
3. Insert the upper end of the screw pile lead section into the anchor driver & secure with the drive pins supplied.
4. Position the anchor at the desired location and at a near vertical position screw the first helix into the ground.
5. When the first helix is buried, begin to make the angular adjustment to maintain verticality. Remember that final angular adjustments should be made before the second helix penetrates the ground.
6. When the installing tool becomes 300mm-500mm from the ground disconnect it from the section in the ground and reconnect it to the next extension.
7. Align the extension with the section in the ground and bolt them together. (Make certain that the bolt and nut are securely tightened)
8. Continue to drive the anchor and add extensions until the desired torque is reached and maintained; and the pile is installed to the correct depth and required height. It may be necessary to cut the pile to the desired length if it cannot be driven to a suitable depth in the ground.
9. Attach the terminations.

### **Industry Support**

*"Having specified and witnessed the installation of screw piles by this contractor I consider they must be one of the most tree friendly foundation systems around. Easy to install from low ground pressure machines working on ground protection they can be installed without material impact to roots. We recommend them for all root sensitive groundwork solutions"*

*ACA Tree Consultants, 2021 (Institute of Chartered Foresters)*