

# Landscape/Arboricultural Technical Note: PBA/02/08

## Ground Penetrating Radar for locating Tree Roots



### OVERVIEW

#### What does it do?

- Ground Penetrating Radar (GPR) combined with bespoke software provides quantified information on the depth and position of tree roots. The same GPR/software combination is also capable of locating and plotting underground services and other underground objects; without excavation or use of an Air-spade.

#### Why use GPR for Tree Roots?

- It avoids the need for excavation and or surface damage.

#### How accurate is it?

- GPR combined with bespoke software offers a high degree of accuracy for detecting, locating and plotting tree roots and other underground artefacts.
- Powerful software is then used to analyse the scan data providing an invaluable tool for the landscape management industry.

### GPR for Tree Roots: how does it work?

GPR has been in use for over 30 years to locate objects underground – a non-invasive method of detecting engineering and environmental targets, without the need for excavation. The use of GPR instrumentation and bespoke software for subsurface structural tree root mapping has now become available.

When Radar pulses encounter a boundary between objects with different properties the electromagnetic waves will reflect, refract, and/or diffract from the boundary in a predictable manner. These electromagnetic differences can now be analysed to enable the position of tree roots to be identified and plotted.

GPR can operate through all types of surfaces - tarmac, concrete, grass and water-bound surfaces.

The software analyses electromagnetic differences and provides reliable data printouts of depth and location of tree roots. It can also detect and analyse the electromagnetic differences in buried objects and services including plastic pipes, cables, and ducts. These are recorded as non-root reflectors.

**The quantifiable results can be used by professionals and arboriculturalists to assess tree root locations and condition and to provide technical information about the subsurface environment.**

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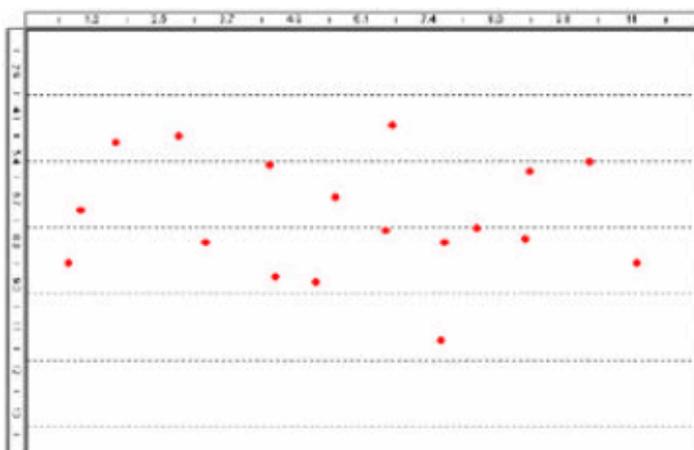
## Ground Penetrating Radar for locating Tree Roots



Ground Penetrating Radar using automated cart to locate tree roots

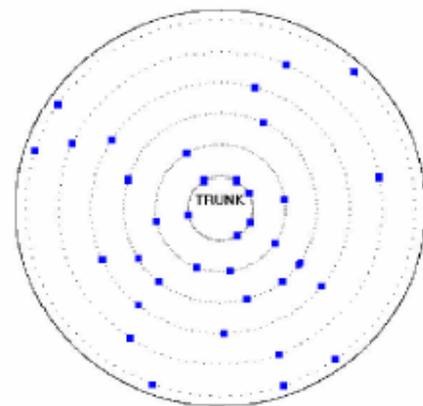


Hand use of GPR on banks



Virtual Trench – Simplified 2D Planar Depth Image of Root Location (top scale) and Depth (left scale) for a single line scan.

This type of image is automatically created when an original radargram is post analysed so that root positions are clearly shown.



Simplified 3D plan view of root layout & density to a depth of one metre created from a number of circumferential line scans.

The image can be further processed to show root positions at various depth 'slices' (ie up to 200mm depth, 200-300mm depth etc).

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### Summary

Ground Penetrating Radar with powerful software provides a full non-invasive investigation facility locating tree roots and associated drains and service runs:

- GPR behaves like a “Virtual Excavator”
- GPR can operate through all types of surfaces, tarmac, concrete, grass and water-bound surfaces.
- There is no damage to the turf or other surfaces
- Roots, drains and service runs can be located by running the equipment cart across the surface in a structured manner.
- The readings are analysed and the position of roots, drains or service are plotted.

### Applications

GPR can be used for locating and assessing tree root spread and position under various surfaces.

Provides a rapid, non-invasive inspection of subsurface structural roots from 10 mm diameter and associated drains and service runs.

Imaging of roots and services under covered soil such as: - water-bound and synthetic sports surfaces, concrete, bricks and asphalt; enables appropriate positions to be selected for planting trees or the installation of signs etc.

Will pin-point root locations in relation to drains and other services.

Detects previous trenching at a development site; for example, too close to the tree, i.e., tree root protection zone violation.

The presence of burrows and sets within proposed working zones can also be identified.

**The combination of electromagnetic radar technology and analytical software represents a powerful tool for landscape consultants, engineers, ecologist, arboriculturalists and other professionals.**