This booklet forms part of the Green Building Reference Manual for promotion of sustainable urban spaces.

Designed to assist landscape architects, civil engineers and consulting arborists, each booklet addresses a key aspect of achieving healthy tree growth in urban contexts. Scientific and technical issues are outlined then linked with available solutions and implementation.
“Conflicts between street tree root growth and hardscape are constraining the development of healthy and productive urban forests in California. Millions of dollars that could be better spent improving tree health are spent on hardscape repair and damage mitigation. To some extent, these conflicts are also expressed as a “downsizing” of California’s urban forest and a loss of benefits associated with diminished tree canopy cover. Community foresters make valiant efforts to extend the useful lifespan of problem trees, but conflicts with hardscape often result in the premature removal of trees, which engenders anger and sense of loss among residents. Furthermore, some property owners who are required pay for repairs may refuse replacements, thereby contributing to the loss of canopy and erosion of support for community forestry.”


Resistance of soil to root penetration, or soil compaction, will affect tree root growth.

3.1 MANAGING TREE ROOTS

Key issues

While we need trees within our cities – to provide shade, reduce the heat-island effect, clean the air and house wildlife – preventing tree roots from interfering with infrastructure is an on-going issue. The most effective solution is to direct tree roots away from surrounding infrastructure and services.
The key points about how tree roots function are these:

- Roots have two main roles—anchoring trees in the ground and collecting minerals, oxygen and moisture to supply the tree. The roots are also a store of moisture and nutrients.
- The root cap is a mass of cells at the tip of the root. Roots grow by lengthening cells behind the root cap, forcing the root cap through the soil.
- Minute root hairs sprout behind the growing tip and absorb soil moisture.
- Roots grow where water, minerals and oxygen are found in the soil which is usually in the surface layer of soil. Hence the largest concentration of feeder roots exists in this zone.
- Tree roots can be guided to grow in certain directions to avoid disrupting surrounding infrastructure, with minimal impact on the tree.

“Tree roots are opportunistic, seeking out favorable growing conditions. Moisture trapped beneath impermeable pavements, oxygenated sand layers, moist conditions in service trenches, cracks in road pavements and curbs—these are some areas that tree roots will explore to satisfy the life needs of the tree.”

“A statewide tree assessment in New Jersey estimated that 25% of street trees were involved with sidewalk damage.”  
Journal of Arboriculture
Approaches to managing tree roots

Root barriers are typically used to guide roots away from infrastructure and can also protect pavements, footings and kerbs from cracking and lifting. Made from either virgin or recycled industrial polymers, root barriers come in various forms and sizes, including modular units and more flexible linear material. Ribbed designs predominate however the linear material is also available in dimpled and smooth forms.

“...comparing modulated root barriers with control trees. ‘Trees with root barriers were able to withstand higher forces than the control trees. It appeared that the reason for this increased resistance was deeper rooting of the barrier-surrounded trees.”

Journal of Arboriculture

Root barriers are best laid before a tree is established although often the barrier can be retrofitted around mature or existing trees. Retrofitting root barriers must be done with extreme care, and preferably under supervision of a qualified consulting Arborist. Severing tree roots can have a detrimental effect on tree health. Overall root barriers are beneficial for trees. Roots are protected, a deeper root system is encouraged and the tree gains greater drought tolerance and improved stability.

Linear root barriers - vertical ribs for root guidance

Continuous root barriers are available incorporating integral, moulded vertical ribs designed to guide exploring tree roots away from nearby services, pavements and building infrastructure. Controlled research has demonstrated convincingly the effectiveness of vertical ribs in diverting tree roots downwards. This high density root barrier is made from 100% recycled post-industrial material and is available in various depths to suit different circumstances.
For example, root barrier in 300mm deep rolls are suitable for applications where tree roots only need to be deflected fairly superficially such as to protect a standard pedestrian kerb line from surface rooting. Depths of 600mm and 1000mm are also available for the protection of paved surfaces, shallow service ducts and utilities. A high strength 2000mm deep root barrier has been developed for deeper applications, for example in new service infrastructure projects, business parks and housing developments. Fig 3.1.7

An important feature of this product is the flexible design which allows the barrier to curve around obstacles but be rigid enough to hold its form when backfilling. It also protects the tree when pavement reinstatement works are carried out.

The use of root barriers encourages a tree to develop a deeper root system, in turn providing greater drought tolerance and improved stability. The root barrier should be installed vertically in a continuous length in a narrow trench dug on the tree side of the pavement or kerb with the top edge flush with the finished ground surface. The root barrier should be positioned so that the ribs run vertically. The trench should be backfilled and tamped sufficiently to avoid later subsidence. The barrier should not be torn or pierced.

**Linear root barriers - smooth**

Non-ribbed root management barriers are available for larger applications requiring the protection of infrastructure and services, and is available in both virgin and recycled versions. Fig 3.1.8

Linear root barriers are manufactured at various thicknesses. Walls of 1.0mm provide superior protection of pavements and services and successfully guide roots. Fig 3.1.9
Modular root barriers

Preformed, ribbed modular units are also available and incorporate many critical features such as tapered sides, prominent root training ribs, no joins for root penetration and ground locking panels to resist root heave. These units may be used to protect pavements and hard landscaped areas, diverting root growth downward and outward.

Installers report that these units are simple and quick to install, however designers and contractors must ensure that an appropriate model is selected, relative to the mature size of the tree species.

These barriers may be used in conjunction with other products including structural root cells, irrigation systems, tree grilles and guards.

Fig 3.1.10 - Loading soil into Root Director.

Fig 3.1.11 - Positioning tree within modular Root Director.

Fig 3.1.12 - Preformed, Modular Root Directors are robust and simple to install.

Fig 3.1.13 - Healthy trees growing in Root Directors in road median.
Water Harvesting with Root Directors

The recent focus on Low Impact Development and the necessity of better utilisation of water resources has led to the development of modular Root Directors that have integrated water harvesting capacity. These patented units carry forward the results of decades of research into tree root behaviour, resulting in tapered sides, root diversion ribs, ground locking ledges and one piece construction, with the addition of molded water distribution channels. These rain channels are connected to drain pipes from house roofs or road gutters, and distribute water evenly around the shoulder of the tree root ball, for dispersion throughout the root zone. Certain fundamental design rules must be followed when installing these Water Harvesting Root Directors, in view of sufficient drainage of surplus water, and correct infiltration.

These units are designed for residential and commercial applications, particularly where trees are being planted in grass verges in proximity to a hard paved area, with available connection to surface water run off. Harvesting and utilising rain water as close as possible to the point of catchment, remains one of the most cost effective ways of reducing storm water run off, stream erosion and resultant turbidity, and restoring pre-development flows to urban areas, both new and old.
ROOTDIRECTOR C SERIES

Benefits

- Integral Lawn Edge
- Tapered sides
- Tough molded construction
- Recycled polymer
- Protection for paved surrounds
- Encourages deep root growth
- Improved drought tolerance
- Greatly enhanced tree stability
- Integral ribbed construction which prevents root swirl
- Compatible with GreenBlue tree pit products
- Simple to install

Modular Root Management Device for Urban Trees

Trees planted in urban settings often require root systems to be directed below the level of hard pavements and road curbs, to prevent costly damage due to root heave. Once a road pavement surface or road curb is broken, water penetrates and encourages further shallow root growth, and the extent of pavement damage escalates rapidly. Often the most economical solution is to remove the tree, to the loss and detriment of the community and environment.

Planting trees with a properly designed root management system is a small cost to pay compared to the cost over time of infrastructure repair, not to mention litigation.

The new C series Root Director range carries forward the function of the original RD640 Root Director, including tapered sides, root training ribs, and seamless sides, with the additional benefit of an integrated circular lawn edge at the top surface for a neat finish to your project. Root Director C series is available in two sizes to suit the most popular rootball dimensions.

RDC600

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ROOTDIRECTOR W SERIES

Benefits

- Unique Patented Water Harvesting Function
- Integral Lawn Edge
- Tapered sides
- Root Training Ribs
- Tough molded construction
- Recycled polymer

Water Harvesting Root Management Device for Urban Trees

The new, patented Water Harvesting RootDirector is an extremely cost effective way of reducing stormwater load on infrastructure while enhancing growth of trees in urban environments, and protecting infrastructure.

Every tree in a suburban street verge setting can draw rain water from house roofs, or the road pavement. This brilliantly simple device encourages deeper rooting, protects pavements from tree root damage, and helps to restore pre-development flows in our highly impervious hardscaped areas. Along with this, implementation of the RootDirector W series can assist in reduction of down stream turbidity and erosion.

The patented W series RootDirector range carries forward the function of the original RD640 RootDirector, including tapered sides, root training ribs, and seamless sides, with the additional benefit of an integrated circular lawn edge at the top surface for a neat finish to your project. RootDirector W series is available in two sizes to suit the most popular rootball dimensions. The water distribution channel can be accessed for maintenance and cleaning without disturbing the tree root system, as it is external to the RootDirector.

 RDW600

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Designed for the protection of pavements and hard landscaped areas, the ribbed RootDirector prevents root swirl and diverts root growth downward and outward, thus avoiding the unsightly and hazardous root damage so commonly seen in urban areas.

The RootDirector's rigid, one-piece construction makes installation simple. As an integrated product within the treepit system, it is compatible with the RootRain irrigation system, Strata Cell® load bearing soil structure and our extensive tree grille and guard range.
**Benefits**

- Deeper root system means greater drought tolerance and improved tree stability
- Deeper root system is not vulnerable to de-icing salts, used extensively on footpaths and cycle paths
- Protects pedestrian kerbs from root heave
- Can be retro-fitted around recently planted trees
- Protects tree when pavement re-instatement works are carried out
- Easy to install, no specialist equipment needed
- Available in three popular depths; 300mm, 600mm and 1000mm
- Ribbed construction prevents root swirl and directs roots downward and outward
- Flexible design allows the barrier to curve around obstacles but is rigid enough to hold its form when backfilling
- ReRoot jointing tape will ensure root-proof joints

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**Linear Root Barrier with Integral Molded Root Training Ribs**

The ReRoot 300 linear ribbed root barrier has been designed for applications where it is not necessary to deflect tree root systems too deeply. This high density root barrier is supplied in 300mm deep rolls. The barrier will deflect the growing roots downward sufficiently to protect a standard pedestrian kerb line or paved sidewalk from surface rooting.

ReRoot 600 and ReRoot 1000 products are ribbed root barriers designed for the protection of paved surfaces, shallow service ducts and utilities. The numbers 600 and 1000 denote the depth of the root barriers in millimetres.

This versatile root management system can be used to surround individual or groups of trees because the ribs are proven to divert lateral root growth downwards. They are also used as an interlock when joining roll ends. Many local authorities now state in their planning policy that trees planted within 3m of a paved/hard surface that will be adopted by the council must be lined with a root barrier. This protects the pavement in the long term and the trees’ root systems in the event of pavement excavation.

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ROOTSTOP RS10/RS20 SERIES

Benefits

• 100% Recycled Polymer
• Environmentally Friendly
• The RS 10 Series protects kerbs, pathways and pavement from intrusive root heave
• The RS 20 Series guides roots away from services and infrastructure
• Retrofitting around recently planted trees
• Easy to install, no specialist equipment needed
• Flexible design allows the barrier to curve around obstacles
• Barrier jointing tape will ensure ‘root-proof’ joints when joining roll ends

Linear, High Density Plain Root Barrier

RootStop™ root management barriers are continuous, non-ribbed root barriers designed for the larger application of protecting infrastructure and services. This product range has been used extensively on many projects around Europe & Australasia, particularly in new service infrastructure projects, business parks and housing developments.

RS10 series RootStop is available in depths of 450mm and 900mm. The RS10 series have a thickness of 1000g/m² or 1mm. Made from 100% recycled HDPE this is a great environmentally-friendly solution.

RS20 series RootStop is a high strength root barrier for deeper applications, and is available in depths of 1500mm and 2000mm. The RS20 series have a thickness of 2000g/m² or 2mm. Similar to most of the GreenBlue range, this is an environmentally-friendly solution (made from 100% recycled HDPE).

RS20 RootStop is rigid enough to hold its form when placed into a trench, and is available in depths of 1500mm and 2000mm. This is a big advantage as it will not be dragged downward during backfilling. Market leading puncture resistance and strength mean that this is the root barrier of choice for specifiers and utility companies requiring root free service corridors.

The high puncture resistance of RS20 allows easier compaction close to the barrier ensuring an excellent product/soil interface.

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The GreenBlue Name

Our name reflects our passion – to help make our cities more sustainable. From our dedication to research and development and hands-on experience in the field has come a firm belief that there are ways of successfully integrating ‘green utilities’ – trees, soil and water – into urban design to make our cities greener and more liveable.

The GreenBlue Vision

Our company vision embraces a world where sustainable green space is within reach of every person, every day – and natural resources are utilized (not wasted) for the benefit of mankind.

Trees in Cities

One of the key focus areas of GreenBlue is green utilities. Trees as green utilities play a major role in maintaining sustainable ecosystems in our cities and should take precedence in urban planning and design if we, and our generations to come, are to reap the benefits.

Aiming to significantly improve urban planting success and increase urban forest canopy, GreenBlue researched the reasons for premature mortality in urban trees and poor tree growth in urban environments. We identified the key issues, devised solutions and designed practical products and systems. Successfully!

Green Walls

Included in the GreenBlue range of green building products is the European brand of green wall trellis systems – Brandmeier Green Walls. This innovative range opens up a whole new dimension to your urban landscape designs.

Greening of facades, pergolas and garden spaces is an ecologically sound method of taking your project beyond the ordinary. Greening of compacted urban landscapes and brownfield sites has an ever increasing importance.
Global Partners - Combined Experience

Collaboration with global research and distribution partners over the last two decades has placed GreenBlue systems at the cutting edge of sustainable tree pit solutions for cities. CityGreen® works closely with renowned European organizations such as Greenleaf (United Kingdom, Germany, Ireland, and Spain) and Scandinavian company Milford (Denmark) and is quickly becoming the North American and Australasian market leader in specialist green technology systems.

Local authorities, arboriculturists, landscape architects, civil engineers and other related professionals increasingly collaborate with GreenBlue in implementing current best practice in green technology. As the industry market leader in specialist green building products, we are able to offer the results of 18 years of frontline experience in the field, exhaustive research, product development and field trials. Our support service, unrivalled in the tree planting world, can help you to achieve your vision.

Research and Development

Ongoing research and development is a key to the growth of GreenBlue with knowledge gained in laboratories and field collaboration construction sites being shared with industry partners. As a company, GreenBlue pursues the current boundaries of design relentlessly to bring to the market proven engineered green building systems that provide optimum solutions for urban planners.

Training and Accreditation

Long term success of engineered green building systems is directly impacted by the quality of installation. Not only is the health of trees and shrubs but also pavement integrity and storm water function in danger of compromise, with potentially dire consequences, if installers are not competent in best practice installation.

For this reason, GreenBlue has developed a unique accredited e-learning program. Installers may complete this comprehensive training course online to gain Arborsystem accreditation. This accreditation status is part of the prerequisite package for product warranty recognition and is further evidence of the dedication of GreenBlue to the Green Building Industry.

Technical Support

GreenBlue strives to provide world class support for designers and installers of the various green building systems available. Complete suites of drawing files in 2D CAD format and PDF are available to designers, free of charge.

Detailed product and installation specifications are available for inclusion in project designs, many of which are fully editable. GreenBlue consultants are also able to obtain independent engineering advice on behalf of clients, utilizing qualified engineers with key experience in the use of GreenBlue green building systems.
Leadership in Energy and Environmental Design (LEED) is an internationally recognized green building certification system, providing third-party verification that a building or community has been designed and built using strategies intended to improve performance. Metrics used include the following: energy savings, water efficiency, CO2 emissions reduction, improved indoor/outdoor environmental quality, and stewardship of resources and sensitivity to their impacts.

Developed by the U.S. Green Building Council (USGBC), LEED is intended to provide building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.

Widely accepted in North America and Canada, LEED uses a points-based system to guide design and measure performance. The higher the number of points awarded to a building or community, the higher its assessed sustainability. Not only is this expected to increase asset value and reduce operating costs, in many cities, LEED ratings qualify for tax rebates, zoning allowances and other incentives.

Using GreenBlue StrataCell® Modules can help clients earn additional points in the categories of: creating sustainable sites, water efficiency, energy and atmosphere, material and resources, indoor environmental quality, neighbourhood pattern and design and green infrastructure and buildings.

If your building project is a candidate for LEED credits, review our LEED Rating System Checklist. Your project is a viable candidate for certification if it meets all prerequisites and can achieve the minimum number of points necessary to earn the credits.
ArborSystem

The definitive urban tree pit package

The GreenBlue ArborSystem brings together the key elements of successful tree pit design and simplifies the design and installation process for specifiers and installers. By utilizing our ArborSystem CAD library (within the resource section of the GreenBlue website), landscape professionals can combine root management, structural soil components, aeration, and irrigation - in a single package – and then choose an appropriate above ground surface grille and vertical guard to match their project.

Since its inception and development over recent years, the ArborSystem integrated tree pit product package has proved itself in many demanding locations. For many landscape specifiers, ArborSystem has become the system of choice for integrating trees into the urban environment.

By utilizing Arborsystem, landscape designers can:

- Ensure product compatibility
- Drastically reduce time spent on specifying, quoting and ordering
- Adapt a system to suit differing location and budget constraints
- Demonstrate to clients a professional long term approach to tree planning and management issues
- Benefit from our onsite support service for peace of mind.
Sketch Grid
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Poland
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Scandinavia