



Managing the Root of the Problem

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URBAN
Establishing the future urban landscape

The Dilemma of Unmanaged Roots

Every year, millions of urban trees die prematurely or are removed due to infrastructure damage and/or public safety concerns caused by poorly managed roots. This problem is largely a result of improper planting techniques, and although specific causes vary, there are some particular issues that account for the majority of issues - one of which is dysfunctional root systems.

It's an undeniable fact that we need trees in our cities. But preventing tree roots from interfering with utilities and other infrastructure is a major ongoing issue.

Conflicts between tree root growth and paved surfaces are constraining the development of healthy and productive trees in our cities. Millions of dollars each year are spent on pavement repair and damage mitigation, that could rather be spent improving tree health. These conflicts also reflect a downsizing of urban tree canopy and the loss of benefits associated with diminishing urban forests.

So why do the roots of urban trees become so problematic, and what are dysfunctional root systems doing to the health of trees?



Millions of dollars are spent on repairing hardscape damage every year.



The Dilemma of Unmanaged Roots

Arborists and researchers regularly study failing trees for signs of disease, insect damage, and other stresses, in an attempt to establish why trees are failing so that measures can be adopted to help future tree populations. Obvious areas of examination such as leaves and bark are aspects that offer important information into the health of a tree. Not so obvious underground aspects of an examination however, can present equally as crucial knowledge into why a tree may be failing, and prove how some trees are being strangled by their own roots.

Flawed root systems and inadequate planting practices can shorten a tree's lifespans by as much as 80% (The Underground Epidemic Killing our Trees). This confirms the old saying that "trees that are ugly above ground are usually even uglier below ground". It's the ugly belowground conditions that the University of Minnesota's research was determined to uncover.

Gary Johnson, a professor of urban forestry at the University of Minnesota, realized that in many cases the tree's roots were wrapping around the base of the trunk, making it difficult for water and nutrients to access the tree later in life.



Poor root management has caused this trees root system to colonize immediately underneath the paving stone roadway. The subsequent pavement damage has left behind a multitude of costly damage.



The Dilemma of Unmanaged Roots

This problem is referred to as stem-girdling roots. A stem-girdling root is a type of dysfunctional root that is growing against a tree's trunk, squeezing or compressing the stem (The Underground Epidemic Killing our Trees). They encircle or run tangential to a tree's stem, eventually compressing the woody and nonwoody tissues of the stem (Gary Johnson). This occurs when the trunk flare is buried deep in the soil. Circling roots tend to grow close to the surface near the trunk, and hence wrap around the trunk flare area.

The degree to which trees are impacted varies with severity of root encirclement, site growing conditions, weather, age, and size of tree. In some cases, trees have completely snapped at the point of constriction.

Research was determining that such problems were being found in field-grown balled and burlapped trees, as well as container-grown trees - meaning that the issue couldn't be traced to a single production method. It was recognized as a widespread problem usually originating at point of early growth in the nursery, according to Gary Watson & Angela Hewitt of the Morton Arboretum.



Stem-girdling roots are a huge risk to trees that can often kill them before they reach maturity.



The Dilemma of Unmanaged Roots

To prevent these disasters from occurring, landscape architects and other specifiers must demand better planting and nursery growing practices. Planting specifications should display the top of the root ball flush with the ground, and should direct the contractor to remove any soil above the trunk flare and main roots, as well as any girdling roots, before planting.

In past years, nursery trees were usually grown in fields and later transplanted with bare roots, making it easy for the grower to inspect the roots and plant the tree properly with main roots and developing trunk flare close to the surface. It's now common for containers to be used for the growing process, even to start the growth of what are claimed to be field-grown trees.

Girdling and other root swirl issues occurs in container-grown trees when a root reaches the wall and curves in a new direction to continue its growth. This curve forces the root to grow in a circular motion along the planter wall.



Appropriate nursery planting and growing conditions are crucial.



The Dilemma of Unmanaged Roots

Container-grown trees must have roots pruned when transplanting to larger planters in order for the root system to release the impression of the smaller container. Even still, root swirl may still continue in the larger planter, creating numerous sets of circling roots.

"Urban trees are already subject to continual natural and manmade stresses, which are all conditions that deviate from optimal growth. Stem-girdling roots add another layer of significant stress on a tree."

Planting specifications for container-grown trees should address not only girdling roots, but also the removal of fine roots forming in a thick mat above the main roots - as these can become future girdling roots. The detail should also demonstrate how to prune roots on the outer edge of the root ball so that all cuts leave root stubs in a radial pattern to the trunk.



This cracking, caving, and bumpy sidewalk is typical in suburban areas where proper root management was not used in tree plantings.



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Research has indicated that although pruning these outer edge roots may appear to damage the root ball, trees are not harmed by this harsh pruning if they are irrigated immediately. The new roots should start by growing out from the root ball in a radial fashion, producing a healthier, more stable tree.

The use of root management systems to encourage root establishment in intended rooting areas and away from paved surfaces and utilities is also a large part of healthy tree growth, but this is covered later in this ebook.

The reality for so many poorly planted urban trees is that, despite the valiant efforts of consulting arborists and urban foresters to extend the useful lifespan of problem trees, the conflicts these trees endure with hardscaped areas often results in the premature removal of trees. When proper urban tree planting systems are used, the likelihood of these issues occurring are minimized or eliminated completely.



Poor root management has caused this trees root system to colonize immediately underneath the paving stone roadway. The subsequent pavement damage has left behind a multitude of costly damage.



Poor Root Management in Practice



Using a RootDirector would have guided root growth to lower depths which would have prevented this upheave at the base of the tree



Root colonization immediately under hardscape area



Using a RootDirector would have guided root growth to lower depths which would have prevented this upheave at the base of the tree



Tree roots lifting and cracking the sidewalk, a common sight in urban areas



Poor Root Management in Practice



This unmanaged root system is pushing the curb out into the road, and it won't be long before this damage increases



This unmanaged root system is pushing the curb out into the road, and it won't be long before this damage increases



There isn't much that can be said for this situation
Mature trees are not easily dealt with when they reach conditions like this



What could have been easily managed at time of tree planting, is a huge problem once a tree reaches maturity like this (if it does at all!)



Poor Root Management in Practice



Try a leisurely walk on this sidewalk!



This cracking, caving, and bumpy sidewalk is typical in suburban areas where proper root management was not used in tree plantings



What a nightmare!



Tree roots lifting and cracking the sidewalk, a common sight in urban areas.



Poor Root Management in Practice



Compact planters attempt to contain roots, but they break free!



This tree has nowhere to grow except over the sidewalk



This unmanaged root system has lifted the curb and created a drainage issue



Uneven paving stones caused by unmanaged root establishment

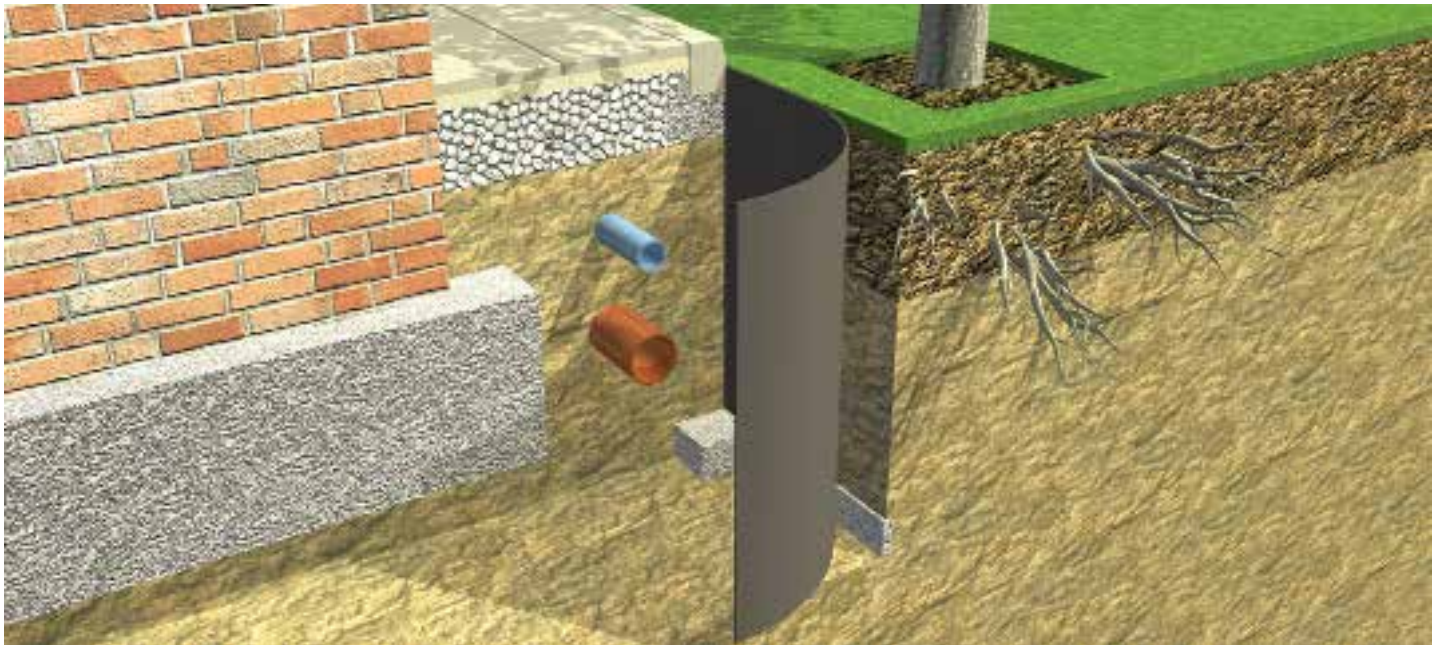


Utilizing Root Management Systems

With clients often requiring complete life costing and other duty-of-care obligations, it is no longer acceptable to simply plant a tree in an urban setting with the hopes that its roots stay out of trouble. In this final section of the *Managing the Root of the Problem* ebook, we discuss current best practice techniques in urban tree root management and explain why one solution doesn't suit every situation.

While the importance of trees in our urban areas is well known, preventing tree roots from interfering with utilities and infrastructure is an on-going issue.

There are numerous types of specialist root management systems, and each type has its ideal function depending on the particular situation. For example, different urban environments and conditions require different approaches. So rather than a one-size-fits-all solution, it is important to use the right system in order to provide the tree with as much growing advantage as possible.



Flexible design allows barrier to curve around obstacles but is rigid enough to hold form when backfilling



Utilizing Root Management Systems

Approaches to Managing Tree Roots

Root barriers are typically used to direct roots away from utilities and infrastructure and into intended rooting zones. They protect pavements, footings, and curbs from cracking and lifting caused by root heave. Made from either virgin or recycled industrial polymers, root barriers come in various sizes and forms, including rigid modular units and more flexible linear material in rolls. Ribbed designs are most popular, however linear material is also available in dimpled and smooth forms.

Linear Root Barriers - vertical ribbed for root guidance

Ribbed linear root barriers are available incorporating integrally molded vertical ribs designed to direct exploring roots away from nearby utilities, infrastructure, and pavement. Research has demonstrated the effectiveness of vertical ribs in guiding roots downwards and away from paved surfaces. This type of high-density root barrier is available in various depths to suit different situations.



Utilizing Root Management Systems

For example, root barrier in 12" (300mm) deep rolls should be used for applications where tree roots need to be moderately deflected, such as to protect a standard pedestrian curb from surface root heave. Whereas depths of 24" (600mm) and 40" (1000mm) can be used for the protection of paved areas, utilities, and shallow service ducts. There has also been a high strength 80" (2000mm) deep root barrier developed for deeper applications such as housing development, business parks, and new service infrastructure projects.

An important feature to have in a root barrier is flexibility in order to allow the barrier to curve around obstacles, while being rigid enough to hold its form when backfilling. This also helps protect the tree when pavement expansion or repair works are carried out.

These root barriers should be installed vertically in a continuous narrow trench dug on the tree side of the pavement or curb with the top edge flush with the finished ground surface, taking care not to tear or pierce the barrier. The root barrier must be positioned with the ribs running vertically, and the trench should be backfilled and tamped sufficiently to avoid later subsidence. The use of root barriers encourages a tree to develop a deeper rooting system to protect paved surfaces while also providing greater drought tolerance and improved stability.



Utilizing Root Management Systems

Linear Root Barriers - smooth

Non-ribbed smooth root barriers are available for larger applications needing protection for services and infrastructure. This style of root barrier is available in various thicknesses. Walls of 1mm and 2mm successfully guide roots and provides superior protection for paved surfaces and utilities.



Smooth linear barrier laid along utilities



Utilizing Root Management Systems

Modular Root Barriers

If the goal is solely to protect paved surfaces from root heave, it is unnecessarily restrictive on the tree to install a vertical root barrier 5ft deep all around the tree. Preformed modular root directors are a more suitable option for such an application. They incorporate many critical features such as tapered sides, prominent root training ribs, ground locking panels to resist root heave, and have no joints to eliminate risk of root penetration.

These units divert root growth slightly downward and outward to a level where they can safely establish without pavement surface damage, therefore protecting paved surfaces and hardscaped areas.

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



Modular root barriers direct roots slightly downward and outwards to protect paved surfaces



Utilizing Root Management Systems

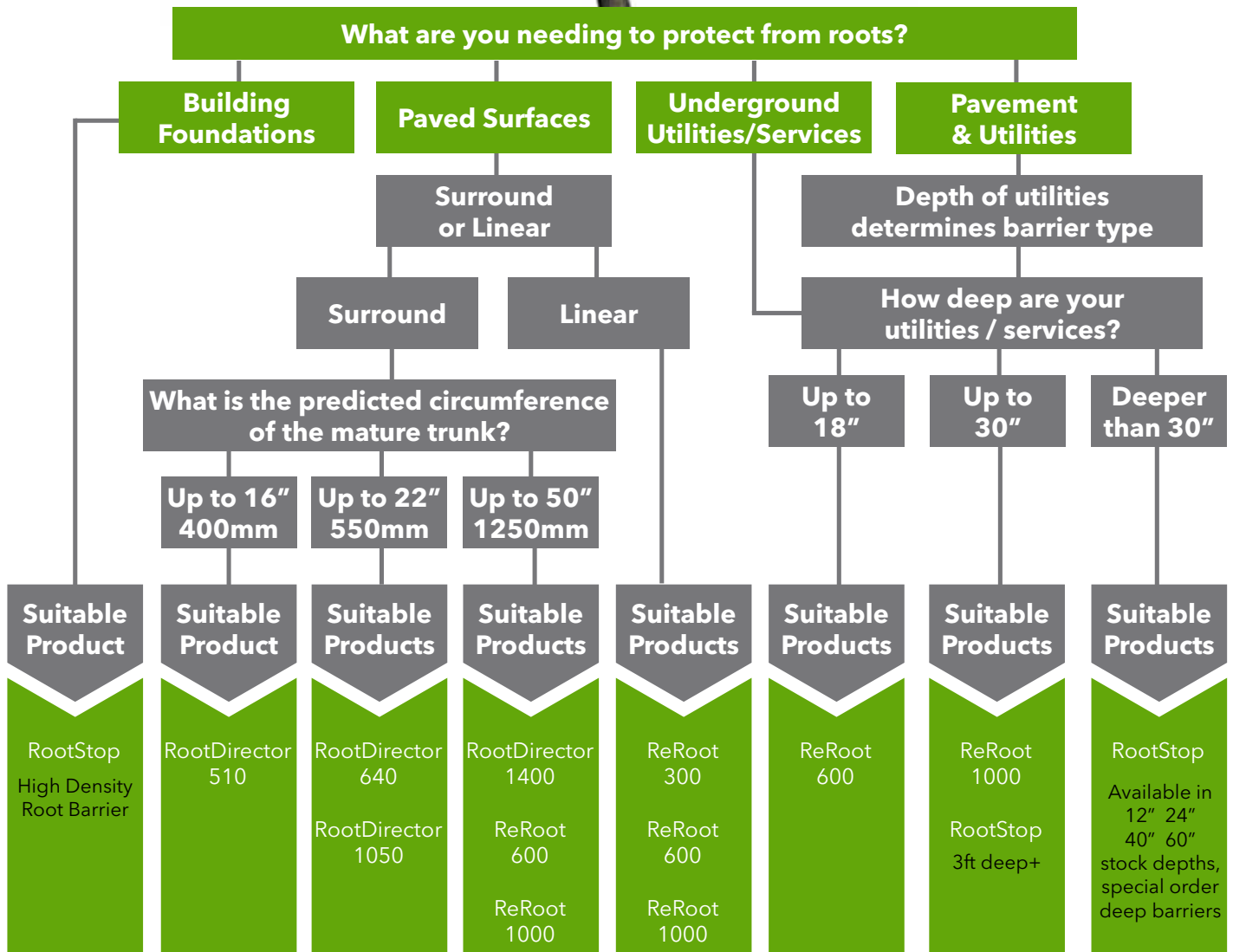
Properly designed root management systems will not only increase the chances of healthy root establishment, but will also minimize the likelihood of root swirl. Barriers can also be used in conjunction with other tree planting products, such as soil support cells, irrigation systems, and tree grates and guards.

So whether the goal is creating a root free corridor for utilities, protecting building foundations, or preventing root heave from damaging paved surfaces, there is a proven method that will help provide the tree with healthy growing conditions while still protecting the built environment.

The 'Root Management Selector Chart' on the following page is a great resource to pinpoint the best solution for most situations.



Utilizing Root Management Systems



This diagram assists in determining which product to use in common situations and is a general guide only



Utilizing Root Management Systems

Planting trees with appropriate root management systems is a small cost to pay compared to the cost over time of infrastructure damage, not to mention possible litigation, and potential loss of ill-established trees. It's critical for specifiers and related professionals to be aware of the options and systems available for managing tree roots in the urban environment.



About GreenBlue Urban

Founded in 1992, GreenBlue was established to conduct research into urban tree planting practices and provide solutions to assist trees in their battle to thrive in urban areas. With the goal of drastically improving urban planting success and increasing leaf canopy in cities, GreenBlue tirelessly analyzed the challenges, the causes of failure, and the reasons for premature mortality in urban trees. We then examined the negative impact that poor planting can have on urban infrastructures. Having identified the key issues in both of these areas, we systematically researched the solutions for those issues and designed practical products and systems to address them.

Local authorities, landscape architects, engineers and other related professionals increasingly turn to GreenBlue for guidance and best practice advice in tree planting implementation. As the global market leader and specialist in urban landscape products, GreenBlue and our overseas partners are able to offer the results of nearly twenty years of frontline experience, exhaustive research, product development and field trials. Our program of continuous product development ensures that specifiers and clients can rest assured that the systems we offer for urban planting schemes represent the best available. For further information, please visit our website or contact our knowledgeable team of consultants.



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