

# Positively the Pits!

## *Successful strategies for sustainable streetscapes*

By Karen Doherty, David V. Bloniarz and H. Dennis P. Ryan



Good planning and proper planting technique can help to create sustainable streetscape settings.

Increasing the tree's rooting space can lead to improved tree health and ability to withstand stressful urban settings.



**T**ree planting pits are relics of the past, but are still commonly used in many of our urban landscapes. Sometimes called “tree vaults,” they are also referred to as “tree coffins,” and with good reason. Although planting in tree pits is not ideal, in many cases pits offer the only opportunity for planting trees in a streetscape setting.

A recent article in the *New York Times* (May, 12, 2003) states that the average street tree being planted in New York City costs \$590 to plant. While this may seem high, one must take into consideration how the citizens of our cities benefit from our urban forest. The average city tree has a value of \$3,225, removes 528 grams of pollutants from the air, cools our homes and streets – AND people like trees!

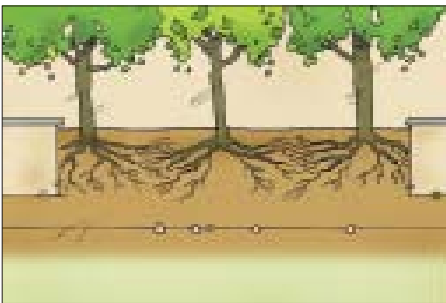
Trees in concrete-laden urban settings struggle with many stresses that inhibit growth. Among these are limited rooting space, air pollution, road salt, excessive temperature effects from the urban heat island, vehicle impacts, and damage from two- and four-legged creatures, to name a few. Trees elsewhere may be able to compensate for a less-than-perfect start in life, but street trees planted in pits need all the help they can get.

Many later problems could be minimized if better planning and planting practices were used in the beginning. If we start thinking positively about planting in pits, we will be better able to create sustainable streetscapes. To that end, we offer the following top ten strategies for survival of trees in planting pits. Green it up!

## Create as much rooting space as possible

Unfortunately, planting success in a tree pit often follows what might be called the “Rule of Four”: the roots of a tree with a 4-inch trunk diameter will fill up a 4 foot X 4 foot X 4 foot pit within 4 years. This usually results in a growth slowdown or stoppage and, eventually, tree death.

A planned street or sidewalk reconstruction offers a prime opportunity to build better tree planting sites. A continuous planting strip can be built beneath the sidewalk, or existing individual tree pits can be connected with underground tunnels filled with soil. Both are practical ways to increase the space available



**Connected or “continuous planting pits” can increase the soil volume available to a tree’s root system.**

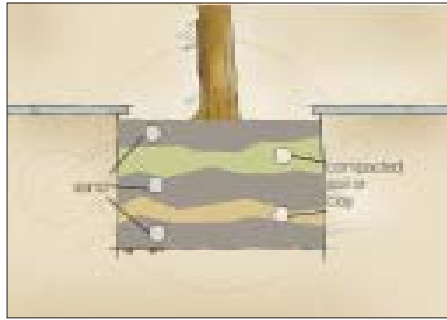
for tree roots to spread out and thrive. In order for planting design features to be incorporated in street reconstruction, a city arborist needs to collaborate with other city departments in the early planning stages. Forging relationships ahead of time with the Departments of Planning, Public Works, Engineering and others helps lay the groundwork for collaboration and ensures that trees have a presence on the streets.

But what if all you have are the 4 x 4 tree vaults and there is no planned reconstruction? The following strategies are the best bets for ensuring tree survival and green streets.

## Start with good soil

Urban soil is an oxymoron. Urban fill is usually made up of bits of concrete, other construction debris, sand, garbage, and more. Left in a pit for any length of time, even fill that resembles soil usually has compacted layers of varying porosity. The result is a stratified situation where water may not be able to percolate through the layers. This causes pooling at one or more levels, and the “stuck” water may suffocate the tree’s roots. In addition, if there is rooting space available beyond the pit, but the soil texture changes, the line between the two soil types becomes a barrier which the roots will have difficulty crossing.

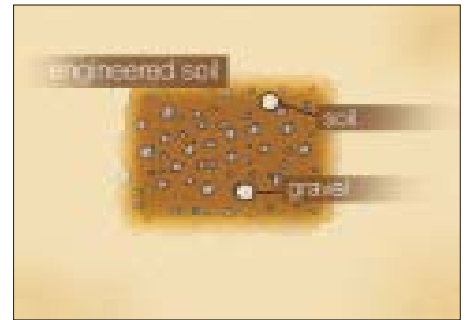
The best method to prepare a pit for planting is to remove everything and refill the pit with uniform, good quality loam. Soil ingredients should be thoroughly prepared and mixed before planting. The soil type should be consistent throughout the pit and to the



**Stratified soil may lead to many problems, including pooling of water and soil barriers.**

outermost location available for root growth.

A structural soil mix, sometimes called an engineered or load-bearing soil, offers a promising alternative medium for planting in pits and under sidewalks. One such formula, developed and patented by Cornell University researchers, consists of approximately 80 percent small triangular stones mixed



**Engineered or structural soil can provide increased rooting opportunities in many streetscape situations.**

with about 20 percent loam, along with a small amount of water retention material that also helps keep the pore spaces open. The mixture is designed to prevent soil compaction, preserve large air spaces, and help ensure oxygen supply to the roots.

When used under a sidewalk, there is promising evidence that this mix will support the pavement and keep it from lifting. Structural soil mix used under sidewalks can also expand the rooting space to extend under the pavement. It can be used to connect existing tree pits and increase available rooting space on the most congested urban thoroughfare. On a residential street, if roots can grow under the sidewalk through such a mix, there is then the possibility for a tree to expand its roots by spreading out into an existing lawn area.

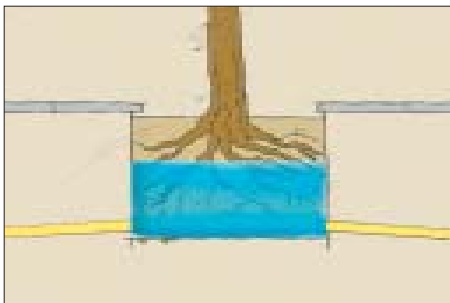
## Control the water

If the minimal soil volume is not enough to slow or prevent growth, a tree in a pit often suffers further from oxygen deprivation due to poor drainage. In addition to filling the pit with a uniform soil profile, drainage can be facilitated by installation of a piping system that will drain excess water away from the roots and prevent drowning. If pits are connected or a continuous planting strip is installed as described above, trees can be linked with a network of pipes.

Too little water can be as significant a problem as too much. The typical tree pit has a volume of only 64 cubic feet, yet research has shown that a tree with a 20 foot diameter canopy requires 300 cubic

feet to have enough water during ten days without rain. New trees in pits should be deeply watered two or three times during backfilling, and there should be deep, regular soakings thereafter. A well to hold water for the newly planted tree is not usually practical in the planting pit situation. Use of pavers instead of concrete can be one way to enable water and oxygen to permeate the soil more easily; unfortunately the heavy compaction involved in base preparation usually defeats the purpose.

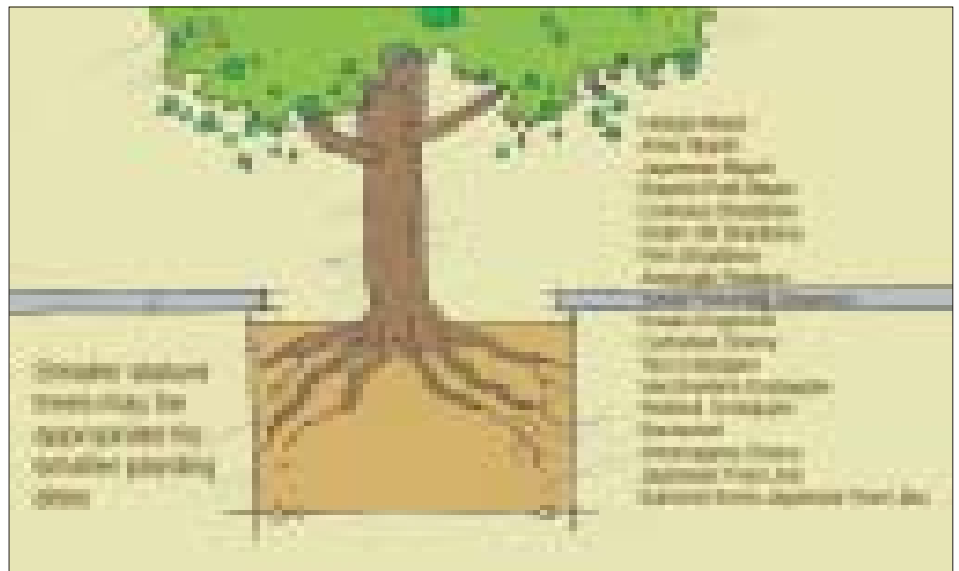
Citizen volunteers concerned with street tree survival are using an innovative irrigation system in Boston. Used in conjunction with a tree grate, the system



**Drainage piping can help to drain excess water away from the tree's root system.**

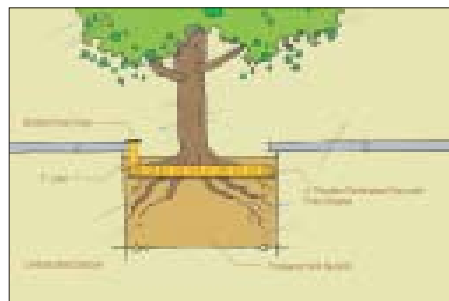
consists of standard materials purchased at a hardware store: 4-inch black flexible perforated pipe inside a filter sleeve to keep out silt; a "T" joint; and a 4-inch round black slotted drain cap. The perforated pipe is laid in a circle just below the soil surface around the root ball, with the "T" joint leading up to the drain cap. Although the cap is protected beneath the grate, it is easily accessible with a hose.

Because of high tree mortality in the past, Boston's tree advocate groups now only plant a tree if and when they have a volunteer committed to water it. Once a week the volunteer uses a hose to fill the system to overflowing, lets it drain, and fills it again. (Trial and error has shown this to be the right amount of water.) The entire system costs about \$10 per tree, and it holds up for about three years, long enough to get the young tree established. The system has been so effective that the City of Boston now specifies its installation in its regular plantings.

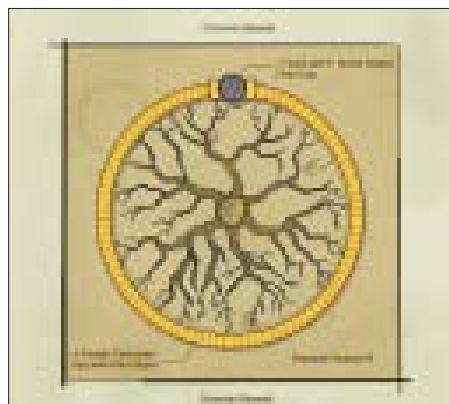


**In some cases smaller stature trees may be considered.**

Plastic irrigator bags are commercially available products that drain very slowly to provide an effectively deep watering of young trees. A number of communities have had success with these, and most report that vandalism has not been a problem despite the visibility of the bags. A scheduled maintenance commitment is necessary to ensure the bags are filled regularly.



**A simple, inexpensive irrigation system can be used to help keep trees watered during dry periods.**



## Choose the right species for the site

A critical step toward the creation of any sustainable streetscape is to select the right tree for the right place. Only small trees can survive in small spaces. Planting in self-contained tree pits dictates the use of slow-growing species that have a relatively small mature size and a tolerance for urban conditions. In addition to the innate problem of minimal rooting space, pits are often built directly under utility wires or too close to buildings. Ornamental species with short mature heights should be chosen for planting under wires. Near structures, planting trees with a columnar shape can avoid costly pruning later. Urban planting pits are perfect for low oxygen flood plain tree species, if they are small enough. Such trees are adapted to having their roots submerged at irregular intervals and hence are more durable in the fluctuating water conditions of a pit. Planting pits can sustain only the smallest trees.

## Go bare (root, that is)

Bare root planting has several advantages: root ball weight is non-existent; root structure is visible, so you can see what you're getting; bare root trees usually have many more fibrous feeder roots than trees whose roots have been cut to make a tidy burlapped



**Various methods to protect the area above a tree's roots may be used to reduce soil compaction.**



**Watering and proper maintenance will help to establish street trees as an integral component of many streetscape settings.**

package; and because there is no root ball, there is no “wall” between balled soil from a nursery and the type of soil in the rest of the pit. Girdling roots, often a problem in containers or balled and burlapped stock, are minimized – and easily corrected – in bare rootstock. The

major disadvantage is that roots dry out and die very quickly, so every effort must be made to keep them constantly moist and plant the trees as soon as possible.

When planting a balled and burlapped tree, the hole should first be backfilled

one third-full to help keep the root ball intact. Then, *the burlap should be cut away from the sides and removed*, so that the roots are free to spread. This is especially important if plastic burlap has been used. Some synthetic burlap developed in recent years is difficult to

distinguish from the natural variety. Because even natural burlap does not decompose efficiently, it is critical to perform this step. *Wire baskets and any rope used for drum lacing or other purpose around the root ball can present a similar problem and should be cut and removed from the planting pit.* Both have the potential to girdle tree roots far in the future, when the roots have grown larger than the basket or rope openings.

## Plant at the proper depth

When a tree is planted too deeply, tree health suffers significantly, so much so that the tree may eventually die. The root flare is buried, the bark rots, the cambium layer is destroyed, and the movement of nutrients and water throughout the tree is interrupted. Roots cannot access needed oxygen in lower soil levels, and they start to grow upward rather than outward.

When planting a tree in a landscaped site, the hole should be dug no deeper than the height of the root ball, and the bottom of the planting hole left undisturbed. This helps avoid later settling that results in a tree planted too deeply – even though it may have been set at the correct height at the time of planting.

The method for planting a tree pit is different. Before a balled and burlapped tree is placed for planting, it is necessary to compact a root ball-sized area of soil at the bottom of the hole, and compact it to the right height. The compacted support pad should be high enough that the top of the root ball is level with or even slightly above the top of the ground or the sidewalk. This limits the amount of settling that takes place after planting. Bare root trees should be planted by first creating a small “hillock” in the pit, at the proper height to ensure the root flare is exposed above final grade, and then spreading the roots evenly over it.

## Protect the ground area around the trunk

A tree grate serves as a sidewalk-like surface for pedestrian traffic, protecting the soil from compaction and still enabling water to reach the roots. Tree grates have fallen out of favor for street tree plantings because the concentric rings of the grates are seldom cut away as the tree trunk grows. Eventually the grate girdles the trunk, nutrient flow is interrupted, and the tree dies.

Instead of tree grates, cobblestones or pavers can be used to create a low-walled area surrounding the planting pit that is 6 to 12 inches above sidewalk level. This raised bed encourages pedestrians to walk around and helps limit compaction over the roots closest to the tree. Organic mulch is normally recommended around trees for water retention and weed prevention. Impractical for street trees set level with sidewalks, mulch may, however, be used



in a raised planting bed if the sides are high enough to contain it. To ensure that the tree is planted at the correct level, a raised bed should be planned and constructed before planting. The raised-bed solution is more practical for a continuous planting strip than for a series of single tree pits, where the danger of pedestrians tripping is greater.

Another solution for surfacing the single tree pit (and one which also works for the continuous pit) is to lay unit pavers level with the sidewalk around the tree. As noted previously, the major advantage of pavers is that air and water can move into the soil through the gravel spaces between the pavers. Pavers are most effective when used in conjunction with structural soils, avoiding the need for a heavily compacted base layer of stone dust or sand.

## Do stake, don't wrap

Although staking is not needed in most cases, one significant exception is the street tree, because it may need to be stabilized against jostling and bumping from pedestrian traffic. Street trees are best supported with only two stakes, set parallel to the curb, so that handicapped traffic on the sidewalk is not hindered. To prevent damage to the root ball, stakes should be placed in the ground beyond the outer edges of the ball.

Perhaps the most important part of staking is its removal. Whether hose-covered wires or a woven tie material is used, guy supports will quickly begin to cut into the growing trunk bark and

interfere with the movement of water and nutrients within the tree. A maintenance schedule should be set up to remove the staking material within one year of planting.

The use of tree wrap to protect young bark is not recommended. Tree wrap causes more harm than good, because it creates a dark, moist environment that fosters the development of insect and disease problems. Sunscald on tender bark was once the primary reason for using tree wrap. Although not as large a problem as once thought, sunscald can be minimized on susceptible thin-barked species by replanting the tree facing the same compass direction as when it was last in the ground.

## Structural prune during the first three years

Structural pruning while a tree is still small is a highly effective strategy to minimize later maintenance and create a strong tree more likely to resist storm damage. The goals of structural pruning are the development of a strong central leader and strong, evenly spaced scaffold branches. Structural pruning is easily accomplished from the ground and can be done relatively quickly. In later maturity, the pruning goal for a pit-bound tree is to keep it a manageable size that will help it maintain a sustainable shoot-to-root ratio. There is a correlation between the amount of growth above ground and below ground, and judicious pruning above may help limit root growth below.

It used to be common practice to do a thorough tree pruning at planting time. We know now that a tree needs all its healthy branches and leaves to help it adjust after the transplant shock and manufacture more carbohydrates to promote growth above and below ground. Pruning after planting is therefore no longer recommended. Only broken, rubbing or crossing branches should be removed. A co-dominant leader, if one exists, should also be pruned out. Do not tip back the main leader! Allow the tree to adjust to its new location with as little pruning as is necessary.

## Enlist volunteers to help with maintenance of young trees

Volunteers can be great assistants for watering and for training young trees with structural pruning from the ground. Volunteers are enthusiastic, they will become protective advocates for public trees, and, best of all, they are cost-effective! Budgets are tight everywhere these days, and a small investment in training volunteers will yield big results. Maintenance on newly planted trees should be planned for at least one year after planting and preferably into the second and third years.

In many communities, planting in the pits is one of the primary opportunities to grow the urban forest. Even though pits are not perfect, sound planting and maintenance practices can go a long way toward compensating for the limiting site factors that pits present. Sometimes there is no choice. In the end, the goal is green – a healthy green environment and all the benefits that come with it. Pits are there, and if planting in them can help us green our communities, let's take full advantage of them. Indeed, why not?

*Karen Doherty, M.S. is a community forestry consultant and co-owner of Trees New England in S. Hadley, Mass. David V. Bloniarz, Ph.D. is an urban forester with USDA Forest Service, Northeast Center for Urban & Community Forestry, in Amherst, Mass. H. Dennis P. Ryan, Ed.D. - arborist, University of Massachusetts/Amherst.*

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## References and suggested reading list:

*From Sketch to Street: Design for the Urban Forest* from USDA Forest Service, Northeast Center for Urban & Community Forestry, Amherst, Mass.

*Principles and Practice of Planting Trees and Shrubs* by Gary W. Watson and E. B. Himelick, ISA, 1997.

*A Practitioner's Guide to Stem Girdling Roots of Trees* by Gary R. Johnson and Richard J. Hauer, University of Minnesota Extension Service, 2000.

*Planting Trees in Designed and Built Community Landscapes* by Mary K. Reynolds and H. Sharon Ossenbruggen, New Hampshire Department of Resources and Economic Development