NEW TECHNIQUES IN URBAN TREE PLANTINGS[1]

by James Urban

Abstract. Changes in the way we construct our urban environment have significantly reduced the chances of success for new plantings. In order to compete for rooting space, new planting details are being created. I will explore things landscape architects do which contribute to the problem as well as changes the profession must make in details and design to assure the growth of new tree plantings.

Résumé. Des changements dans la manière de construire notre environnement urbain ont réduit significativement les chances de succès de nos nouvelles plantations. Afin de compétionner pour l'espace souterrain, de nouvelles façons de planter les arbres sont créées. Les choses que les architectes du paysage font et qui contribuent au problème sont présentées, de même que les changements que la profession doit faire lors de la planification des projets afin d'assurer la croissance des arbres.

Trees in the urban environment often fail or at best simply survive. This is true even on prestigious projects where the landscape architect should meet with success. There is something wrong in the way we are practicing our profession. We have shut off the communication with the horticultural community and there is a lot that we need to learn from them.

All too frequently the site plan in an urban project is conceived and sold on the fact that the trees are going to become very large. We describe how the canopy will knit together, how the trees will make the space, and create a shaded, dappled effect on the sidewalk. Unfortunately, most of the time the trees don't make it to a size sufficient to achieve the effect.

Trees have a root system that is very thin in depth but large in area. While the natural model of a tree is a broad, flat root system, the landscape architect tries to roll up all the little roots and stick them into a tiny hole. The results are predictable.

When trees are successful in intensive urban conditions we can usually find evidence of the trees struggling to break out of their confined area often ruining the adjacent pavement. Sometimes these trees make it to fairly large sizes. If we look at the leaf area index of these trees, however, we see that while they have continued to grow, the roots have often used up much of the available soil and it will not put on any more leaves. The leaves will start getting smaller and further apart. There will be the same number of leaves or the same area of leaves but they will have to support an ever increasingly larger tree mass with diminishing success.

A tree can continue for a very long time in this condition, however each year it gets weaker and weaker. Eventually disease, drought or something else will kill it.

Life Cycle Impacts

In order to better understand how to successfully provide for urban trees, the entire life cycle must be examined. Landscape architects are a very small player in the life of the tree. They have limited control over it during the design and construction period and only sometimes during the early guarantee and maintenance period. Other players, the nursery, the landscape contractor, and the owner have much more control before and after the construction process.

Let's start by examining the landscape architect. Our first impact is in the basic design of the site plan itself. Often the earliest decisions will determine how much soil the tree will have access to. Then there is the detailed design, plant selections and specifications. The profession is currently using the same details developed for planting trees in the suburban landscape or the great estates of a generation ago. Unfortunately urban environmental conditions have changed significantly and we must re-examine all of our "standards".

Now let's look at the genesis of the tree, its propagation, and the nursery which grows it. Frequently, the nurseryman is not the same company that is the propagator. Do we really know what the

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root stock of the tree is or if the graft was successful? Where did the seed stock come from? For example, a particular cultivar that will do well in Connecticut, may be grafted onto roots that were taken from trees in Minnesota, the original clonal material may be from New Jersey, put together in Oregon, shipped as a liner to Tennessee where it is grown in the Tennessee soil and environment and then finally dug and shipped to Connecticut for planting. Throughout that whole process records are not kept very well. There needs to be a lot more communication with the nursery industry so the source of the tree is really known.

Next is transportation. Moving the tree from the nursery to the landscape is probably the shortest part of the tree's traumatic process from birth to death in the urban environment. Mistakes made at this time can cause a lot of damage and the results may not show up during the guarantee period.

The next player is the landscape contractor. They are the last people to touch the tree before it is signed off to the owner and is easily blamed for everything. We need to work together and landscape architects also must learn a lot from them. Many of the things that happen during installation also don't show up during the guarantee period. Unless you are at the site every day, many of the problems will be buried.

Before we leave the construction period, the other contractors on the job site must be discussed. In suburbia or on less intensively developed sites, other contractors at the site are probably a nuisance but not necessarily a problem. In the urban environment, however, many things that other contractors on the site do will have an impact on the tree. In some cases this can be several years prior to arrival of the landscape contractor. Urban trees are always at the limit of their tolerance and the slightest additional disruption may be the thing that pushes them over the edge. Even once the project is completed other contractors are constantly coming in; utility crews, sidewalk repair crews, etc. do their job without considering the needs of the trees.

Finally, assuming the tree is still alive, there is the long period where the owner provides maintenance. This will be a big factor as to whether the tree, twenty or thirty years from now, is still alive.

Landscape Construction Details

Trees are now being put in incredibly severe urban environments. Is the size of the hole big enough? Should we even be talking about a hole or should we start thinking in terms of rooting space. What is the material at the edge of the rooting space? Will roots grow out into it?

Root balls. Are the AAN Standards for root ball sizes adequate or should the tree in the urban environment be given a little better boost? AAN Standards cut off 90-95% of the tree's roots and leave them in the nursery. If the root ball was another 10-20% bigger, it might have a big impact on whether the trees were successful.

Drainage. This is probably the biggest cause of death of trees in the city. Will water flow out of the rooting space? Throwing the burden of discovery on the contractor isn't adequate. Don't write specifications that require the contractor to be the one who reports drainage problems. He's probably not going to do that unless the problem is extreme and at that point in the job, it's probably too late to do something about it. If trees are to be placed in areas surrounded by paving, we need to investigate the site sufficiently to determine if there is adequate drainage. A better approach would be to always design a drainage system and take it out if it is not needed.

Wire baskets and synthetic burlap. In the last 5 to 10 years wire baskets with synthetic burlap have become a major way of wrapping root balls. These baskets are all galvanized and don't break down readily. Typically they have a hole size of about 4" square between the grids. Through this hole the tree sends out butt flare roots that could be easily 10" in diameter. This girdled root will not support a tree that will become 30" in diameter and 50' tall. The baskets need to be cut off and turned down into the hole so that you know they're not going to interfere with tree roots. Synthetic burlap must be removed!

Tree staking details. The work of Dr. Richard Harris suggests that trees don't really like to be staked. Staking details originated when most trees were transplanted as bare root. Landscape architects who have given up staking confirm that the trees are mostly unaffected. Occasionally a tree in a very windy spot will require a single stake on the prevailing wind side. We should dispense

with staking not only in the urban environment but throughout the profession. Frequently, the tree ends up holding up the broken stake, or worse, if the stakes are not removed, the wires left on the trees will kill it.

Tree wrap. It is supposed to prevent frost cracks. More often the tree is killed by tree wrap itself, while there is little evidence of trees killed by not being wrapped. Even cotton twine may not rot fast enough to keep from girdling a small tree. If every string is not removed the tree may die, but not during the guarantee period. Tree wrap is also an excellent place for disease and insects to live.

Tree grates. An incredible amount of money is spent on tree grates, however, many trees are killed by them. While the grates are suppose to be cut back, it is not something we can guarantee will happen and frequently it is not. The tree can begin to grow into the grate in as few as 3-5 years. When some kind of pavement around trees is required, more flexible pavers such as granite sets or bricks set in sand should be considered. These are able to move as the base area of the tree gets larger. In any case leave 8"-10" all the way around the trunk.

Tree guards. Invented to keep horses from nibbling at tree bark, tree guards have gotten smaller and smaller in diameter as the price has gone up. They are really cute and add a special level of interest to the urban landscape reminding us of days when they might have been a good place to tie up a horse. If the tree guard is too small there is not enough room for the tree to move inside the ring which then causes mechanical damage to the tree trunk. In the inner city where we are chaining bicycles to trees, some kind of cage around the tree may be valid, but make it really big (3' square) and make it so it can be taken out very easily once the tree grows.

Soil. The typical planting detail shows the hole 6"-12" bigger than the root ball and is based on the assumption that roots will grow into the soil around the hole. In urban areas it is more correct to assume that roots will not grow out of the hole. As a beginning point, take away as much soil as possible and provide new soil that has good drainage.

Poor drainage is probably the biggest problem. There are tremendous differences in soil types even from tree to tree in a given block. The level of construction intensity at the typical urban site is so great that by the time the landscape contractor arrives there is not much drainage capability left in the soil. Roots can't grow in compacted or saturated soil layers. Fewer roots will cause the tree to develop crown dieback, smaller leaves or chlorotic leaves, all of which are an early indicator of problems in the soil. Landscape architects must learn to recognize abnormal leaf, size, color and density to become aware of soil problems.

In urban areas rooting space must compete with sidewalk space for surface area. A calculation of available and projected usable soil areas should be performed during the design process. Only those soils with adequate drainage and sufficient pore space for root development should be included.

To grow a really big tree, 30" dbh, requires in excess of 1,000-1,500 cubic feet of soil assuming that an optimum depth of about 2½-3 feet. To provide that much soil in an intensively developed urban site, the trees would use most of the available surface area and the project would become very suburban in appearance. Additional soil space must be obtained in areas which can coexist with the needs for walks, drives, sitting areas, and utilities.

Urban trees are fundamentally a compromise to their growth requirements. It is difficult to obtain the needed soil requirements and therefore a lower threshold will be necessary. Assuming the tree will take advantage of some of the other available urban soils, 300 cubic feet of good soil may be a beginning point for designing the soil needs. We know that isn't enough but it's a lot more than is currently being provided. Always design for every cubic foot of soil possible. Depth is also as important as volume. Soil much deeper than about 3' becomes excessively drained and the top layer gets too dry. If the soil is too shallow then it also dries out too rapidly.

One way of achieving larger soil volumes is to remove the existing soil in an area and replace it with better drainage and soil. The walkways are then put on top of this area using a pervious pavement i.e. small sand set pavers. This system has been successful but the smoothness of the pavers varies considerably. It is very difficult to

achieve a compaction rate which will hold up those pavers consistently while also not being so compacted as to cause the trees to be a problem. The method has proven successful in some projects and it is one method of introducing large soil volumes into the urban landscape that should be investigated further.

Another way that shows promise is separating the structure of the pavement with the soil needs of the plant. The area is excavated and a soil shaft that runs continuous from tree to tree is installed. Because the paving must span over the soil zone, this system forces the soil into a more linear configuration. The bottom of the trench is filled with gravel and a drain pipe which connects to either a storm drain or a drywell sump. Soil is added and compacted to approximately 75 or 80% to keep shifting and settlement to a minimum. A layer of gravel is added on top of the soil to allow air and water to flow under the sidewalk. This includes another perforated drain line which connects to a box set into the pavement. The tree is watered by pouring water in the box and letting it flow out under the pavement. This passive irrigation system is not pressurized and requires someone to water the tree. However, these trees need water only about twice a summer since there is almost no evaporation of water out of the soil.

The soil shaft is capped off with concrete and a unit paver if desired. Four feet is about the maximum width of the trench limited by the structural capability of the concrete to span over the loosely compacted fill.

This new level of complexity means that planting plans must become engineering drawings where the tree's needs have been very carefully engineered with the competing urban elements. There is a lot of competition for underground space, utilities, foundations, etc. We must force ourselves into the design process early to protect the interest of the urban trees.

The most effective way to provide trees with more soil is to get the trees out of the pavement. Group trees separately from walkways in "urban tree islands". Design shared rooting spaces where there is maximum soil surface that is unobstructed by pavement. These trees will provide much more canopy, be healthier, and make significantly more impact than trees planted in tree pits.

Some of these solutions are expensive. Often projects do not have the budget to spend $2,000.00 or more per tree. There are some interim things that we can do to improve tree growth without excessive cost. The first is to provide more drainage for every tree in the urban environment.

Rethink the basic design process so that money is put into soil for trees and tree growth before money is committed for accessories in urban landscape; tree grates, tree guards, fancy pavement. Design access to the soil underneath the pavement to water and fertilize.

Simplify the technology. If forests in your region grow without pressurized irrigation then urban trees given the good soil and the right species selection should also be able to grow! Irrigation systems kill a lot of trees. Use drought tolerant species and design non-pressurized systems that are manually operated.

Rethink putting lights in and around trees. Often these lights compete for rooting space, or worse can be harmful to the tree. Get the lighting away from the tree until you have solved the other basic horticultural requirements.

Annual flower plantings underneath trees is harmful. Planting annuals disturbs valuable feeder roots. Put these plants in separate containers so that the rooting space for annuals is not the same as rooting space for trees.

Ultimately we need to come up with a formula which can calculate the odds for success of any given tree. Just like the engineer who calculates how much water will flow through a pipe, we need to be able to calculate whether or not the tree will be alive in twenty years. Unfortunately, we're not even close to having that kind of data base to design this formula and much research remains to be done.

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