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Toronto's New Soil and Tree-based Standards for Boulevards

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Introduction

In 2012, the city of Toronto embarked on a process to develop and implement new standards for tree planting and sidewalk design for trees in the most difficult and densely developed areas of the city including commercial and multi-family residential districts. These new standards reflect the most current thinking on developing healthy trees. The standards begin with setting new soil volume standards and seek to find solutions to the most difficult problems confronting trees in difficult spaces. These standards had to negotiate the needs and conflicting goals of all city departments and Toronto's private utility companies. The standards included developing new details for all aspects of the paving and features in the pedestrian right of way. Specifications for planting, soils and other critical elements were completely rewritten. The project took almost two years to complete.

The new Toronto tree standards are not only an impressive accomplishment for this city, but can serve as a template for standards in other cities in Canada and the United States and developed cities around the world.

Standards Development Process

The process to develop the standards grew out of many previous years of work and pilot projects around the city, which was committed to improving tree quality on streets and urban spaces. The important first step was to establish new protocols with respect to tree planting and the utility companies. Past practices prohibited trees from being planted in proximity to gas, electrical and telecommunication ducts. This prevented the planting of trees in most locations due to the limited sidewalk widths. This meant that as the city grew and underground services increased, opportunities for tree planting within city sidewalks would continue to decrease. This was at odds with the City's Official Plan mandate to increase the city's tree canopy and improve the quality of our urban environment.

After many meetings were the utility companies gained a better understanding of what is involved in growing trees and all parties were able to articulate their concerns, solutions were found. These discussions revealed that the utility companies concern was not that the trees would damage their "plant" but that in the course of maintenance and repair, they will damage the tree.

Understanding this identified the need to revise tree protection policies and specifications that reflect the nature of utility work within the boulevard.
With the cooperation of the utility companies, new protocols where used on a project-by-project basis that coordinated the planting of trees on or near utility installations. Through this process trees truly came to be considered an integral

part of the city's infrastructure. Work is ongoing to create a Memorandum of Understanding between the City of Toronto Urban Forestry Division and the utility companies that will have general application for all future projects.

Major developments funded by the city, including reconstruction of two major shopping streets and a number of large redevelopment areas to accommodate residential and park uses in an area previously industrial, are demonstrating that changes in the way streets are built were possible and that healthy trees could be grown in difficult urban spaces. These initial projects have demonstrated a commitment by the city to improve the conditions for trees in the city. They reflect a willingness to consider different approaches by all stakeholders to change the way the city is built in order to achieve the collective objective of successfully growing trees in the urban landscape.

The architecture, planning and landscape architecture firm of DTAH in Toronto was hired to do the study and develop the solutions. Their team included ARUP, Civil Engineering; Urban Trees + Soils; and Urban Tree Innovations Inc. The inclusion of a civil engineering consultant was critical, as they had to develop new structural details for the different solutions that emerged. The ideas were not just suppose to be planning concepts but the final manual was intended to be the detailed basis for constructing sidewalks.

The approval process involved circulating several increasingly detailed drafts thru the various departments of the city. Through each exchange greater degrees of agreement developed. The final document would need signoff from each department.

The success of the project, like all complex endeavors was due to having several key people working hard over a very long time to see the proposed changes through to adoption. These key people came from many city divisions including Urban Forestry, Toronto Water, Transportation and Urban Design. The importance of healthy trees was not just seen as good for trees but critical to creating a healthy city.

Soil and tree goals

Six critical areas of tree growth were identified as needing to be addressed by the new standards. Theses were: adequate soil volume; space for the future trunk flare and zone of rapid taper roots; getting water into the soil; getting excess water out of the soil; providing room to grow for the canopy; and assuring that newly planted trees were quality nursery stock including the root systems.

Soil volume: The city already had a minimum soil volume requirement of 30 cubic meters for single trees but this could be reduced to 15 cubic meters per tree for trees in shared soil volumes. The city was improving its soil volume in certain pilot sidewalk projects to test the impact of various options on constructability, and cost. The new standards increased the soil volume for shared soil areas to 20 cubic meters per tree and developed standard drawings and specifications to build the needed structures to attain the increased soil.

Trunk flare and Zone of rapid taper roots: The city was already in the process of eliminating the concrete cover around the tree base with a very small opening less than 300mm for the tree. Most trees were being installed in 1200mm square openings that were either mulched or covered with a metal tree grate. The new standard widened the opening to 1500mm and discourages the use of tree grates.

Water into the soil: Making the tree a part of the storm water management system was a critical alliance to gaining acceptance of the new standards. Several systems were developed to harvest rainwater into the soil under the pavement to keep the trees hydrated while reducing runoff into the storm water system

Water out of the soil: The soils in Toronto can drain very slowly and assuring that each tree had a drainage line is critical to the health of the tree.

Room to grow: Existing street trees were being spaced on very tight spacing 7-8 meters on center. The new standards encourage wider spacing of over 10 meters. This not only gives each tree greater space for its canopy, but also was critical in reaching the soil volume goals in narrow sidewalks.

Quality nursery stock: The Toronto area has many of the tree quality issues that are found in the nursery industry around the United States. Improving nursery stock through stronger specifications and city inspection processes is included in the standards.

Accommodating each of the above principles is woven into the overall standards, details and specifications.

Kit of Parts

The following are some of the important design decisions in the standards:

Soil volume: The standards use soil volume as the primary measuring point to determine if the trees are being provided with adequate growing conditions. Since this is the most expensive part of the standard, there are several options that allow compliance to reflect different design approaches, site conditions, and construction techniques. The least restrictive approach uses open planting areas where large amounts of usable soil can be created with minimum structural interventions. These may be along the curbside or between the building and the sidewalk. Additional soil approaches include several types of soil under suspended pavement options These fall into paving under structural concrete paving slabs that span over wide soil beds and paving supported by structural cells such as Silva Cells. These different options reflect that there are different site conditions that might favor one approach over another.

Soil specification: A new citywide soil specification was developed for these standards. The intent was to find a single soil type that would work for all applications including soils in open planters, under pavement, and storm water bio-retention applications. This proved a difficult task and the soil specification

that was finally included needs further testing. Once the soil is tested it is believed that it will become a standard mix available as a stock product from the major local soil manufacturers.

Trunk flare and Zone of rapid taper roots: The tree goal with the greatest compromise to the project goals was in the area of the trunk flare and zone of rapid taper requirements. The minimum planting hole in the pavement is set at 1500mm square. This is large enough for the likely trunk flares of the size tree that could grow in the minimum soil volume requirement, but insufficient in locations where a tree such as elm or oak found additional soil volumes beyond that required. In the open planning zones the requirements for the base of larger trees will be accommodated. The zone of rapid taper in the limited size planting holes is to be accommodated by the use of root barriers to guide the large structural roots downward into the enlarges soil volumes.

The tree opening itself is to be covered with bark mulch, crushed gravel or planted. The planted are may need further protection by a perimeter fence or other barrier. Fence design is not controlled to allow this to become an individual neighborhood design element. Tree grates are permitted but discouraged.

Tree trunk protection: Tree trunks in busy urban areas need trunk protection at the earliest stage in development, but as the tree matures this need recedes as trunks enlarge and bark increases in thickness. A temporary plastic guard is required that can easily be removed. Metal trunk guards are permitted but discouraged.

Water into the soil: Water is supplied to the soil using two alternative approaches. The first, and by far the best approach, is to use porous pavers over the soil zones. But porous paving is only compatible with the suspended pavement using the structural cells approach. For the structural concrete paving approach, water is harvested in a double set of grooves tooled into the concrete or molded into precast concrete units. These lead to small inlets, one per tree that conduct water into distribution piles under the pavement. During droughts, additional water can be added to the inlet by water trucks. The internal distribution pipes under the slabs must be set nearly level to operate and may be subjected to clogging. Several cleanout locations are associated with each tree. Designing these piped systems becomes increasingly difficult as the sidewalk slope increases, favoring a porous paver over structural cell approach.

Urban storm water contains a large amount of debris from silts and sand to trash, cigarettes, and plant parts. As the trees mature the amount of plant parts including flowers, leaves, fruit, twigs and bark will increase dramatically. This will put increasing pressure on the need to clean out these piped systems. The cost of maintaining a closed piped system may make the porous paving over structural cell option much more cost effective over the life of the system.

Water out of the soil: All soil systems are required to include a piped drain line connected to a storm drain.

Room to grow: The recommended spacing for trees in 10.5 M (approx 34.5 feet) on center. This spacing was proposed as the best compromise to allowing adequate canopy space between trees for the tree sizes expected, allows attaining the minimum soil volumes with the standard paving soil sections and providing a reasonable canopy appearance when the trees are small.

Quality nursery stock: An entirely new planting specification was developed for the standards to reflect the latest understanding of nursery quality issues and the capability of the local nursery industry. Due to the significant problems with container grown tree stock, trees grown in containers are not permitted.

Implementation

The next step is to incorporate the new details and specifications into the city's Streetscape Manual. This is a document that informs private developers of the city's urban design requirements for development approval. The target for completion is October 2013. The next step is to incorporate the new details and specifications into the city's Streetscape Manual. This is a document that informs private developers of the city's urban design requirements for development approval. The target for completion is October 2013. The details prepared by DTAH are general and typical in nature. In order to provide clear guidance as to how to construct all components of the sidewalk a more comprehensive set of detailed "Standards" drawings based on the details recommended by DTAH will be prepared.

There are already a number of projects scheduled to be constructed in 2013 and 2014 that are based on the new standard. They are acting as pilot projects that will allow the fine-tuning of the construction and design details.

City construction supervisors will require training to ensure quality control. These details, specifications and construction methods will be new to them.

A comprehensive Maintenance Manual for utility installation, maintenance and repairs also will be prepared as well as finalizing the Memorandum of Understanding between Urban Forestry and the utilities. A database will need to be developed, mapping the locations of the new sidewalks with links to details. This is needed to inform utility companies applying for a permit to do work, what the nature of the sidewalk construction is at any given location. This database will be an important aspect of integrating street trees in the dynamic process of maintaining the city's infrastructure.

Conclusions

There are many stakeholders involved in creating the conditions required to successfully grow trees in the constructed landscape of cities. Educating them about what a tree needs to grow is essential in order to develop a collaborative working relationship that can generate creative solutions.

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James Urban was a consultant to the Toronto Standards Development team. He is a Landscape Architect who specializes in the design of trees and soils in urban areas. His 2008 book “Up By Roots: Healthy soils and trees in the built environment”, published by ISA, is a significant reference for urban foresters, landscape architects and planners and won an honor Award from the ASLA. He is a frequent contributor to *Arborist News* and *Landscape Architecture Magazine*.

Peter Simon
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Peter Simon has been working in Urban Forestry for the City of Toronto for the last 12 years. The main focus of his work has been on improving the planting conditions for trees in hard surfaced urban areas. Peter is a graduate of the University of Toronto School Of Architecture. His experience as an architect includes working on large commercial, institutional and residential projects. During his career as an architect Peter acted as a consultant for the City of Toronto at varying times for the Planning, Housing and Parks and Recreation Departments. He become involved with trees through building projects including the Metro Toronto Convention Centre and a number of City parks that required an engineered structure to support the conditions needed for trees to grow to maturity. Peter’s interest is the integration of trees within the city infrastructure, the integration of the urban forest into the built environment. He was recently awarded an honorary membership to the Ontario Association of Landscape Architects.