

CITY OF TORONTO

TREE PLANTING SOLUTIONS IN HARD BOULEVARD SURFACES Best Practices Manual

Consulting Team

dtah / Arup / Urban Trees + Soils / Urban Forest Innovations Inc



James Urban, FASLA, ISA
urbantree@toad.net
<http://www.jamesurban.net>

Missed opportunities ?

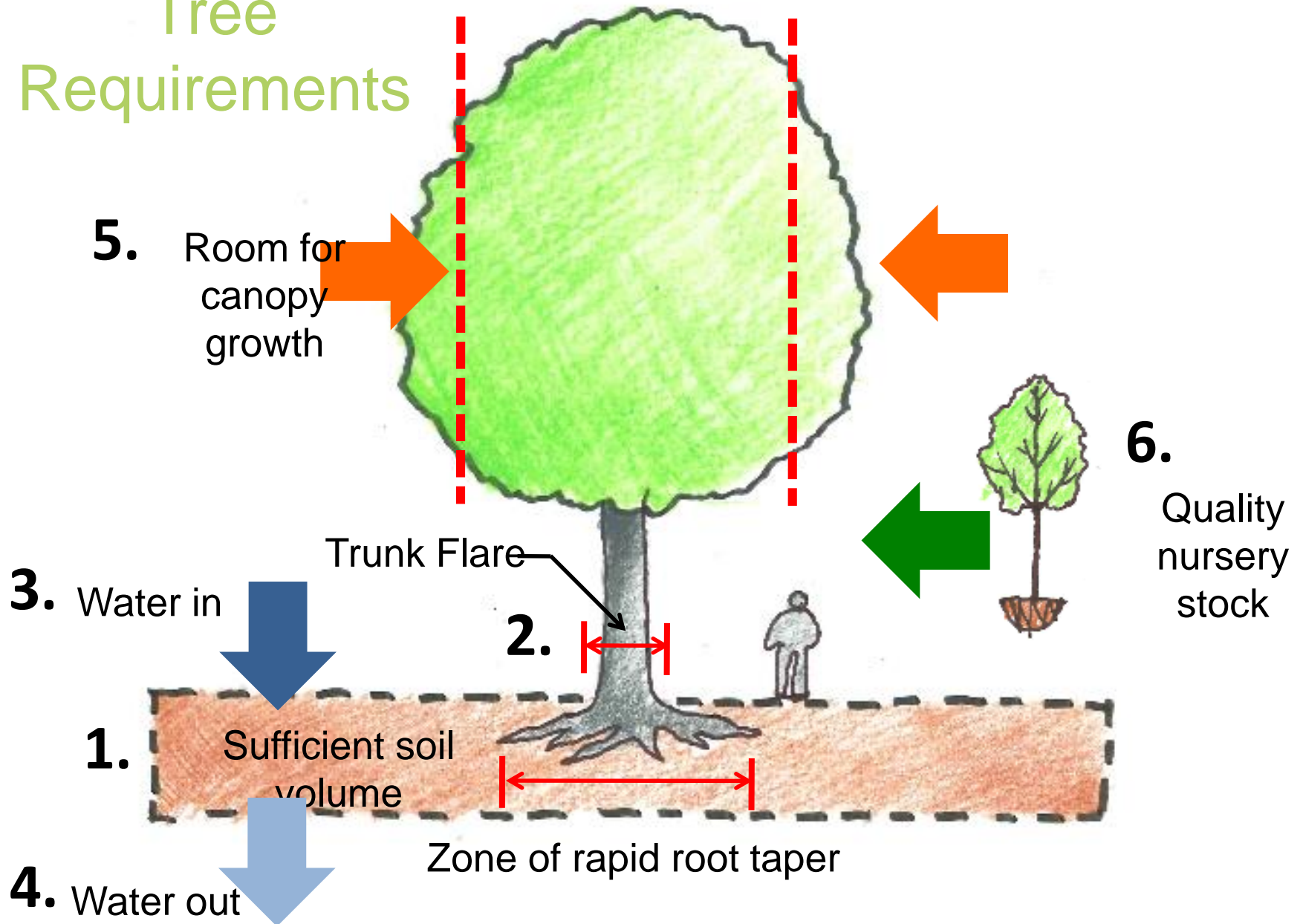


Bay and Lakeshore



Previous standard

Tree Requirements



Best Practices Manual :

Overall Strategies

1. Grow a decent tree.

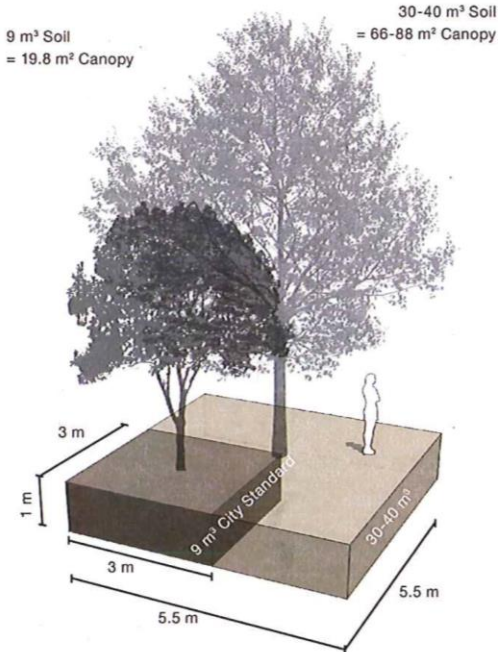
1. The public realm is acceptable and affordable on day one.

1. Appropriate for the utility access requirements.

2.1 Principle 1: More Soil Yields Larger, Healthier Trees

Key Recommendations

- Individually-planted trees each need a minimum of 30m³ of soil (in contrast to the current City standard of 9m³ of soil per tree).
- A grouping of ≥ 2 trees in a soil bed need a minimum of 20m³ of soil per tree.
- Adequate soil depth is 1m; greater depth if available is better; minimum soil depth is the depth of the tree's root ball
- Where existing soil resources are available, they should be used.
- An approach that prioritizes total tree canopy size over quantity of trees, should be used.



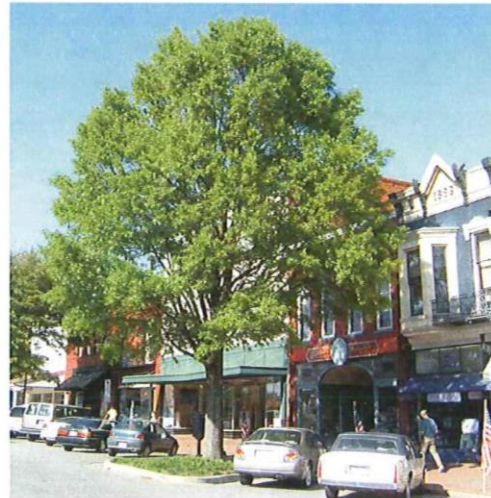
Comparison of the tree height attainable from the soil volume of the current City standard tree detail (covered trench T3-A) to the tree height attainable with recommended target of 30-40 m³ soil volume.

It is a fact that more lateral soil volume will yield larger, healthier trees.

Each cubic metre of soil volume will support approximately 2.2m² of tree canopy area (canopy area is defined as the area on the ground directly under the canopy). Accommodations must be made laterally, as trees roots run laterally rather than vertically down.

A single, mature tree with a canopy diameter of 4m requires 30m³ of soil volume. Street trees that share soil resources in a continuous trench or planting bed require 20m³ of soil volume per tree to achieve a healthy, mature size. In places where especially large, long-lived trees are essential to the streetscape, such as important boulevards and promenades, shared soil volumes of 40m³ per tree should be provided, if space and budget allow.

Native soil resources may be available in the urban condition. This can offset the volume of new growing medium brought to site to reach the recommended soil volume. Urban trees find soil resources in many places besides the planting soil provided. These can include



Single, large trees have a significant streetscape impact.

Sets of first principles

More Soil

Larger pavement openings for trees

Integrated utilities

Cost effective design

Fewer large trees are better than many small trees!

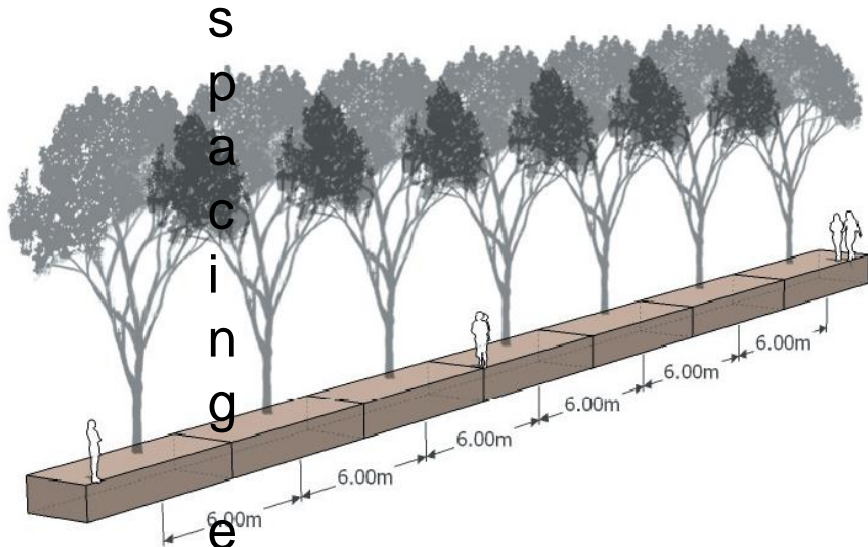


Wider space equals more soil per tree!

Goal – **30 m³** per tree or 20 m³ per tree if grouped

EXISTING SPACING

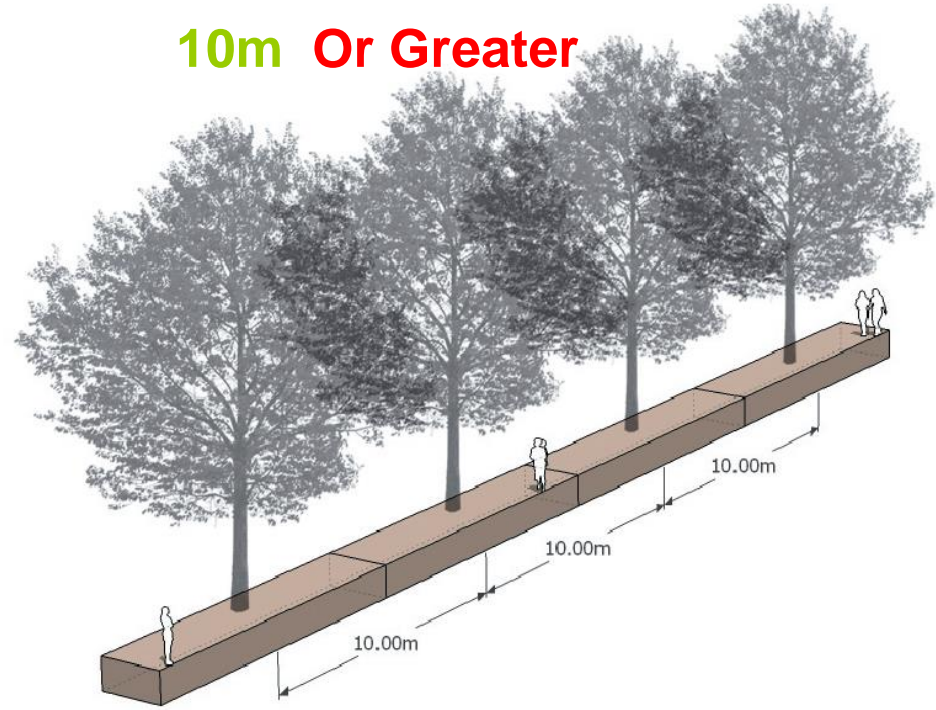
6-8m



11m³ per tree

PROPOSED SPACING

10m Or Greater



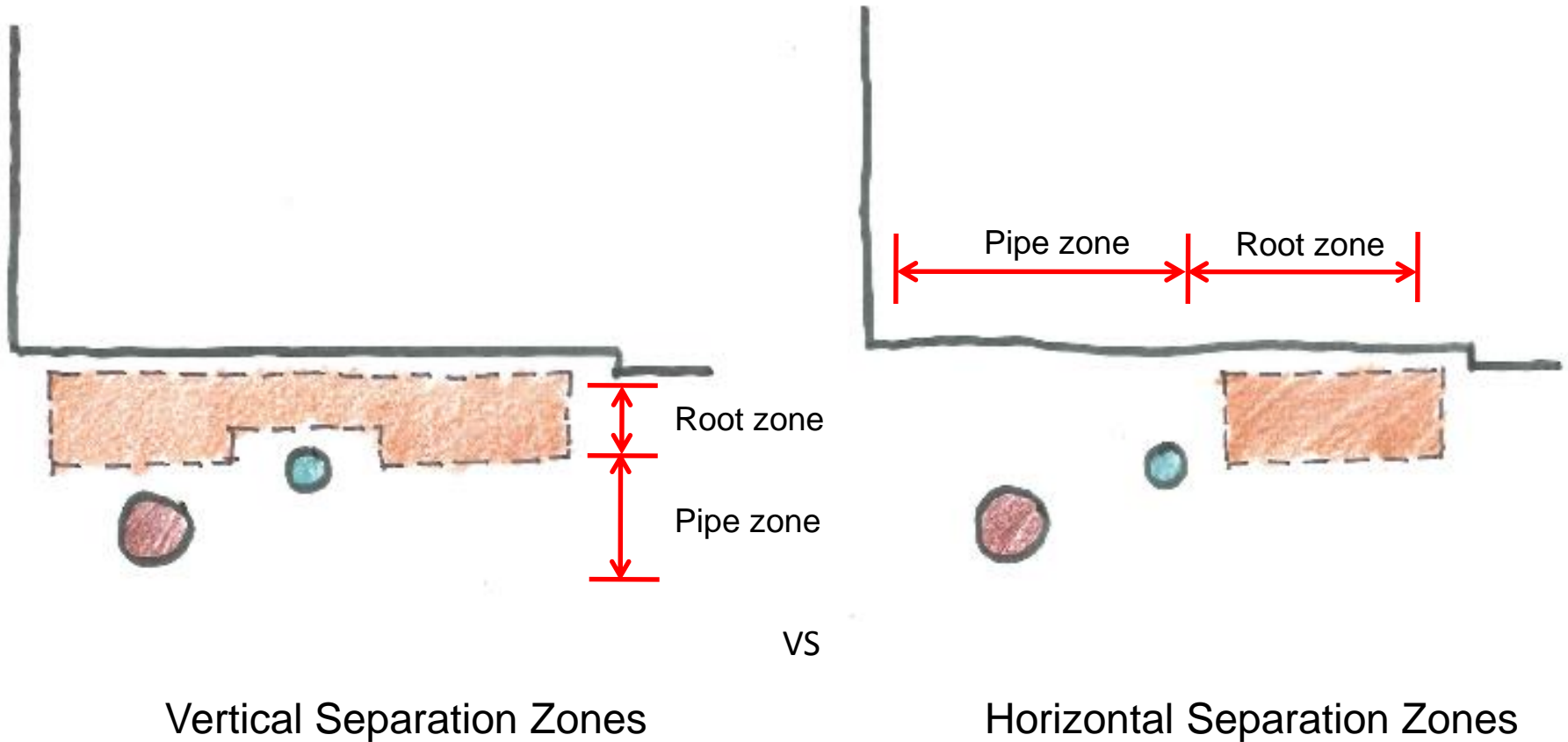
20m³ per tree

same 80m³ of soil...

W
i
d
e
s
p
a
c
i
n
g
e
q
u
a
l
s

Tree / Utility Conflict Management

Horizontal zoning will seldom yield acceptable soil volumes.



Pavement repair after utility repair

Two stage repair - standard:

Utility contractor repairs utility. Leaves the site filled with non shrink fill and asphalt. City paving contractor later makes final repair to match paving.

Single stage repair:

Repair to paving made at the same time as the utility repair.



Two stage repair

Three different approaches are proposed to increase root zone volume.

Type 1: Pavement Bridge System



Cast in place
concrete

Poured in place reinforced concrete paving slab

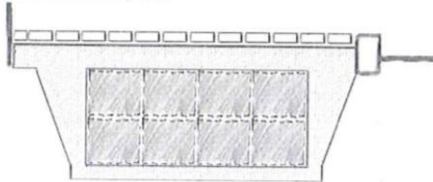


Pre cast concrete
with pavers

Precast concrete panel under unit paving

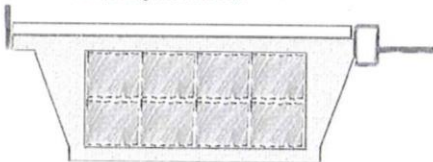
**SUSPENDED PAVEMENT
'BRIDGE' OVER ROOT
ZONE TRENCH**

Type 2: Soil Cell System



Pavers

Unit paving over soil cells



Concrete

Poured in place concrete paving over soil cells

**SUSPENDED PAVEMENT
OVER SOIL CELLS**

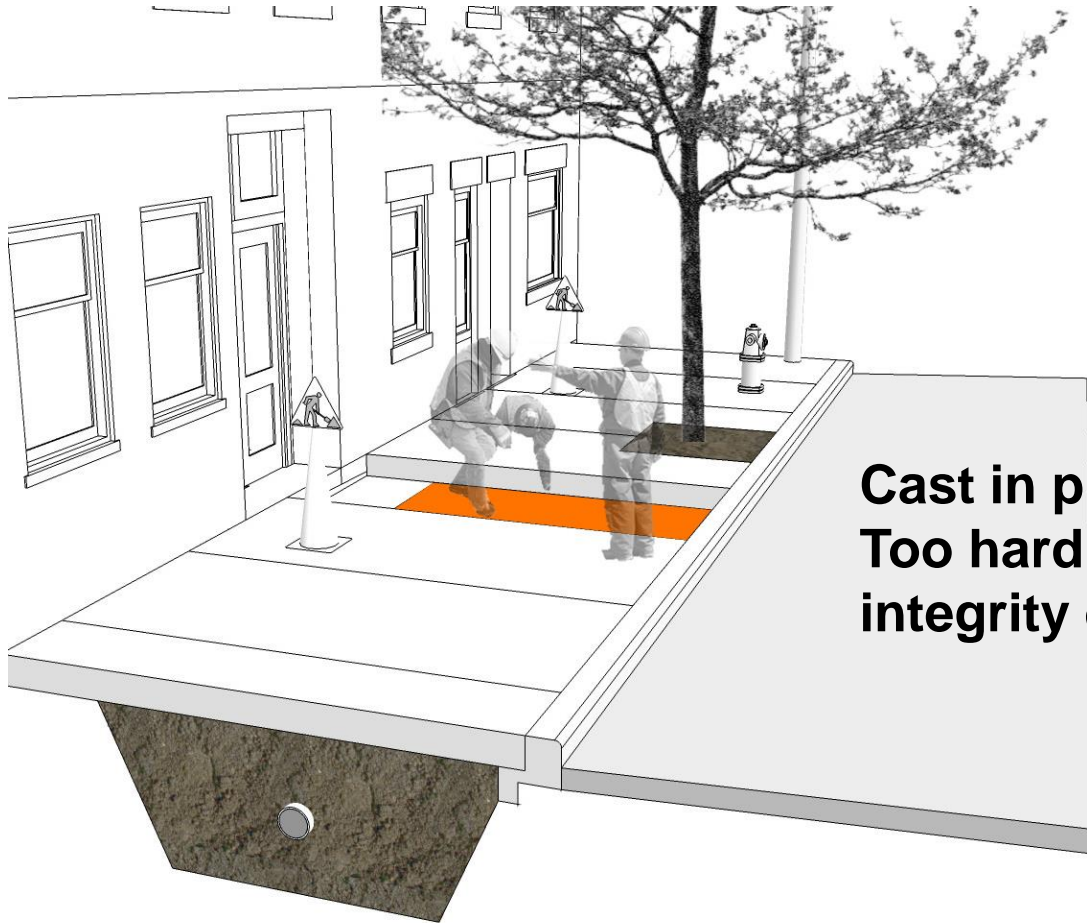
Type 3: Open Planter System



Planted

OPEN PLANTER

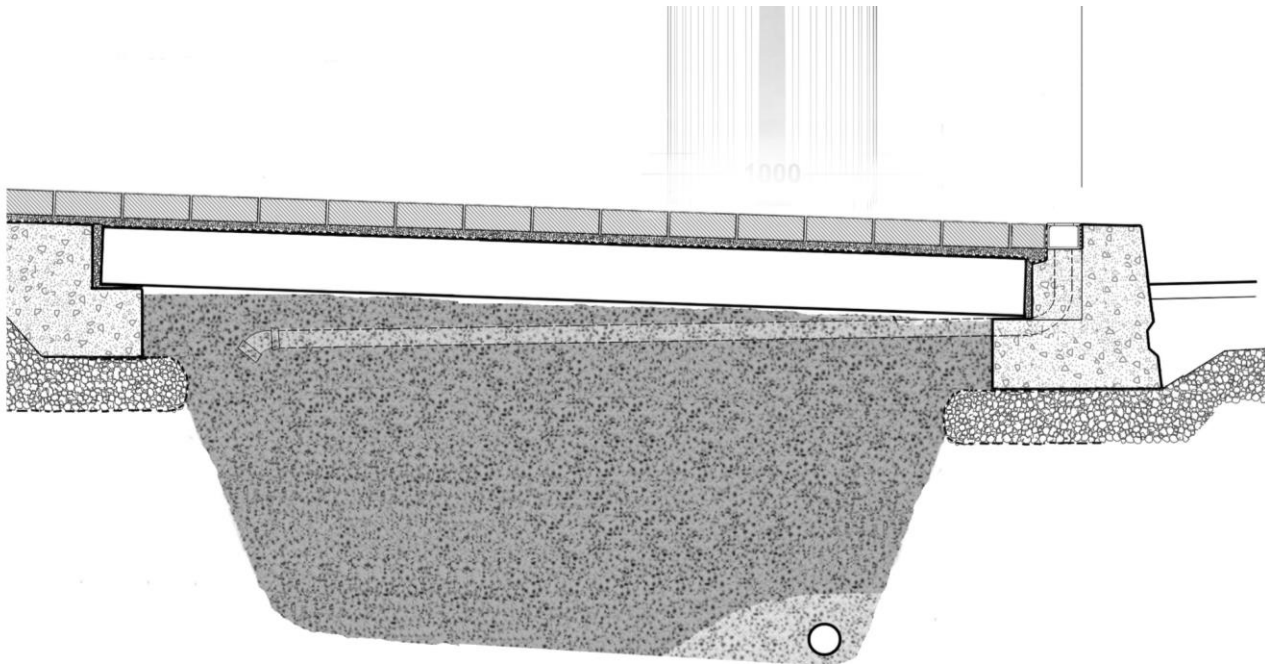
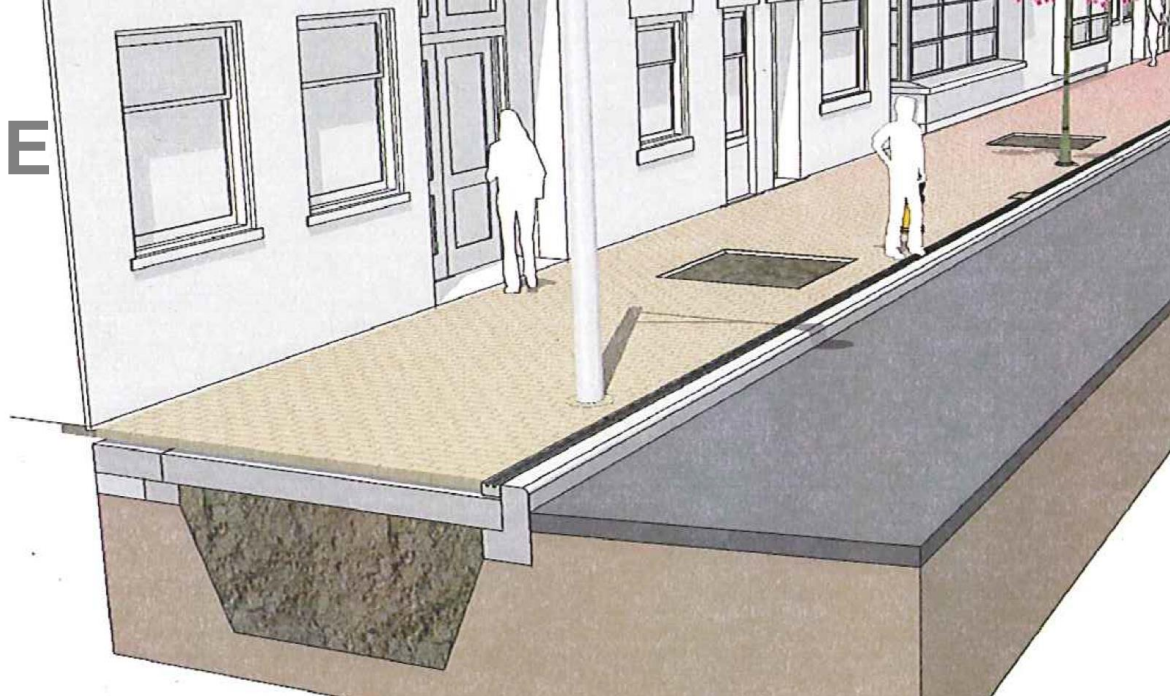
PAVEMENT BRIDGE



Cast in place concrete
Too hard to restore the structural integrity of the paving after a repair.

Cast in place concrete
Utility repair
Two stage not possible

PAVEMENT BRIDGE



**Pre-cast
concrete**

PAVEMENT BRIDGE

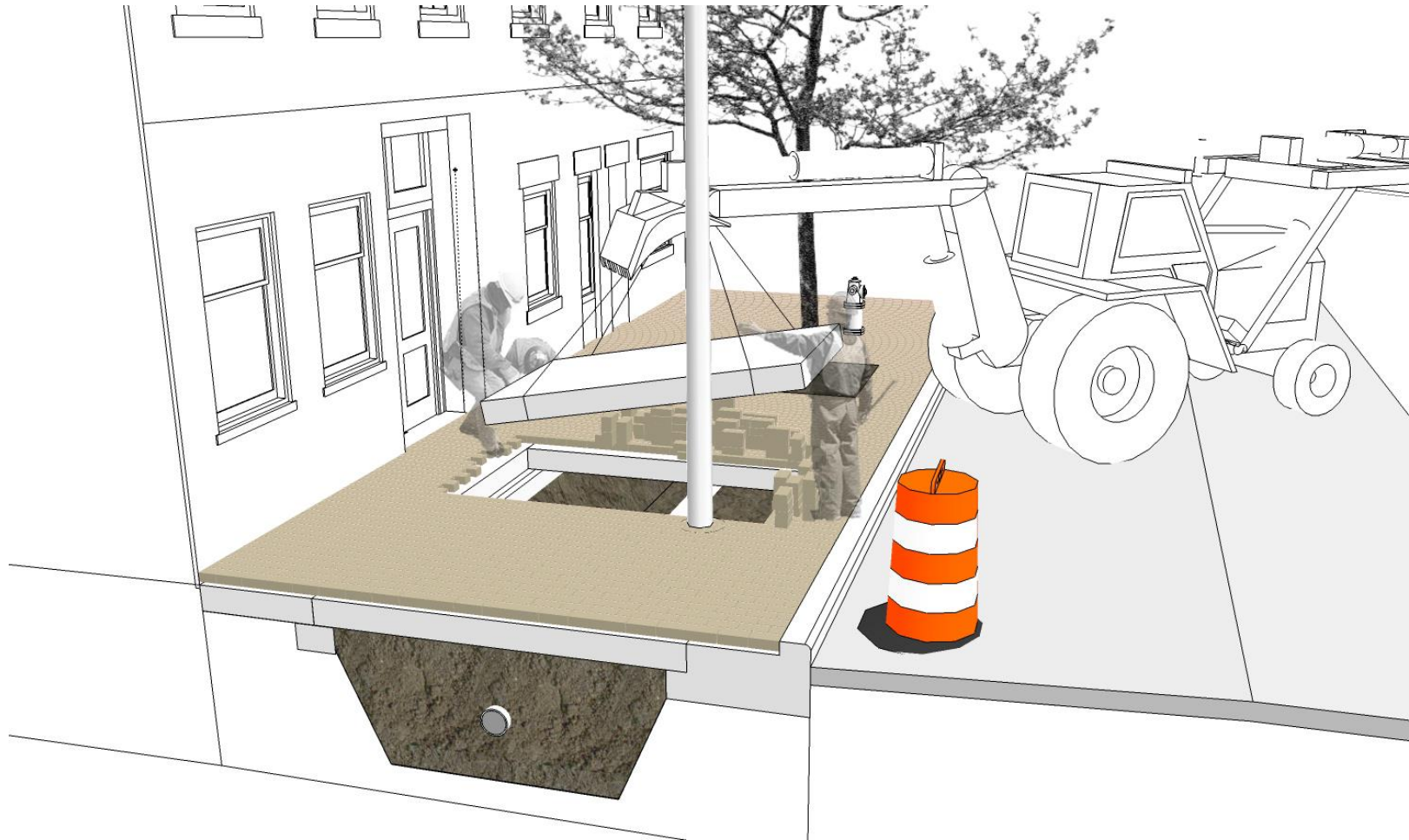


Roncesvalles



Pre-cast concrete

PAVEMENT BRIDGE



Pre-cast concrete
Utility Repair
Two stage repair possible

Soil Cells



Soil Cells



Soil Cells
Utility Repair
Two stage repair possible ?

Open Planters

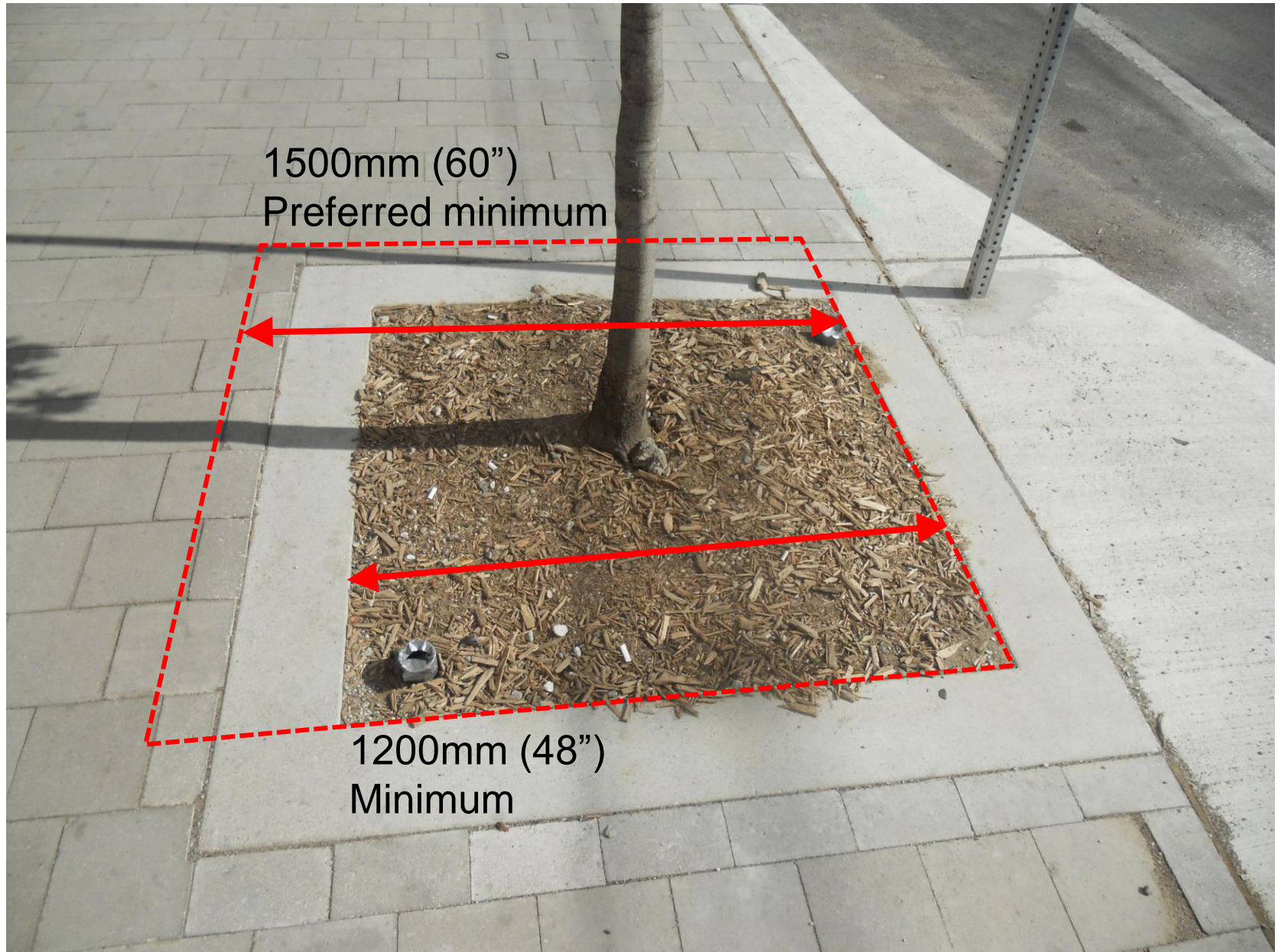


Britain street

Hybrid systems

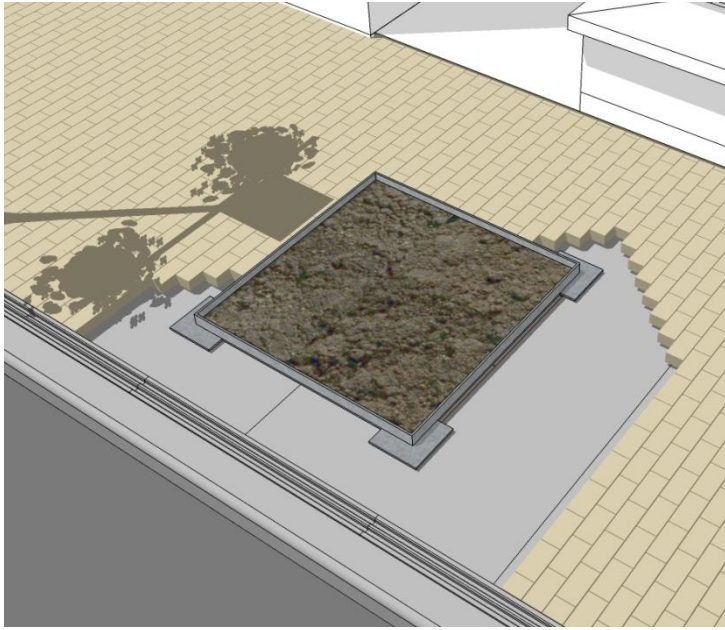


Kit of Parts: *Tree Opening Size*



Kit of Parts: *Align tree opening to paving joints*

Adjustable metal rim to reduce odd shaped cut pavers



Kit of Parts: *Tree Opening Materials*

LOOSE GRAVEL



MULCH



PLANTING



SAVE MONEY – NO TREE GRATES

Kit of Parts: *Trunk Protection*

Plastic mesh temporary trunk protector





Please No Tree Grates

1. Do not protect the tree.
2. Hide root and trunk flare problems.
3. Still a tripping hazard.
4. Eventually girdle or damage the tree.
5. Very expensive, spend money on soil.





**BETTER DESIGN
BUT...**

**+/- \$3K IN
+/- \$ 1K OUT**

**EVENTUAL
TRIPPING
HAZARD AS
TREE BECOMES
SUCCESSFUL**

Kit of Parts: *Root Zone ID – Ontario ONE CALL*

ID MARKERS AT EACH TREE OPENING ALLOW UTILITY COMPANIES TO KNOW WHAT IS BELOW THE SURFACE WITHIN PLANTED TREES.



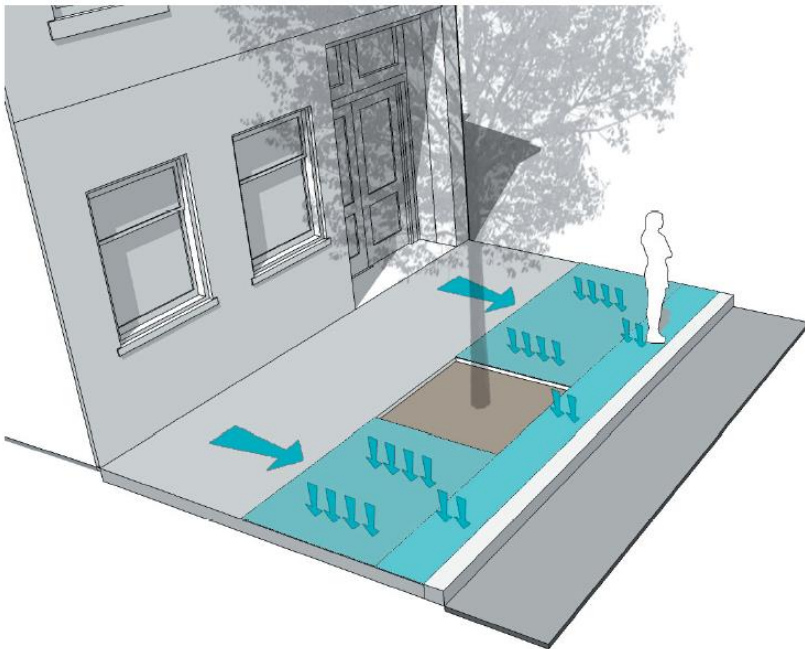


We are too focused on tree shape.
**The problems are
below the soil line!**

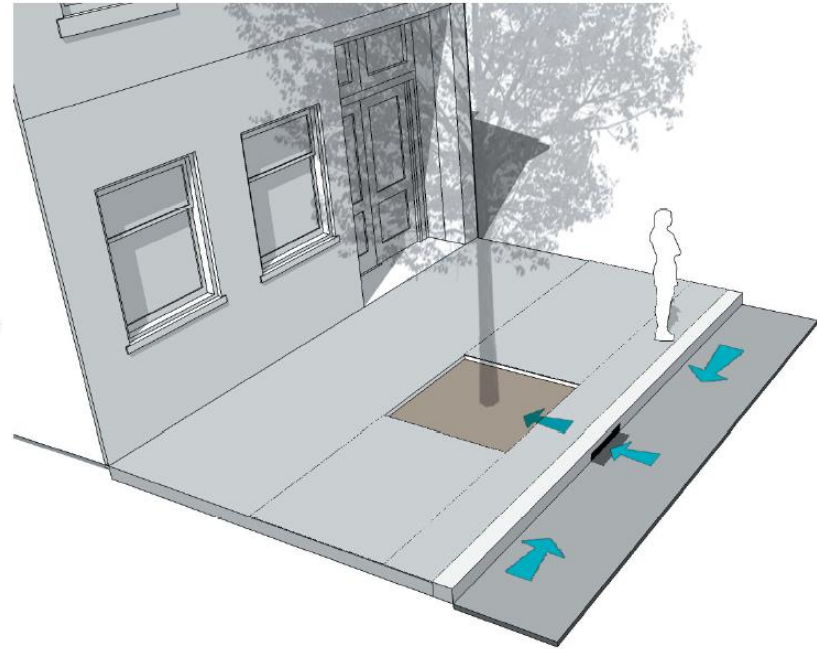
Kit of Parts: *Water Harvesting*



Sidewalk water into channels

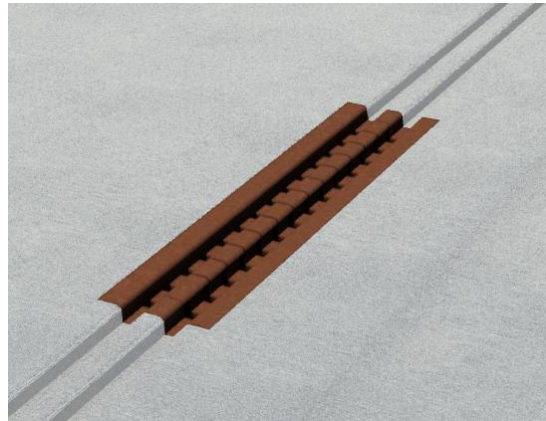
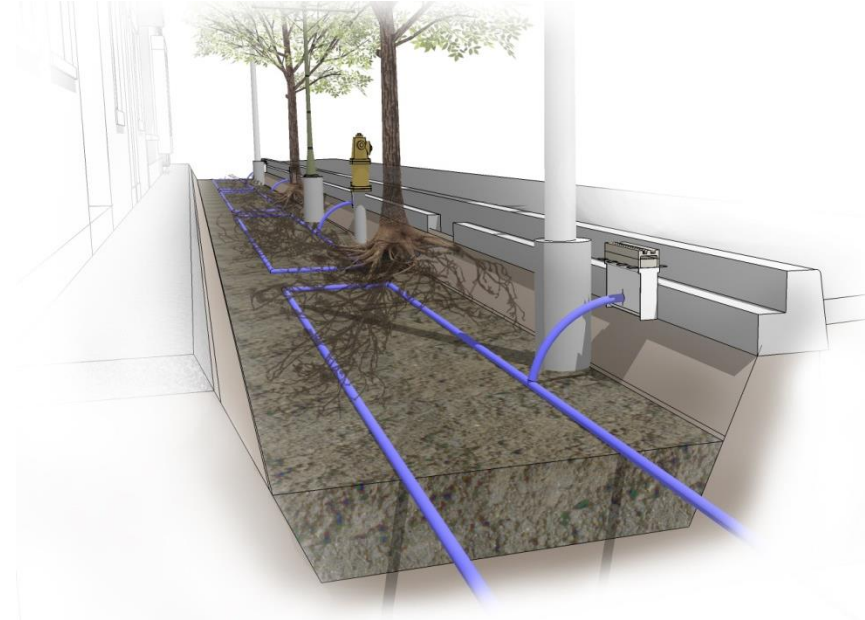


Pervious pavers



Gutter water into inlets

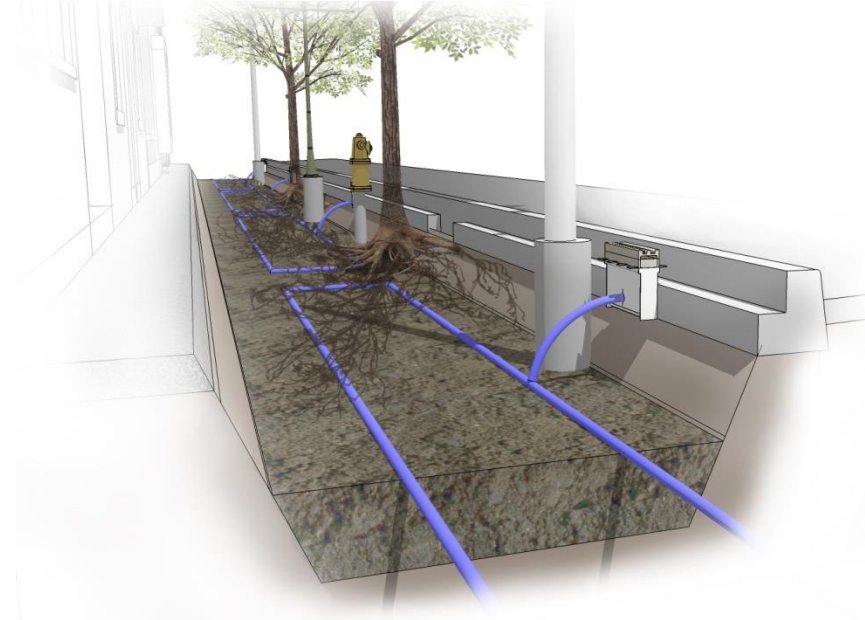
Kit of Parts: *Water Harvesting*



Sidewalk water into channels

Lessons from Bloor Street:
Riglets and inlets determined
to be too small

Kit of Parts: *Water Harvesting*



Continuous trench drain is preferred

Best Practices Manual :

Pilot Projects: Bloor Street



Best Practices Manual :Pilot Projects: Nashdene Yard Utility Test for Silva Cells

Two utility stakeholders explorations: Enbridge (gas) and Toronto Water.





Soil cell trench filled with soil



Soil cell decking system.



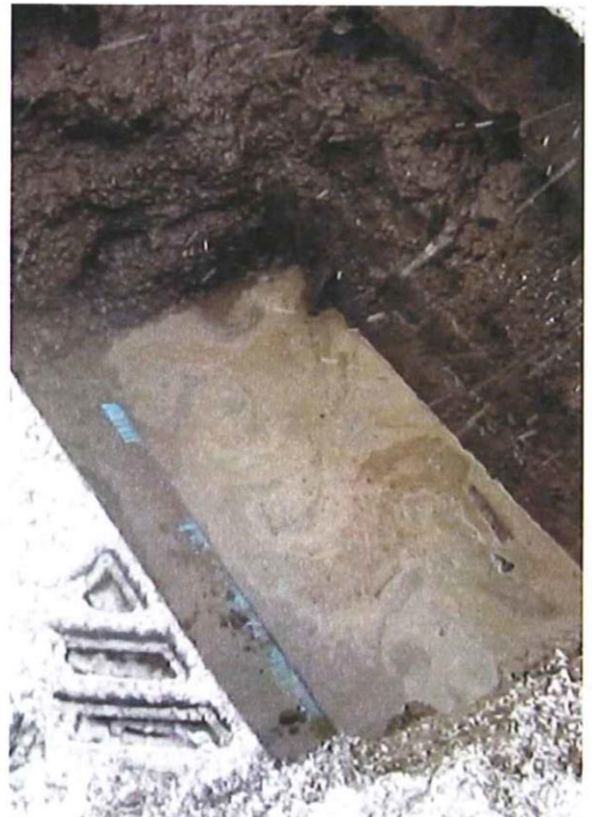
Backfill installation on top of deck.



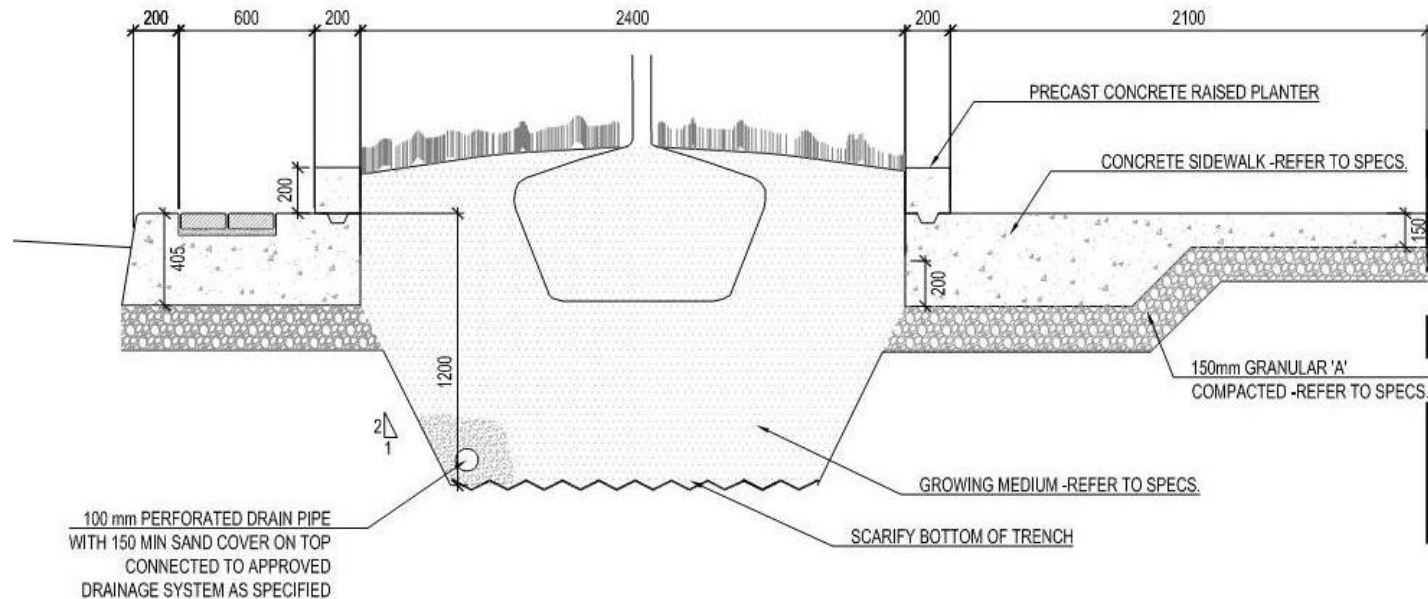
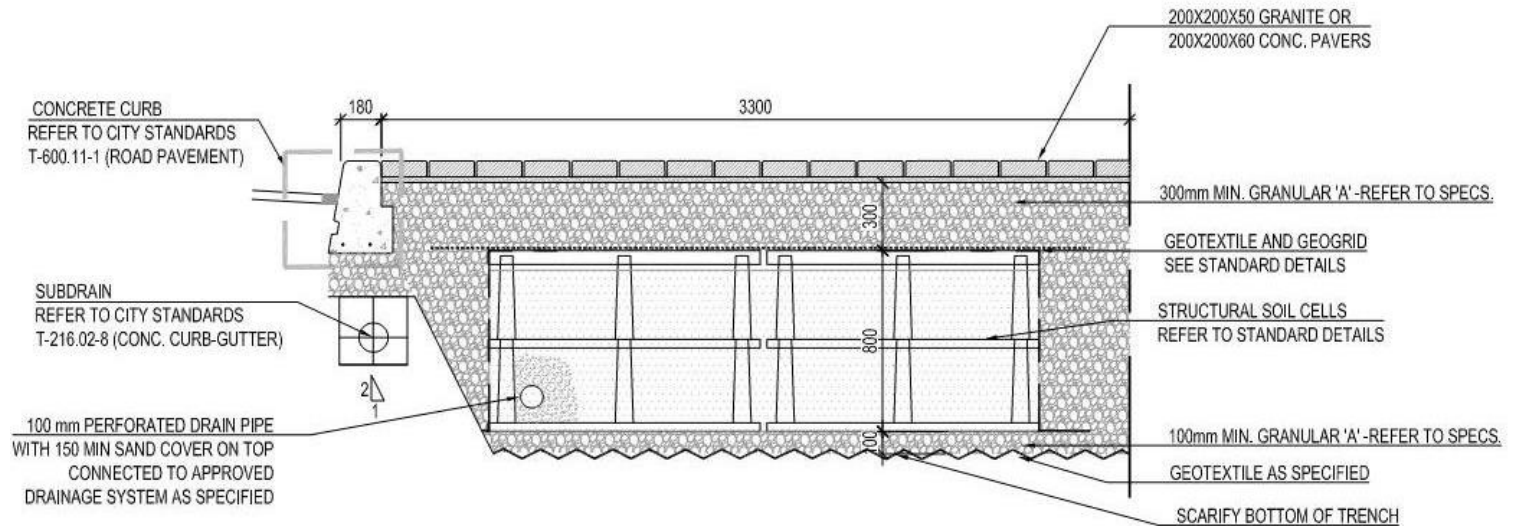
Manual removal of two decks, unscrewed and set aside for future re-installation.



Excavation below bottom of soil cells to daylight water pipe.



Kit of Parts: Standard details



PART 1 - GENERAL

1.1 WORK INCLUDES

- .1 The work consists of installing irrigation cover, inlets and pipes for the irrigation system.
- .2 The construction of the irrigation equipment, also including the installation of the irrigation system.

1.2 RELATED WORK

- .1 Section 03 45 00.02 Pre-qualified
- .2 Section 05 50 00 Metal
- .3 Section 32 91 21 Growing Medium
- .4 Section 32 93 00 Planting

1.3 MATERIALS AND WORKMANSHIP

- .1 Engage an experienced contractor similar in material, design and workmanship.
- .2 All materials will be new and of the highest quality.
- .3 All materials will be guaranteed by the manufacturer.

1.4 SUBMITTALS

- .1 Prior to construction, submit samples of all materials that will be used in construction begins.

1.5 MOCK-UP OF SYSTEM

- .1 The installer shall prepare a mock-up of the system that shall be completed and approved by the City before construction begins.
- .2 Stage 1 shall consist of installing the piping as specified. The piping shall demonstrate the ability to hold water to the point of use.
- .3 Stage 2 will consist of installing the drain inlet and catchment.

1.6 AS-BUILT DRAWINGS

CITY OF TORONTO
TREE PLANTING SOLUTIONS
IN HARD BOULEVARD SURFACES

2.2 Plants - Balled and Burlapped Trees

- .1 All Trees shall be field grown and dug balled and wrapped in the following modifications to standard nursery practices:
 - .1 Prior to digging each tree check for the following:
 - 1. The first main structural roots within the root ball shall be defined in paragraph "Plants General: structural roots".
 - 2. The soil around the trunk of the plant to be dug shall be inspected for structural roots. The City may randomly inspect the soil from the base of the trunk to inspect for structural roots.
 - 3. A minimum of three radial roots shall be dug and included in the root ball. Roots shall be defined as large woody roots approximately the same depth with a diameter of 10mm or greater. Adventitious and circling roots shall be removed and the plant shall be rejected if the removal will compromise the future growth of the tree.
 - 4. Apply a 25 mm diameter, dot of paint or marker to all trees 300 mm above the natural ground line.
 - 5. Prior to digging any tree, using hand tools, the root ball to the natural ground shall be marked to avoid damage to the bark of the root flare and the trunk.
 - 6. Plants shall be burlap wrapped either in the nursery or in the container. If wire baskets are used, a low profile basket shall be used, having the top of the highest root no greater than 200 mm below the top of the root ball.
 - 7. Twine and burlap used for wrapping shall be biodegradable material.
 - 8. Apply 3mm thick, wax sealed, corrugated plastic to the trunk of the tree from the top of the root ball to the cardboard with biodegradable twine.

2.3 Plants - Container Grown Trees

- .1 Trees that have been grown in a container or pot shall be dug during the growing period, (containerized trees) shall be dug during the growing period.

2.4 Water

- .1 Potable and free of impurities that would inhibit the growth of the tree.

2.5 Tree Guying Material

- .1 Tree guying to be flat woven polypropylene netting. Color to be Green. Product to be approved by the City. Partners, L.P. (800) 458-7668, or approved equivalent.
- .2 Dead man shall be 89mm x 89mm x 1200mm.
- .3 Straps shall be 35mm x 35mm x 1800mm.
- .4 Straps shall be equipped at one end with an approximate 100mm diameter eye for attachment to the tree.

CITY OF TORONTO
TREE PLANTING SOLUTIONS
IN HARD BOULEVARD SURFACES

- .1 Metal content shall comply with Interim Guidelines for the Production and Use of Aerobic Compost in Ontario (2004) except for copper and zinc, which must comply with Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act Table 3 (medium to fine textured soils).
- .2 Pathogen reduction shall meet Section 6.0 of Interim Guidelines for the Production and Use of Aerobic Compost in Ontario (2004).
- .10 Submit two four liter samples with manufacturer's literature and material testing certification that the product meets the requirements.

GROWING MEDIUM- (for use in open planting spaces, soil trenches and Soil Cell installations below paving)

- .1 A mixture of Topsoil, Coarse Sand and Pine Bark Compost mixed to the following proportions, by volume:

.1 Topsoil	40-45%
.2 Coarse Sand	40-50%
.3 Pine Bark Compost	12-15%
- .2 The Growing Medium shall meet the following parameters as measured by dry weight:
 - .1 Particle distribution:
 - .1 Total sand/gravel sized 0.25mm – 5mm: Minimum 45%
 - .2 Total combined silt and clay: Between 18 and 35%
 - .2 Organic matter: Between 3.0 and 5.0%.
 - .3 pH: between 6.0 and 7.8.

Note to specifiers: The pH maximum of 7.8 will be acceptable for most trees and other plants in the Toronto area. However, if the design team specifies pH sensitive trees or plants, the pH maximum should be lowered to an appropriate level for those plants. Note that lower pH growing medium will cost more due to the lack of availability of lower pH components. Coordinate the specification with the design team on species requirements.
 - .4 Chemical analysis; Acceptable ranges in PPM

.1 Phosphorous ppm	10-60
.2 Potassium ppm	80-250
.3 Calcium ppm	<5000
.4 Magnesium ppm	100-300
 - .5 Soluble salts mmhos/cm <1.5
- .3 Mix the Growing Medium with a loader bucket to preserve Topsoil peds using the following method:
 - .1 Mix the Coarse Sand and Compost together separately.
 - .2 Mix the Coarse Sand and Compost approximately 300 mm thick and apply the required proportions of Coarse Sand/Compost mix over the Topsoil.
 - .3 Push the Topsoil, Coarse Sand and Compost into a pile and then drag out into a layer mixing the soil with the bucket. Repeat the mixing action a second time to gain an approximate mixture of the material. Do not over mix.
 - .4 This method assumes that there is an additional mixing of the materials as it is moved to the final stockpile, placed into the delivery trucks, deposited at the project site, and spread into the planting space.
 - .5 This method assumes that soil will not be installed using soil blower or soil slinging equipment.

Kit of Parts: Specifications

CITY OF TORONTO

TREE PLANTING SOLUTIONS IN HARD BOULEVARD SURFACES Best Practices Manual

Consulting Team

dtah / Arup / Urban Trees + Soils / Urban Forest Innovations Inc



James Urban, FASLA, ISA
urbantree@toad.net
<http://www.jamesurban.net>