Research Technical Note
Urban Greenery Series
RTN
05-2013
March

# Sampling Strategy for Urban Soils Assessment

Author: Subhadip Ghosh

## Introduction

Soils in urban environment have been affected by human and construction activities; hence they differ in composition and characteristics from natural soils. Poor soil quality may affect the growth of urban trees, therefore analysis of soil properties is important in the determination and execution of a proper soil management plan.

Because of high variability of urban soils, it is important to collect representative samples of the site for laboratory testing. Improper soil sampling procedures may lead to inaccurate conclusion and hence ineffective recommendations.

This Research Technical Note (RTN) outlines the sampling scheme for urban streetscape soils, which can significantly lower the variation of soil test results, as compared to the more common practice of averaging results from multiple point samples.

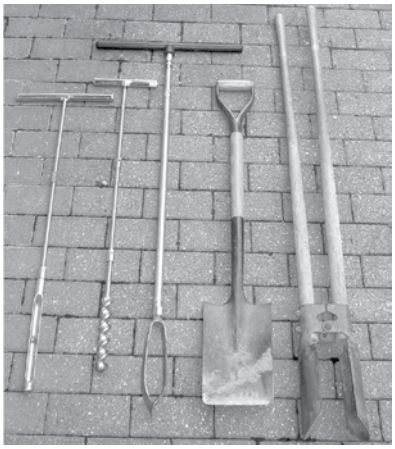


**Fig 1.** Tools used for soil sampling.

## Importance of Urban Soil Sampling

- Research on urban soils characteristics, particularly in tropical urban landscapes is limited. Implementation of proper soil sampling methodology is important to determine the soil variability across the urban land uses.
- Assessment of soil parameters is complicated due to heterogeneous and disturbed nature of urban soils. Therefore information is needed on the variability of urban soils in order to identify soil related factors for poor plant performance.
- Systematic approach to urban soil sampling and methodological protocols for soil quality assessment will help to implement an efficient soil management programme for better plant growth in urban landscapes.
- Proper diagnosis of soil conditions commences with extracting representative samples from the site. A composite soil sample should represent a uniform field area that has similar land management history for at least the last two years.

## Tools for Soil Sampling

**Fig 1** shows a range of common tools that are used for collection of soil samples. Selection of suitable soil sampling tool is dependent on the structure and composition of the soil and on the research objectives. The soil probe, auger, spade are basic soil sampling tools for field officers to collect soil samples at or near the soil surface for the purpose of normal soil assessment. For collection of undisturbed soil samples at desired depth and to measure in situ (i.e. measurement at site) bulk density, bulk density sampler and core sampler are used.

After collection of sample cores, a clean and dry bucket is needed to mix them into a homogenous and representative composite sample. Soil sample bags used for storing samples should be properly labelled.

To obtain a representative sample from a large area, it is advisable to sample in smaller units based on land uses, planting history, or past management practices.

## Sampling Procedure for Streetscape Soils

It is extremely challenging to obtain representative soil samples along roadside verges. The sampling technique is dependent on a number of factors: practicability, cost and research objectives. The fragmentation of exposed surfaces and the variability of urban soil properties make it difficult to follow any conventional sampling techniques. Therefore, a stratified sampling protocol (**Fig 2 and 3**) will help reduce the variability of soil properties. The detailed sampling scheme for streetscape soils is described below.

1. Determine the length of the street to be sampled (**Fig 2**).
2. Divide the road into three strata or locations (L1, L2 and L3), each location will be further divided into three sub-locations or sampling points (A, B and C). Soil samples will be collected from both sides of the road in a quadrat from each point.
3. Define sampling points at approximately 200 m intervals along the entire accessible length of the road.
4. Collect, at each point, samples (5 specimens from 1 $m^2$) for each depth (**Fig 3**).
5. Mix all the five samples collected at each depth into one composite sample for each depth, and for each location.
6. Record the GPS reference for each sampling point to facilitate future sampling.
7. Record plant data (such as plant height, girth diameter) at each sampling point. This information is useful in assessing the influence of soil properties on street tree performance.
8. Repeat soil and plant sampling at least once a year.

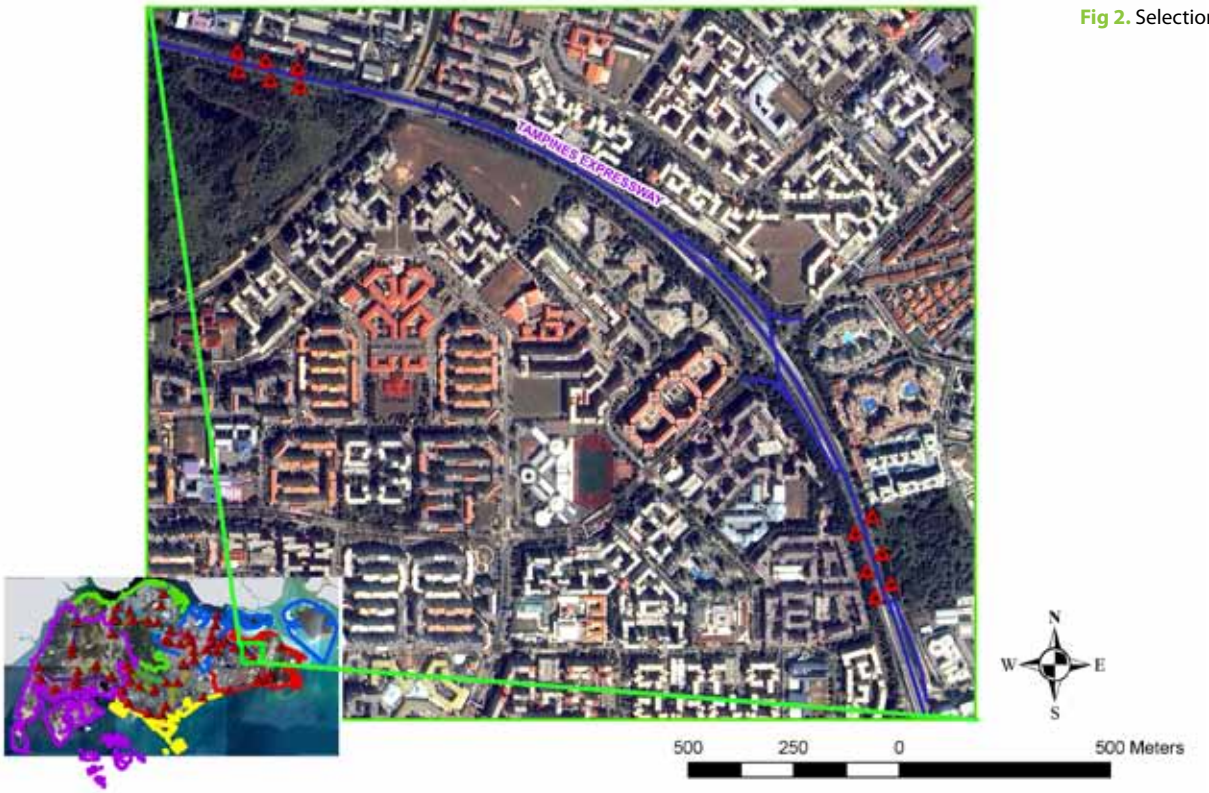
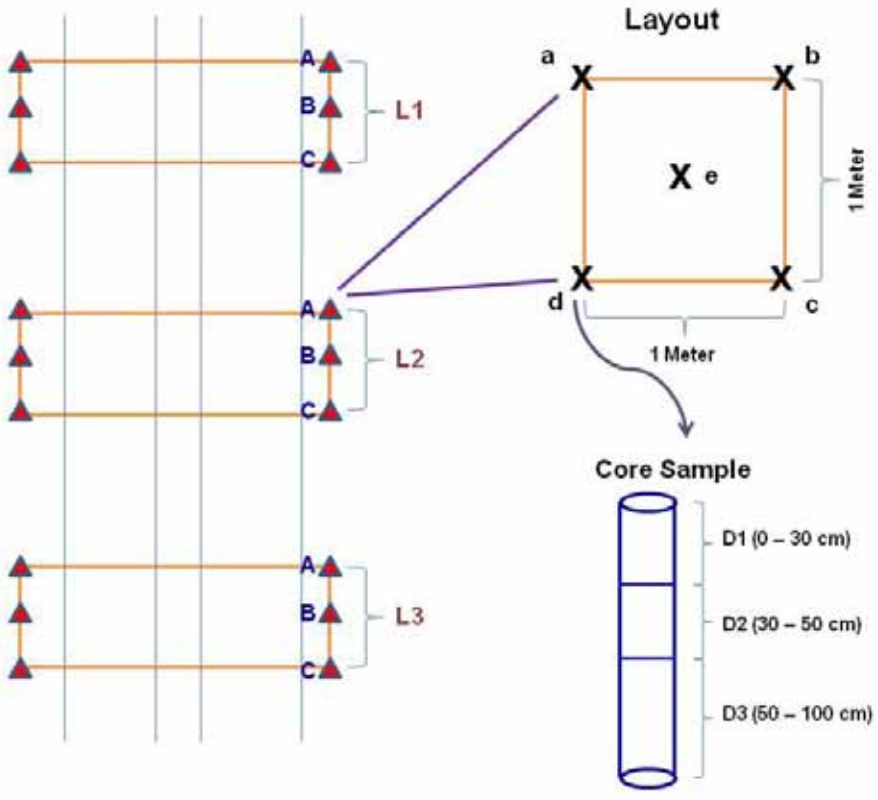



**Fig 2.** Selection of site along a street.

**Fig 3.** Layout of sampling methodology



## Collection of Soil Samples

Fig 4 shows an example of soil sample collection using the soil corer. This method is used to collect depth-wise undisturbed soil samples for specific research purposes.

A 50 mm diameter corer is used, which will also help to determine the in situ bulk density. The probe with a small diameter will minimise soil disturbances associated with sampling, and in some cases facilitate obtaining permission for sampling. A mallet is used to drive the probe into the soil to the specified depth and the probe can be pulled out by hand.

**Fig 4.** Collection of in-depth undisturbed soil samples.

## Sampling Depth

The characteristics of urban soils are determined by the degree of disturbance they have undergone. These activities cause compaction of the surface soil layers as well as in the lower soil profile. Due to the lack of a distinct vertical profile, urban soils should be sampled by depth increments rather than by soil horizons. The samples should be collected from 0-100 cm depth, with subsequent divisions of 0-30 cm, 30-50 cm and 50-100 cm.

## Labelling of Sampling Bags

Soil samples should be stored in properly labelled sealable bags before sending to the soil testing laboratory for analysis. Label each sample differently and also keep record of the sampling site.

Each sample label should have the following information as required by the soil testing laboratory (Fig 5).


**Fig 5.** Labelling of sample bags

## Conclusions

The stratified random sampling strategy described in this RTN will help users obtain a more representative set of soil samples, which then enables a better estimation of urban soil properties. The number of soil samples needed depends on the precision required, accessibility of the site and the cost allocated. The sampling protocol describes the minimum sample size required to ensure adequate estimation of stratum distribution which improves the overall accuracy of soil quality assessment in the urban streetscape.