

Effect of soil improvement treatment to the tree stability

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Soil compaction is a major cause of tree decline in urban areas. It reduces the ability of air and water to move through the soil, causes root decline and reduces the physiological vitality of the tree. At present, therefore, site improvements techniques are increasingly used. Compacted soil can be improved by the AirSpade excavation. The positive effect of these treatment is well described, but little is known about the effect of the treatment on tree stability.

Objectives

- The aim of the project is to examine **the effect of site improvement** within the root space of the tree **on its immediate stability**, especially the probability of uprooting.
- Tree stability test by using **pulling test**.

Material

- 5 *Celtis occidentalis* street trees were evaluated, in Prague city centre.
- The size of the pavement opening, the type of surrounding paved area was describe.

Soil compaction

The soil in the area of the original and enlarged pavement opening showed an average penetration resistance of 2.77 MPa. The critical value is 3.3 - 3.7 MPa.

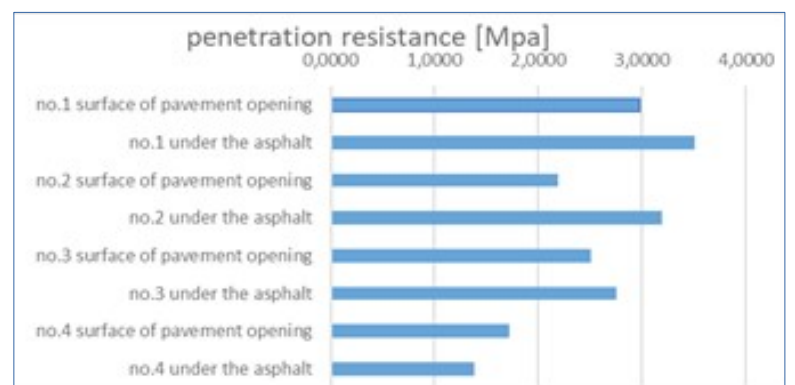


Fig. 1: The penetration resistance of the soil.

Site improvement - AirSpade

Pavement opening was enlarged by removal of asphalt cover and 20 cm of soil were replaced by structural substrate.



<Fig. 2: AirSpade excavation.

Pulling test

Pulling test took place just before and after the site improvement within the same moisture and other soil conditions.

	Safety factor against uprooting									
	Tree no. 1		Tree no. 2		Tree no. 3		Tree no. 4		Tree no. 5	
	Before	After	Before	After	Before	After	Before	After	Before	After
Inclinometer 1	3,13	1,55	1,09	0,77	1,18	1,18	1,02	0,96	1,16	1,04
Inclinometer 2	3,65	1,69	1,03	0,76	1,3	1,21	1,28	1,1	1,15	1,08

Tab. 1: The resistance against uprooting is expressed as Safety factor against uprooting .

Conclusion

- **Removal of the asphalt cover** and **replacement of the surface layer** of the soil caused significant **decrease in the uprooting resistance (UR)**, as the safety factors show.
- Four tested trees showed decrease of UR at least 10 % (0,1), tree no. 1 showed 50 % decrease of UR. Tree no. 3 showed just a slight decrease in UR.
- Further measurements are needed after a longer period following the treatment, when the effect of a new rooting within the added substrate is expected.