Use of a Permeafor to Determine Infiltration Characteristics of Soils

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Report Title

Improved Practices for Determining the Infiltration Characteristics of Soils for Design of Stormwater BMPs

Principal Investigators

Jean Benoît, Project Investigator

Steven Wuebbolt and Alex Lefebvre, Graduate Students

University of New Hampshire

Report Link

https://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/26962u.htm

NHDOT Research Unit

Bureau of Materials and Research
5 Hazen Drive
Concord, NH 03302
(603) 271-3151

Why was it studied?

There are currently several in situ and laboratory methods of determining hydraulic conductivity of soils, however, it remains a difficult parameter to obtain accurately and economically. To characterize hydraulic conductivity for the design of stormwater best management practices (BMPs), the NHDOT currently uses a traditional field test, the borehole infiltration test. The interpretation method of this test uses general assumptions and lacks vigorous analysis due to its development in the 1950's. The proposed solution to these issues is to use a Permeafor, an instrument originally developed in France to measure horizontal hydraulic conductivity in situ. This property is determined by means of flowing water into the soil at any given depth, then obtained through the relation of applied hydraulic head and resulting flow.

What was done?

A Permeafor has been designed, built, and tested at the University of New Hampshire. A simple testing procedure has been devised which allows the test to be carried out rapidly and with accurate measurements of pressure and flow into the ground during the permeability test. The tool has been used extensively on 7 different sites across New Hampshire where the soil varied in characterization from coarse to silty sands. The tool can be advanced into the ground using conventional drilling methods and each test takes less than 20 minutes.

What did we learn?

The results from more than 120 field tests demonstrated the potential of the Permeafor to rapidly characterize soils at different depths to generate profiles of hydraulic conductivity. The Permeafor permeability results were in general agreement with estimates made using laboratory permeability tests and empirical relationships based on grain size and grain size distribution. This new test method allowed for faster and more reliable site estimates of hydraulic conductivity compared to the borehole infiltration test. A Permeafor profile can be completed in a few hours while a profile completed using the borehole infiltration method can take several days. Therefore, the Permeafor is a useful tool in bridging the gap between time consuming testing at few locations and efficient broad scale permeability testing.

How can we use it?

The results of this research suggest that the Permeafor is capable of rapidly and accurately estimating hydraulic conductivity in situ. Other methods such as borehole infiltration testing are slow and provide limited data to support the required permeability measurements needed for design of BMPs.