



Florida Department of Transportation Research

Field Implementation of the Vertical In situ Permeameter (VIP)

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Project Number

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Current Situation

The movement of water through soil, specifically the rate of movement, is a subject of interest in many areas. Measurements of this rate can help determine how well surface water will drain or how quickly pollutants can travel through the ground. This rate is called permeability, and it is measured with a permeameter, which must be inserted into the soil. However, this can disturb surrounding soil and alter the apparent permeability. Also, these devices may be easily clogged or caked with clay, which is a challenge when one considers the variability of soil, with its different materials, different grain sizes and orientations, density, and degrees of saturation. A number of permeameters have been developed in an effort to overcome these challenges and to improve the efficiency and accuracy of hydraulic conductivity data.

Research Objectives

University of Florida researchers conducted tests of a promising new permeameter, the vertical in situ permeameter (VIP), at sites across the state of Florida.

Project Activities

The “vertical” in VIP reflects the vertical injection of water used by the probe; however, the probe still measures mean permeability, not vertical permeability. The unique probe design, including its injection system and retractable tip, differs from previous direct-push probes and minimizes smearing and other site effects. Other aspects of the design improve its accuracy.

In preliminary testing in a previous project (BDV31 977-23), the design of the VIP had been refined, and its abilities demonstrated. In this project, the researchers fully documented the finalized design of the VIP and its calibration as well as testing the new VIP and finalizing methods for using it.

The testing program included locations in all seven Florida Department of Transportation (FDOT) districts and Florida’s Turnpike in order to validate the test method and to use the VIP in a large representative sampling of Florida soil conditions, including soil types and stratifications. In total, 109 VIP tests were conducted at 10 locations. VIP test results compared favorably with standard in situ methods and historical data, showing the probe’s ability to efficiently and accurately measure hydraulic conductivity at multiple depths throughout Florida.

Secondary objectives included improving the test procedure and the probe’s design and updating the test procedures and shop drawings. The Florida Test Method (FM 5-614), which outlines the procedure to determine mean permeability using the VIP probe, was revised based on this project’s recommendations. Eight probes were fabricated and distributed to each FDOT district as were eight falling head vessels, an above-ground component of the probe apparatus. An instructional video was created for training purposes and to promote the use of the newly developed VIP test method.

Project Benefits

The VIP will make possible more efficient, accurate, and comparable measurements of hydraulic conductivity across Florida, resulting in potential time and cost savings when permeability measurements are required for geotechnical site investigations.

For more information, please see www.fdot.gov/research/.



A technician has attached the VIP to a drill rod and prepares to lower it to the ground.