# Development of an Improved Vertical and Horizontal In-situ Permeameter (VAHIP)

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GRIP August 9, 2018

# VERTICAL IN SITU PERMEAMETER (VIP) PROJECT

- New permeability probe recently developed by UF and FDOT
  - Measurements were in good agreement with results obtained from various conventional methods
  - Includes both cased and uncased methods
- Requires far less test time
  - Greatly improves efficiency
  - More data can be collected with less effort
- New Florida Method of Test was developed for the probe
  - FM 5-614
- Issues
  - Delivers some "average" conductivity rather than independent values of $k_v$ and $k_h$
  - Difficulty to drive the probe into deeper layer
    - Old VIP – difficulty in layers deeper than 10 ft
    - Improved VIP – TBD

# IMPROVED VAHIP

- Advances in flow theory
  - Potential for estimating vertical and horizontal permeabilities $k_v$ and $k_h$ under saturated conditions
- Simple mechanical design
  - No moving parts
- Automated data acquisition using pressure transducers
  - No hand readings
- Potentially capable of reaching greater depths
- Potentially insensitive to smearing and compaction near probe surface
  - Use of SPT hammer

# VERTICAL AND HORIZONTAL IN SITU PERMEAMETER PROJECT (VAHIP)

- Project Tasks

✓ 1. Identification of an appropriate pressure measurement system

✓ 2. Development of computer-aided drawings (CAD) for the proposed probe

✓ 3. Fabrication of a PVC-prototype and possible adjustments of injection system

✓ 4. Testing of PVC-prototype at the DOT test pit

5. Fabrication of a steel probe

6. Final report

# DOT TEST PIT

- Data acquisition (DAQ) module
  - Track and record the measurement in real time during the test procedure
    - No more stop watch and hand readings
    - Potentially be extended to real time conductivity estimates
      - Visualization of tests results on the same screen
      - Ability to determine if test results are stable and replicable when running more than one test
      - No more hand or spreadsheet calculations
  - Created an instruction manual for the DAQ
  - Development of a standard test procedure

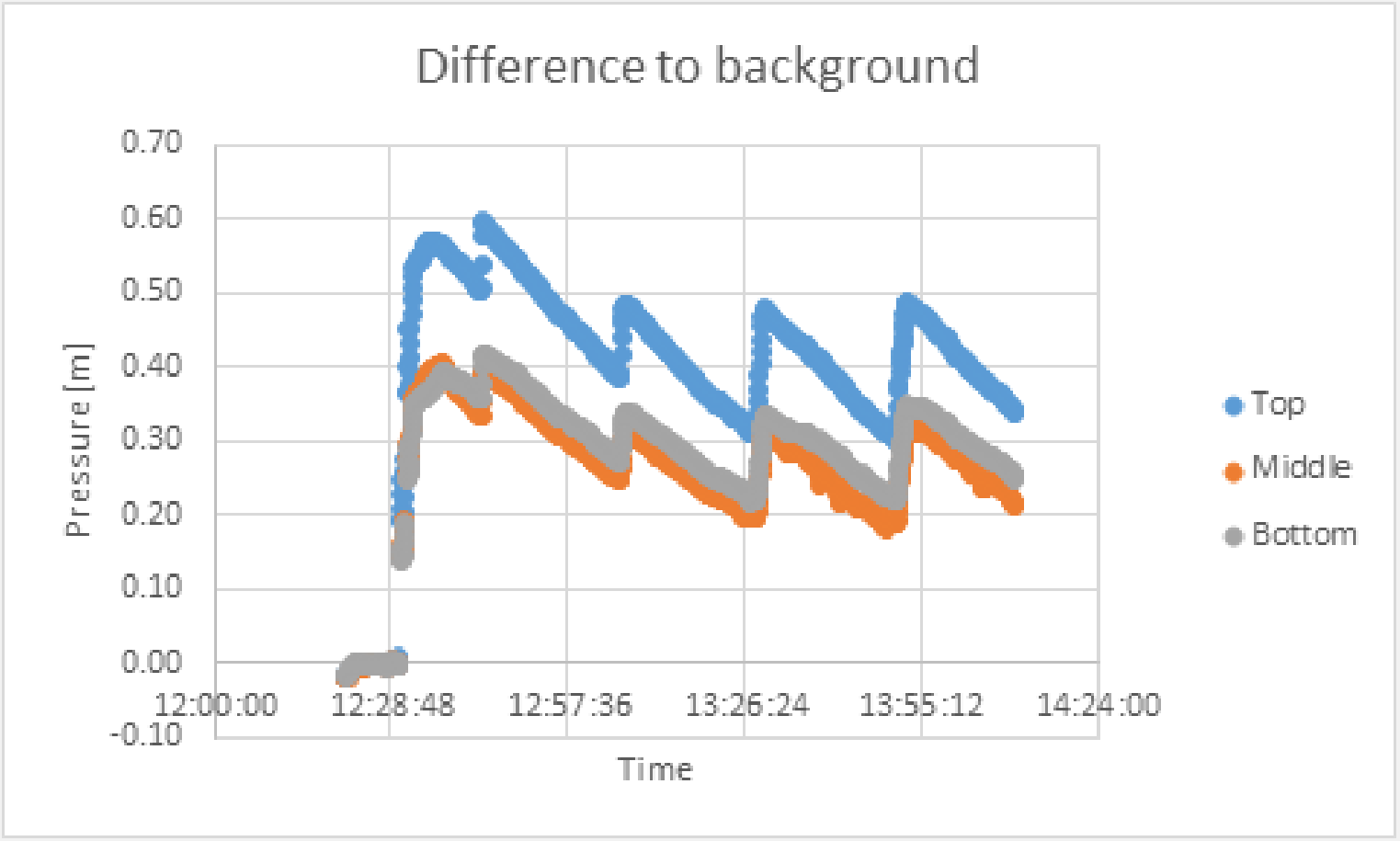
# DOT TEST PIT

- 2 day testing
  - 3 tests on 1st day
    - Pipping during 3rd test
      - Solution
        - Deeper embedment of probe
        - Lower the total head at the beginning of the test
        - Not an issue during tests in the field
  - 4 tests on 2nd day
    - No issues

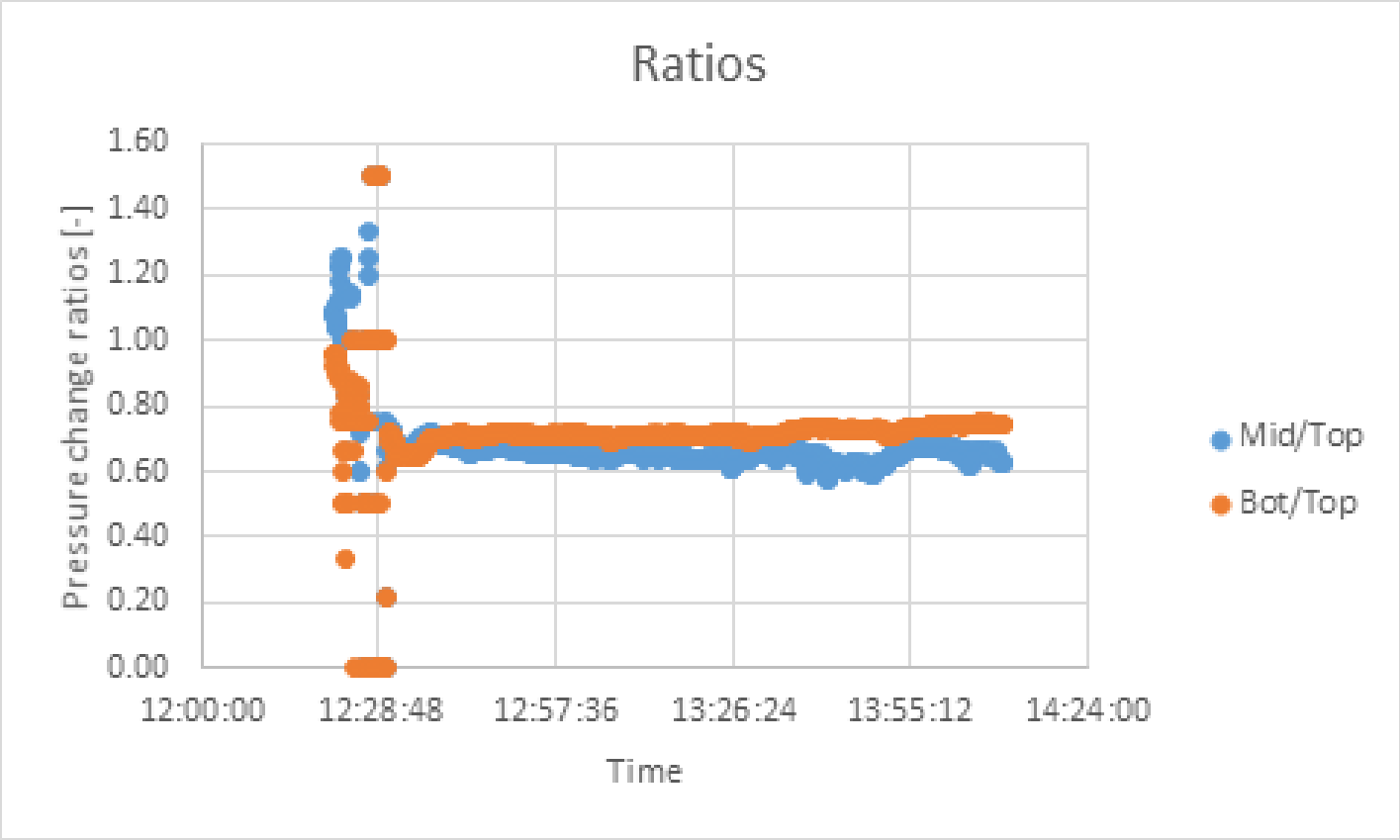

# DOT TEST PIT


File Edit Operate Tools Window Help
GWT level drop another 6"
Test 1 (12:44:21)
Test 2 (13:07:03)
Test 3 (13:29:45)
Test 4 (13:53:45)
Waveform Graph
Plot 0
Top
15.14
file path (dialog if empty)
C:\
Task
VIP Sensors
Test Name
VIP July 20th
Samples/ Minute
0.1
Record
clear graphs
save data
stop
STOP
Current Time
14:10:57
start fill up the tank with water
PSI
Data Points
Waveform Graph 2
Plot 0
Middle
15.029
Waveform Graph 3
Plot 0
Bottom
15.203

# DOT TEST PIT


Difference to background
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
Pressure [m]
12:00:00
12:28:48
12:57:36
13:26:24
13:55:12
14:24:00
Time
Top
Middle
Bottom

# DOT TEST PIT


Ratios
Pressure change ratios [-]
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
12:00:00
12:28:48
12:57:36
13:26:24
13:55:12
14:24:00
Time
Mid/Top
Bot/Top

# UPCOMING TASKS

- PVC probe test
  - Data analysis of last tests
  - Manufacture steel probe (in progress)
    - Porous steel
- Test steel probe in DOT test pit and/or filed using DOT rig
- Final report

# THANK YOU