PRESSUREMETER TESTS IN GLACIAL TILLS IN TORONTO

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Outlines

- Introduction
- Project Site Conditions
- Geotechnical Investigations and Test Results
- Discussions of Test Results
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Introduction

For a tunnel project in glacial till deposits in Toronto, Canada, the glacial till properties are determined from following tests:

(1) In-situ testing
   Pressuremeter tests
   SPTs
   Cross-hole or down-hole seismic tests
(2) Laboratory testing
   Index and general properties
   One dimensional consolidation tests
   Triaxial tests
Project Description

- The project site is located at Eglinton Avenue in Toronto, Canada. Lake Ontario is approximately 7 km south of the project site.
- Proposed LRT is about 33 km in length, including 24 stations.
- Proposed LRT route includes 10 km long, 6.5 m in diameter twin tunnel section.

Construction began in 2011
Tunneling finished in April 2015
Site Conditions – Glacial Tills

Glacial tills consist largely of unsorted and heterogeneous mixtures of sand, silt, and clay soil particles, with gravel, cobbles, and boulders.

0 to 1 boulder (≥ 300mm) in 10 m³
0 to 160 cobbles (75 – 300mm) in 10 m³
Property of Silty clay to Clayey Silt Till:

- Grain size: 1 to 11% gravel, 14 to 42% sand, 38 to 64% silt and 13 to 33% clay
- Water contents: 7% to 30%
- LL: 14 to 26; PL: 10 to 17 and PI: 4 to 10.
- Unit weight: 20 to 23 kN/m³
- Initial void ratio: 0.2 to 0.4
- Effective angle of internal friction: 32° to 44°
- Effective cohesion: 0 to 120 kPa
Preboring Pressuremeter Tests

TEXAM Pressuremeter

Typical Test Result
SPTs, PMTs and shear wave measurements at Keele Station site

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SPT\ N = \frac{SPT\ N\ (measured)}{305\ mm}\ \text{measured penetration depth}
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SPTs, PMTs and shear wave measurements at location 1 of Allen Station site
SPTs, PMTs and shear wave measurements at location 2 of Allen Station site
Correlation between SPT N value and $E_{pmt}$ for silty clay to clayey silt till
Predicted versus measured $E_{pmt}$
Correlation between $E_{pmt}$ and $G_0$:
(a) silty clay to clayey silt (till) and (b) sand to silt.
Conclusions

- The properties of the glacial tills can be more reliable determined from pressuremeter tests, compared with the standard penetration tests which often reach refusal when the sampler hits a boulder or cobble.

- There is no good relationship between the SPT N value and pressuremeter modulus. For practical use, pressuremeter modulus can be assumed as 0.9 times the SPT N value for the silty clay to clay silt till in Toronto.

- There is no good relationship between the pressuremeter modulus and the maximum shear modulus calculated from the shear wave measurement. For a preliminary estimation, the maximum shear modulus can be taken as 5 times pressuremeter modulus for the silty clay to clayey silt (till) and 6 times pressuremeter modulus for the sand to silt in Toronto.
Thank You