1. The project

Statement
The actual procedure to obtain thaw consolidation data requires heavy logistic especially when the site tested is far away from the laboratory. This sample transportation problem leads to reduce the investigation productivity because of high costs.

Objective
To develop a core-barrel able to perform the laboratory consolidation test, in situ.

Constrains
Consolidation test
Quick enough to allow several characterizations in a day.
Drilling equipment
Light drill rigs such as the Minuteman, without drilling fluids.
Permafrost coring
Great performance for rich ice soils coring. 2 m deep working depth, under the natural sol surface, reached by casing.
Handling
Easily replaceable wearing parts. Easy tool cleaning.

2. The core-barrel

Settlement reading
Direct reading of the pneumatic cylinder rod displacement.
Upper part
Pneumatic cylinder compartment.
Lower part
Consolidation test parts: heating element, filter and piston. Test performed on a 30 mm diameter, 200 mm high soil sample.
Core-barrel head
Two combined cutting effects for a proper coring.

3. Laboratory tests

Experimental setup
Minuteman Barrel

<table>
<thead>
<tr>
<th>Barrels constitution</th>
<th>Silt</th>
<th>Sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice lenses avg. thick.</td>
<td>4.6 cm</td>
<td>2.2 cm</td>
</tr>
<tr>
<td>Soil layers avg. thick.</td>
<td>7.4 cm</td>
<td>4.3 cm</td>
</tr>
<tr>
<td>% excess ice</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>Analyzed tests</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>

Consolidation tests

Results of procedure # 1

Coring
Melting (20-40 min)
168 kPa loading

Method of determination of the initial thaw settlement

Tangents intersection: example

Relative error and uncertainty

Conclusion

- Two procedures have been followed
- Initial settlement and strain under a range of stresses could be obtained
- Initial settlement values accuracy range was +/- 10 % from the expected values
- $C_c$ computed from strain vs stress data seemed inaccurate (x 4.7)
- Sensitivity to friction of piston against the filter should be reduced to improve the accuracy