NTEC
Nottingham Transportation Engineering Centre

Grout for use in cold ground

P. Schmall, A.R. Dawson & G.D. Airey

Background
Tunnels and shafts that are to be installed into granular soils often require the ground to be frozen before they can be dug. This is because the ground water would flow into the excavation during construction, washing in sand and disrupting the surrounding ground. However, a problem is sometimes experienced. Ground water arriving at the site brings in heat and freezing may cease after a while if the heat energy is arriving faster than the cooling.

Aim
The aim of the project is to find a means of slowing the water flow, in cold (but not frozen) ground that will thus allow the freezing to complete

Methodology
The work involves:

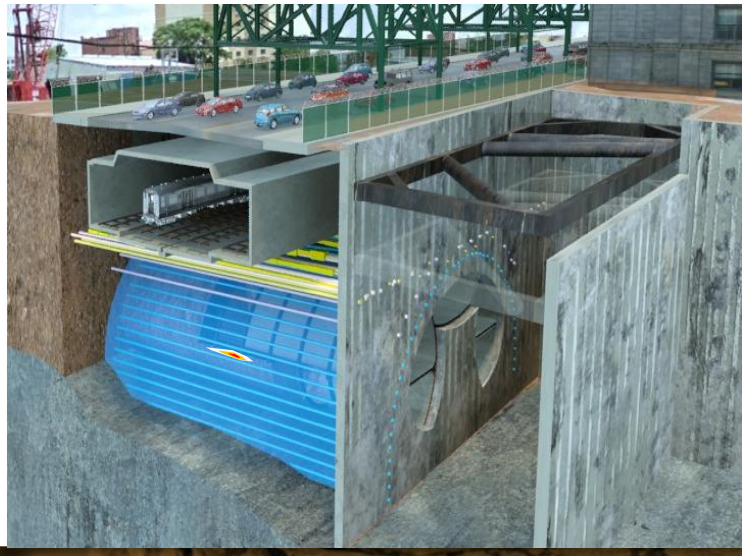
- Analysis of case histories which experienced difficulties in achieving fully frozen ground due to heat brought in by flowing water
- Construction of a simplified lab-scale model of the conditions that pertain in such cases
- Use of the model to investigate grout alternatives
- Modelling of laboratory experiments using spreadsheet
- Extension of spreadsheet model to something like real conditions.

Current Progress
The laboratory testing is complete and a candidate grout that goes solid in the cold water near a freezing front has been shown to be effective at laboratory scale. Numerical modelling of the laboratory work is in progress to be extended to simulate full-scale situations soon.

Collaboration / Support

The work is supported by Moretrench, a New Jersey (USA) based specialist shaft sinking and groundworks contractor.

Tel: +44 (0) 115 951 3902
Email: andrew.dawson@nottingham.ac.uk
www.nottingham.ac.uk/ntec



Schematic of an annular ring of frozen ground (shown in blue) which allows a tunnel to be excavated through it while train and road traffic continues above. The freeze tubes (brighter blue) don't always develop frozen ground in every place (coloured lens) and water preferentially flows there, bringing in heat locally and making final freeze 'closure' even more difficult.

The University of Nottingham