

The Protective Technology Research Centre (PTRC/NTU)
and
The Society for Rock Mechanics & Engineering Geology
Singapore (SRMEG)

Invite you for a technical seminar

An Introduction to the Norwegian Tunnelling Techniques

Presented by

**Dr. Lu Ming, UTRE Visiting Professor
Chief Scientist, SINTEF Building and Infrastructure, Norway
Adjunct Professor, Norwegian University of Science and
Technology (NTNU)**

Wednesday 25 July 2007 @3.00 – 5.30 pm

LT15, North Spine, NTU (level 4, near Block N1, see the attached location map)

Light refreshment will be provided during the break between 4.00 – 4.30 pm.

Please kindly confirm your attendance by email to Ms An Xinmei at:
ANXI0001@ntu.edu.sg by Tuesday 24 July 2007.

ABSTRACT

The seminar will start with a brief introduction of Norway and SINTEF GROUP, and a short description of Norwegian tunnelling and use of underground space, and be followed by the following three technical presentations:

TUNNEL SUPPORT DESIGN IN NORWAY

The design of rock support for tunnel and cavern is based on the principle of using shotcrete and bolting as much as possible. The design is based on empirical way according to the rock mass classification system, for instance the Q-system, and referring experience from existing projects. For the fault and fracture zones spiling bolts and sprayed concrete ribs are adopted. Cast-in-place concrete is only used in adverse ground conditions. Numerical analysis is commonly used, but is only for verifying the design made by the empirical means. The lecture will address the tunnel support design methods and guidelines. An example of the support design for the special lighting cavern of the Qinling road tunnel will also be presented.

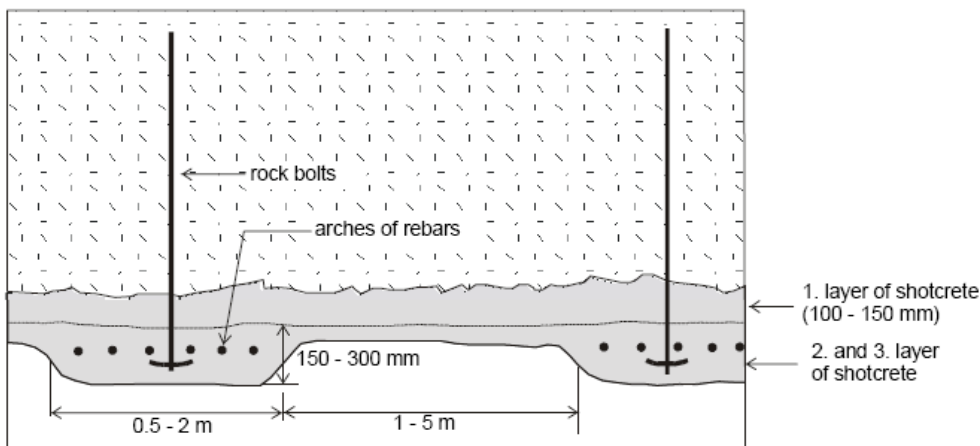


Figure 1. Fault and weakness zone section - reinforced sprayed concrete rib.

SUBSEA TUNNELLING

Demanded by fjord-crossing along the west coast tens of subsea tunnels have been constructed in the last two decades and a complete Norwegian Subsea Tunnelling Concept has been developed. In the lecture following topics will be discussed: site investigation, minimum rock cover, water leakage and control and problems related to the saline water. In comparison to the land tunnel the site investigation presents the greatest challenge for the subsea tunnel which requires special techniques. Horizontal Directional Core Drilling (HDD) and Bottom Cable Refraction Seismic are widely used in Norway for this purpose. Water leakage prediction and control is the most critical issue during construction. Experience demonstrates probe drilling and pre-grouting are the successful techniques in handling the water problem.

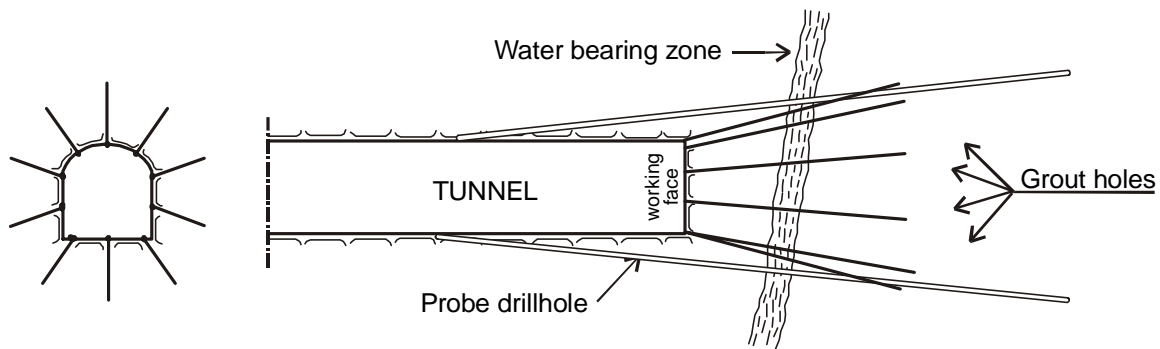


Figure 2. Probe drilling and re-grouting for subsea tunnelling.

UNDERGROUND OIL AND GAS STORAGE

The lecture will give a general description of varying types of storage caverns including unlined shallow cavern, leached rock salt cavern, aquifer, abandoned mine and depleted oil/gas reservoir as well as lined caverns. The lecture will then focus on storing of oil and gas in unlined rock caverns which is believed to be a proven technology. The major rock mechanics problems associated with such caverns such as cavern stability, product containment, gas leakage, and corresponding engineering measures will be discussed. Some examples will also be presented.

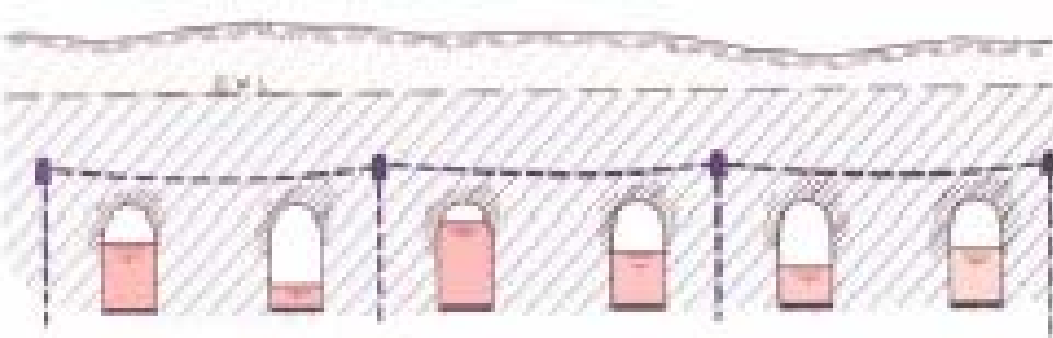


Figure 3. Horizontal and vertical water curtain for product containment.

Biography of Speaker

NAME: LU, Ming (吕明)
CURRENT POSITION: Chief Scientist, SINTEF Building and Infrastructure
Adjunct professor, Norwegian University of Science and Technology (NTNU)
EDUCATION: 1967 Graduated from Department of Hydraulic Engineering, Tsinghua University, Beijing, China
1981 Master of Engineering in Rock Mechanics, Department of Hydraulic Engineering, Tsinghua University, Beijing, China
1987 Ph.D. in Rock Mechanics, Imperial College, University of London, London, United Kingdom

KEY QUALIFICATIONS:

- Design and construction of underground power houses and tunnels for large hydropower developments
- Design, consultancy and quality assurance of road tunnels
- Underground oil/gas storage of different types
- Planning and implementation of geological investigation of underground works
- Research and development on numerical analysis for rock mechanics
- Rock mechanics research for off-shore oil industry
- Expert witness for engineering lawsuit cases
- Supervising PhD and Master students

Location Map, NTU

Take lift here to reach
LT15 at level 4

