



Control and Monitoring of Tunnels and Underground Space

27-29 November 2017

Bhutan

Objective: To provide information, methods, and examples of “monitoring” the effects of tunnelling, including the monitoring of tunnel machine performance, to control tunnelling to achieve acceptable excavation performance with stable underground structures, and prevent damage to existing structures and utilities. Monitoring allows the tunnel design and construction procedures to be adjusted and validated as tunnelling takes place.

Topics include instrumentation (equipment and typical applications), interpretation of monitoring data, role of monitoring in risk management, contractual aspects, and case histories. The course is of interest for owners, designers and construction engineers, supervisors, and managers.

Monday, 27th November

Session 1: Introduction and Overview

09.00-09.15: Welcome and opening : ITA and local representatives
09.15-09.45: General presentation on tunnel monitoring (objectives, why, what and who)
09.45-10.30: Types of instruments, data collection, information management
10.30-11.00: Coffee Break
11.00-11.45: Monitoring during investigation and study process
11.45-12.30: Role of monitoring in a risk management approach
12.30- 13.00: Questions and Answerse
13.00-14.00: Lunch

Session 2: Monitoring during construction

14.00-14.45: Monitoring methods in conventional tunnelling
14.45-15.30: Case study 1 : Conventional project
15.30-16.00: Coffee Break
16.00-16.45: Monitoring methods in mechanized tunnelling
16.45-17.30: Case study 2 : Mechanized project
17.30-18.00: Questions and answers

Tuesday, 28th November

Session 3: Tools and organisation

09.00-09.45: Topographical methods to monitor deformations
09.45-10.30: Instrumentation installation
10.30-11.00: Coffee Break
11.00-11.45: Monitoring Interpretation – Case Studies
11.45-12.30: Contractual roles and responsibilities: what entity has responsibility?
12.30- 13.00: Questions and Answers
13.00-14.00: Lunch

Session 4: Case studies – Learnings from various projects

14.00-14.45: Case study : Monitoring on Hard Rock TBMs
14.45-15.15: Coffee break
15.15-16.00: Case study : Monitoring a tunnel in a landslide area
16.00-16.45: Round table : Future developments in monitoring
16.45-17.15: Closing Remarks



Wednesday, 29th November

Technical site visit - Punatshangchhu Hydroelectric Project