CIVIL-404 **Underground construction**

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Cursus	Sem.	Type
Civil Engineering	MA2, MA4	Opt.
Civil engineering minor	E	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
Hours	**3 weekly**
Lecture	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course is addressed to students who want to deepen their knowledge of underground space and works, including planning, design and management, construction techniques and methods, risk assessment and environmental considerations.

Content

- Geoplanning and underground space design: geological considerations and investigations, planning and design;
- Risk assessment, construction and safety management (including environment);
- Underground works/construction techniques: conventional and mechanised methods, pipe-jacking, shaft construction, ground improvement, temporary support and permanent lining, water management (drainage and sealing systems), instrumentation and monitoring;
- Tunnel conservation: long-term behaviour of structures, degradation and instabilities, tunnel investigation and maintenance;
- Examples / Case studies: underground space projects, urban and base tunnels, caverns, tunnel repair and refurbishment projects.

Keywords

Underground space and constructions, Tunnels, Caverns, Planning and Design, Construction methods and techniques, Risk assessment, Maintenance, Case studies, Project

Learning Prerequisites

Required courses

Geology (CIVIL-211), Rock mechanics (CIVIL-308)

Important concepts to start the course

- Characterisation and classification of rock masses
- Rock mass stresses and displacements around underground structures
- Interaction between rock/ground mass and structure
- Design of supports

Learning Outcomes

By the end of the course, the student must be able to:

- Classify and identify rock mass behaviour and excavation classes.
- Examine , determine and compare: Determine major risks, Examine and Compare possible options (e.g. alignments)

for an underground construction project.

• Propose , evaluate the best solution using multi-criteria analysis methods comparing different solutions for design and alignment of an underground structure.

• Choose the most appropriate construction method, type of support and ground improvement for the selected alignment, considering associated risks.

• Defend and justify the proposed solution and synthetize the results obtained in a final report.

Transversal skills

• Access and evaluate appropriate sources of information.

• Make an oral presentation.

• Write a scientific or technical report.

• Plan and carry out activities in a way which makes optimal use of available time and other resources.

• Demonstrate the capacity for critical thinking

Teaching methods

- Ex cathedra
- Case studies
- Group project discussion during exercise sessions

Expected student activities

- Attend lectures
- Participate in discussions / exercises
- Develop an underground structure project by working in group

Assessment methods

Continuous assessment focused on the project: analysis of variants, drafting of final report, presentation and oral defence of results

Supervision

Office hours	No
Assistants	No
Forum	No

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

Course slides, case studies and support documents for developing the project are posted weekly on Moodle

Moodle Link

• https://go.epfl.ch/CIVIL-404

Prerequisite for

Master Project