



## 15<sup>th</sup> ISRM Congress and 72<sup>nd</sup> Geomechanics Colloquium, 9-14 October 2023

### SEMINAR

#### “The second generation of Eurocode 7 and the integration of rock engineering”

**Date:** 10 October 2023, 9:00-18:15  
**Venue:** Salzburg Congress – Doopler room, Salzburg, Austria  
**Organisation:** Rock Engineering Platform of CEN/TC250/SC7  
**Coordination:** Luís Lamas and John Harrison

#### SUMMARY

The Structural Eurocodes (EN 199x) are a suite of European standards for the design of buildings and civil engineering works, published in 2006 by the European Committee for Standardization (CEN) and with implementation starting in 2010. EN 1990 (the Eurocode) sets out the basis of structural design, with the other Eurocodes dealing with different materials and specific aspects of the design; EN 1997 (Eurocode 7) deals with geotechnical design. Although initially developed for structures involving soils, the scope of Eurocode 7 also includes rock engineering design.

In 2010, CEN began a process of evolving the Eurocodes in order to: i) incorporate improvements that reflect the state-of-the-art in engineering design and the needs of the civil engineering market; ii) improve the ease-of-use of the standards; iii) harmonize practice between countries. The revised EN 1990 presents substantial improvements, so much so that its title has been changed to “Basis of structural and geotechnical design”. A major target of the EN 1997 revision was that the second generation of the code treats soil and rock on an equal basis. The second generation of the Eurocode 7 is now nearly finished and will be subject to formal voting in 2024.

The evolution of the Eurocode 7 has been accompanied by a large group of rock engineering experts from across Europe working under the auspices of CEN TC250/SC7: in the task group WG1/TG3 – Rock Mechanics from 2011 to 2020, and in the Rock Engineering Platform (REP) since 2020.

The REP recognises that a large proportion of the rock engineering community has had little contact with the Eurocodes, despite their use in design being mandatory in many European countries. With this in mind the REP organises this informative Seminar, directed precisely at an audience of rock engineering practitioners and with the aim of presenting the main aspects of the second generation of the Eurocode (EN 1990 - Basis of structural and geotechnical design) and of the Eurocode 7 (EN 1997 - Geotechnical design).

The Seminar will present:

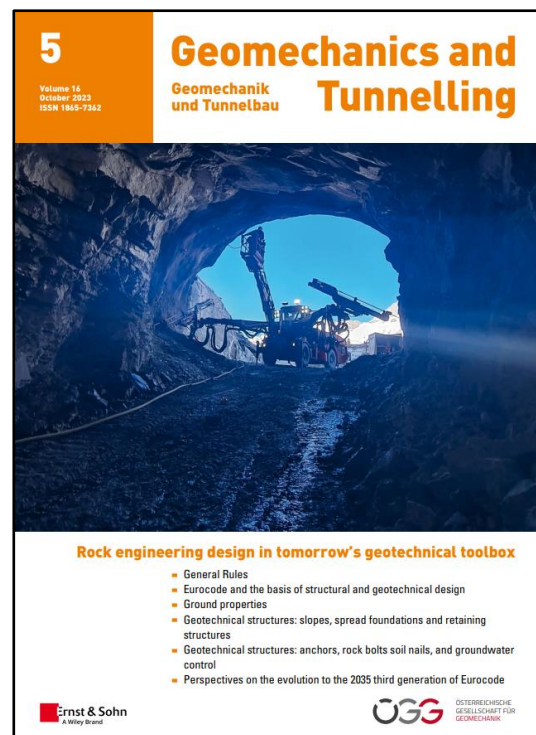
- the general concept of the Eurocodes;
- the main differences between the first and the second generations of the Eurocodes, in particular of Eurocode 7, and the changes of particular significance to rock engineering;

- how customary rock mechanics and rock engineering fit in the context of limit state design;
- the most relevant aspects of the three parts of the second generation of EN 1997:
  - Part 1: General rules,
  - Part 2: Ground properties,
  - Part 3: Geotechnical structures;
- design examples;
- the applicability of the Eurocodes for the design of underground structures.

## PAPERS PUBLISHED IN THE JOURNAL GEOMECHANICS AND TUNNELLING

This Seminar is accompanied by a series of 6 papers, authored by REP members, published in the journal Geomechanics and Tunnelling, Volume 16, Issue 5, of October 2023, with information on the second generation of Eurocode 7 and the integration of rock engineering. All the papers, published in English and German, are listed below and have a common title *Rock engineering design in tomorrow's geotechnical toolbox*, followed by the topic covered.

1. Lamas, L.; Burbaum, U.; Estaire, J.; Harrison, J.; Nuijten, G.; Pereira, R. (2023) *Rock engineering design in tomorrow's geotechnical toolbox: Eurocode and the basis of structural and geotechnical design (the second generation of EN 1990 and EN 1997)*. Geomechanics and Tunnelling, 16: 469-490. <https://doi.org/10.1002/geot.202300021>.
2. Walter, H.; Lamas, L.; Labiouse, V.; Nuijten, G.; Spross, J.; Stille, H. (2023) *Rock engineering design in tomorrow's geotechnical toolbox: Eurocode 7 – General rules (EN 1997-1:2024)*. Geomechanics and Tunnelling, 16: 491-509. <https://doi.org/10.1002/geot.202300019>.
3. Estaire, J.; Heintz, R.; Johansson, E.; Muralha, J.; Nuijten, G.; Segalini, A. (2023) *Rock engineering design in tomorrow's geotechnical toolbox: Eurocode 7 – Ground properties (EN 1997-2:2024)*. Geomechanics and Tunnelling, 16: 510-523. <https://doi.org/10.1002/geot.202300023>.
4. Stille, H.; Ashcroft, B.; Boley, C.; Labiouse, V.; Pinto, P. (2023) *Rock engineering design in tomorrow's geotechnical toolbox: Eurocode 7 – Geotechnical structures: slopes, spread foundations and retaining structures (EN 1997-3:2024)*. Geomechanics and Tunnelling, 16: 524-535. <https://doi.org/10.1002/geot.202300025>.
5. Maca, N.; Dietz, K.; Stille, H.; Virely, D. (2023) *Rock engineering design in tomorrow's geotechnical toolbox: Eurocode 7 – Geotechnical structures: anchors, rock bolts, soil nails and groundwater control (EN 1997-3:2024)*. Geomechanics and Tunnelling 16: 536-558. <https://doi.org/10.1002/geot.202300026>.
6. Harrison, J.; Burbaum, U.; Lamas, L.; Spross, J.; Stille, H. (2023) *Rock engineering design in tomorrow's geotechnical toolbox: Eurocode 7 – Perspectives of the evolution to the 2035 third generation*. Geomechanics and Tunnelling 16: 560-572. <https://doi.org/10.1002/geot.202300027>.



## PROGRAM

### Session 1 – 9:00-10:45 – The Eurocodes: from structural to geotechnical and rock engineering design

#### Opening remarks

#### General aspects

- Eurocode 7 – From 1st to 2nd Generation – Overview. The European rules for geotechnical design.  
*Adriaan van Seters, Chair of the CEN/TC250 Subcommittee 7 (SC7) on Eurocode 7. Fugro, Netherlands*
- General aspects of the second generation of EN 1990 and EN 1997, with a focus on rock engineering.  
*Luís Lamas, Convenor of the Rock Engineering Platform (REP) of CEN/TC250/SC7. LNEC, Portugal*
- Background to the principles of limit state design (LSD), particularly its basis in probability and customary rock mechanics and rock engineering in the context of LSD  
*John Harrison, University of Toronto, Canada and UK*
- Discussion

– Coffee break –

### Session 2 – 11:00-12:30 – Presentations on Eurocode 7: Geotechnical design

#### Eurocode 7, Part 1 – General rules

*Herbert Walter, Austria (Coordinator)*  
*Johan Spross, KTH, Sweden*  
*Renato Pereira, LNEC, Portugal*  
*Guido Nujten, AFRY Finland Oy, Finland*

- New approach to geotechnical categories (criteria, consequences etc.)
- Methods for verifications of limit states
- Some details of verifications by reliability-based methods, numerical methods and the observational method
- Changes and new content concerning implementation of design and reporting
- Discussion

– Lunch break –

### Session 3 – 14:00-16:15 – Presentations on Eurocode 7: Geotechnical design

#### Eurocode 7, Part 2 – Ground properties

*José Estaire, CEDEX, Spain (Coordinator)*  
*Guido Nujten, AFRY Finland Oy, Finland*  
*José Muralha, LNEC, Portugal*

- The key role of ground model
- Design of ground investigation



- Ground properties and their relationship with *in-situ* and laboratory tests – EN standards
- Discussion

### **Eurocode 7, Part 3 – Geotechnical structures**

#### **a) slopes, spread foundations and retaining structures**

*Paulo Pinto, University of Coimbra, Portugal (Coordinator)*

*Håkan Stille, KTH, Sweden (Coordinator)*

- General aspect on limit states for ground-structure interaction problems
- Rock mechanical aspects on slopes, spread foundations and retaining structures
- Verification methods: calculations, prescriptive rules and observational methods

#### **b) anchors, rock bolts, soil nails and groundwater control**

*Natalia Maca, Titan Polska, Poland (Coordinator)*

*Didier Virely, CEREMA, France*

*Klaus Dietz, Dietz Geotechnik Consult GmbH, Germany*

- Eurocode 7 new content regarding the design of rock engineering structures
- Definitions and set of standards governing tension-supporting elements
- Design of rock bolts: limit states, verification methods, calculation models and other design aspects
- Testing of rock bolts
- Discussion for topics a) and b)

– Coffee break –

### **Session 4 – 16:30-18:15 – Design examples and underground structures**

#### **Design examples**

*Bruce Ashcroft, Multiconsult Norge AS, Norway (Coordinator)*

*Rima Ghazal, Itasca, France*

*José Estaire, CEDEX, Spain*

- Rock engineering design examples following the second generation of Eurocode 7
- Discussion

#### **Applicability of the Eurocodes to the design of underground structures**

*Adriaan van Seters, Chair of the CEN/TC250/SC7. Fugro, Netherlands (Coordinator)*

*Urs Grunicke, UHG Consult Ziviltechniker, Austria*

- Joint Research Centre (JRC) report "Assessment of applicability of EN 1997 for tunnels and other underground structures" of April 2022
- JRC technical report "Prospects for designing tunnels and other underground structures in the context of the Eurocodes" of November 2022
- Current steps towards the application of the Eurocodes to underground structures
- Discussion

#### **Closing remarks**



## List of contributors to the Seminar presentations:

*Adriaan van Seters, Fugro, Netherlands*

*Andrea Segalini, University of Parma, Italy*

*Bruce Ashcroft, Multiconsult Norge AS, Norway*

*Conrad Boley, Bundeswehr University Munich, Germany*

*Didier Virely, CEREMA, Complexe scientifique de Ranguéil, France*

*Erik Johansson, AINS Group, Finland*

*Guido Nuijten, AFRY Finland Oy, Finland*

*Håkan Stille, KTH Royal Institute of Technology, Sweden*

*Herbert Walter, Austria*

*Johan Spross, KTH Royal Institute of Technology, Sweden*

*John Harrison, University of Toronto, Canada*

*José Estaire, CEDEX, Spain*

*José Muralha, LNEC – Portuguese National Laboratory for Civil Engineering, Portugal*

*Klaus Dietz, Dietz Geotechnik Consult GmbH, Germany*

*Luís Lamas, LNEC – Portuguese National Laboratory for Civil Engineering, Portugal*

*Natalia Maca, Titan Polska, Poland*

*Paulo Pinto, University of Coimbra, Portugal*

*Renato Pereira, LNEC – Portuguese National Laboratory for Civil Engineering, Portugal*

*Rima Ghazal, Itasca Consultants S.A.S., France*

*Robert Heintz, Eurasol, S.A, Luxemburg*

*Ulrich Burbaum, University of Applied Sciences Darmstadt, Germany*

*Urs Grunicke, UHG Consult Ziviltechniker, Austria*

*Vincent Labiouse, University of Applied Sciences and Arts Western Switzerland, Switzerland*