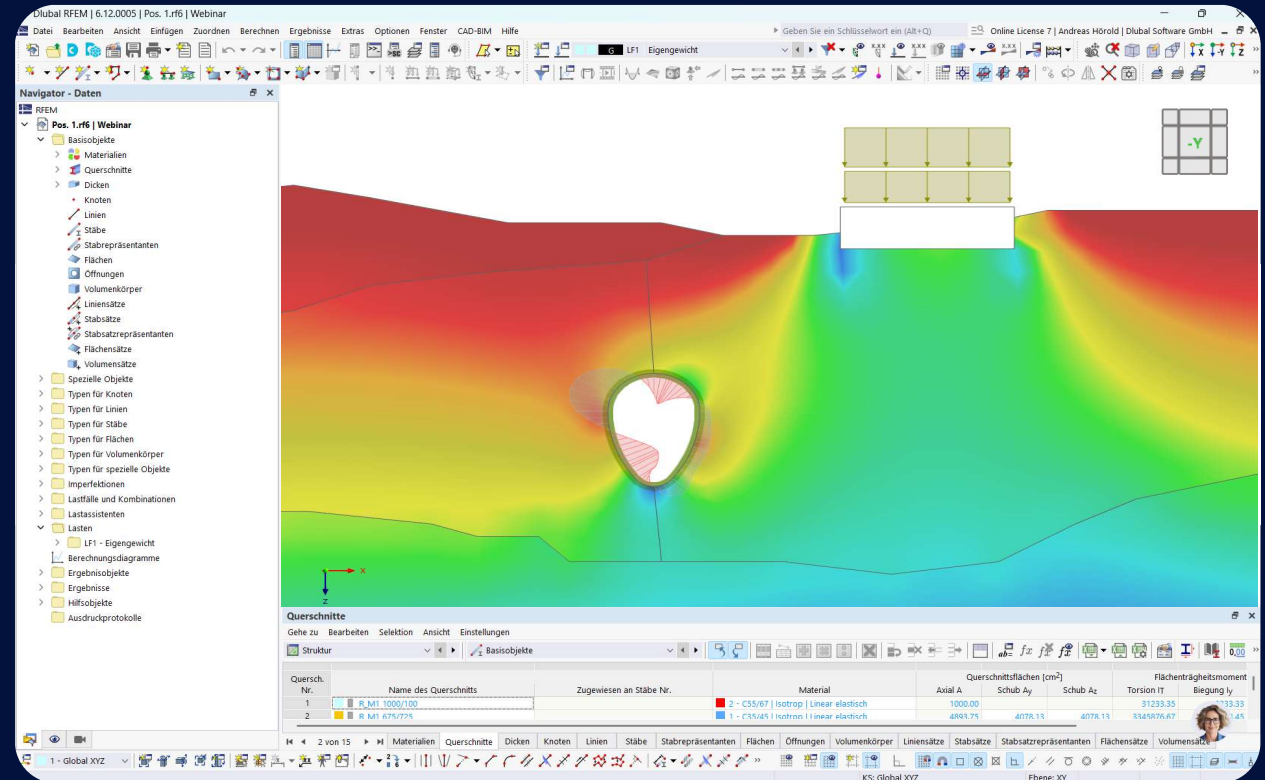


Webinar

Dlubal

Tunnel Structure Analysis in RFEM 6

www.dlubal.com



Heute mit



**Dipl.-Ing. (FH)
Andreas Hörold**

Organizer

Marketing & Public Relations
Dlupal Software GmbH



**Dipl.-Ing. Juliane
Stopper-Akdag**

Co-Organizer

Product Engineering &
Customer Support
Dlupal Software GmbH



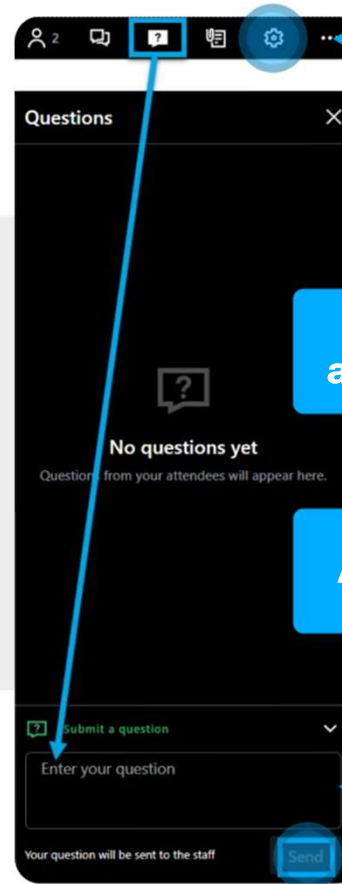
**Marc Gebhardt,
M.Sc.**

Co-Organizer

Product Engineering &
Customer Support
Dlupal Software GmbH

Questions During the Presentation

1
**Webinar Control
Panel Desktop**



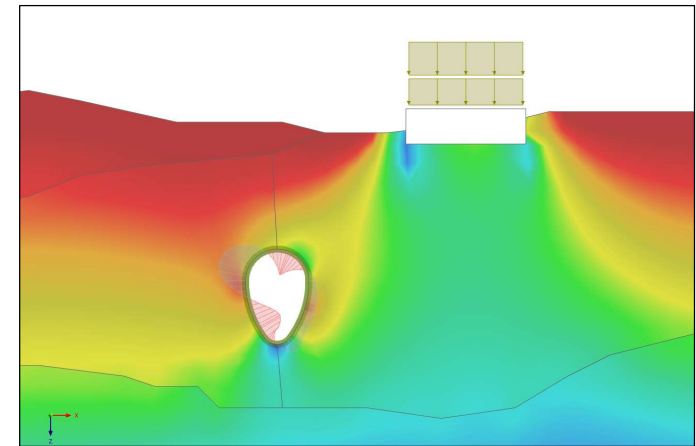
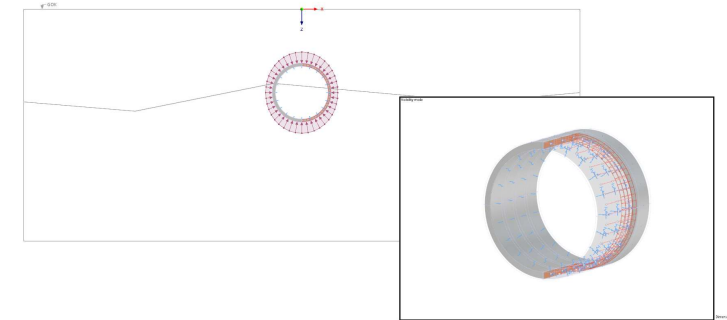
**Adjust
audio settings**

Ask question

or **2**
info@dlubal.com

Agenda

- 1 Introduction**
- 2 Tunnel lining bedded on springs**
- 3 Tunnel lining in soil continuum**
 - **Modeling with construction stages**
 - **Results, evaluation, and documentation**
- 4 Outlook**



1. Introduction – Tunnel Construction

Types of tunnel by construction method:

Cut-and-cover construction: the tunnel is excavated from above, the void structure is installed and the trench is backfilled. Variants include top-down construction and immersed tunnel construction.

→ This method is typical of shallow urban locations, such as metro systems.

Mined construction: excavation takes place entirely underground without opening the surface. This includes classical methods such as the New Austrian Tunnelling Method (NATM), shotcrete construction and cyclic drill-and-blast excavation. The support system, typically comprising shotcrete and anchors, is adapted to the behaviour of the ground and installed progressively.

→ This method is suitable for deep alignments and variable ground conditions.

Shield tunnelling (TBM): involves fully mechanised excavation using a tunnel boring machine. Depending on the ground conditions, an earth pressure balance shield, a slurry shield or an open rock TBM may be used.

→ This method is particularly economical for long, uniform tunnel drives.



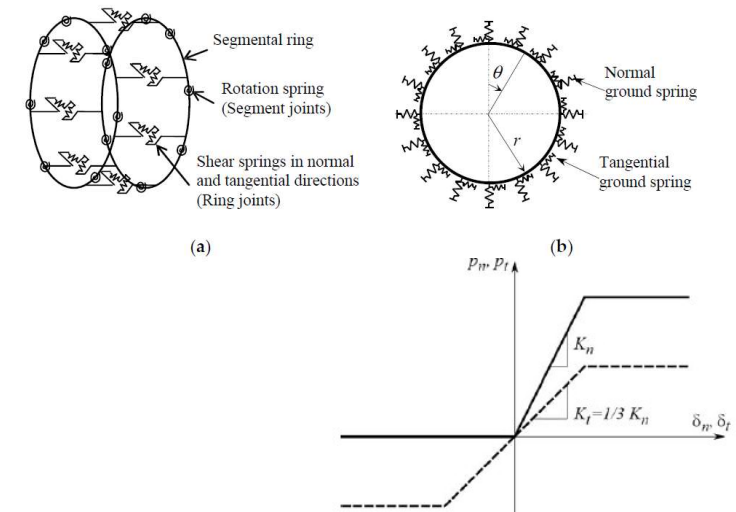
1. Introduction – Numerical Modeling

Model definition

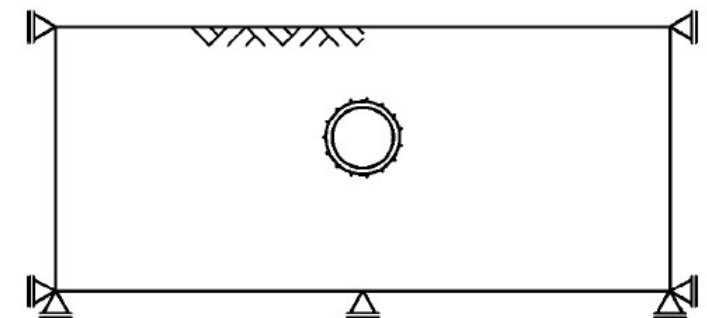
- **Tunnel structure:** bedded beams, shells or volume elements
- **Ground model:** bedding/ springs or continuum
- **Connections:** contacts, hinges via coupling elements, rotational springs, or nonlinear springs

For preliminary design, an **embedded beam** line is often used.

For more complex boundary conditions or spatial effects, a 3D **continuum** model is generally more appropriate.



Source: <https://www.mdpi.com/2076-3417/10/3/1084>

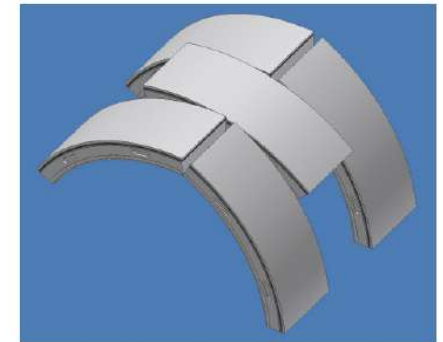
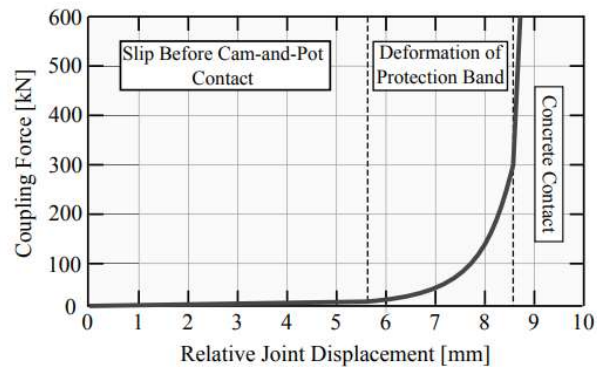


Source: EANG, DGGT, 2014

1. Introduction – Numerical Modeling

Couplings in support modeling

- Joint between tunnel segments in the longitudinal direction of the tunnel



- Hinges between tunnel segments in the circumferential direction

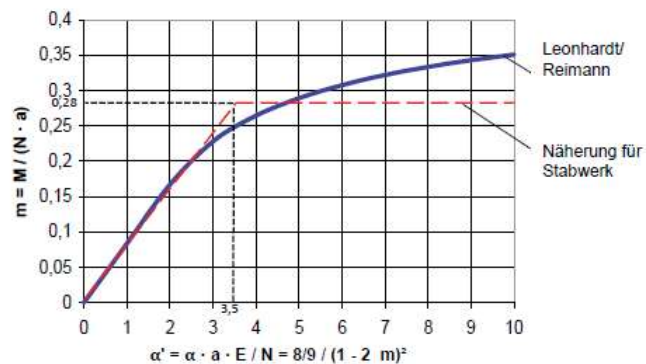
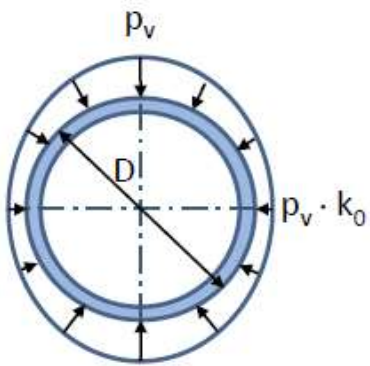


Image source for this slide:
“Recommendations for the design,
manufacture and installation of segmental
rings,” DAUB, 2024.

2. Ground as Spring Support

Ground pressure simplified as a superimposed radial load

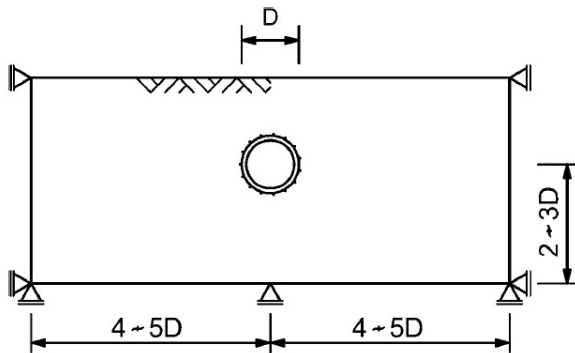


In tunnel lining design, the rock pressure acting on the segmental ring is simplified as a superimposed radial load composed of a uniform isotropic component and a cosine-shaped deviatoric component.

Image source for this slide: "Recommendations for the design, manufacture and installation of segmental rings," DAUB, 2024.

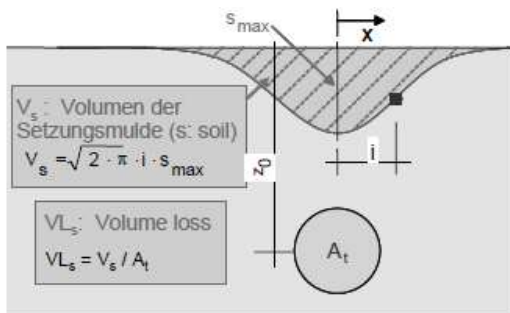
3. Ground as continuum

3.1 Continuum model dimensions and boundary conditions according to EANG



Source: "Numerical analysis in geotechnology", DGGT, 2014

3.2 Volume loss



Unintentional void or material loss during excavation is a direct indicator of expected settlement and of the risk of damage to adjacent structures.

Source: <https://mediatum.ub.tum.de/doc/1138070/file.pdf>

4. Outlook for Geotechnical Analysis in RFEM 6

Next features

- Plane Strain model type
- Material models
 - Cam Clay Model
 - Jointed Rock Model
- Spring supported pile foundations

Online Courses

RFEM⁶ Masterclass

All you need to know for a start!



[Go to course](#)

Eurocode 2 Masterclass

Dive in Reinforced Concrete Design with RFEM 6!



[Go to course](#)

Eurocode 3 Masterclass

Deep Dive in Steel Design with RFEM 6!



[Go to course](#)

Online Courses

Eurocode 5 Masterclass

Deep Dive in Timber Design with RFEM 6!



[Go to course](#)

Eurocode 8 Masterclass

Deep Dive into Earthquake Design with RFEM 6!



[Go to course](#)

AI Masterclass

Ensuring Safe and Compliant Use of Artificial Intelligence!

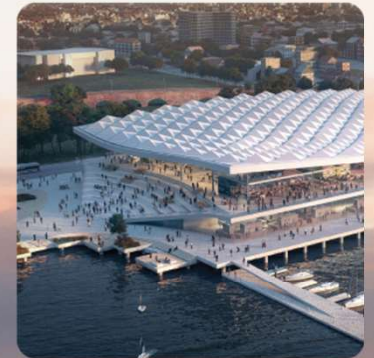


[Go to course](#)

Submit your customer project and receive ^{SEP} a free online course!

For each published project, you will receive a voucher for an Online Course on RFEM 6, Eurocode 2, Eurocode 3, Eurocode 5, or Eurocode 8, valued at 199 - 399€.

→ **Submit your Project**



BOLLINGER + GROHMANN
Ingenieure

Jakob
Rope Systems

Haas

PIRMIN JUNG

RUBNER



Free Online Services

90-Day Full Trial Version Download

Experience the full power of our structural analysis and design software with a free 90-day trial. Get access to all programs and add-ons without restrictions.



DLUBAL COMMUNITY >



GEO ZONE TOOL >



CROSS-SECTION PROPERTIES >



3D MODELS TO DOWNLOAD >

Explore All Our Services >



Get Further Details About Dlubal

- Videos and recorded webinars
- Newsletters
- Events and conferences
- Knowledge Base Articles
- MIA AI Assistant
- Download 90-Day Full Trial Version

www.dlubal.com

Dlubal Software GmbH

Am Zellweg 2
93464 Tiefenbach, Germany

+49 9673 9203-0
info@dlubal.com

90-Day
Full Free
Trial



Thank You for Your Attention

