

Tunnel design is one of the most fascinating but also one of the most difficult engineering disciplines. It combines theory and practise into a separate building science. On top of this the specifications and requirements for tunnel design have drastically increased over the years. Advances into weaker types of rock and the implementation of cross-sections under high loads and little cover, cannot be done with simple stress analyses anymore. Risky building projects call for exact and complex analyses, which cannot be controlled by simple means any longer. Due to these facts, the Finite Element Analysis has become a method of outmost importance for engineers.

With different pre- and post processors the complex generation of the systems and their analysis can be handled quicker and more efficiently.

**Non-linear material models**

- **Elasto-plastic**
  - Von Mises, associated
  - Drucker-Prager, associated
  - Mohr-Coulomb, non-associated
  - Gudehus, non-associated
  - Lade, non-associated
  
- **Hypoplastic**
  - Acc. to Duncan-Chang
  - Acc. to Schad
  
- **Viscoplastic enhancements for**
  - Mohr-Coulomb
  - Drucker-Prager
  - Von Mises
  
- **GRAN – Granular Soil**
  - Hyperbolic consolidation accd. to Kondner (-> triaxial stress)
  - Stress-related stiffness
  - Load and un-loading behaviour
  - Failure criteria according to Mohr-Coulomb
  - Shows the dillatance (non-associate plastic yielding)
  - Automatic calibration to oedometric and triaxial loading
  
- **SWEL – Soil with swelling potential**
  - Consideration of the stress-related swelling-strain for the finite state
  
- **Additional definition of distinctive shear planes for jointed materials**
  
- **Interface to create user-defined material models**

