

# FIRE ANALYSIS OF RC PRECAST SEGMENTAL TUNNELS

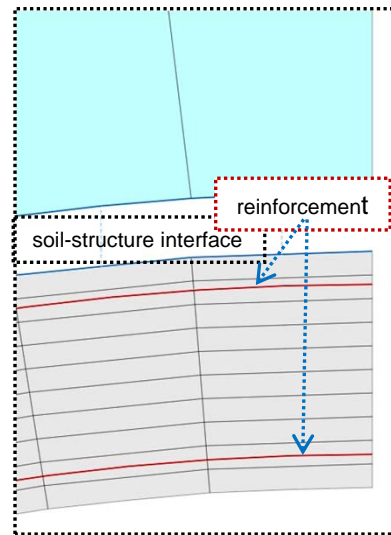
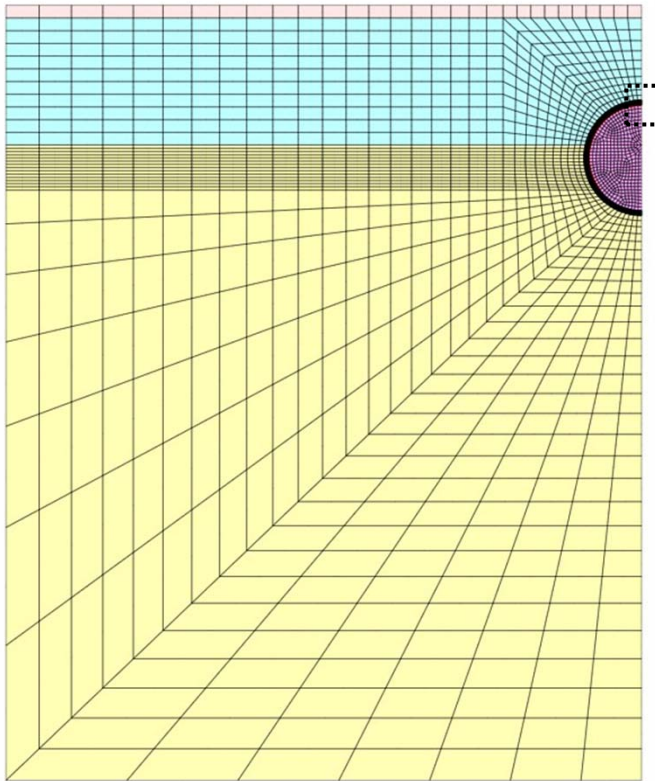
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## Behaviour of tunnels excavated in soft soil under fire

- Soil-structure interaction
- Material degradation
- Structural damage

Application of Structural Fire Design  
29 April 2011, Prague, Czech Republic

# Model



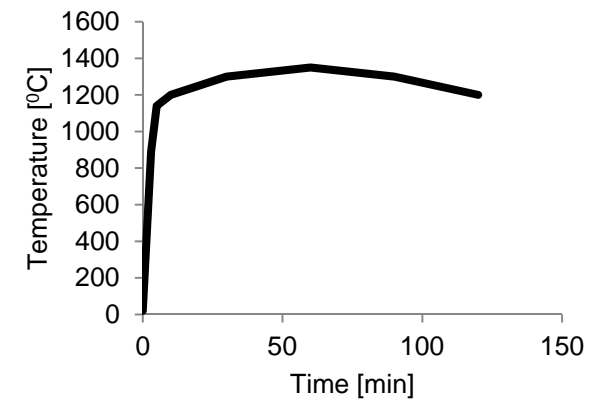
**Phased, partially coupled thermal-stress analysis**

**Phase 1**

- Stress initialization with K0 procedure in the soil prior to construction of the tunnel segment

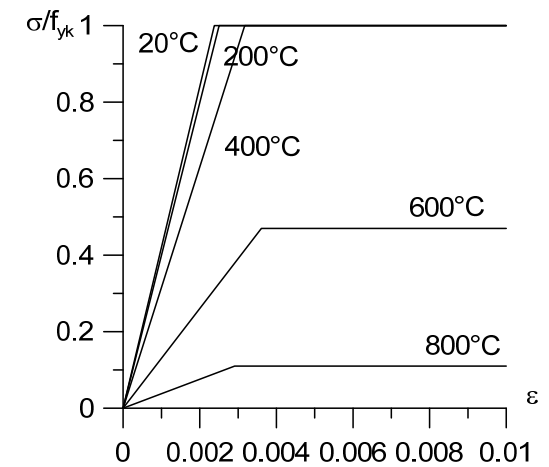
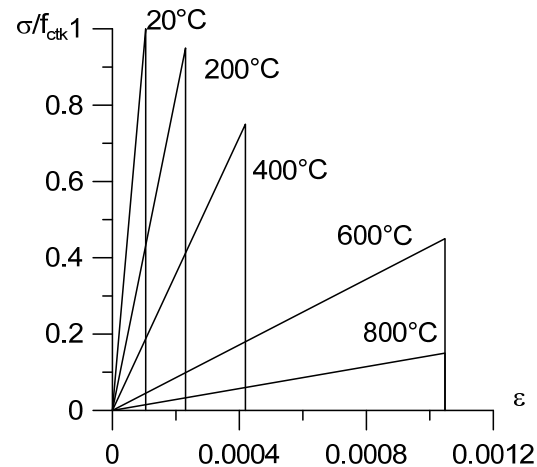
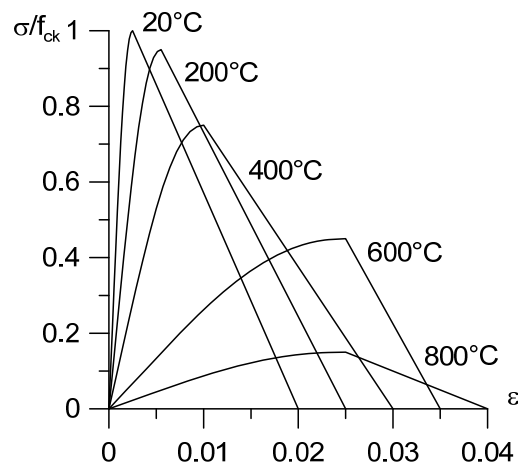
**Phase 2**

- Excavation and installation of the tunnel segment
- Fire load

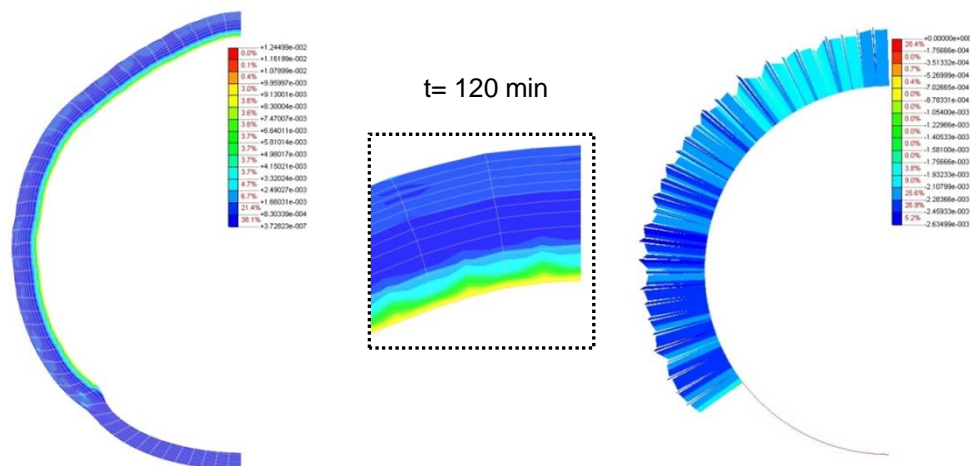
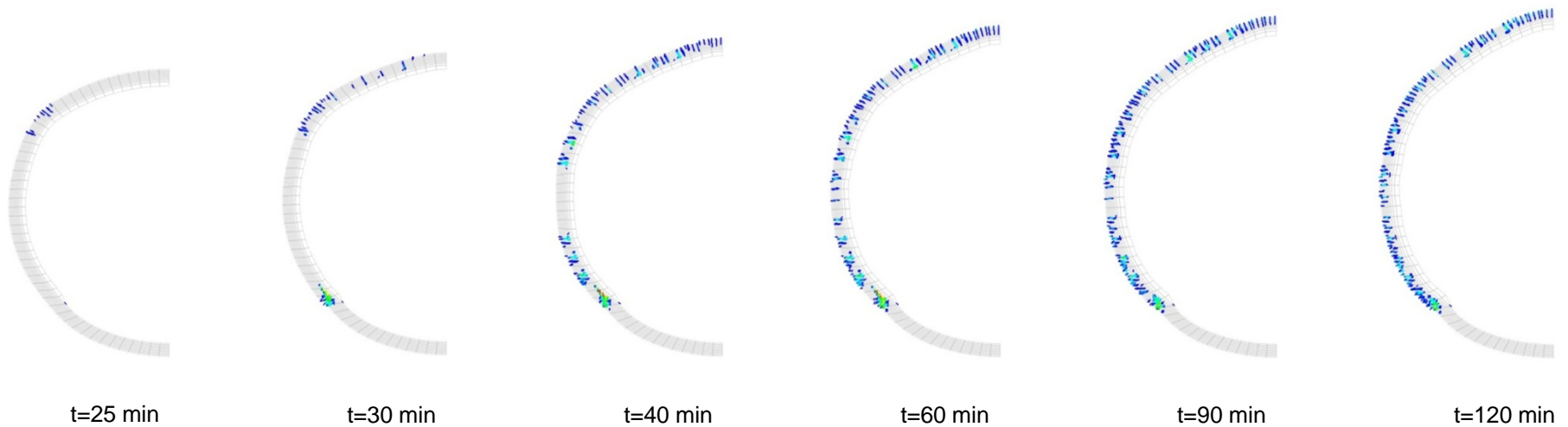


# Materials

- **Mohr-Coulomb for soil**
- **Friction-Coulomb with tension cut-off for interfaces**
- **temperature dependent thermal properties**
- **temperature dependent mechanical properties for concrete and steel, following EN1992-1-2**
- **total strain based crack model for concrete**
  - **brittle in tension**
  - **compression as specified in EN1992-1-2**
- **Von Mises elasto- perfectly plastic for reinforcements**



# Results



- extensive cracking at the extrados, with reduction of stresses induced by differential thermal expansion
- limited damage, caused by thermal degradation of the material properties at the intrados
- yielding of reinforcements at the intrados
- structure remains stable up to 120 min fire