Fire tests on HPC columns with and without restraint

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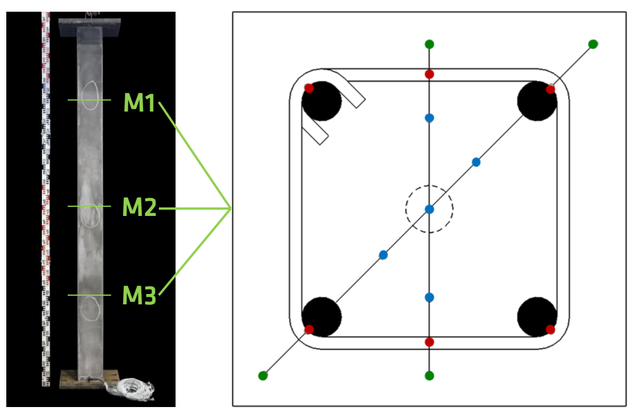
Manufacturing of the high-performance steel-reinforced concrete columns

Instrumentation

Temperature measurement points

- In the concrete cover
  - ➢ Sheath thermocouples
- On the steel reinforcement
  - ➢ Flexible thermocouples (welded)
- Inside the reinforcement cage
  - ➢ Flexible thermocouples

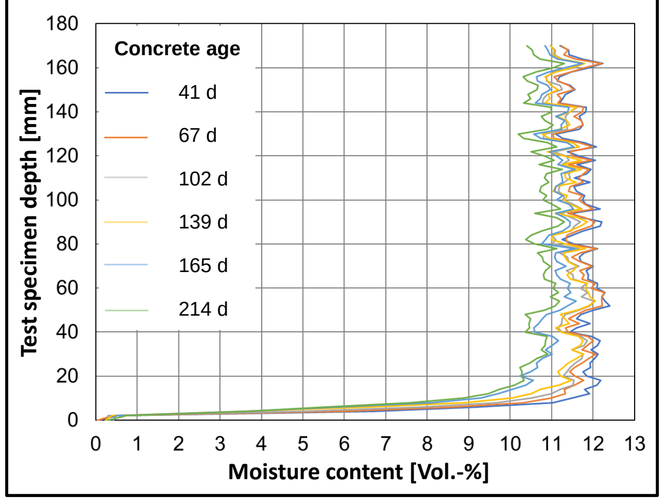


Concreting

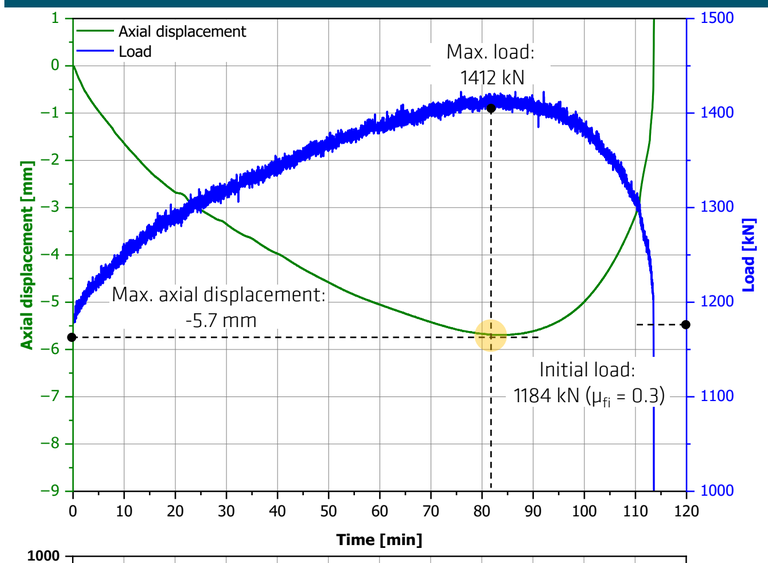
- Column length (with head and foot plates): **3600 mm**
- Fire resistance acc. to DIN EN 1992-1-2: **R90**
- Cross-section: **250 mm x 250 mm**
- Concrete cover: **36 mm**
- Reinforcement ratio: **3.14 %**
- High-performance concrete:
  - ➢ C 80/95 with CEM I 42.5 N
  - ➢ 2 kg/m³ PP-fibres (Ø 32 µm/6 mm)

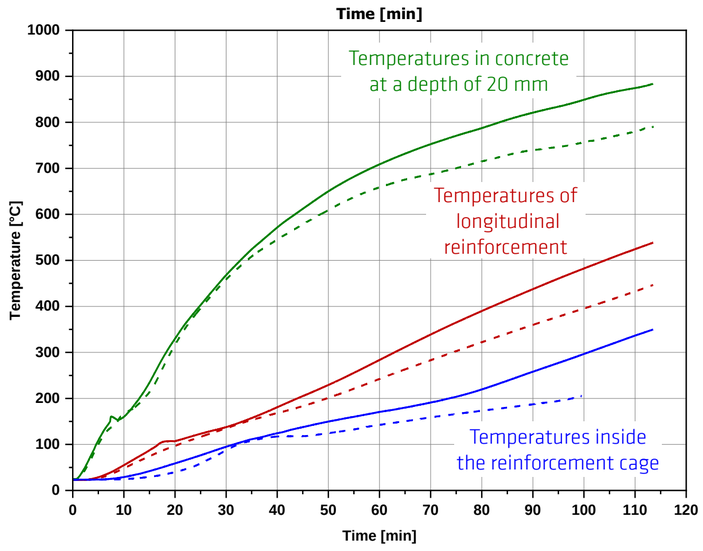
Conditioning

- According to DIN EN 1363-1
  - ➢ **23 °C and 50 % rel. humidity**
- ^{1}H-Nuclear-Magnetic-Resonance and gravimetric measurements on accompanying samples
  - ➢ Recording moisture changes
  - ➢ Depth-resolved information on moisture content in concrete

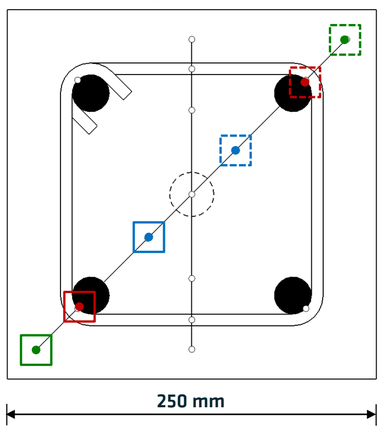


Restrained column fire test (40 kN/mm)

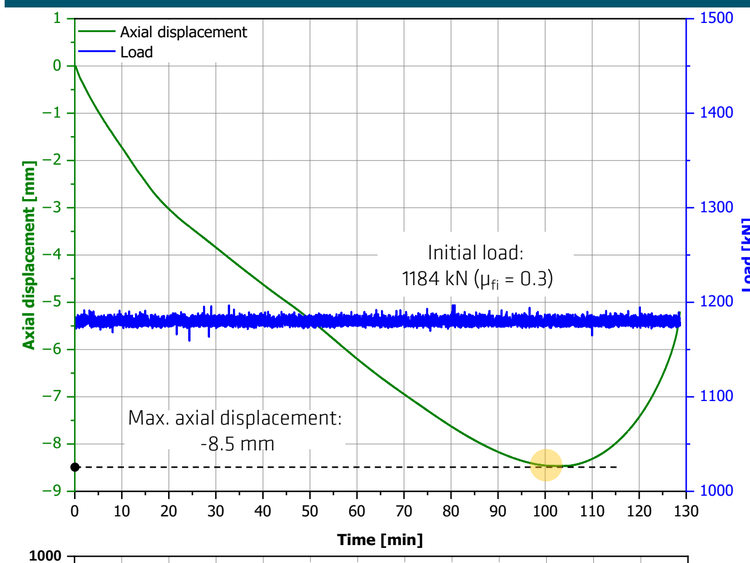


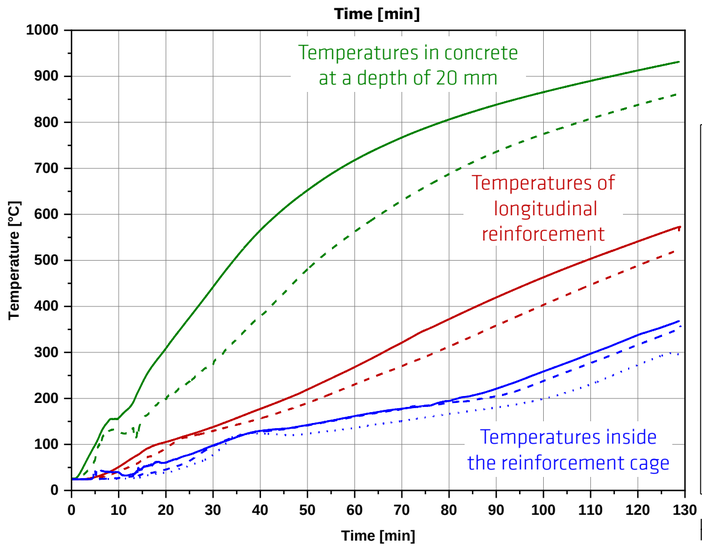


Measuring cross-section

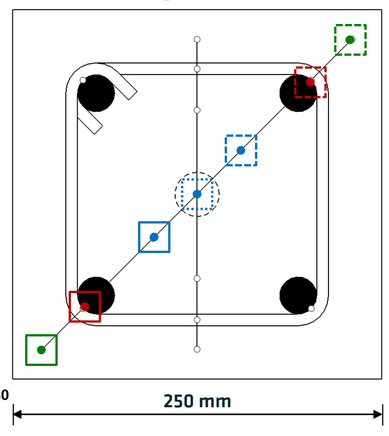


Unrestrained column fire test





Measuring cross-section



Summary

- Reduction of axial expansion as a result of restraint force
- Restraining forces lead to earlier column failure
- Both columns do not show any spalling and have a comparable temperature field

Sicherheit in Technik und Chemie

Funder and partner

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