

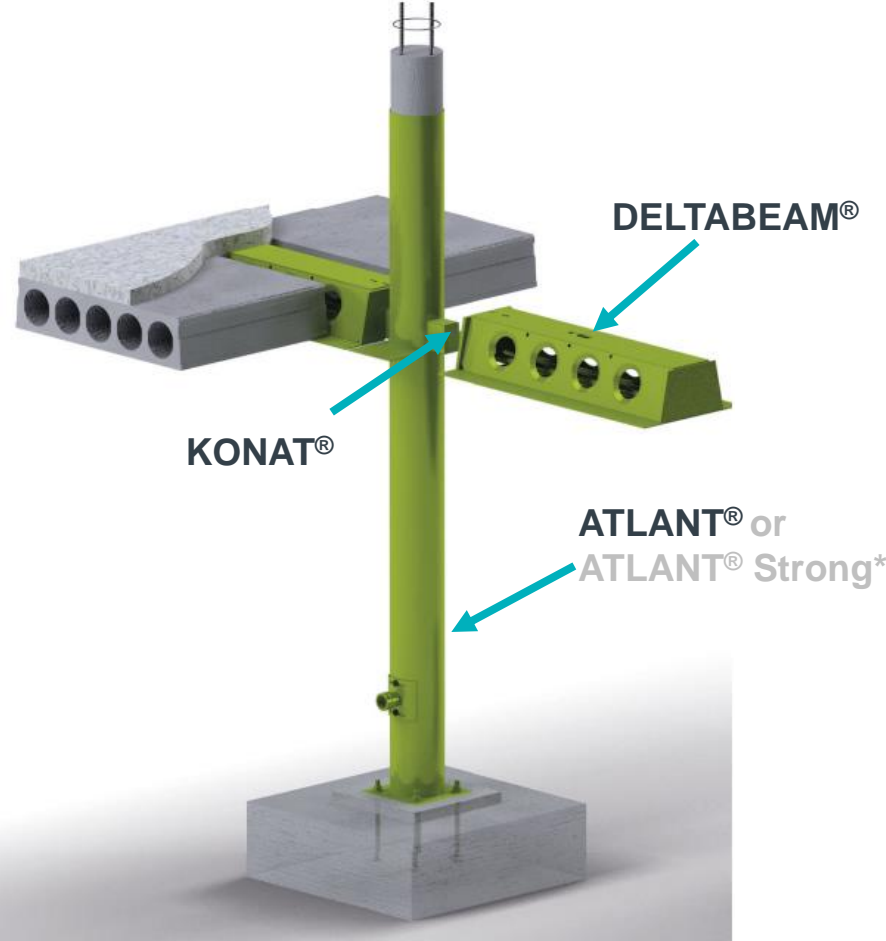


Developments of ATLANT® Composite Columns Family

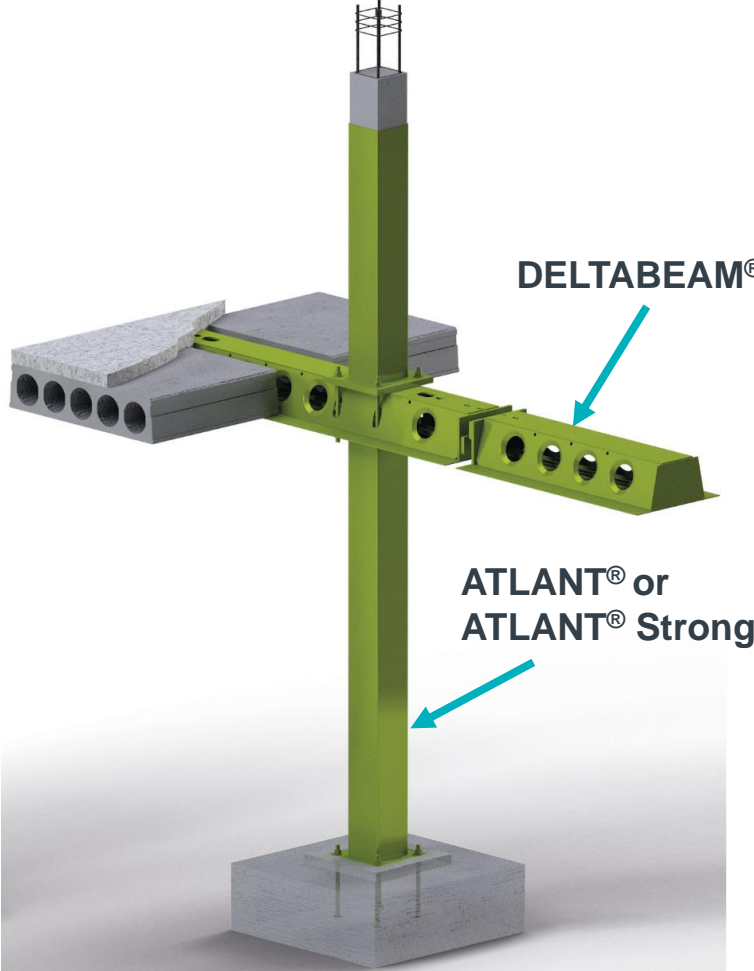
Šarūnas Kelpša



Peikko's DELTABEAM® Frame

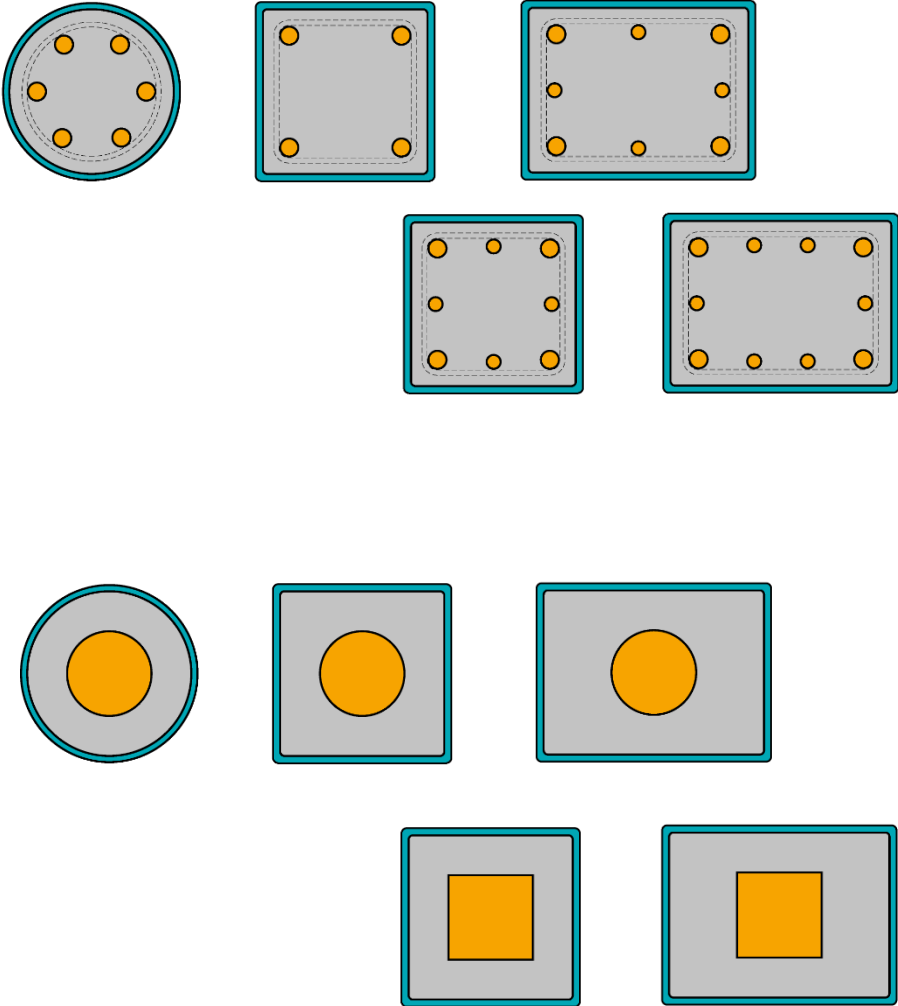


Multi-storey ATLANT® family columns



Single-storey ATLANT® family columns

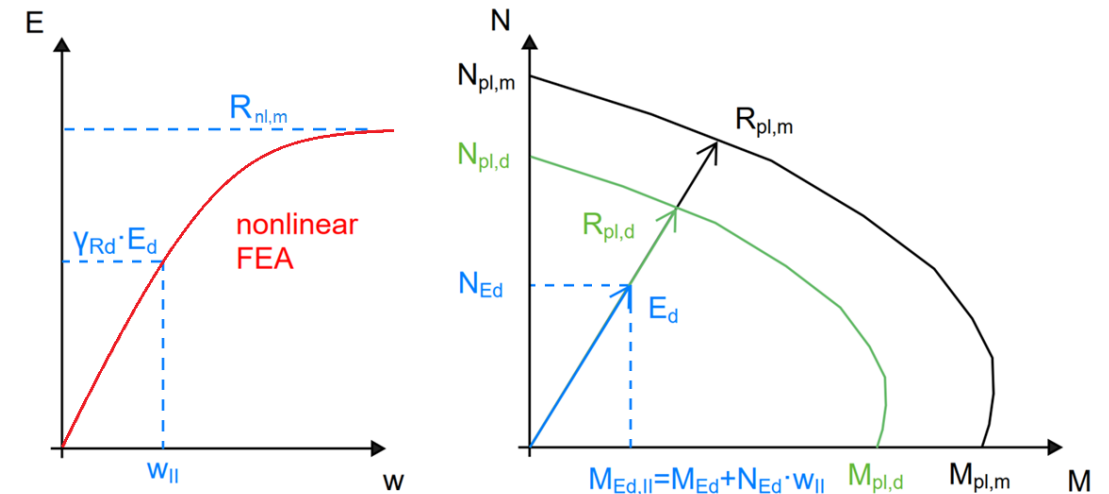
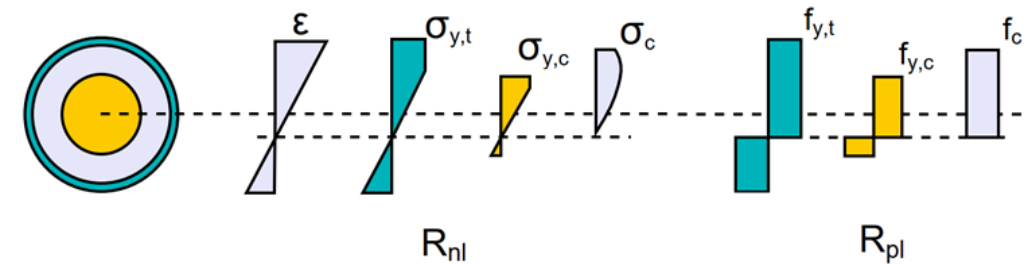
ATLANT[®] Composite Columns Family



Launch on 12th September
at Eurosteel 2023 in Amsterdam

ATLANT[®] Strong design

- **Erection stage** EN 1993-1-1 or EN 1994-1-1
- **Final stage** according to EN 1994-1-1
General method of design
 - Nonlinear behaviour of materials
 - Geometrical imperfections
 - Residual stresses in steel core
 - Concrete creep, etc.
- **Fire situation** according to EN 1994-1-2
Advanced model



$$\gamma_{Rd} E (\gamma_g G_k + \gamma_q Q_k) \leq R \left(\frac{R_m}{\gamma_0} \right) \quad \gamma_0 = \frac{R_{pl,m}}{R_{pl,d}}$$

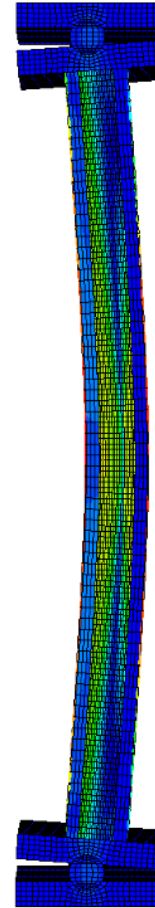
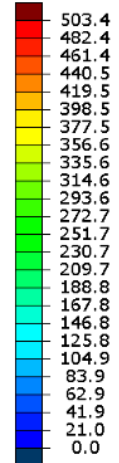
DIN - Deutsches Institut für Normung (2010) DIN EN 1994-1-1 +NA - Eurocode 4: Bemessung und Konstruktion von Verbundtragwerken aus Stahl und Beton ...

Initial and Final Finite Element Analyses (FEA)

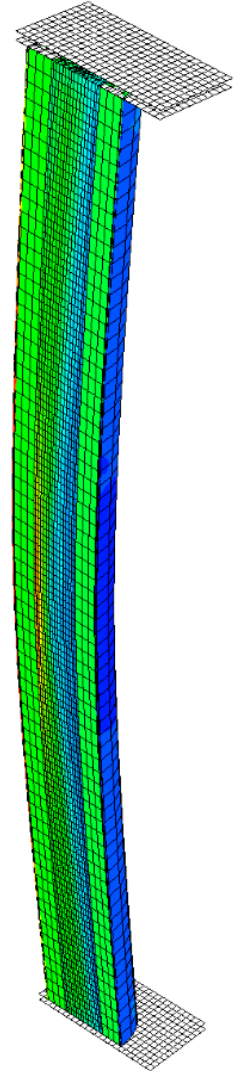
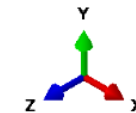
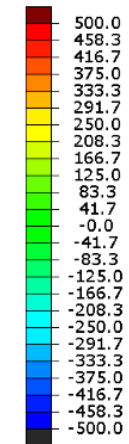
ABAQUS simulations:

- Sensitivity analysis
- Parametric study
- Calibration with tests results

S, Mises
SNEG, (fraction = -1.0)
SPOS, (fraction = 1.0)
(Avg: 75%)



S, Max. Principal (Abs)
SNEG, (fraction = -1.0)
SPOS, (fraction = 1.0)
(Avg: 75%)



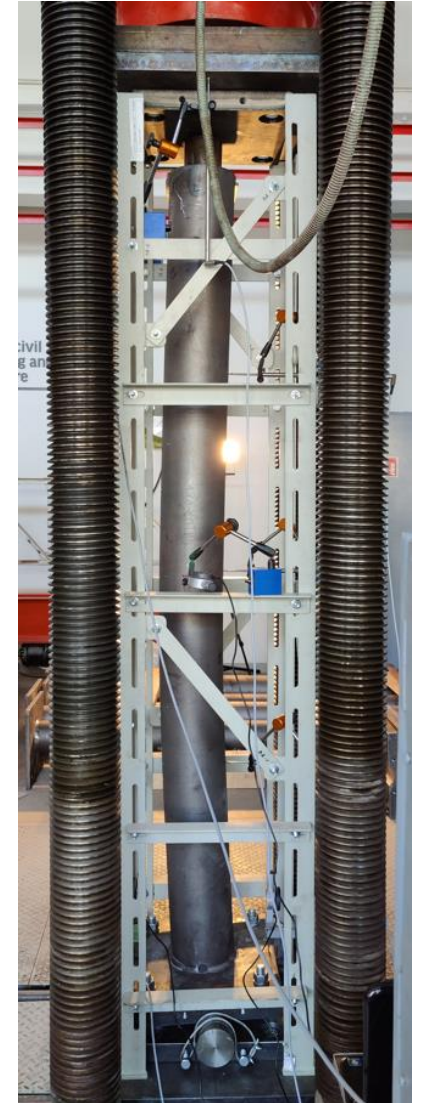
Full-scale tests

- Tests at Ruhr University Bochum (Germany)
- Measurements of production tolerances
- 4 pcs. 4.0 m long columns
- Various cross-section parameters
- Material tests
- Disassembly after tests



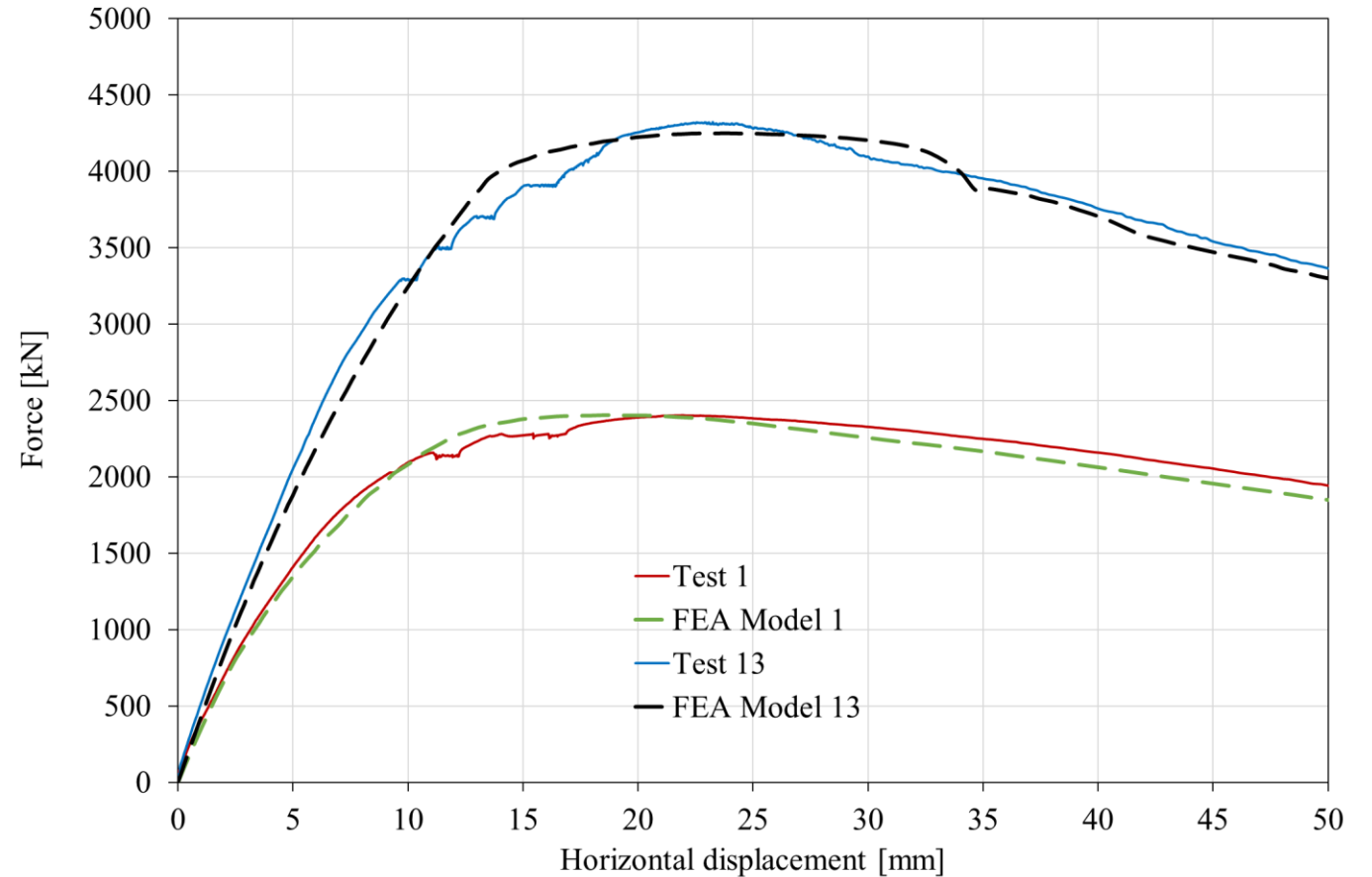
Small-scale tests

- Tests at Kaunas University of Technology (Lithuania)
- Measurements of production tolerances
- Hinge tests
- 17 (19*) pcs. 2.2 m long columns
- Various cross-section parameters
- Material tests
- Disassembly after tests



Design method calibration

- Calibration:
 - Tests results vs sophisticated FEA results
 - Sophisticated FEA results vs practical FEA results
- $\leq 5\%$ deviation from tests results

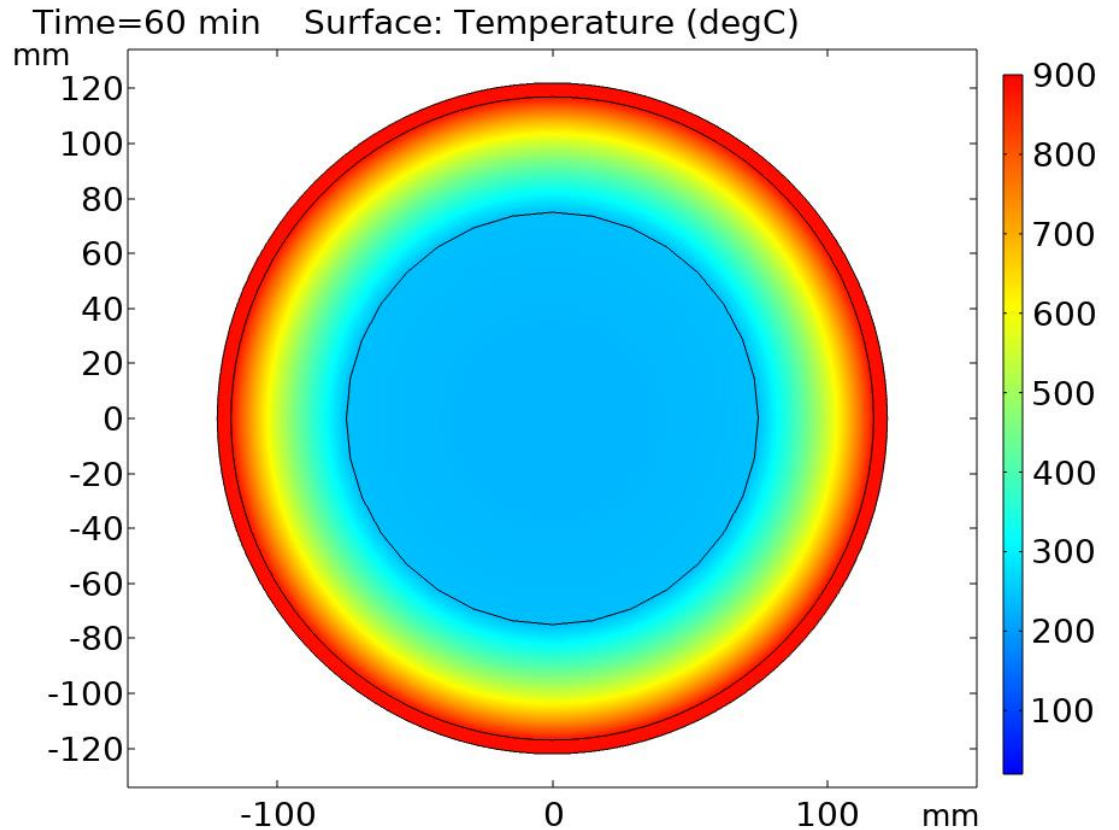


Design for Fire Situations

Design method calibrated with tests results

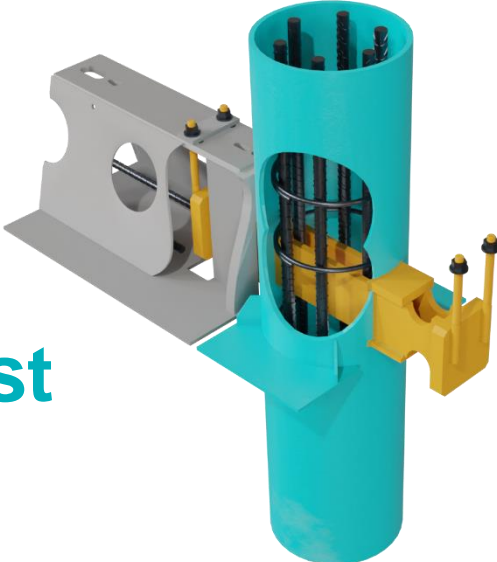
Key observations:

- Sensitivity of FEA parameters
- Thermal material properties
- Thermal expansion strains
- Steel core insulation by concrete
- Column boundary conditions

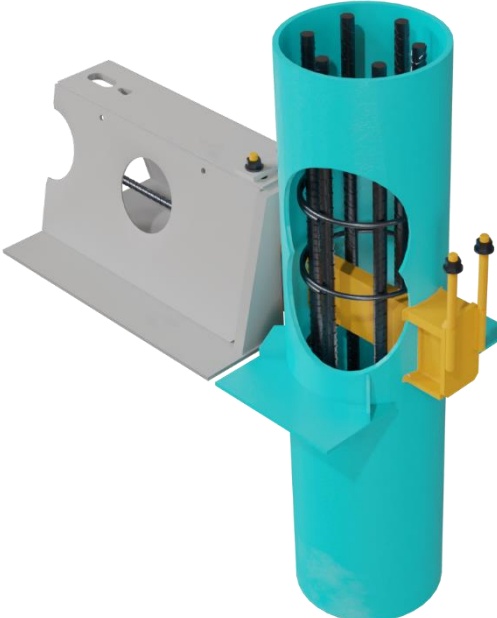


KONAT[®] consoles

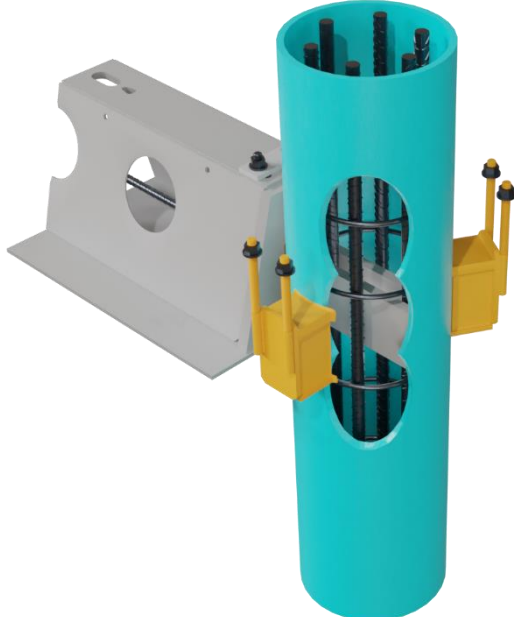
KONAT[®] Robust



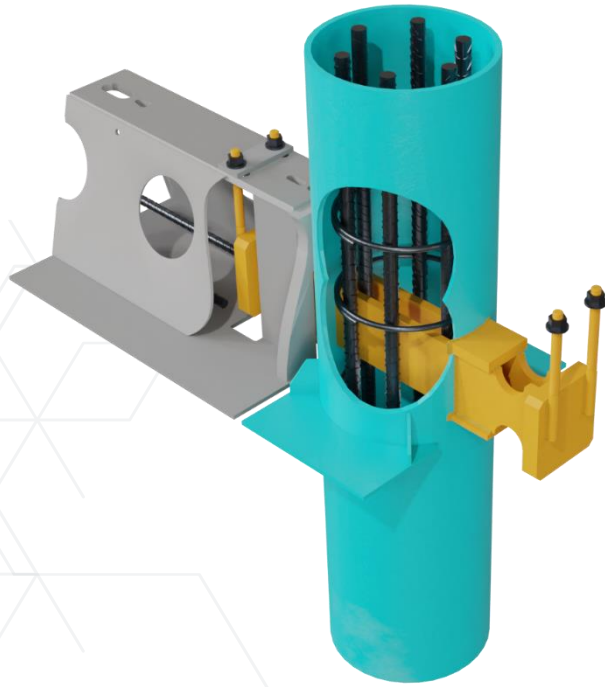
KONAT[®]



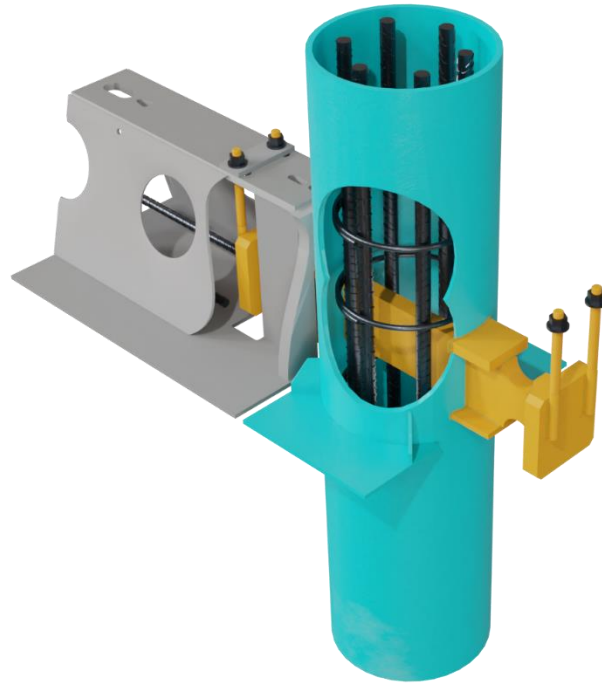
KONAT[®] Multi



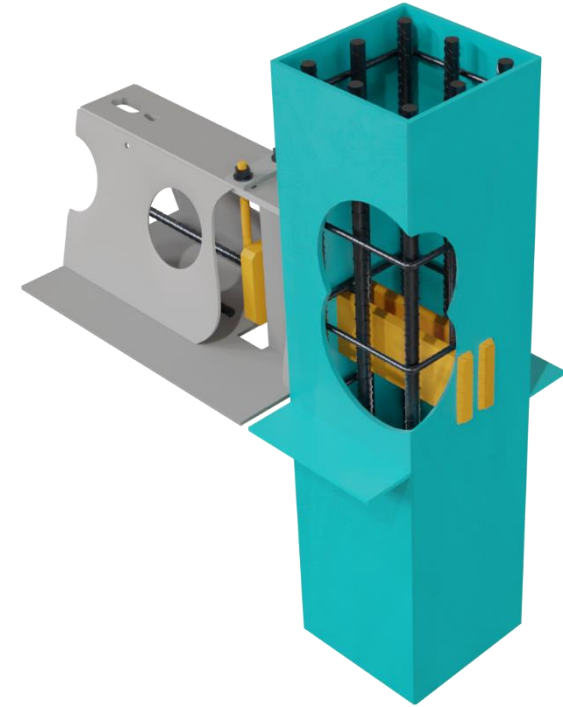
KONAT® Robust



2 gusset plates, two-sided console



1 gusset plate, two-sided console



2 gusset plates, one-sided console

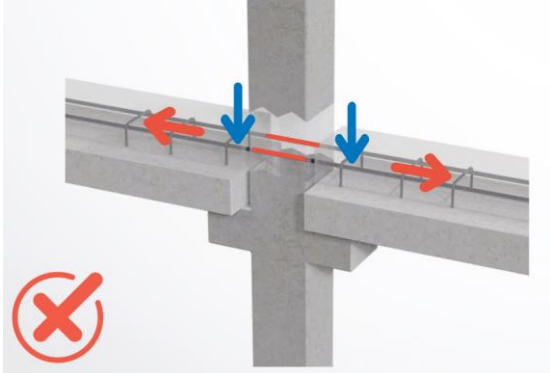
Load classes

3	5	7	10*	15*
300 kN	500 kN	700 kN	1000 kN	1500 kN

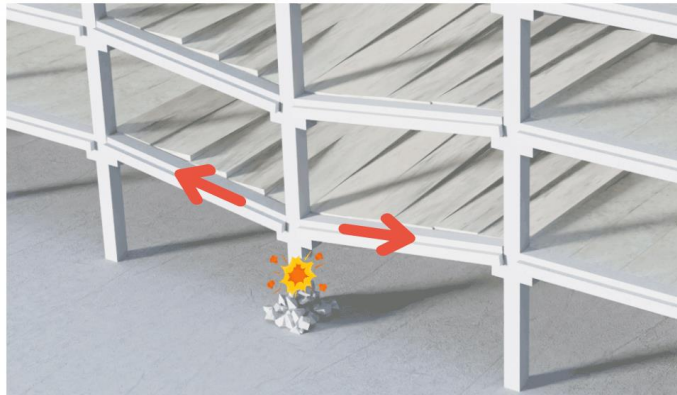
Benefits of KONAT[®] Robust



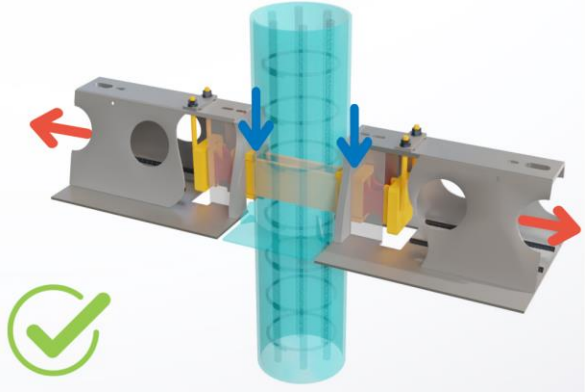
Normal exploitation situation



Inconvenient anchoring to reinforced concrete column

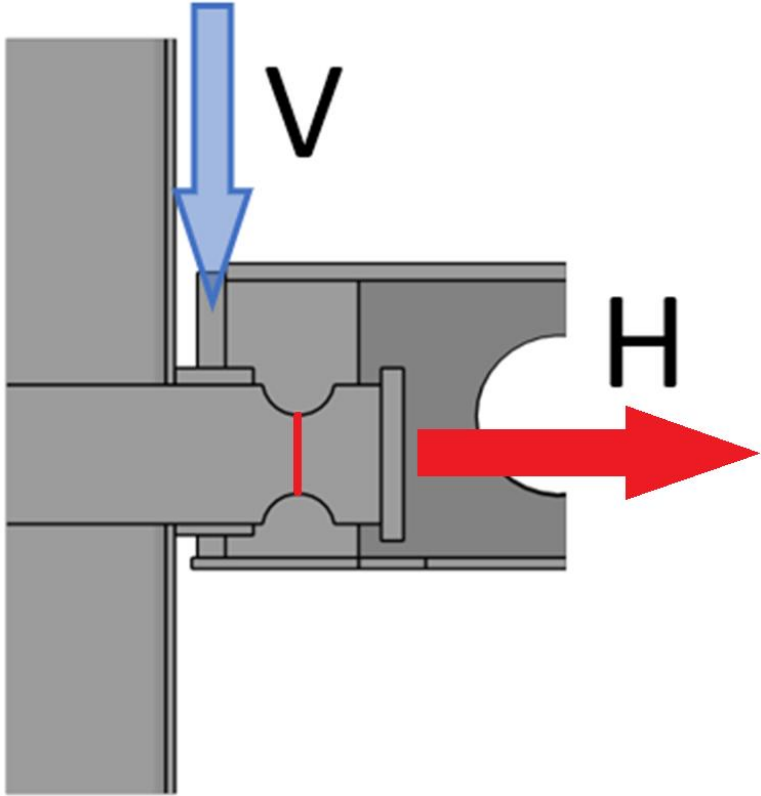


Accidental situation



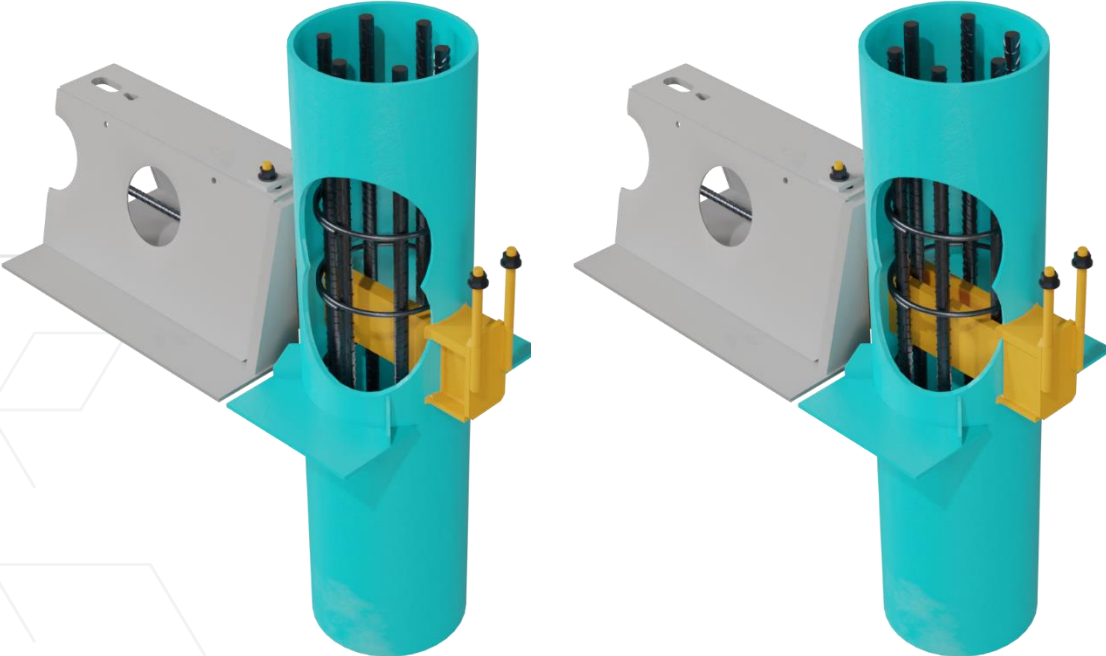
KONAT[®] Robust designed for normal and accidental situations

Fulfilled robustness requirements against progressive collapse acc. to EN 1991-1-7



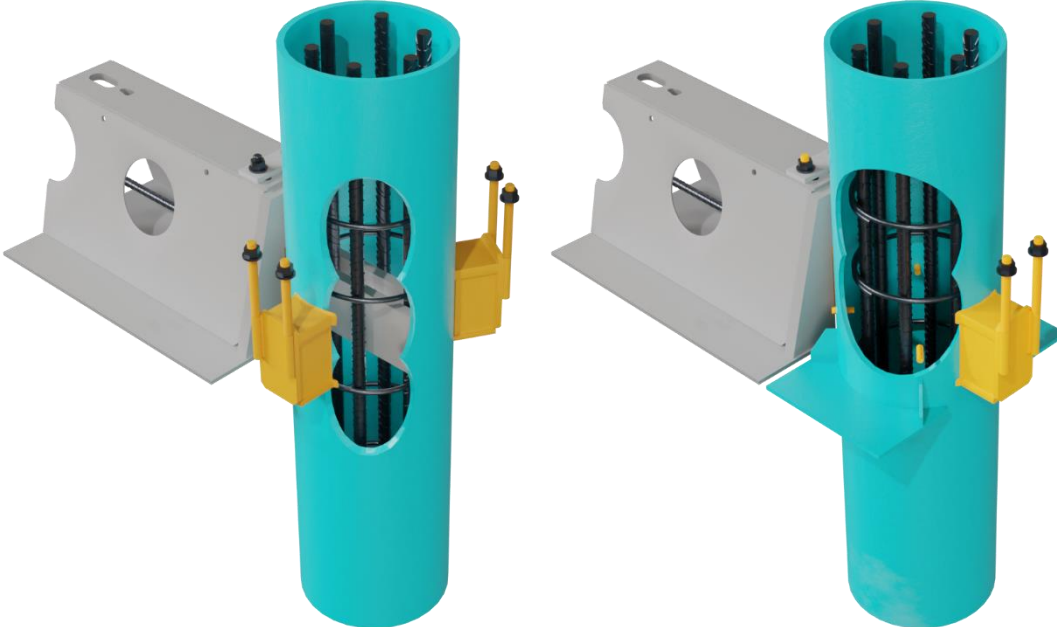
Principal scheme of actions and critical section in accidental situation

KONAT[®] and KONAT[®] Multi



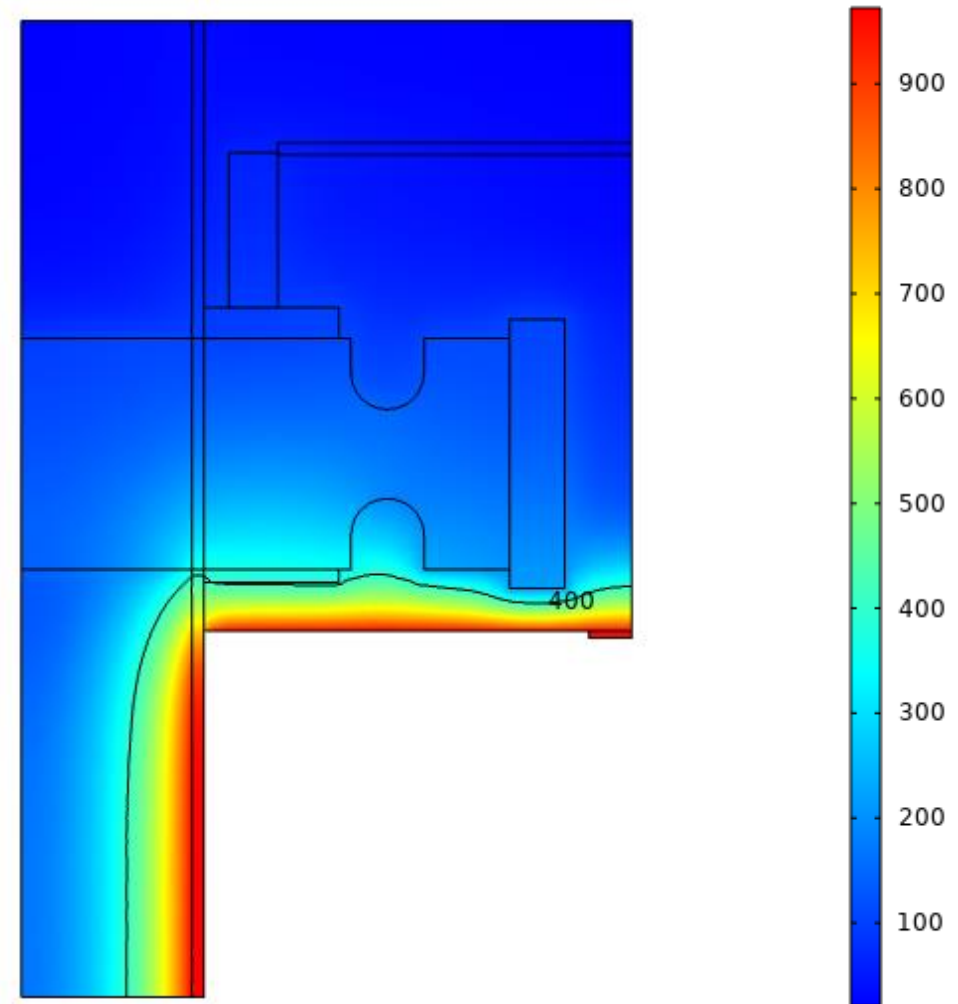
Two-sided KONAT[®] consoles with 1 and 2 gusset plates

Solutions with KONAT[®] Multi



Design in Fire situation

- Concrete layer insulates steel components
- Example: FEA simulated temperature distribution in a joint with KONAT[®] Robust after 90 minutes of fire exposure





**Thank You for Your Attention
Any Questions?**

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