

Hollow-Core Slabs on Flexible Supports

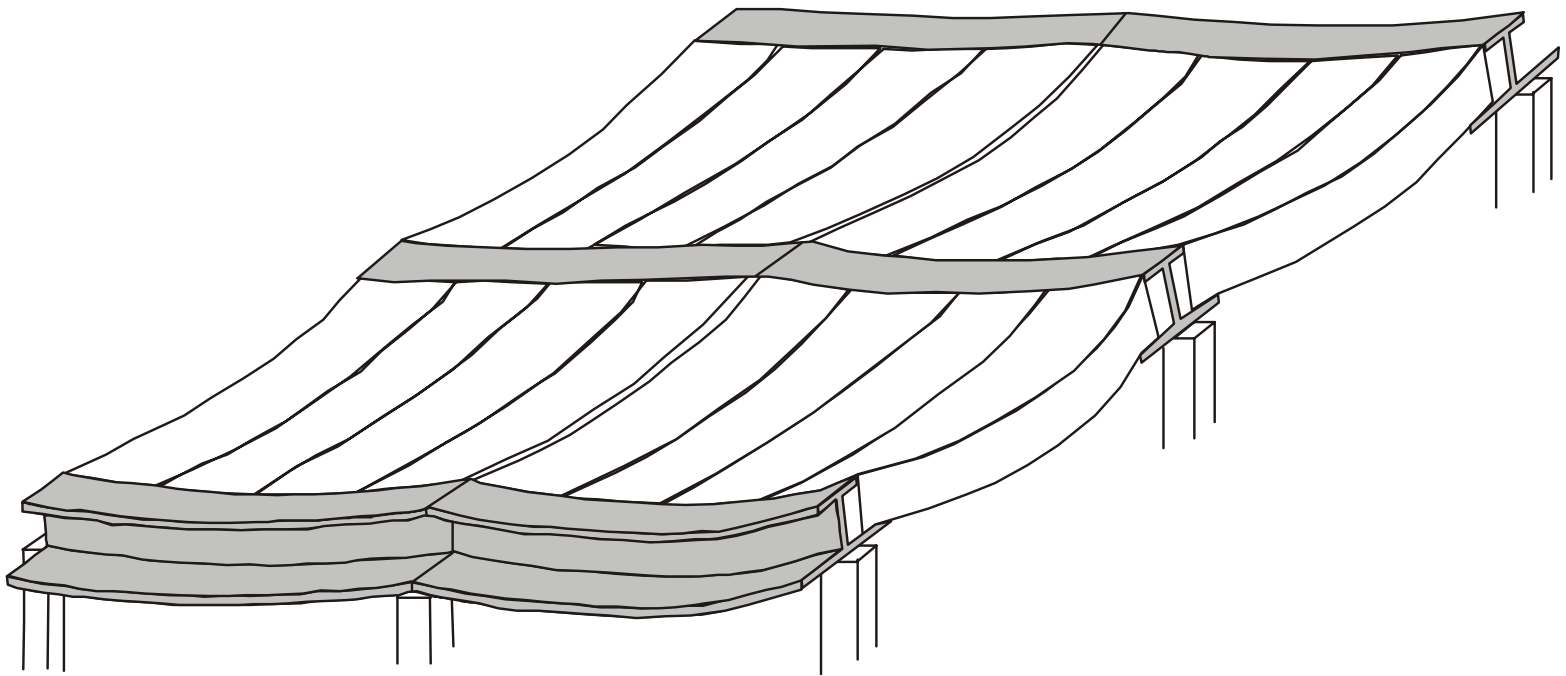
*FE-Investigations of Prestressed
Hollow-Core Slabs on non-rigid
supports*

*Prof. Dr.-Ing. Josef Hegger
Dipl.-Ing. Sebastian Bülte
RWTH Aachen*

*Dr.-Ing. Naceur Kerkeni
Hegger+Partners Consulting Aachen*

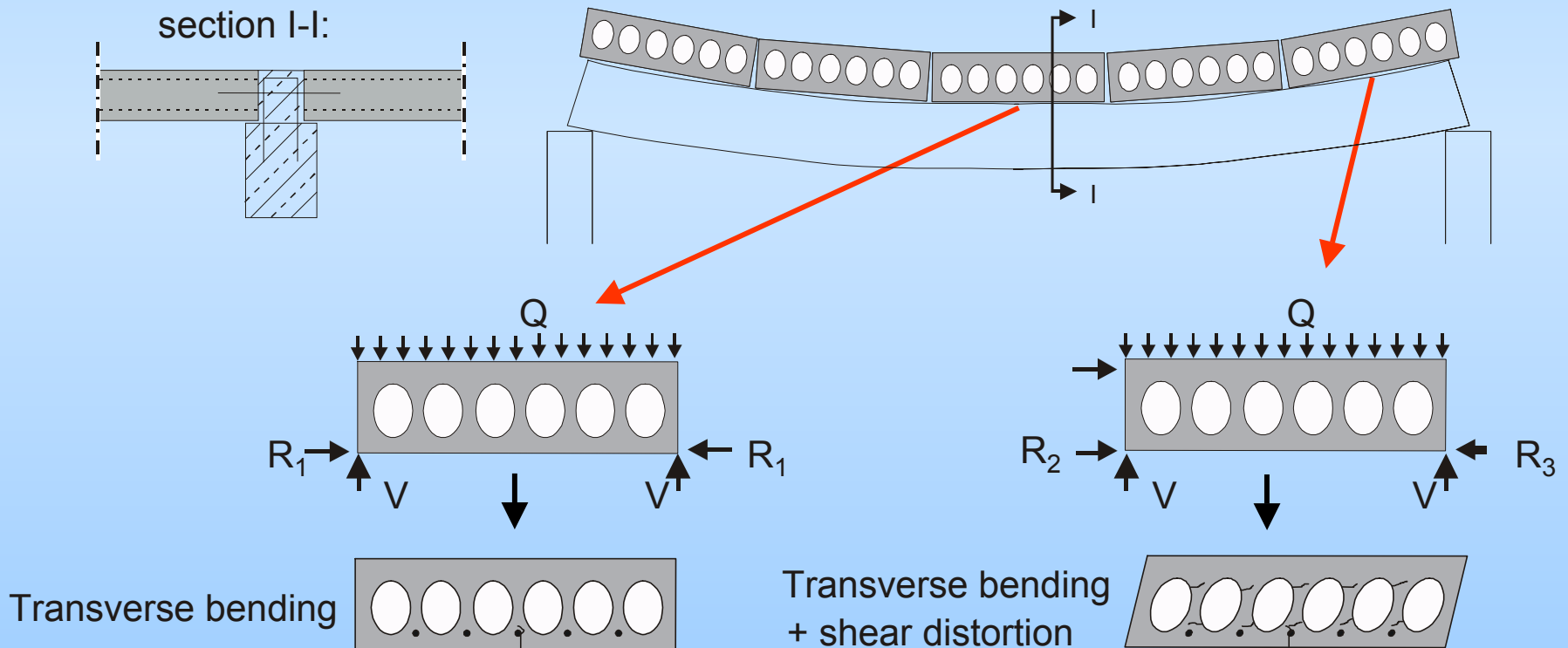
Hollow-Core Slabs on Flexible Supports

Additional stress caused by 2-axial bending, lateral tension and shear distortion



Hollow-Core Slabs on Concrete Beams

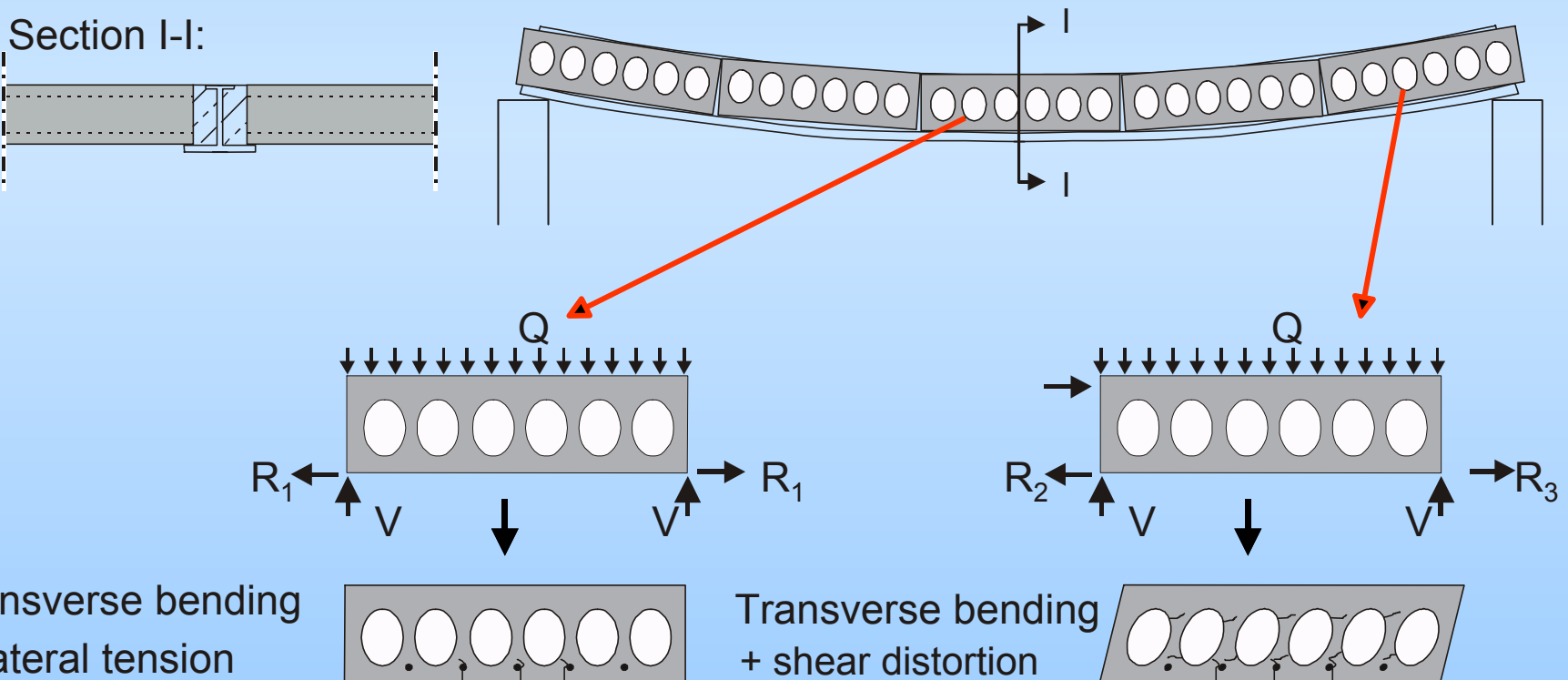
Additional stress of prestressed hollow-core slabs supported on a regular concrete beam is little.



Hollow-Core Slab on Steel Beams

(Slim-floor)

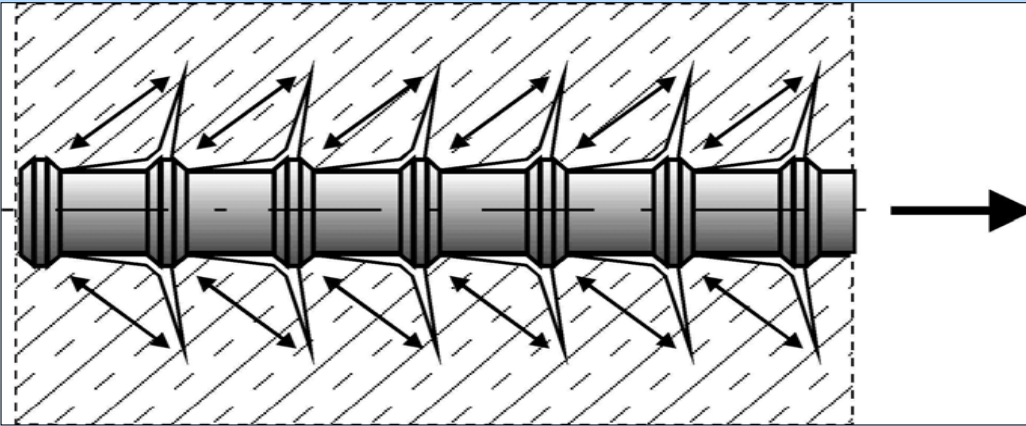
Additional stress of slabs has to be determined for each individual case.



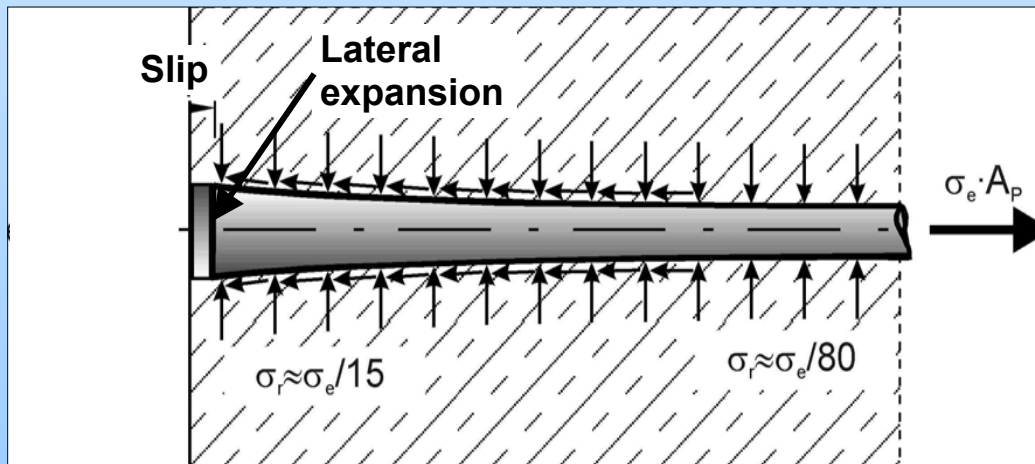
Bond Mechanisms

Reinforcing rods

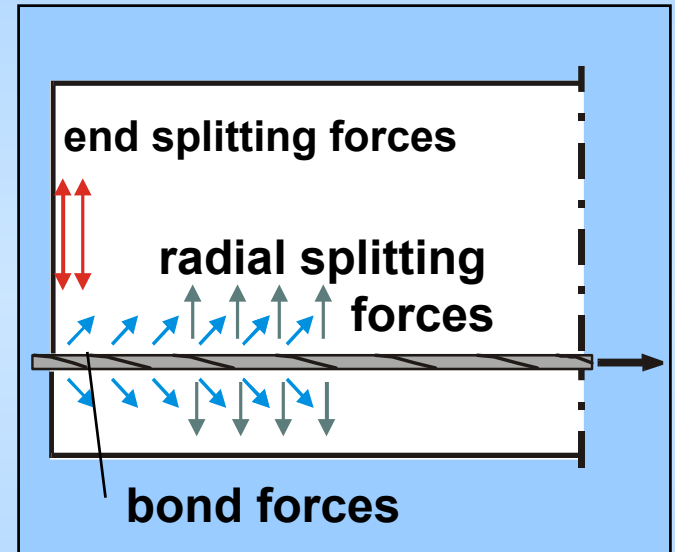
➔ bearing forces



Prestressed tendons



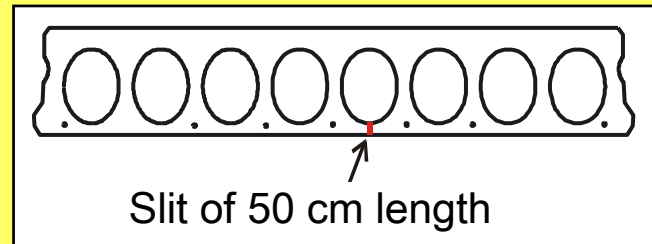
Anchorage stresses



➔ adhesion and friction
➔ Hoyer effect (wedge-action)

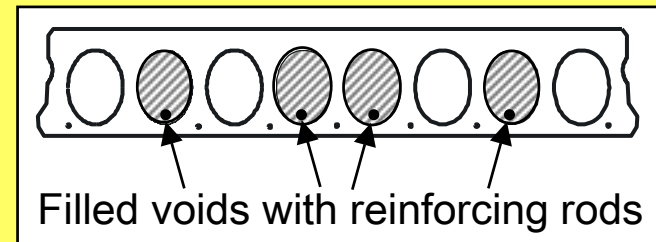
Possible Solutions

1. Slits in the soffit of the slabs with a length of approximately 50 cm starting from the support

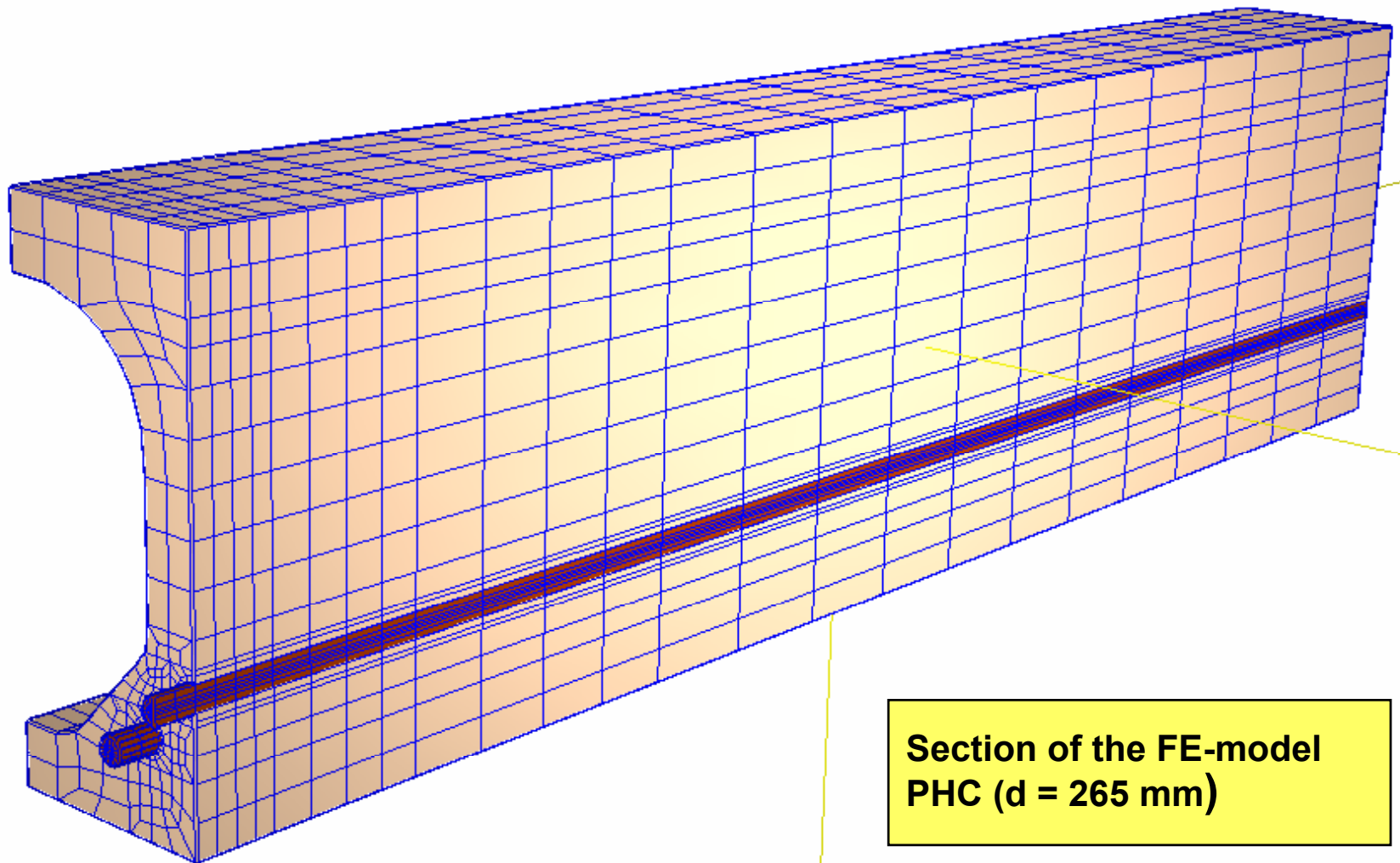


2. Tests on prestressed hollow-core slabs on flexible-supports to determine the number of longitudinal cracks per element
3. Finite element analysis on floor systems to appoint the hidden assets of slim-floor structures

4. Additional reinforcing rods to resist the acting tensile force in the anchorage zone (Laps of rods and tendons are required)

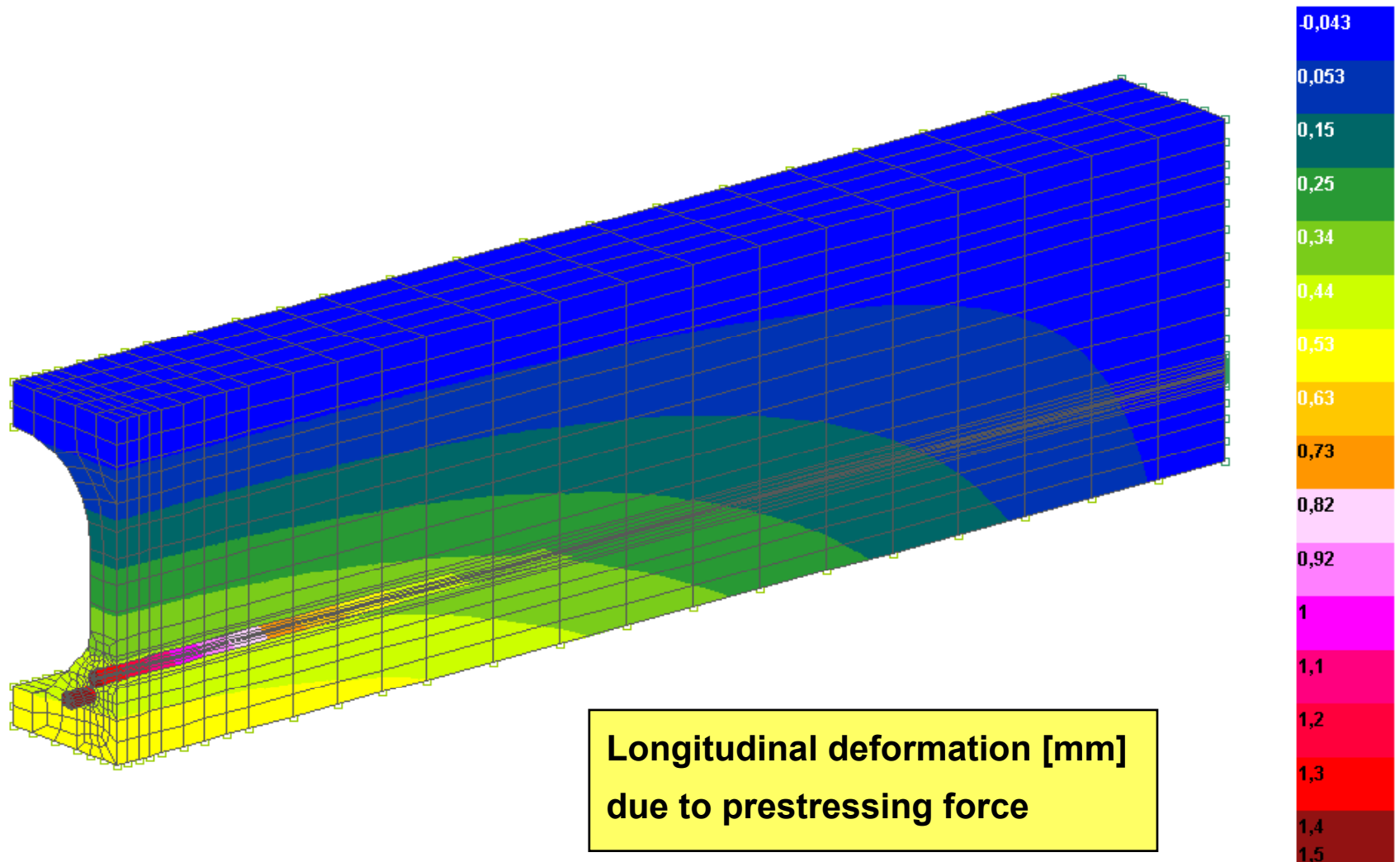


Finite Element Analysis of a Prestressed Hollow-Core Slab I

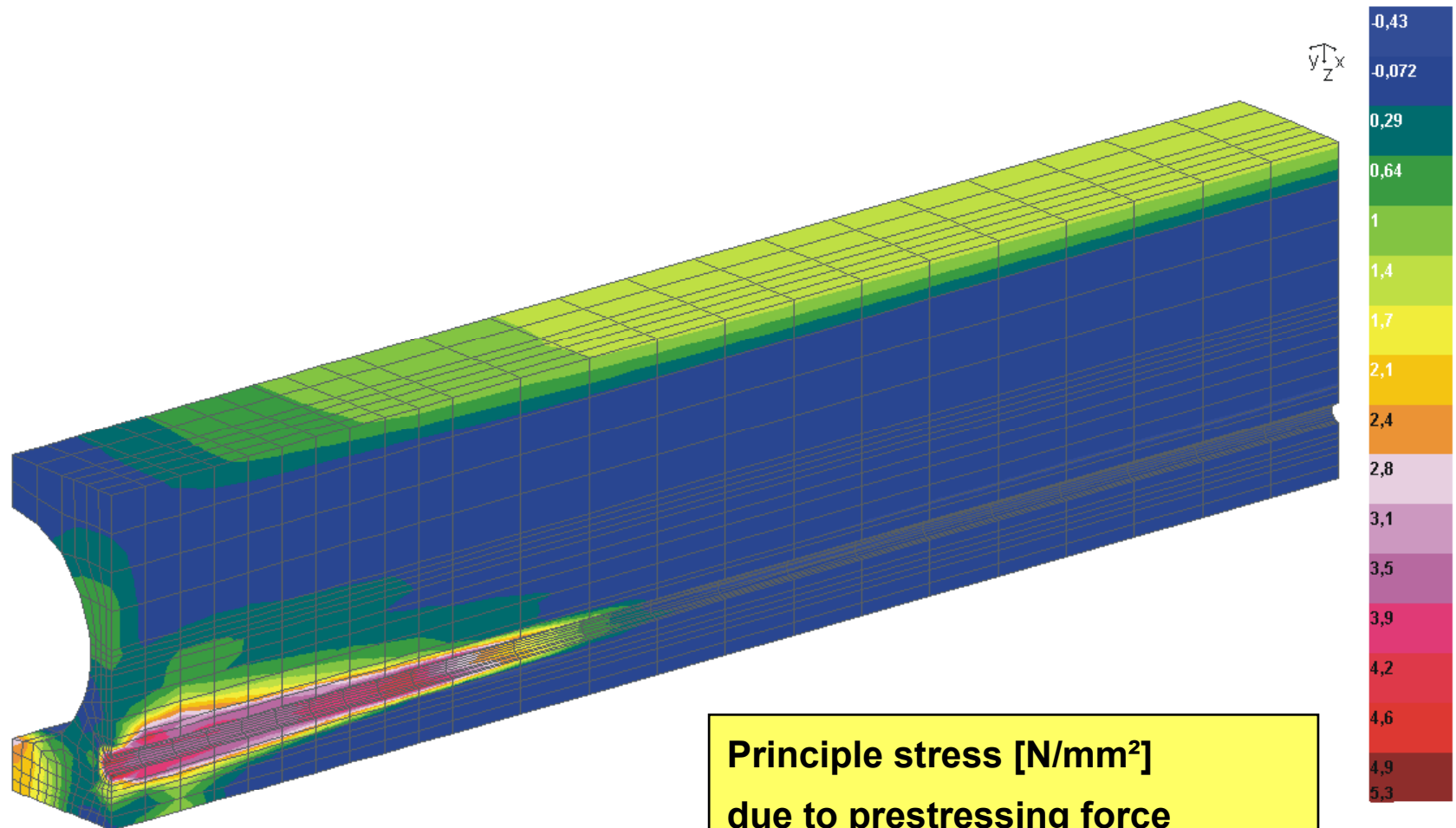


Section of the FE-model
PHC (d = 265 mm)

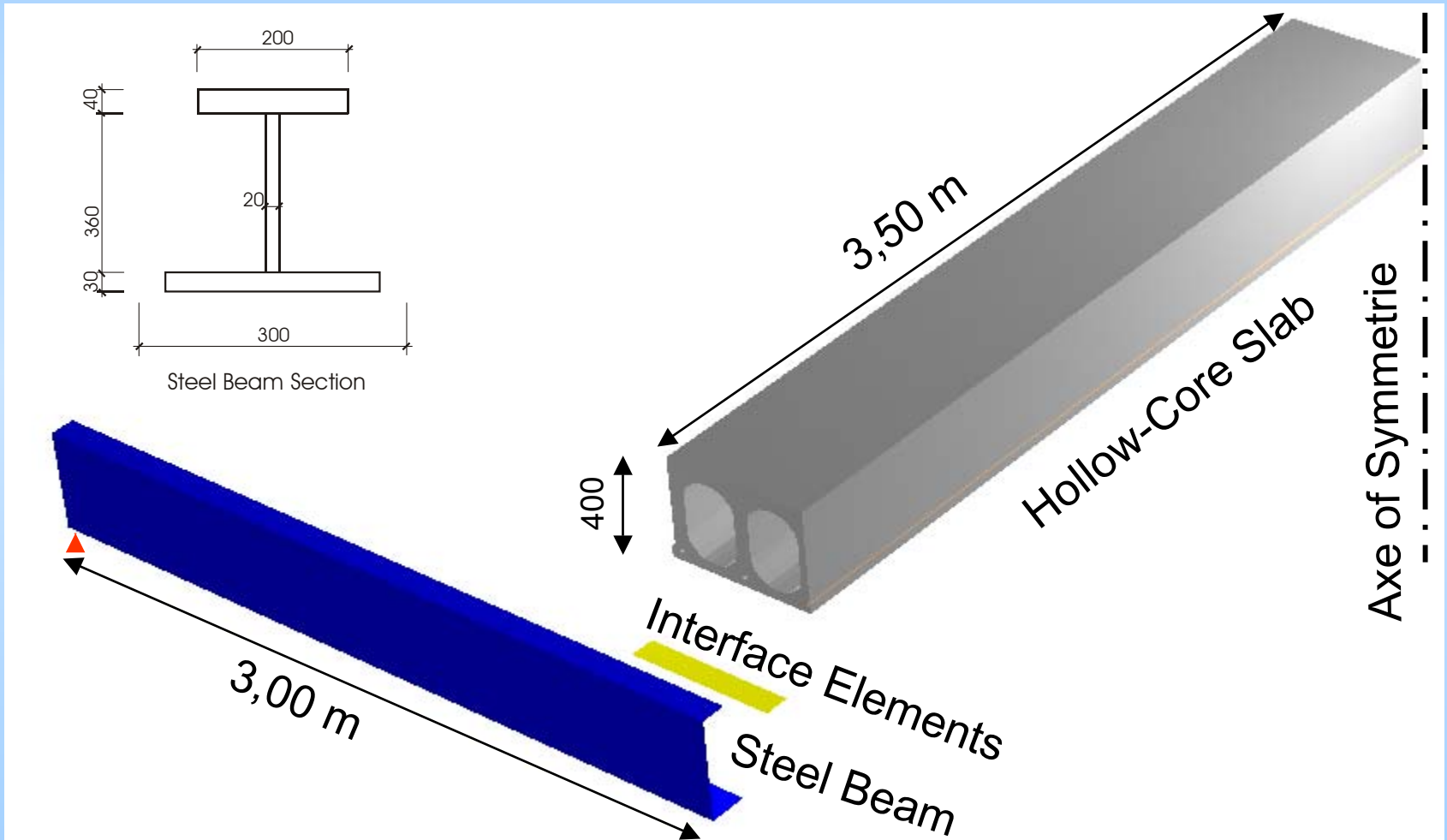
Finite Element Analysis of a Prestressed Hollow-Core Slab II



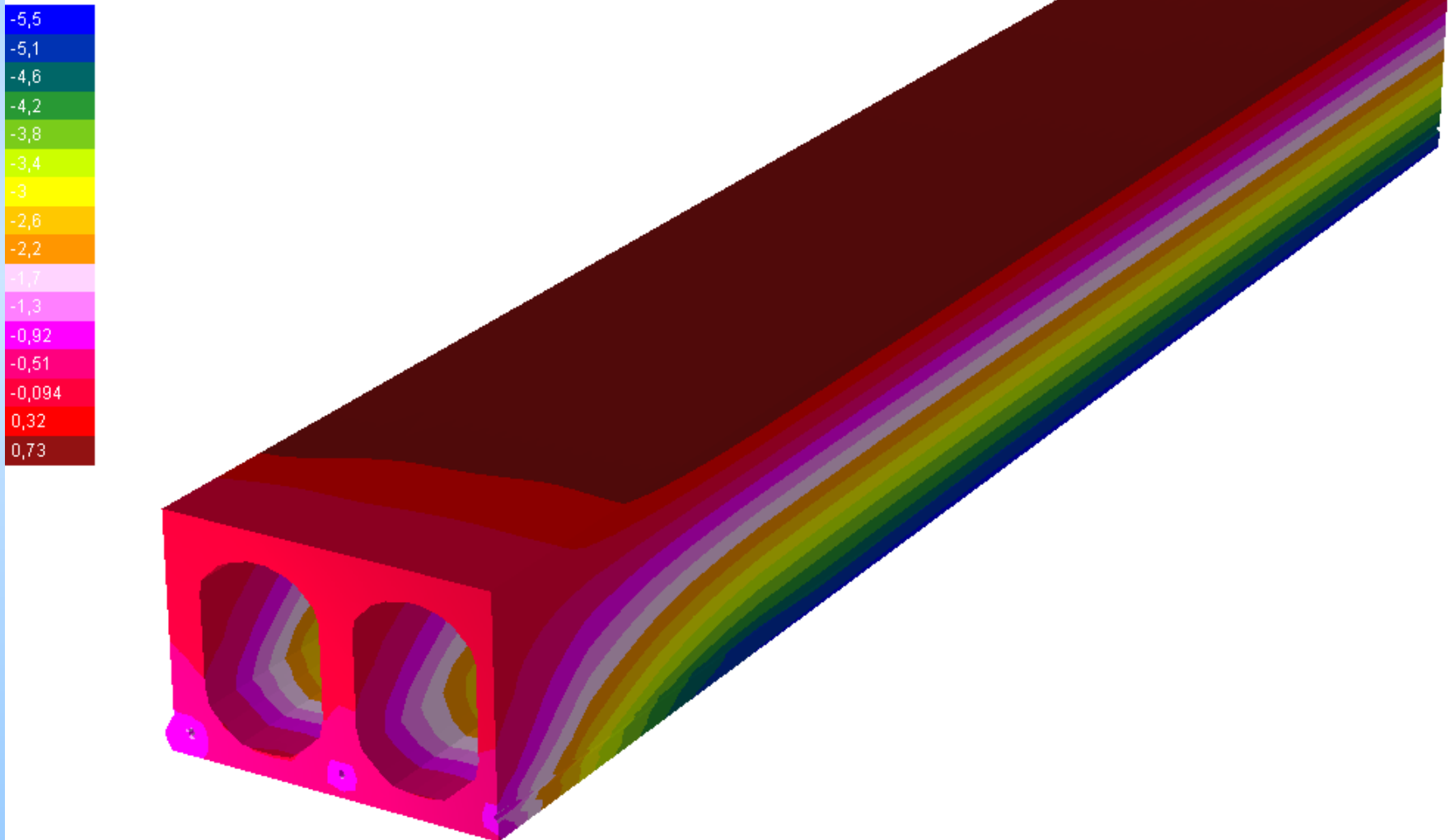
Finite Element Analysis of a Prestressed Hollow-Core Slab II



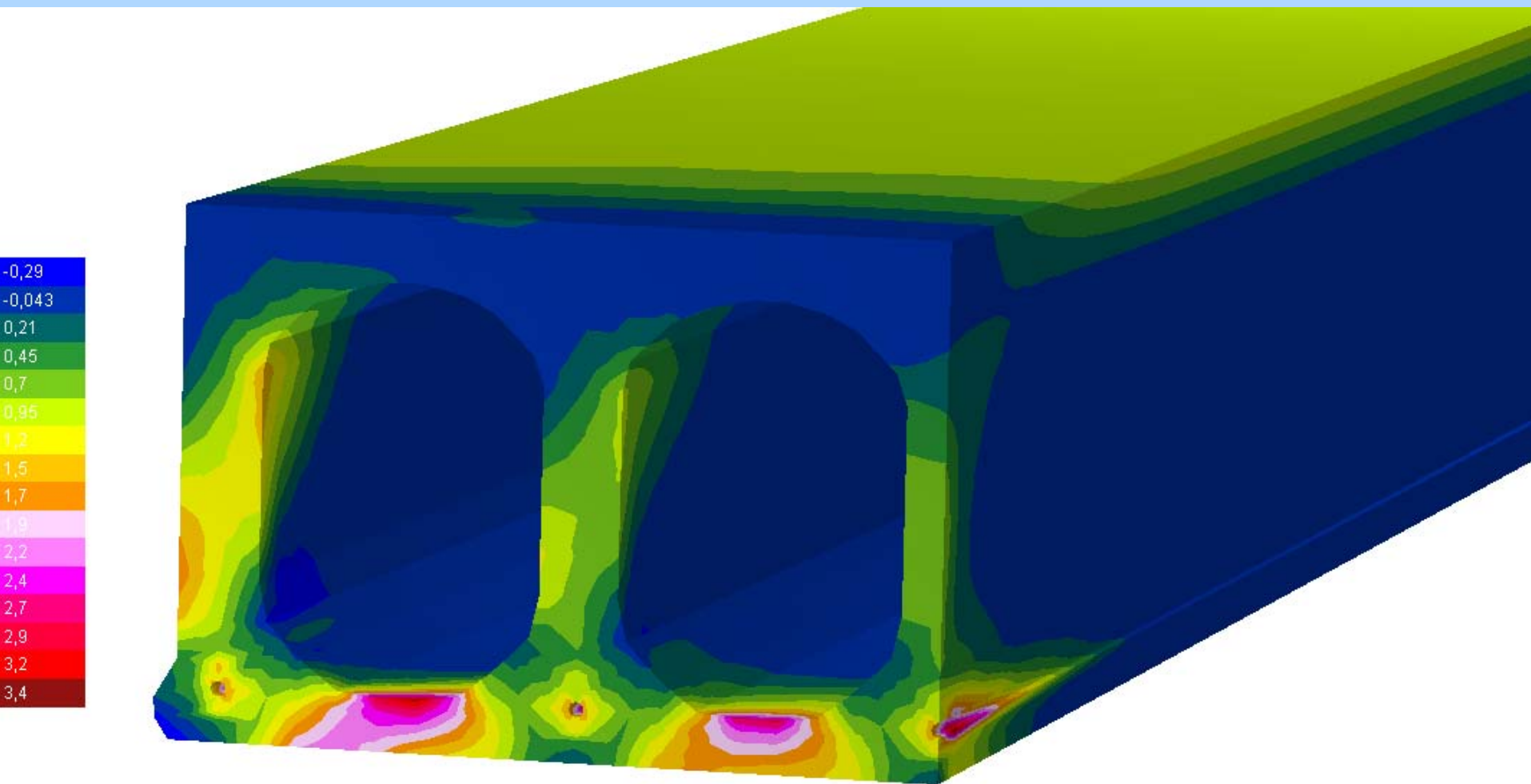
FE-Model



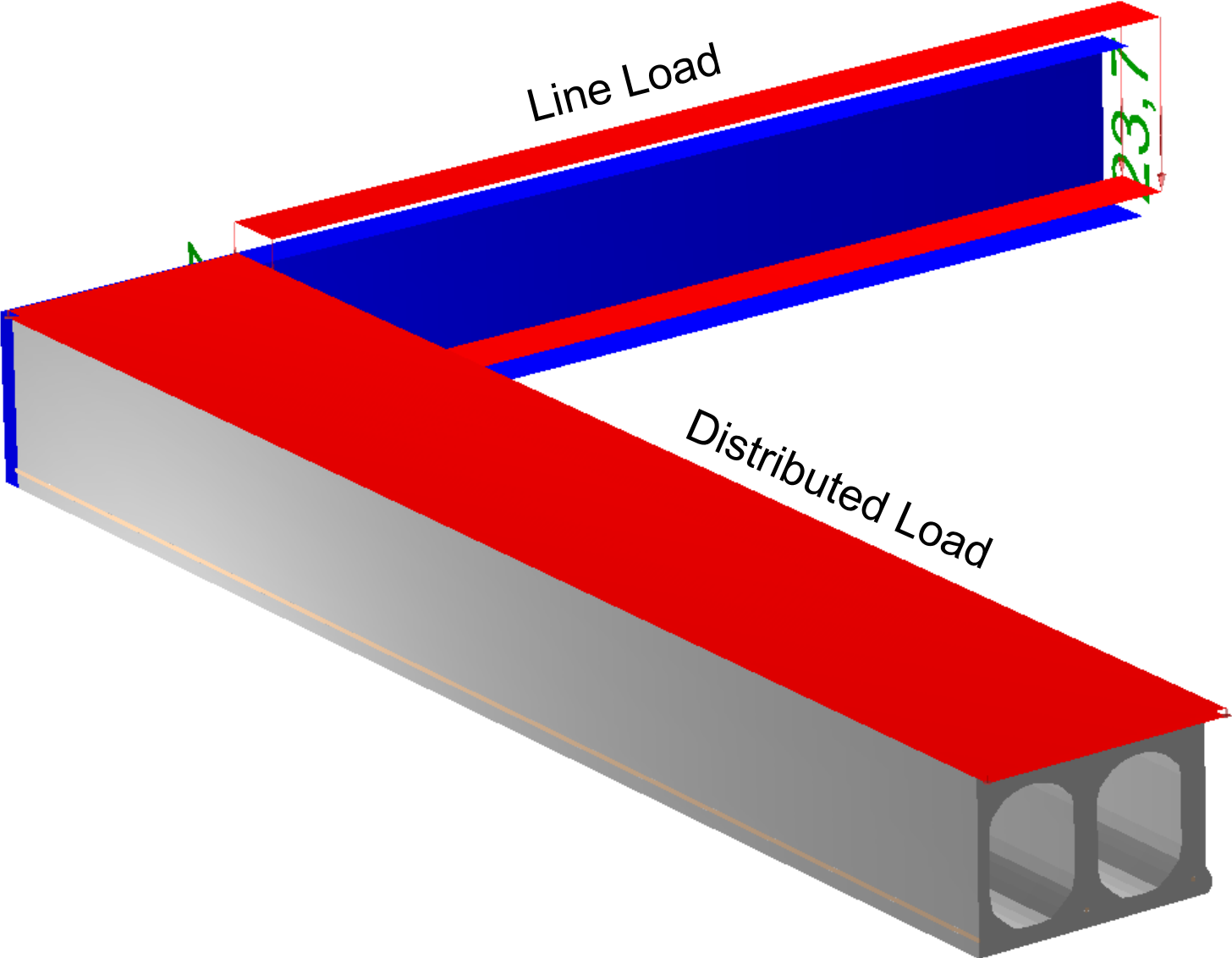
Longitudinal Stresses due to Prestressing



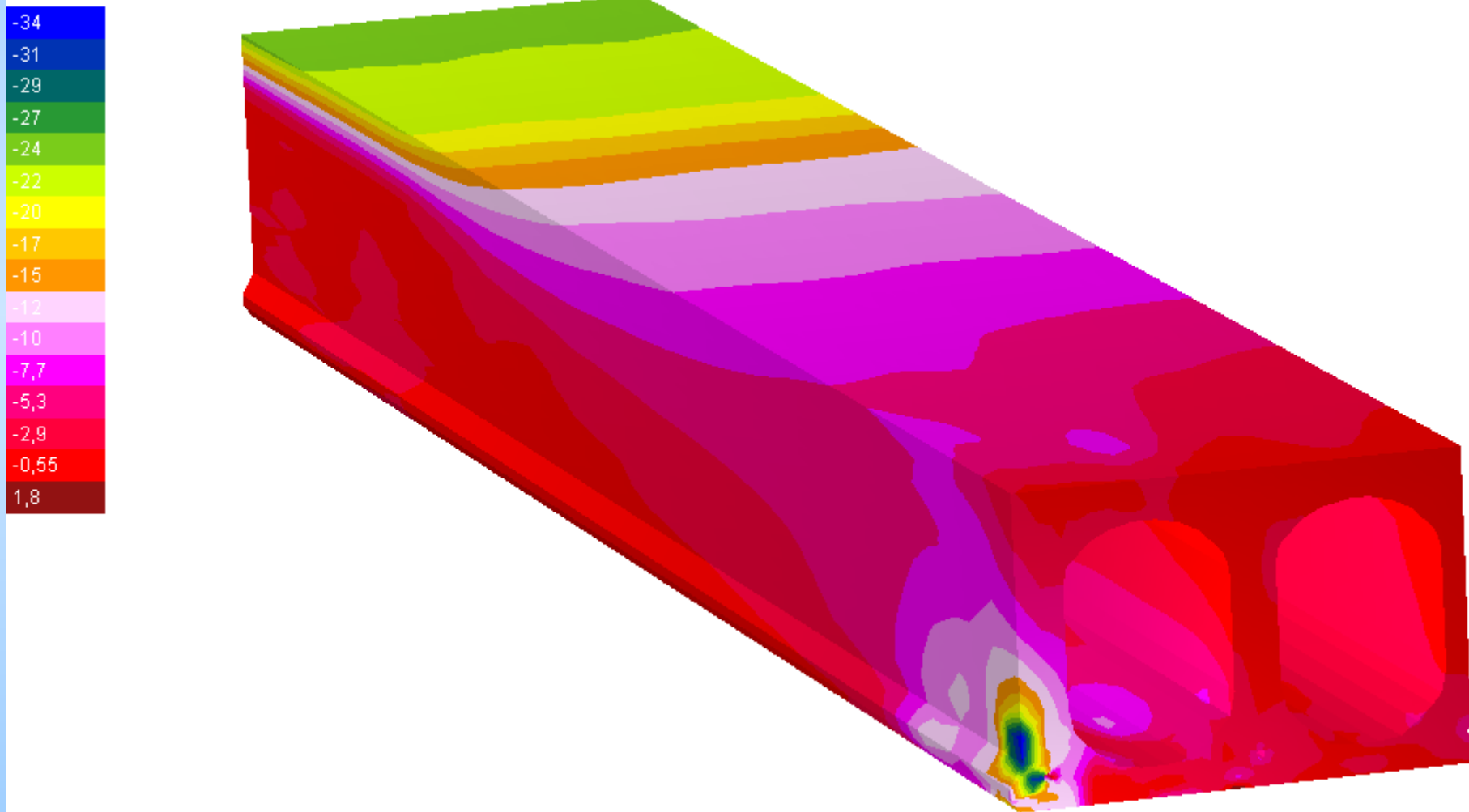
Mean Tensile Stresses due to Prestressing



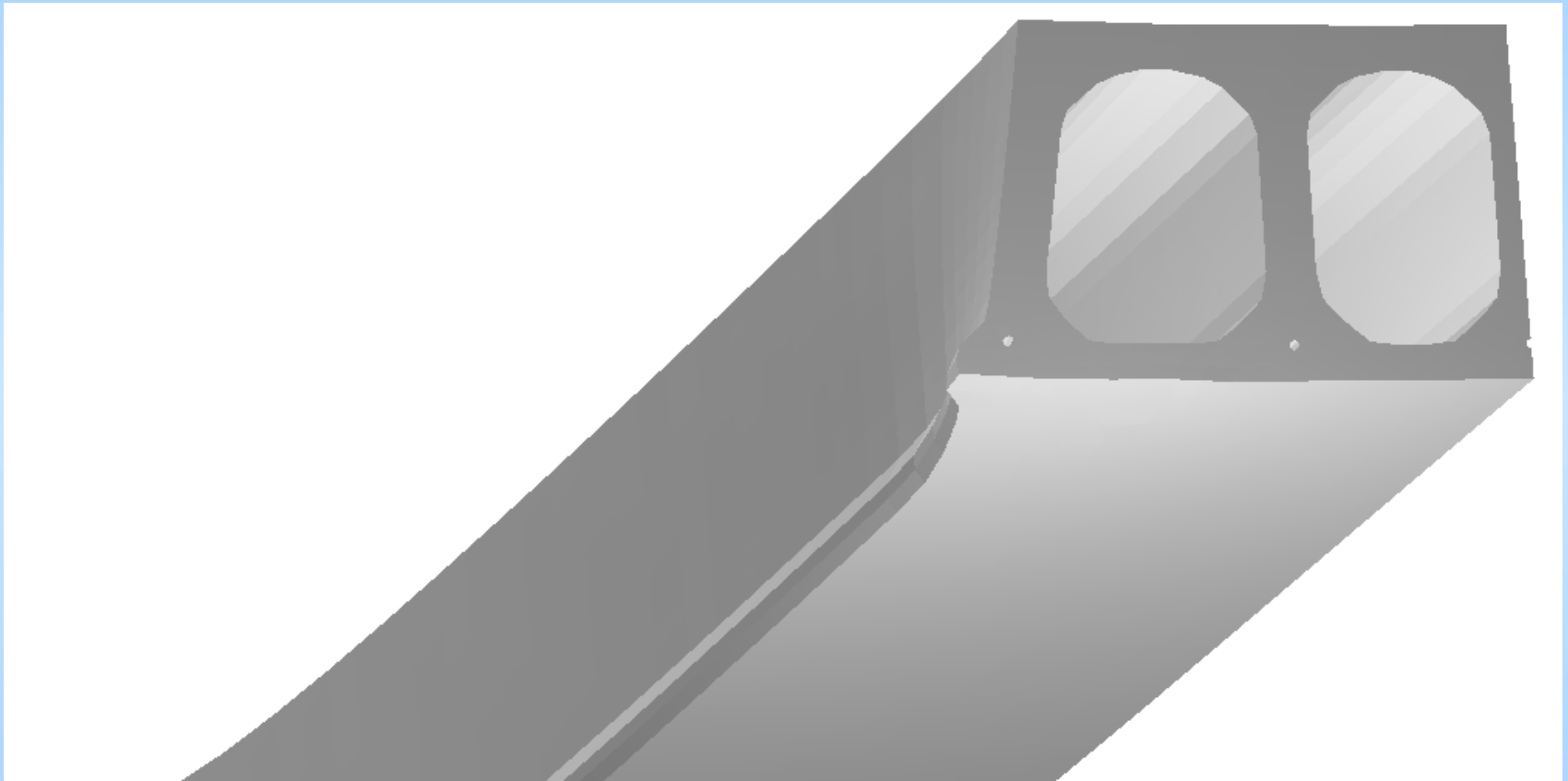
Loads



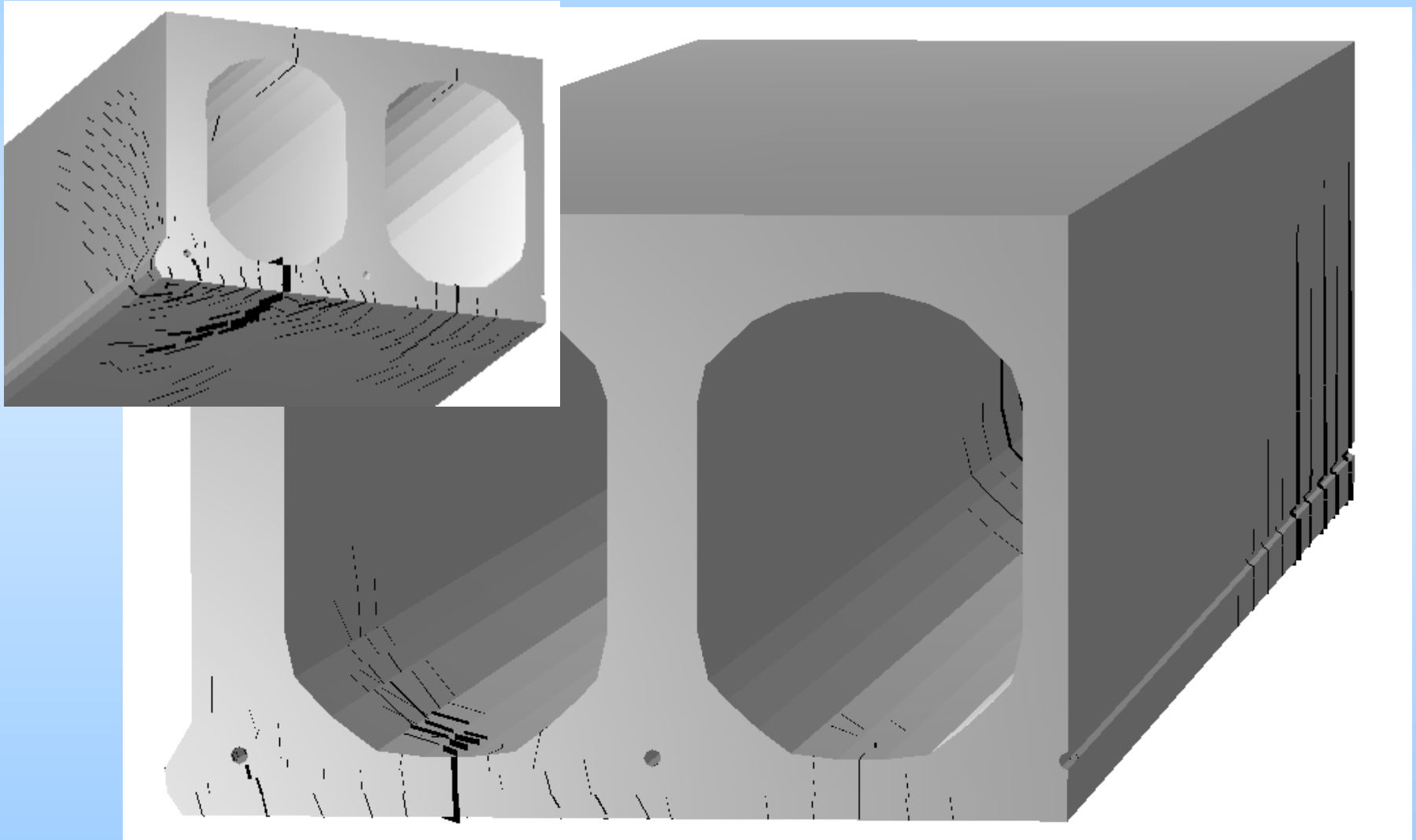
Mean Compressive Stresses (V=193 kN/Slab)



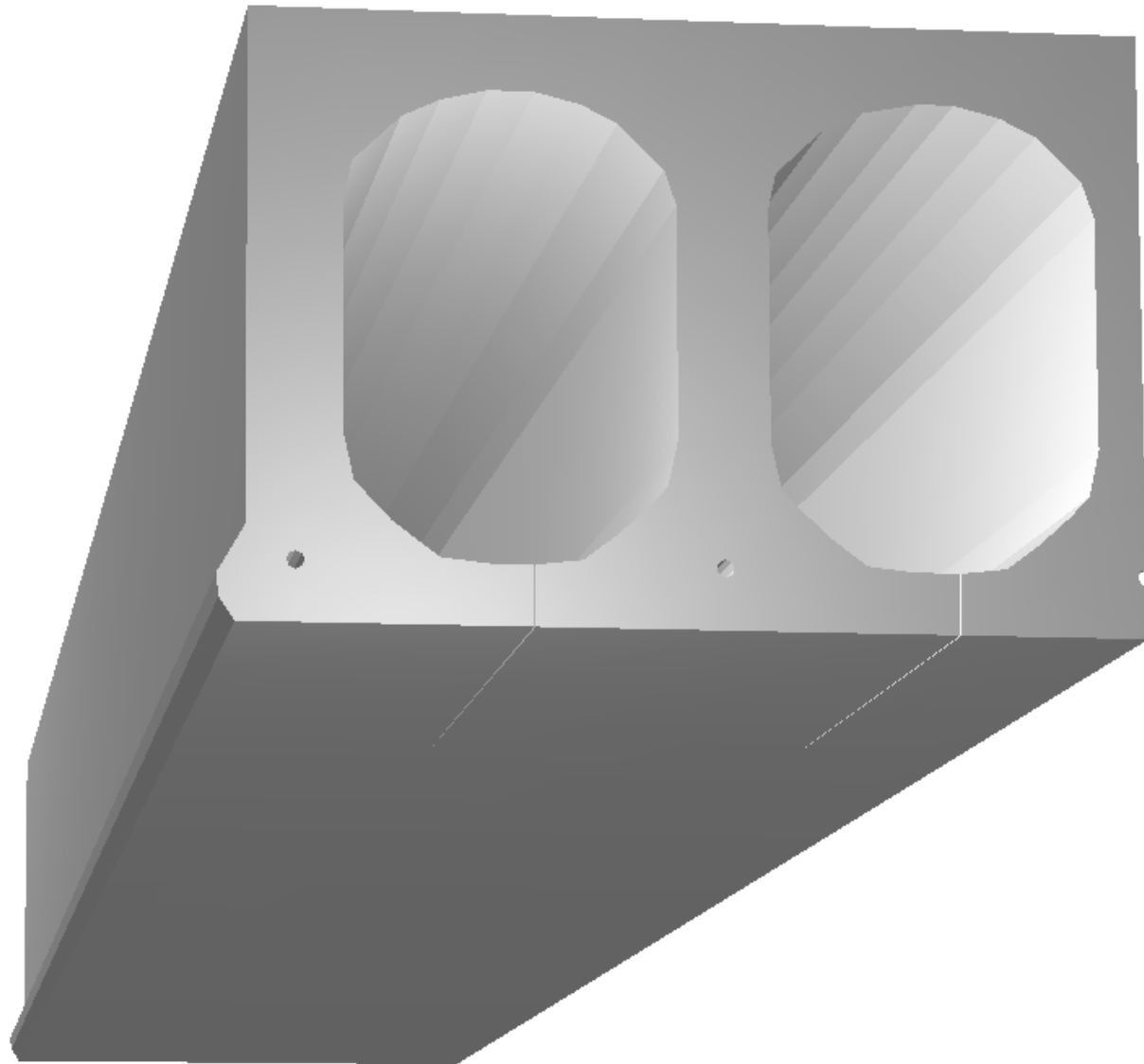
Deformation at Failure (scaled in transv. Direc.)



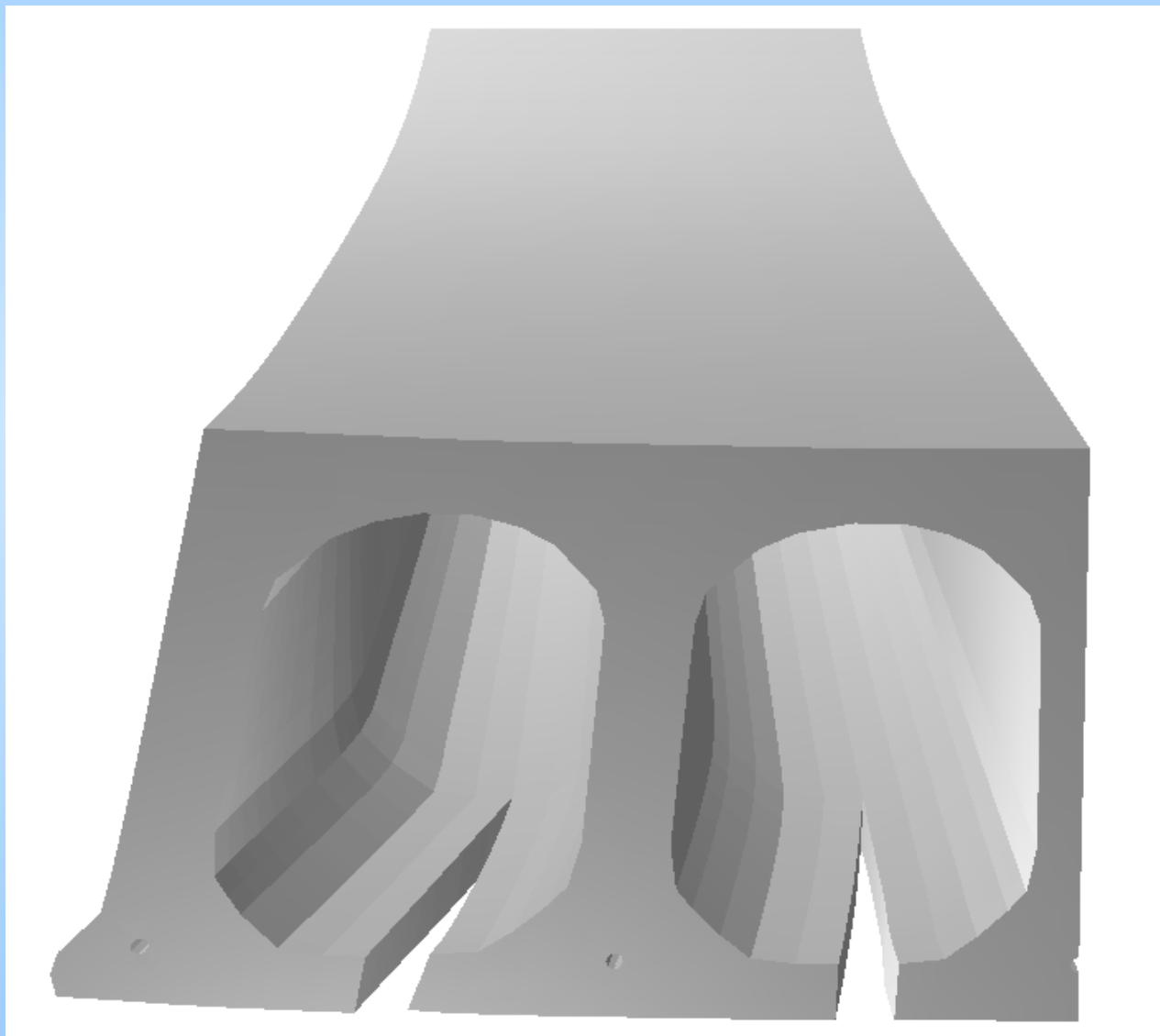
Crack Pattern at Failure



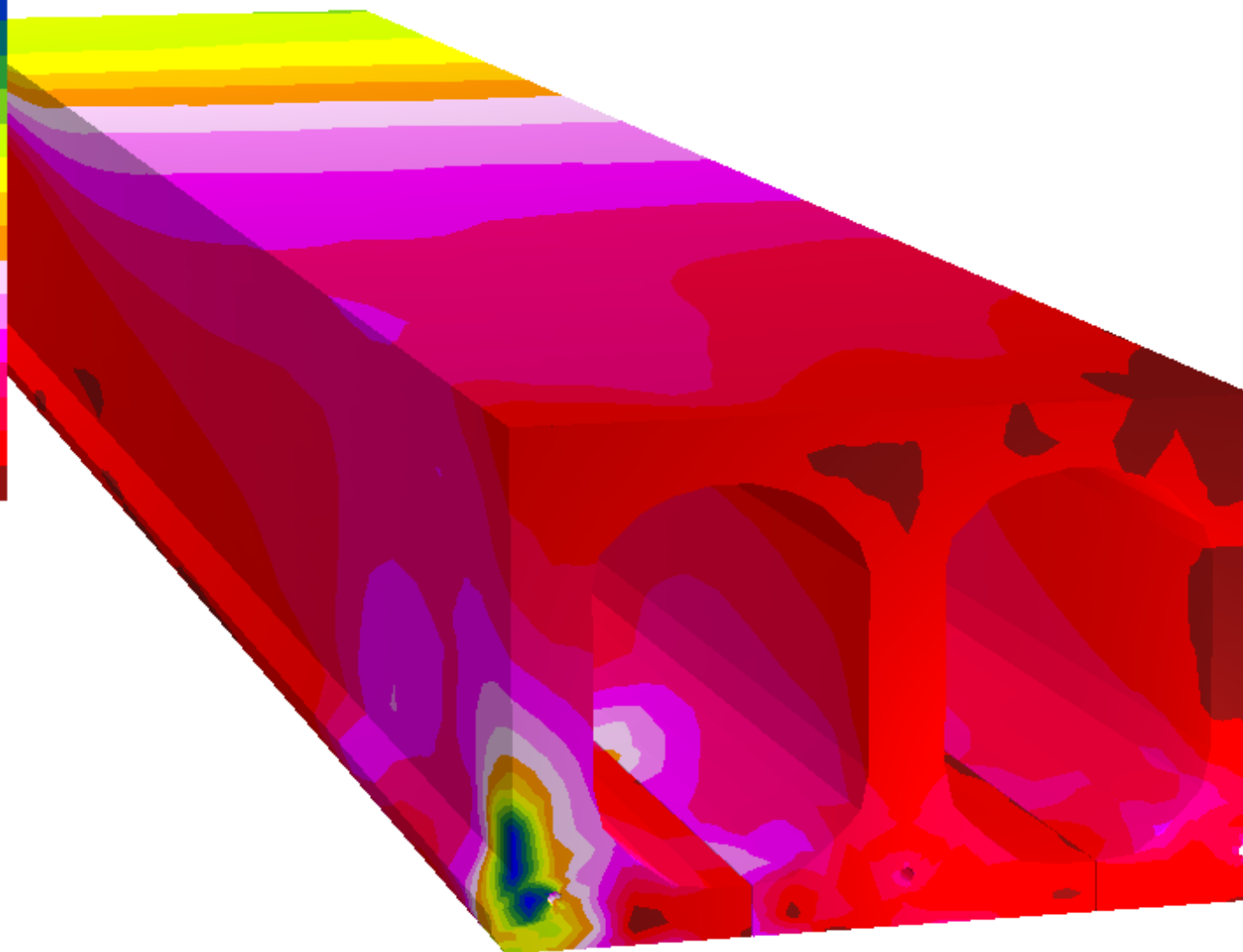
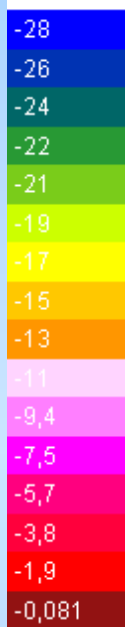
Slits in the soffit of the slabs



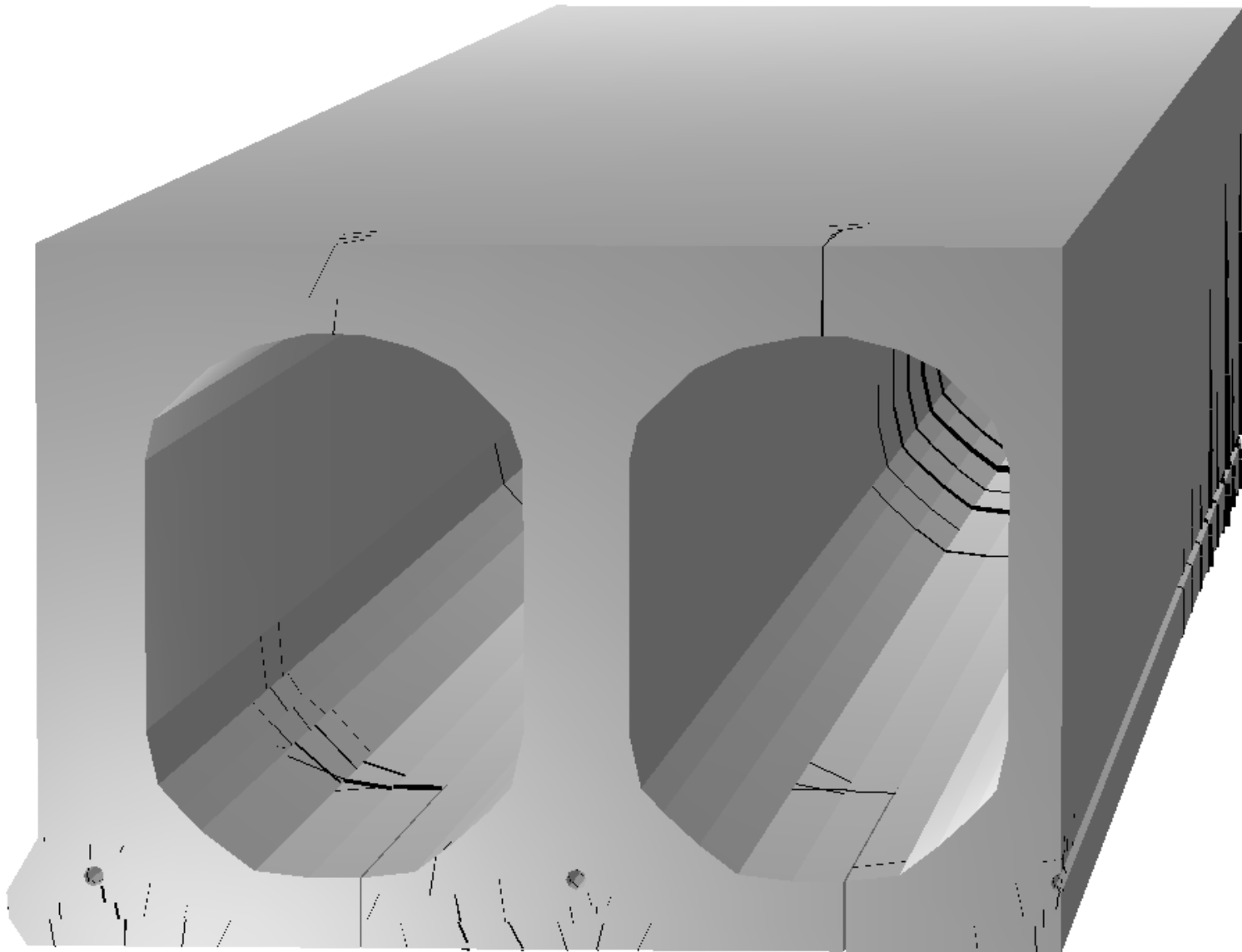
Deformation at Failure (scaled in trans. Direc.)



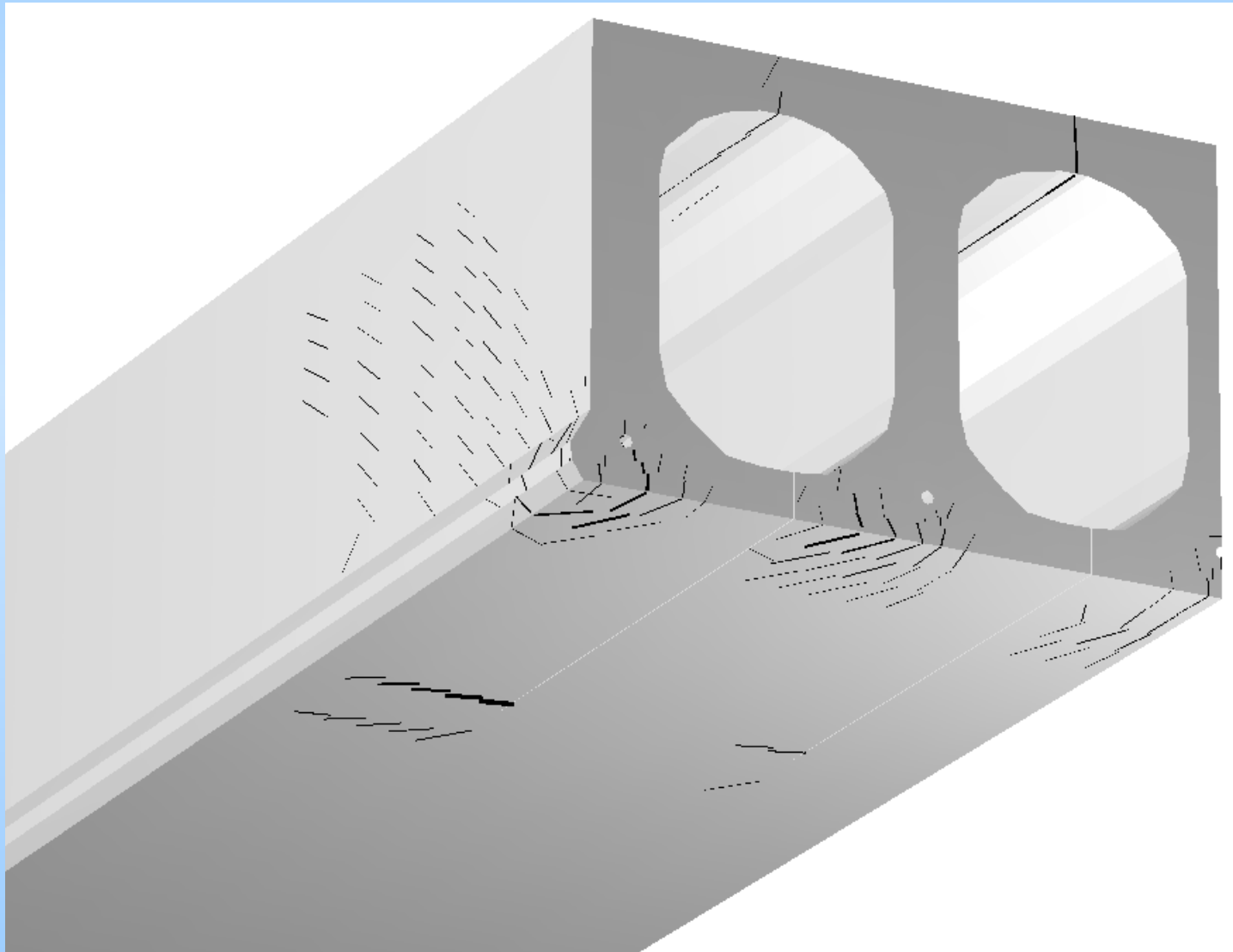
Mean Compressive Stress at Failure



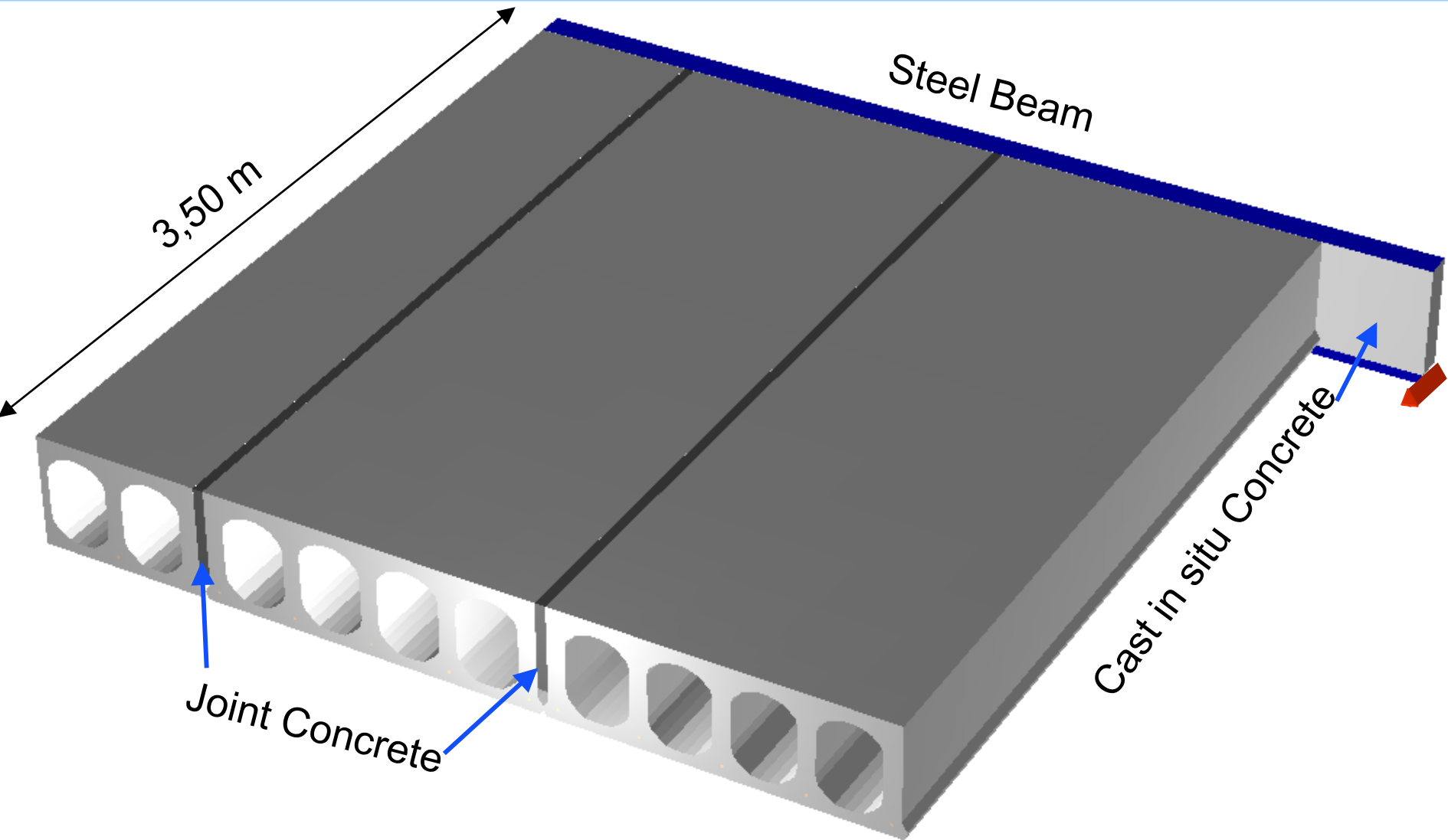
Crack Pattern at Failure



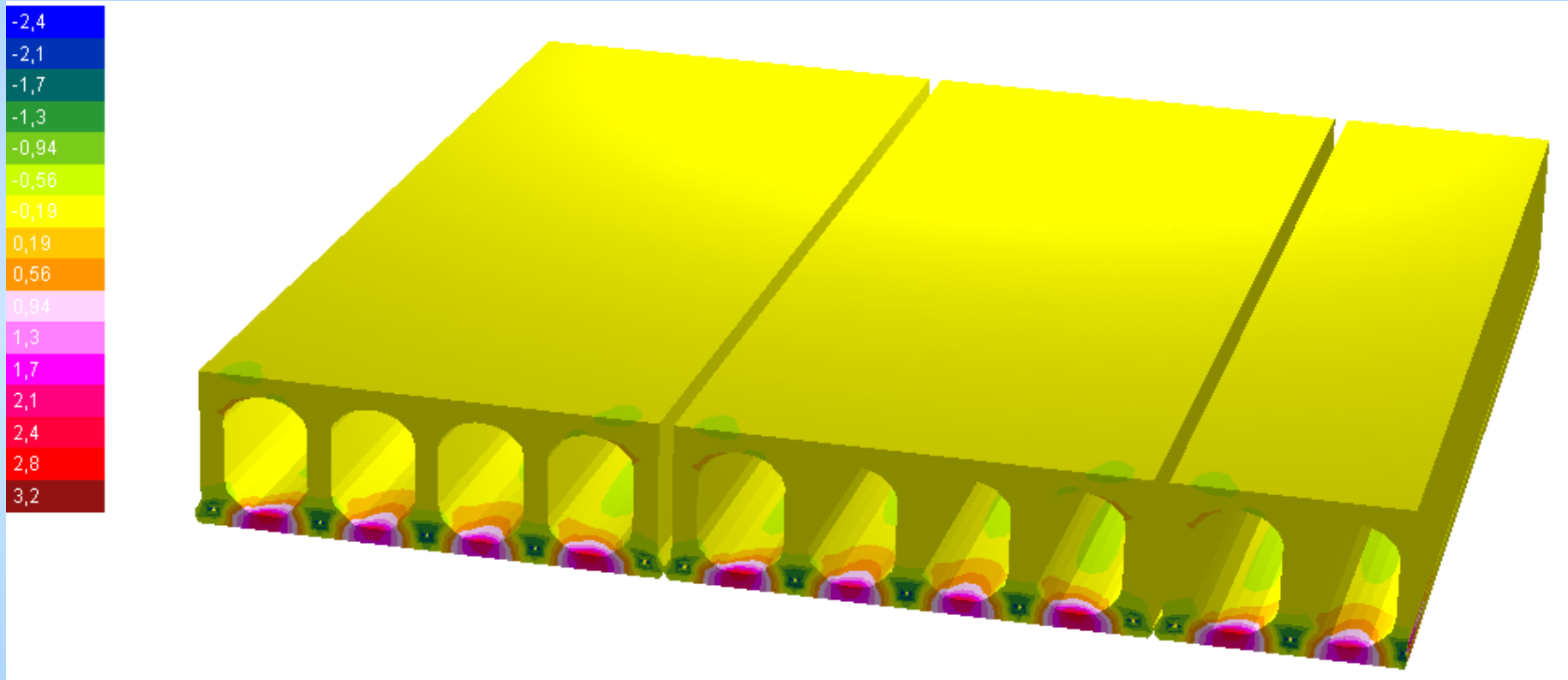
Crack Pattern at Failure



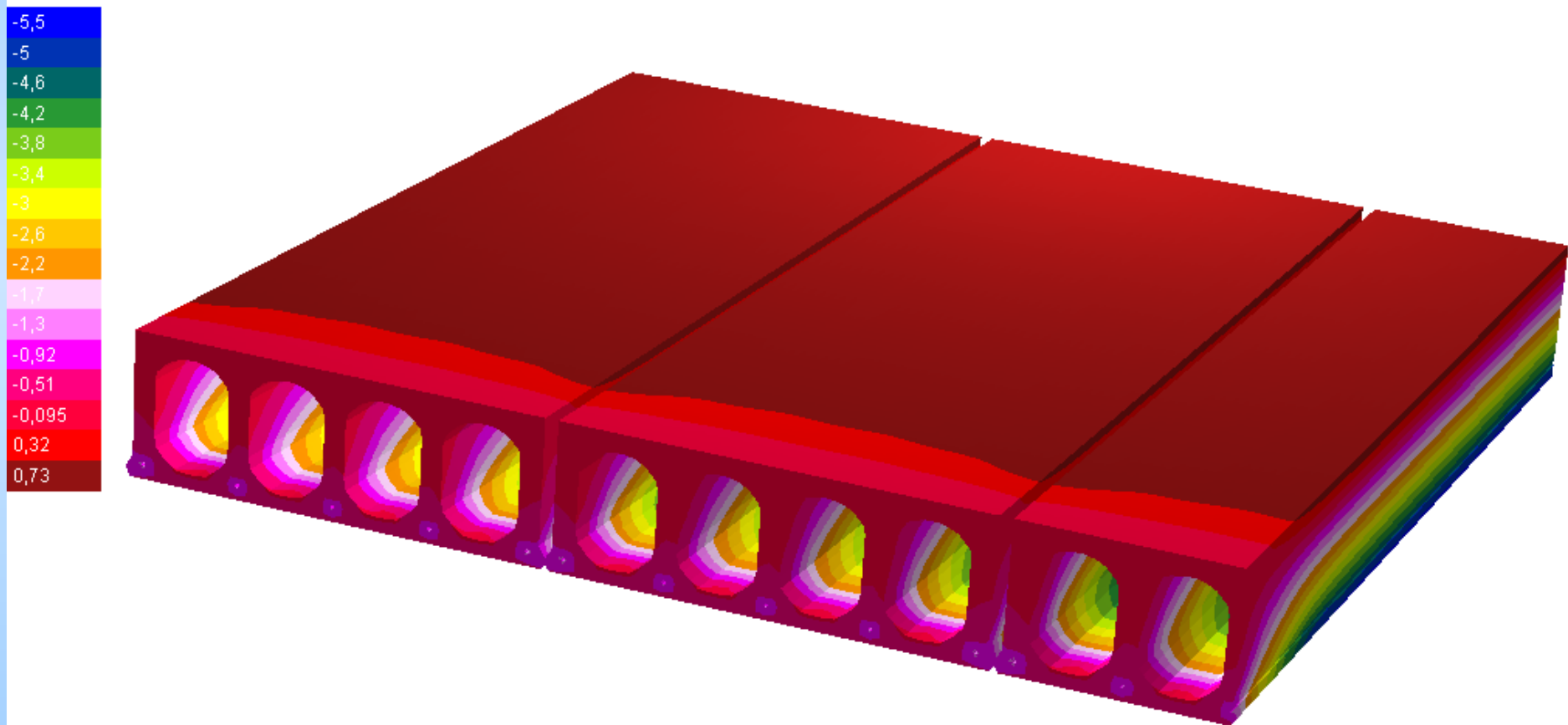
Future Investigation



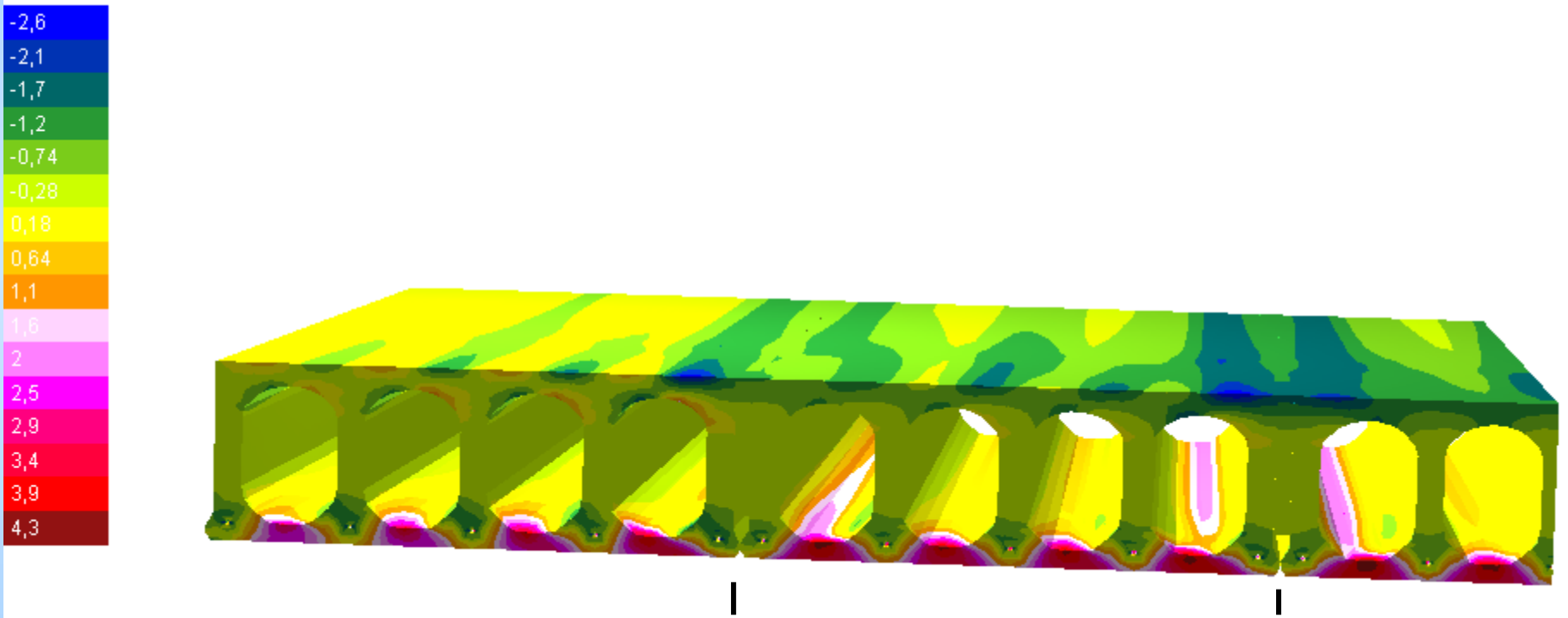
Transversal Stresses due to Prestressing



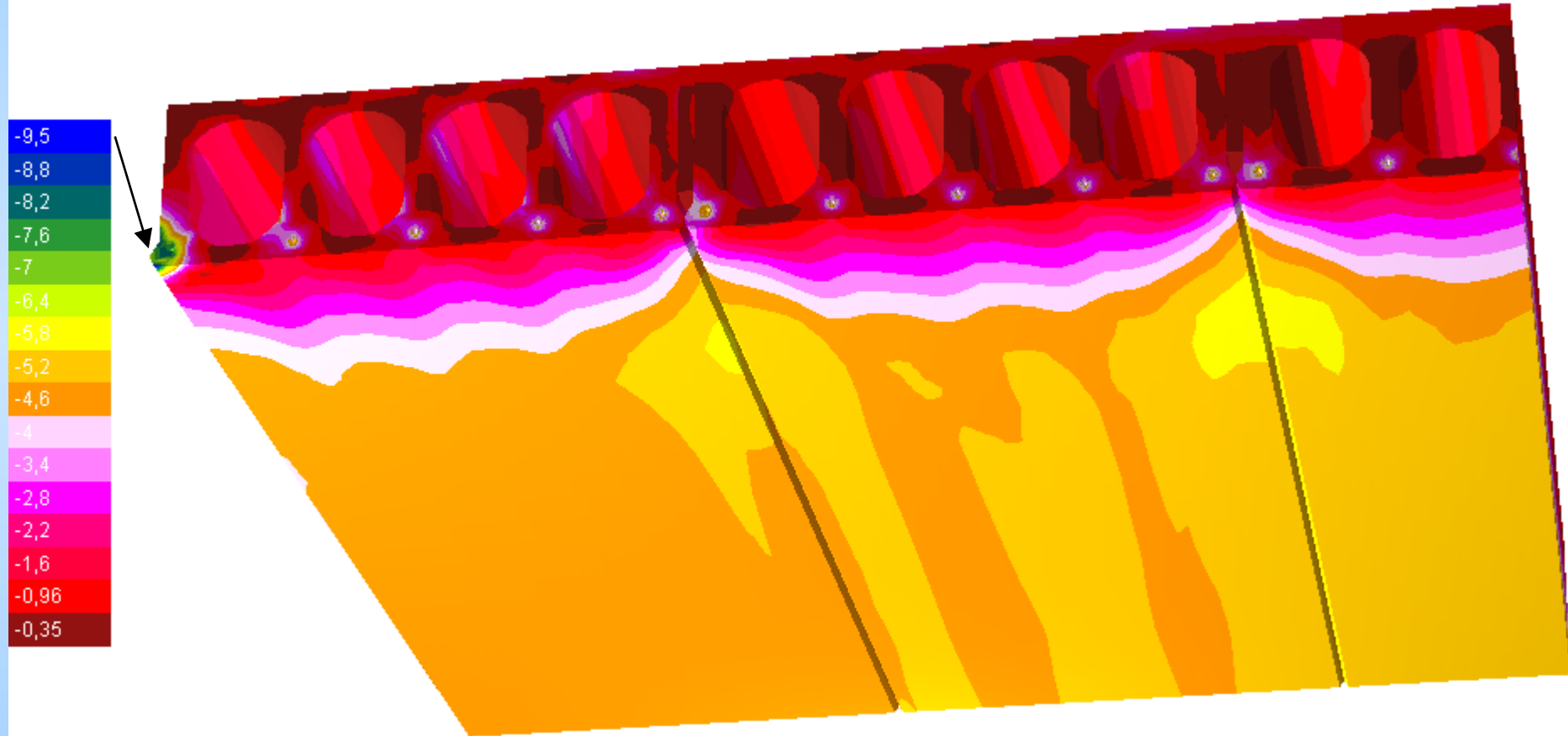
Longitudinal Stresses due to Prestressing



Transversal Stresses at $V=17$ kN/Slab



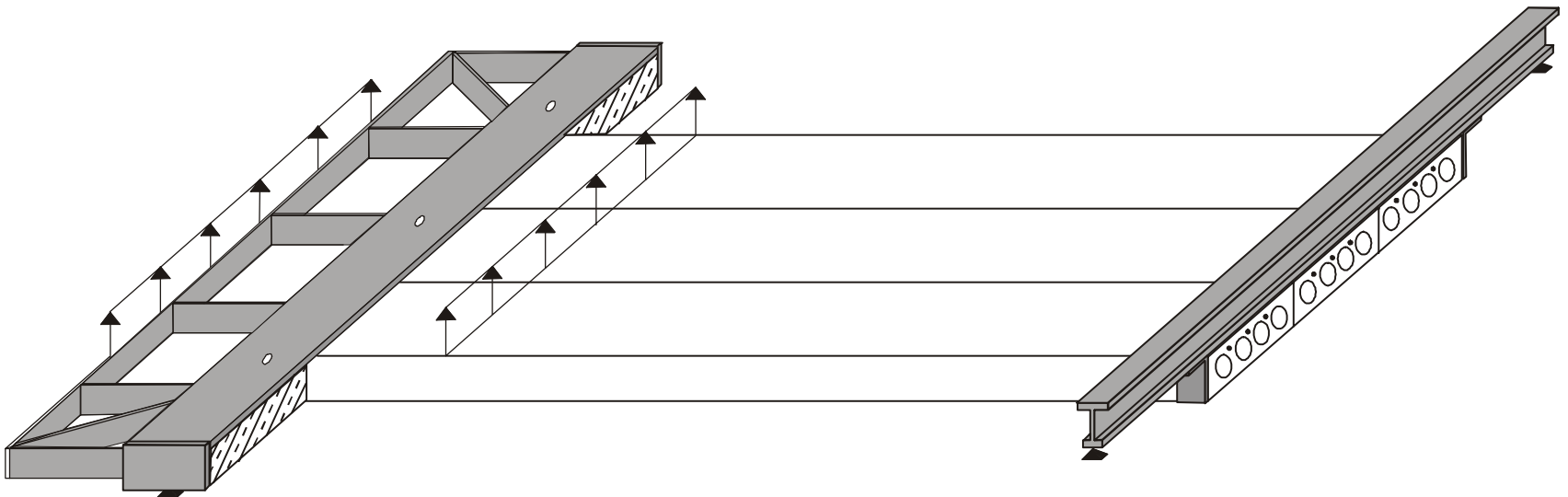
Mean Compressive Stresses at $V=17\text{kN}/\text{Slab}$



Experimental Test Set-Up

Test set up regarding EN 1168

- Span of Slabs approx. 6,0 m
- Span of Beams approx. 8,0 m



Measurement II

- loading
- deflection of slabs / beams (a)
- longitudinal cracking (strain gauges; b)
- strain of slabs and beam (c)
- relative displacement of slabs/ beam (d)
- crack opening slab/beam (e)
- slip of strands (f)
- rotation of beam

