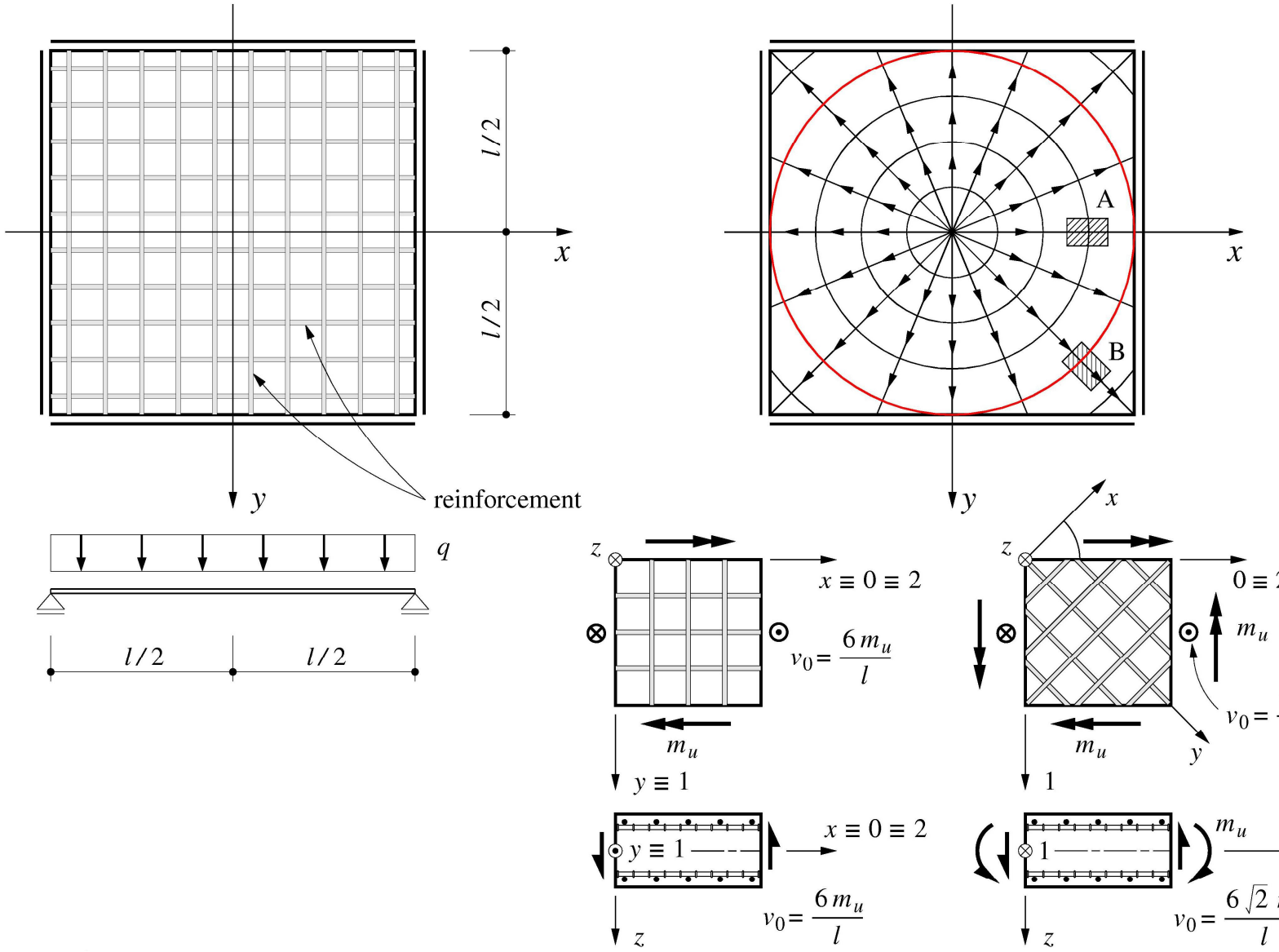
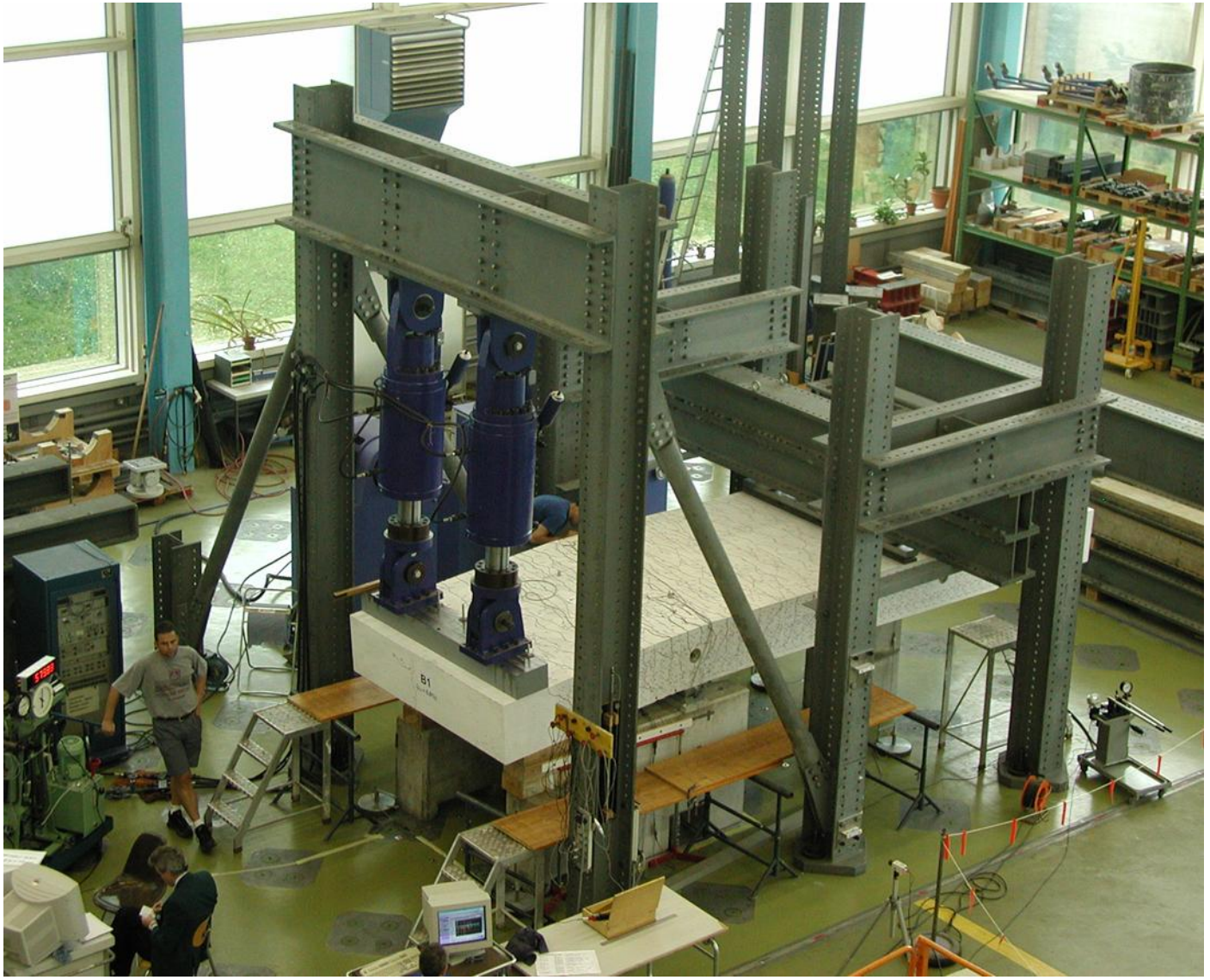
Stahlbeton III

Querkraftwiderstand und Verformungsvermögen von Stahlbetonplatten

Introduction – shear transfer



Tests on Reinforced Concrete Slabs

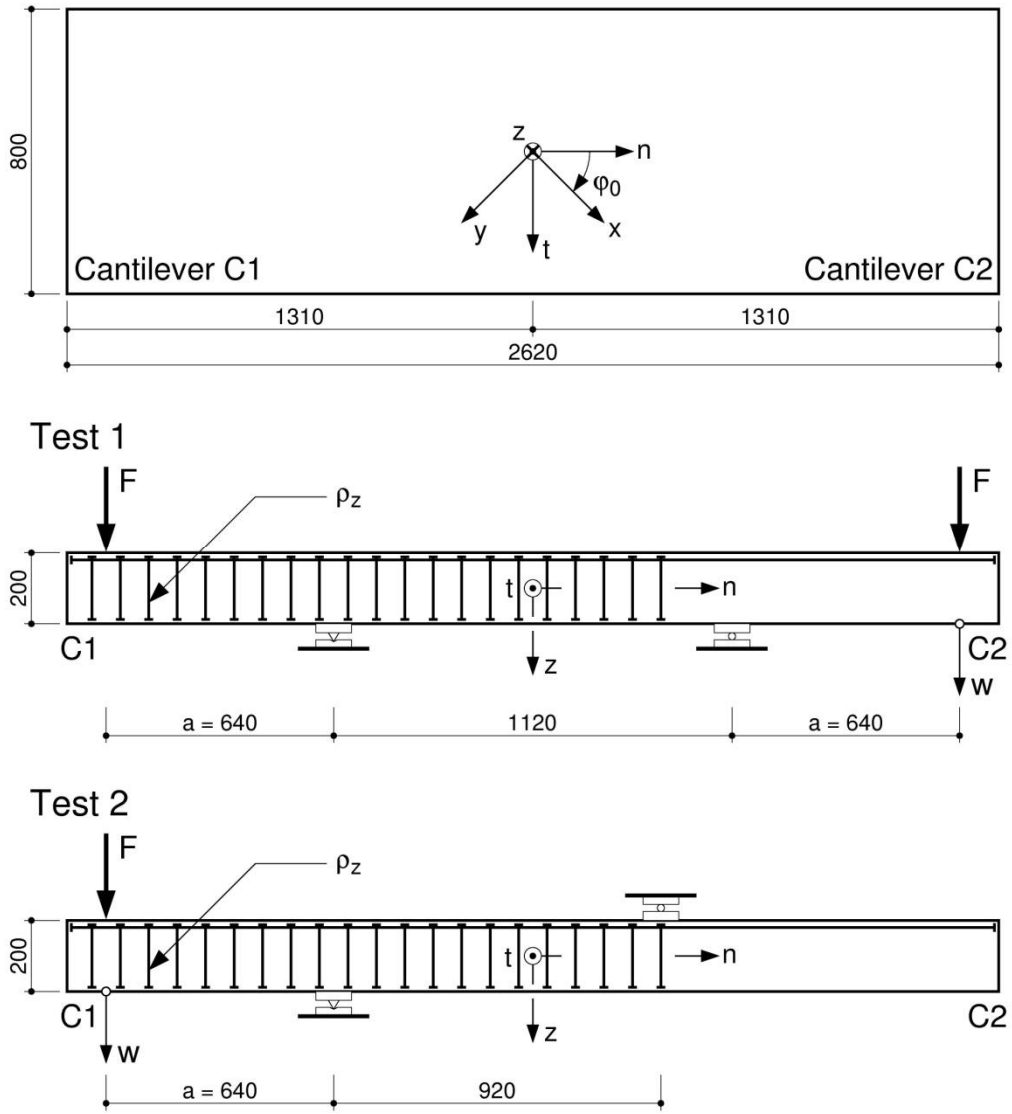


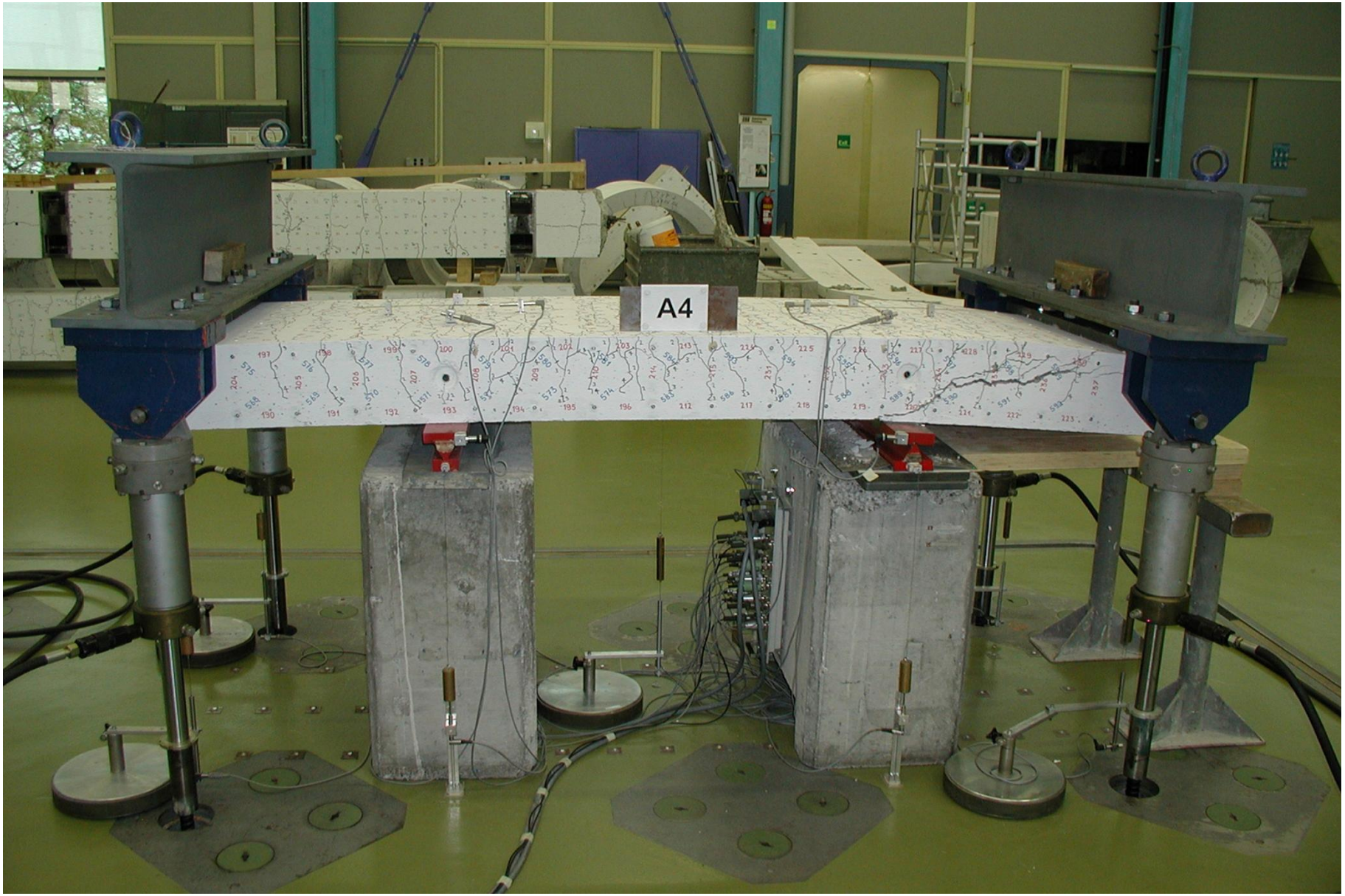
Tests on RC Slabs

Parameters

- **Slab thickness**
- **in-plane reinforcement directions**
- **in-plane reinforcement ratio**
- **Transverse reinforcement ratio**
- **Curtailment of the in-plane reinforcement**

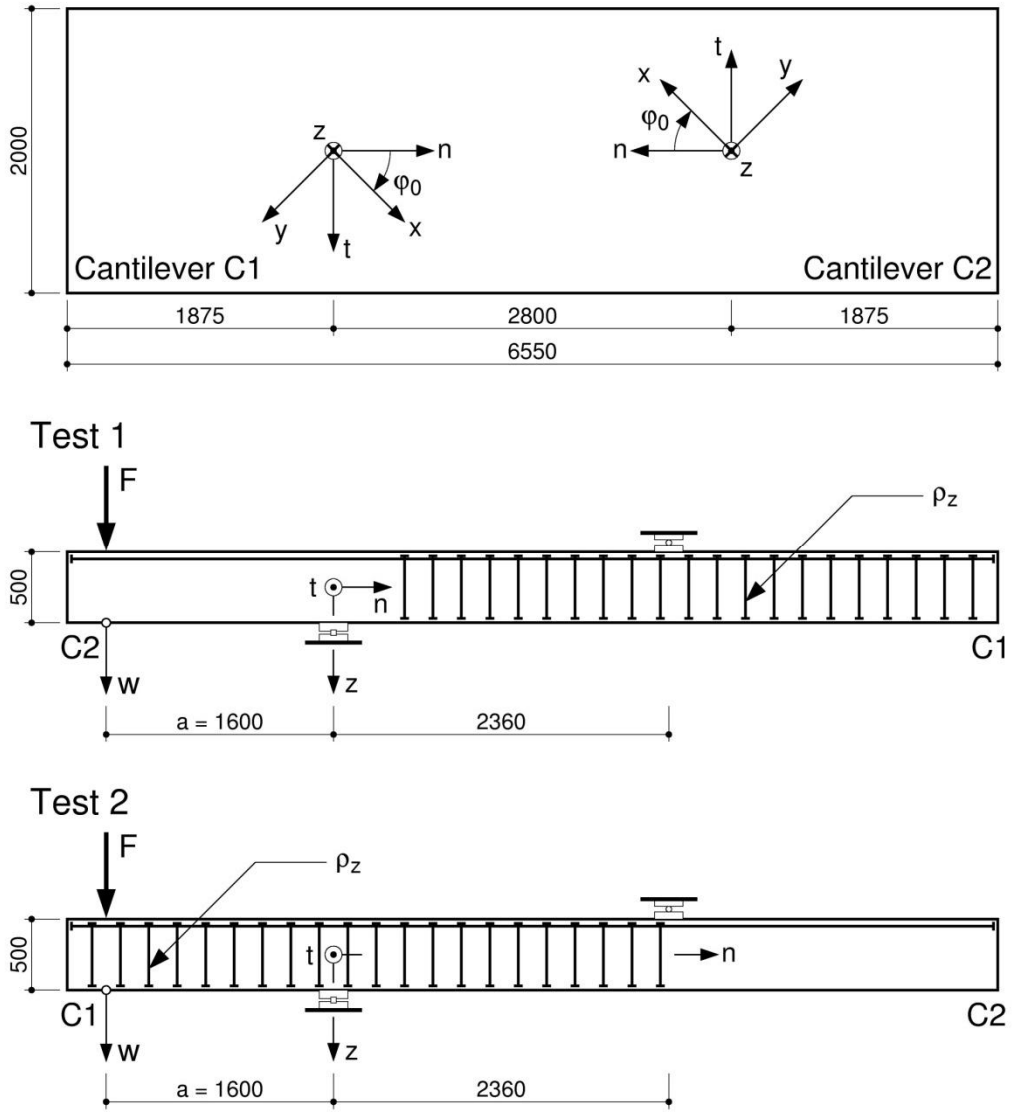
Test concept of Slab Series A

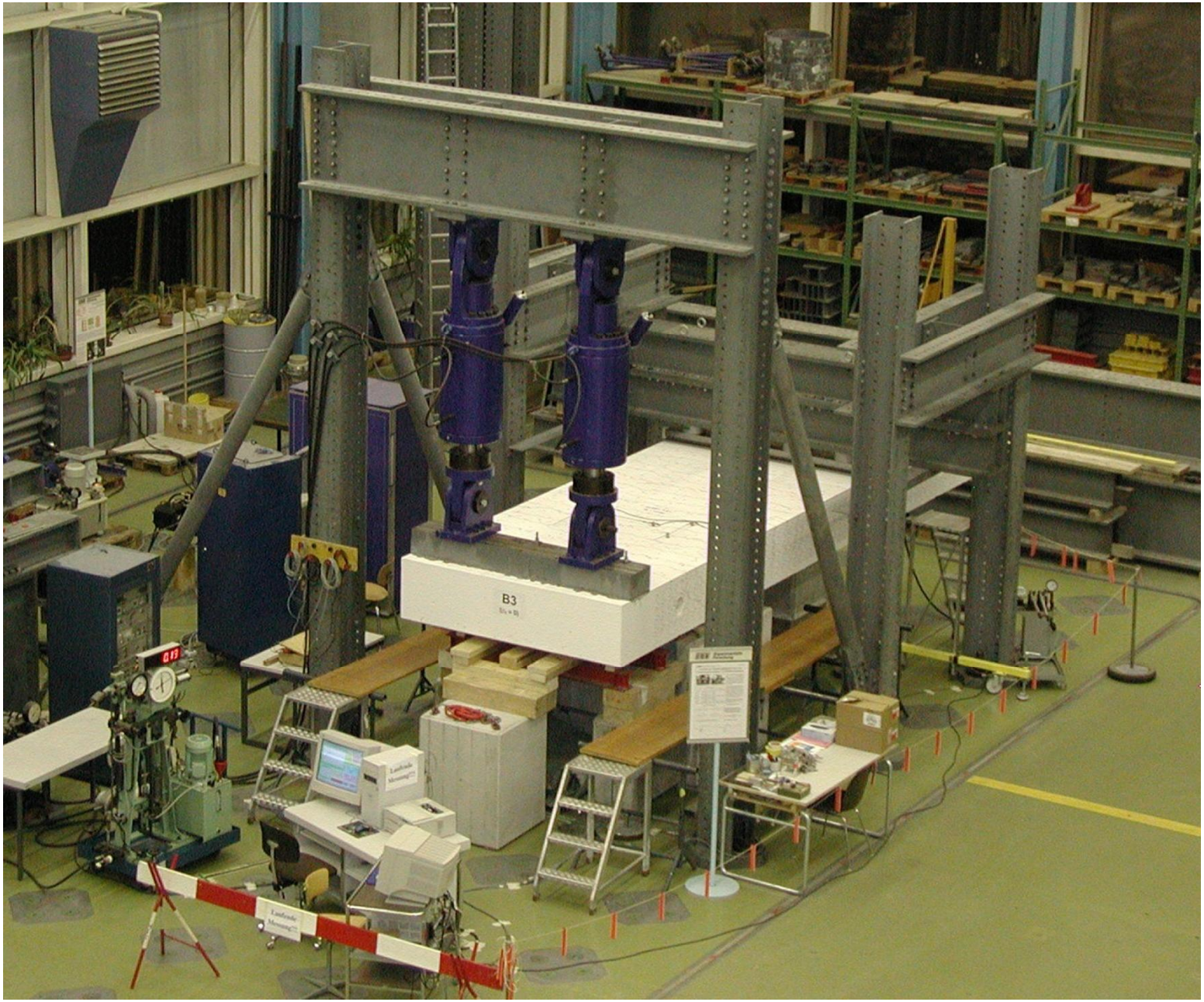



A4

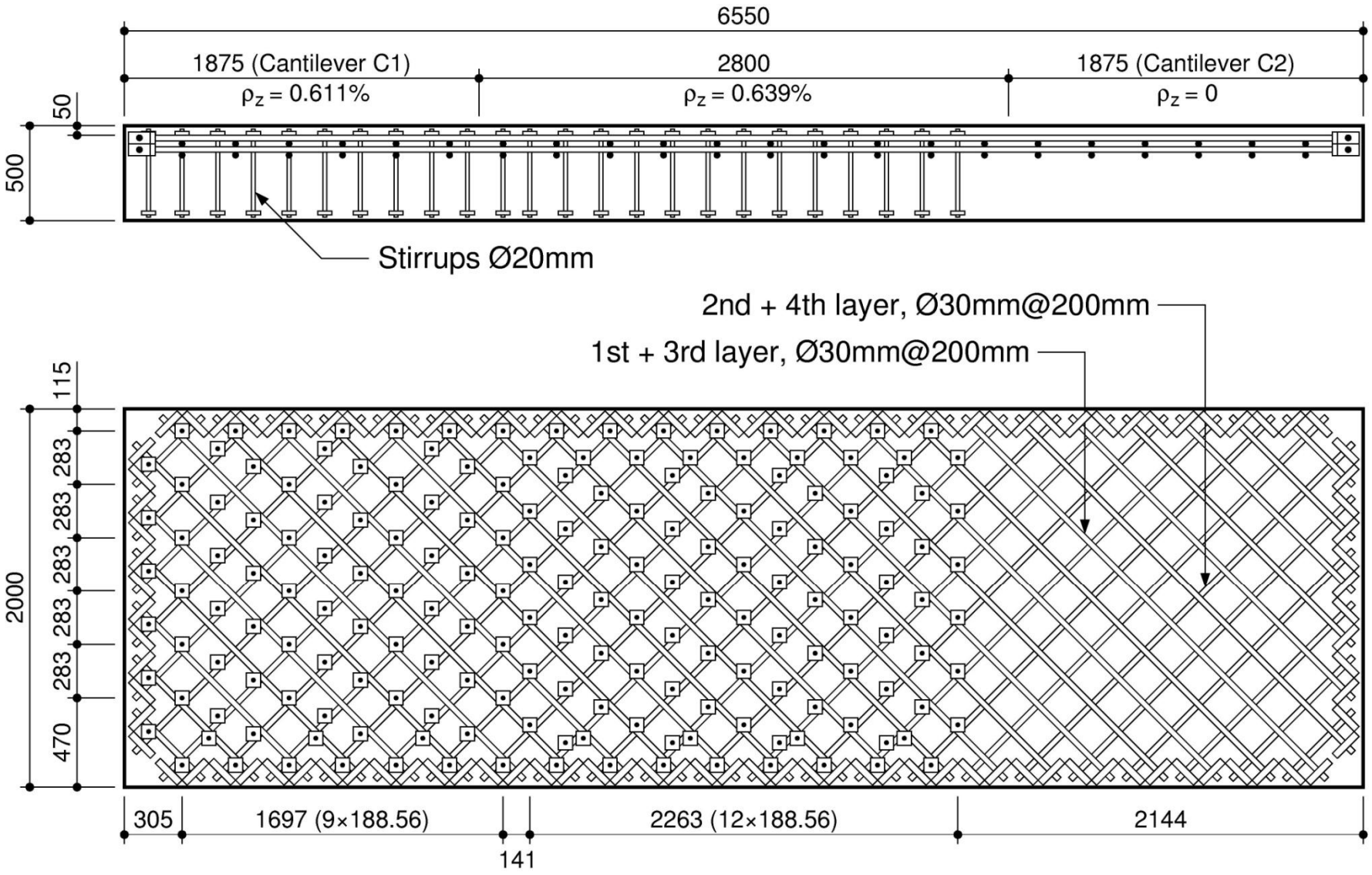

A4
LS 9: 180 kN

Test concept of Slab Series B

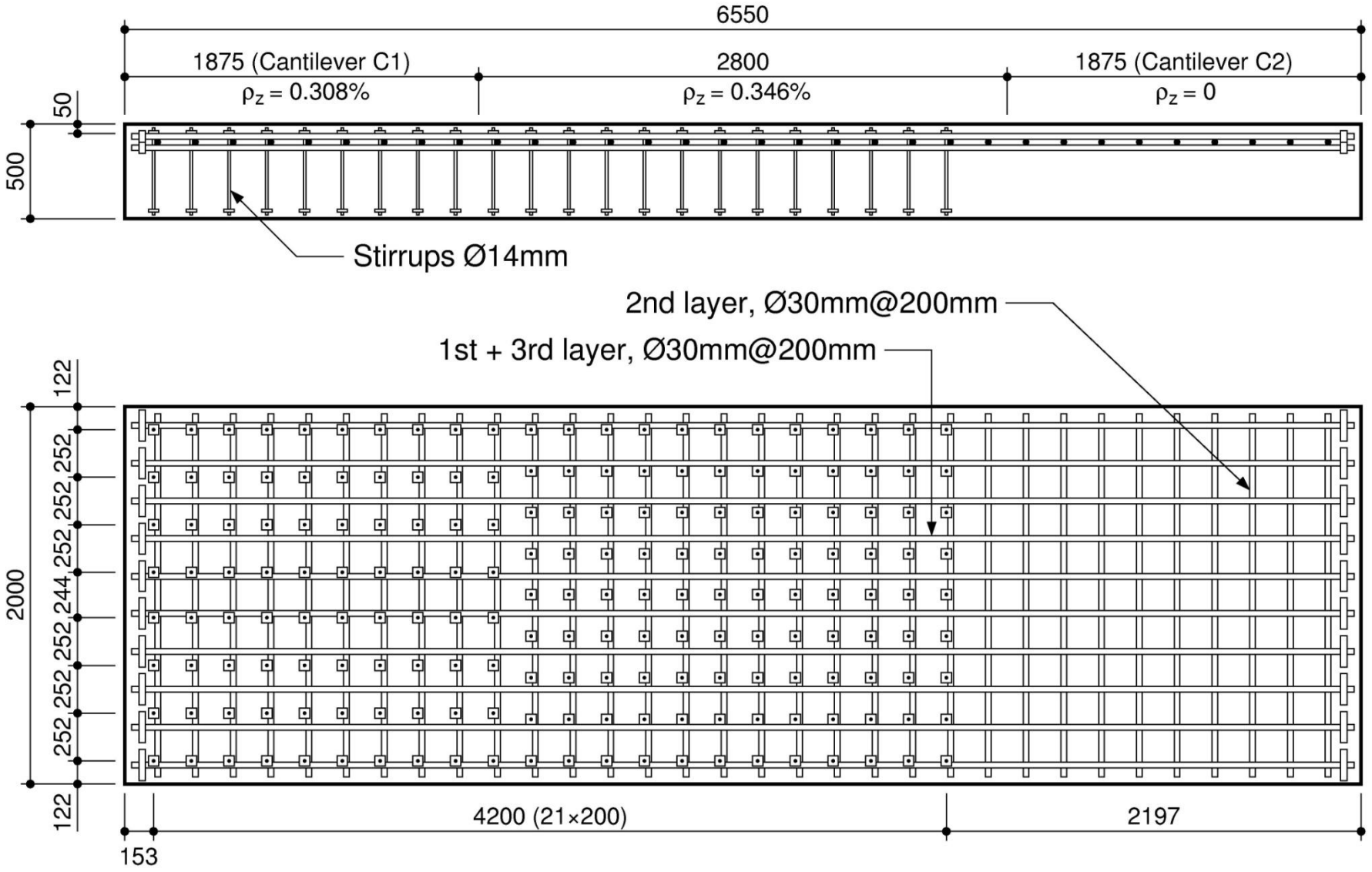


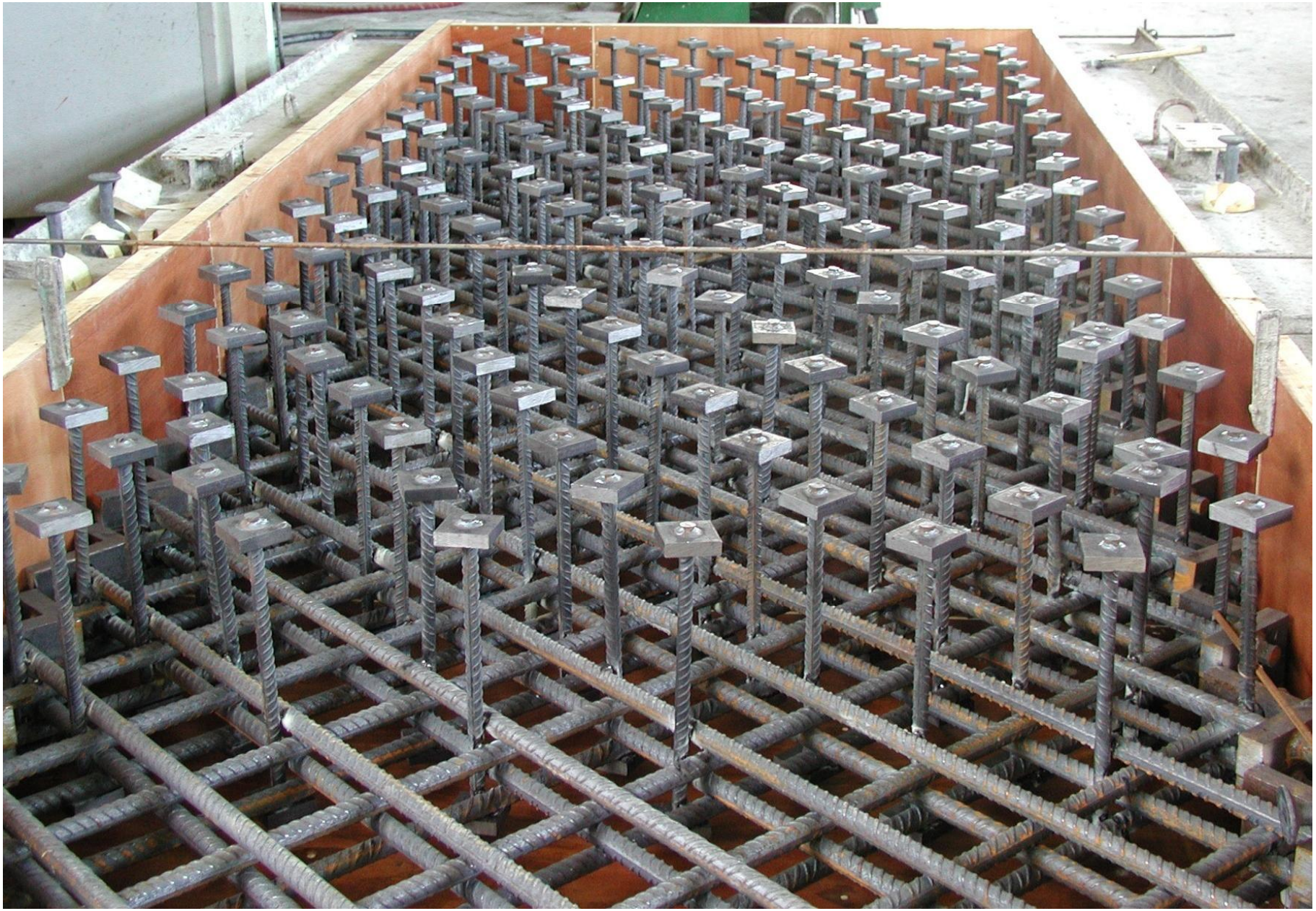

B3

Geometry and reinforcement of Slab B1

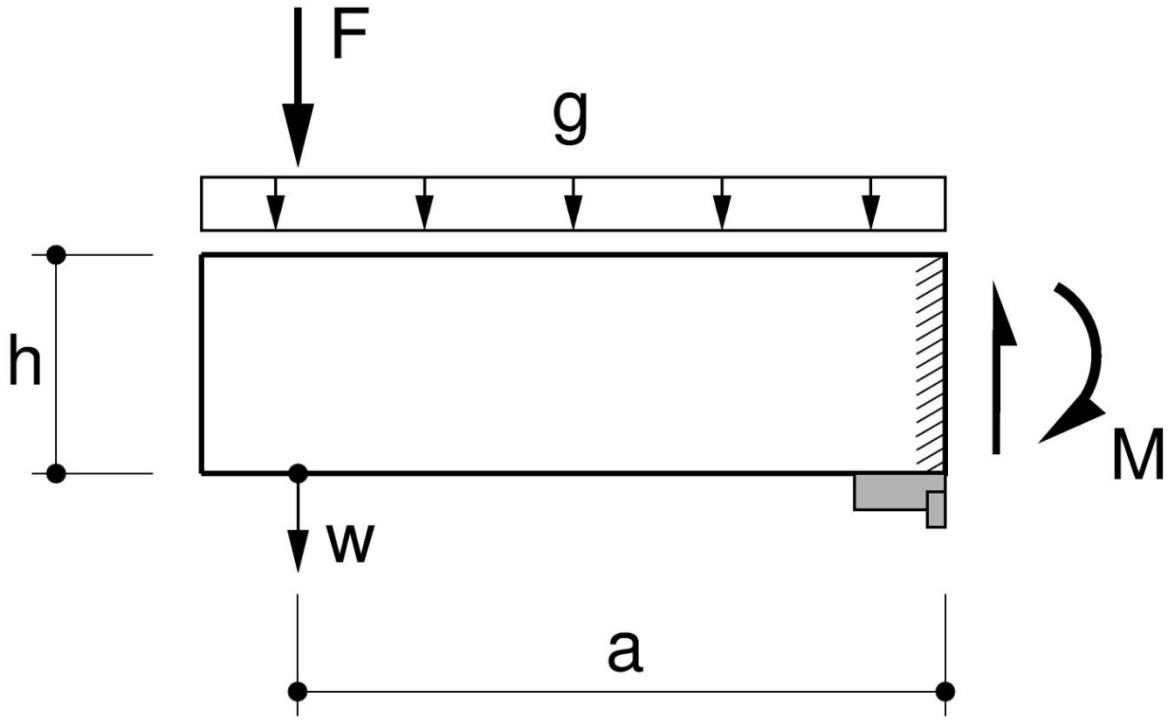


Geometry and reinforcement of Slab B3

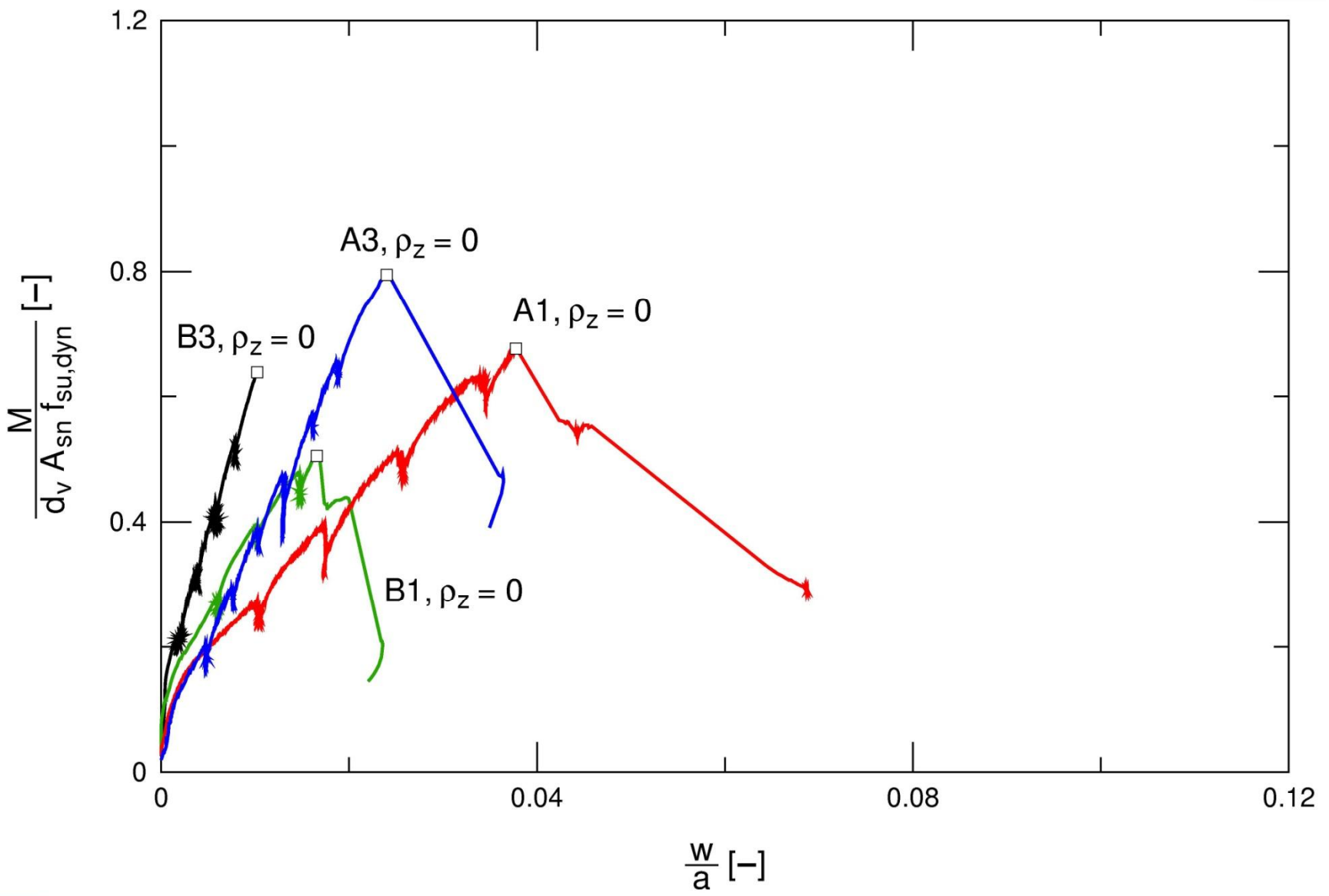




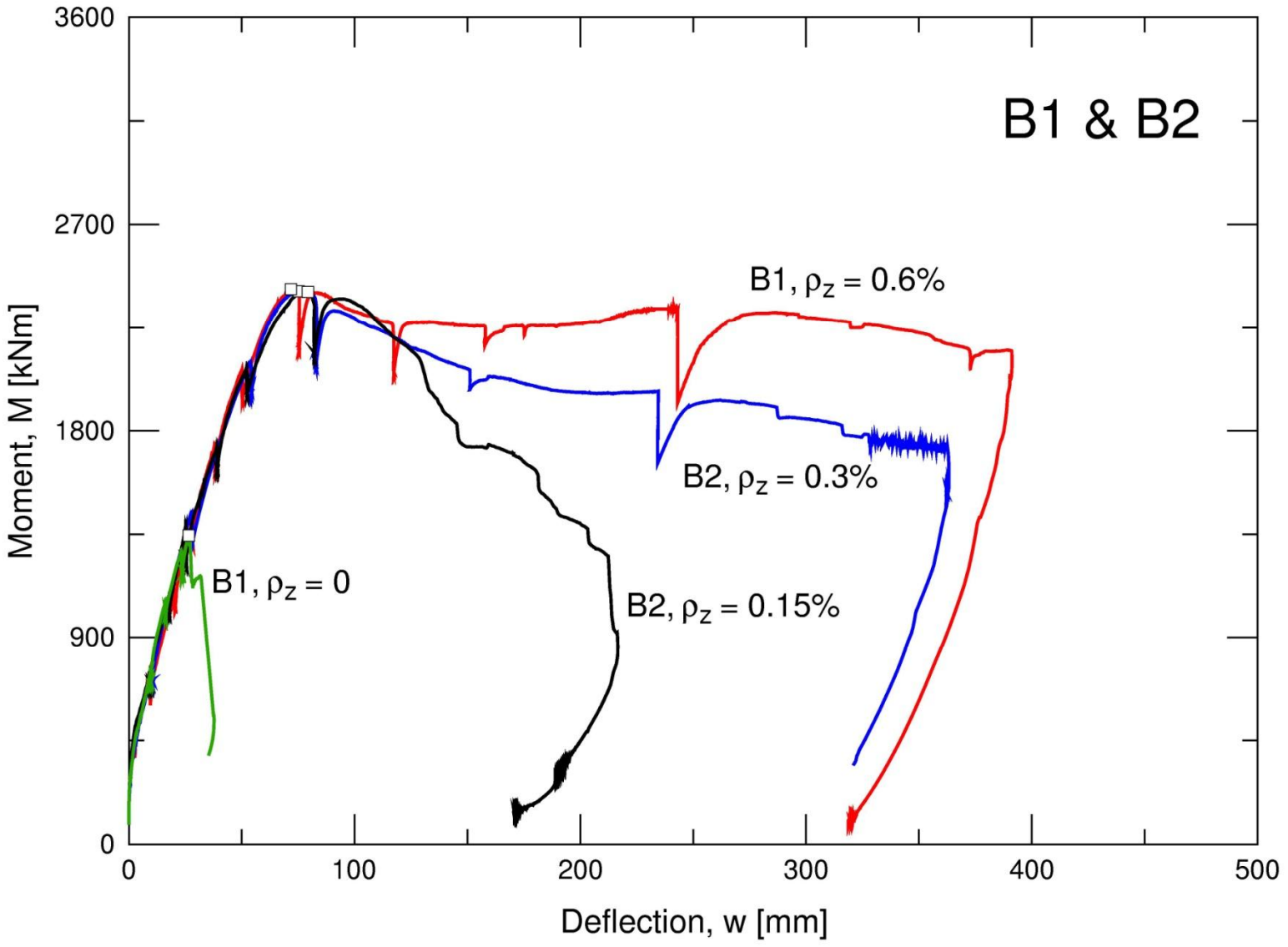
Notation



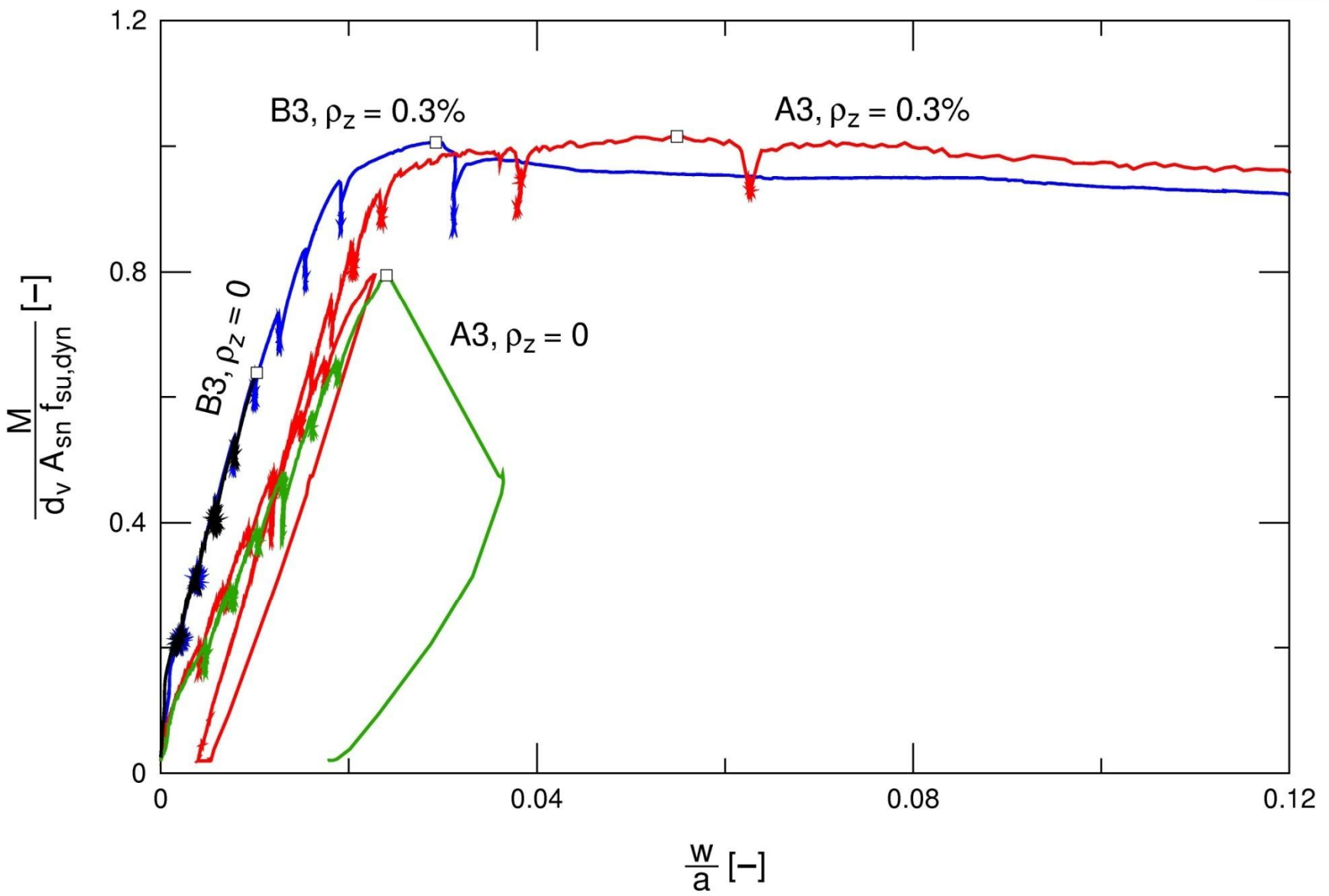
Experimental results



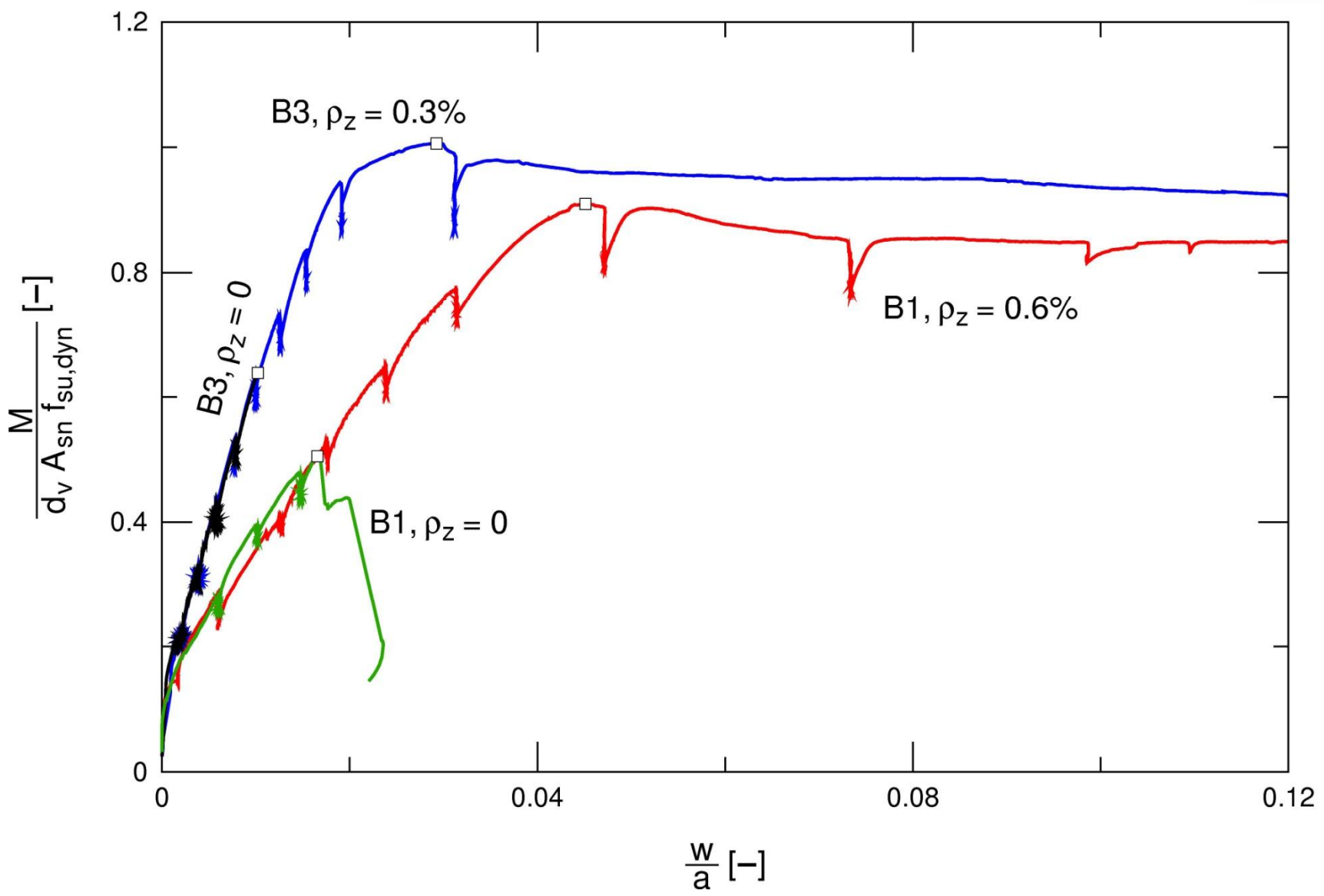
Experimental results

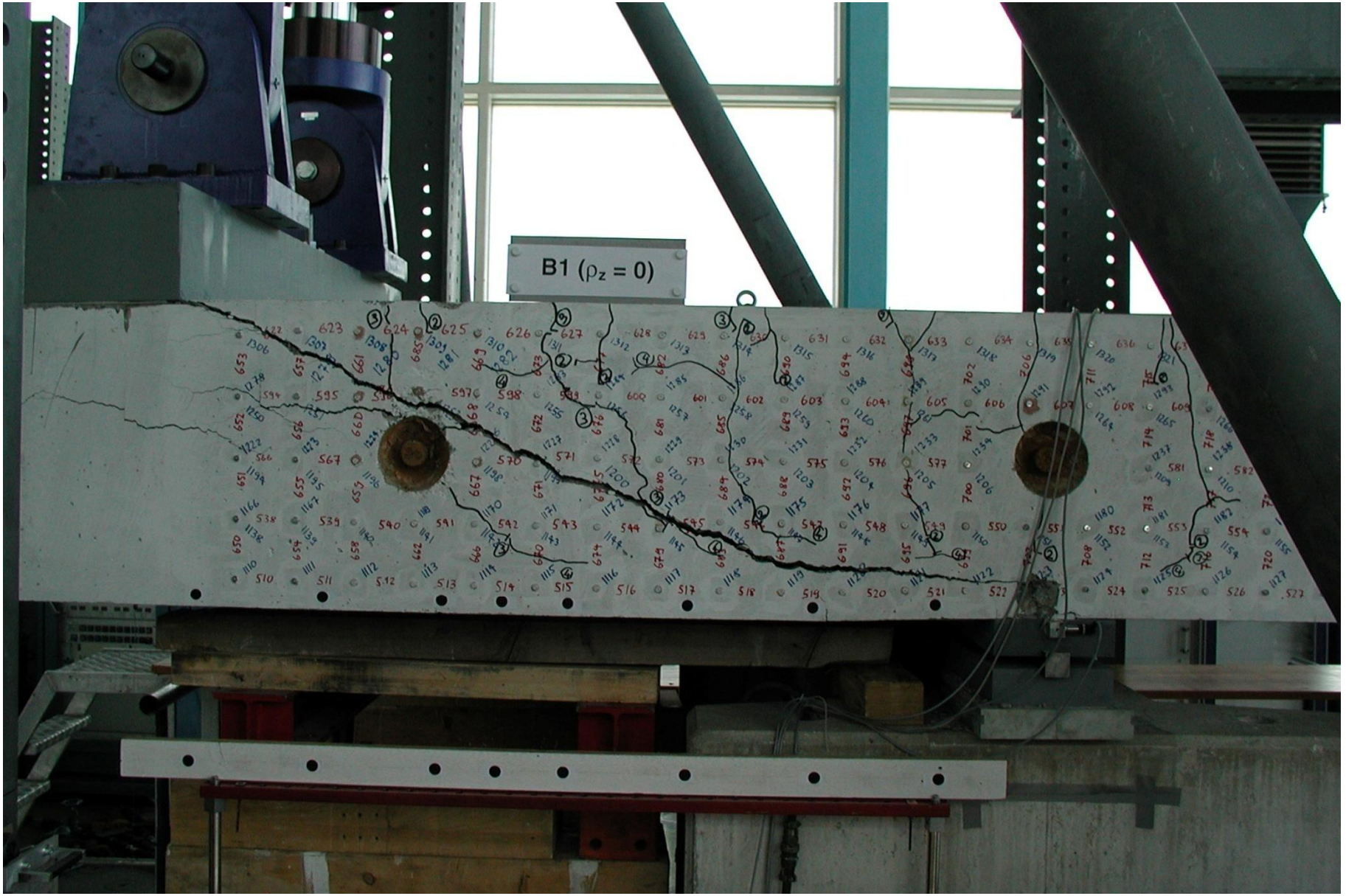


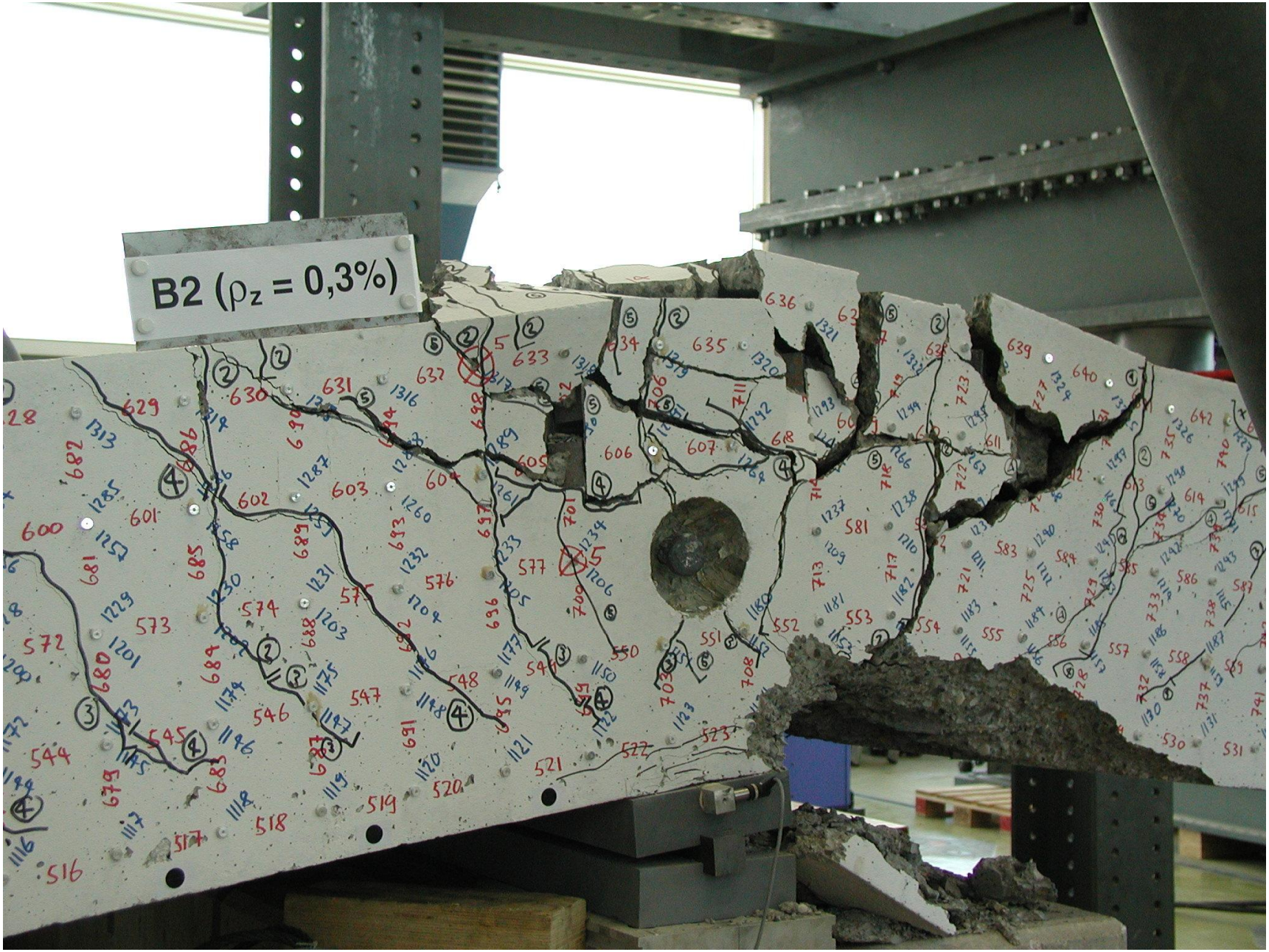
Experimental results

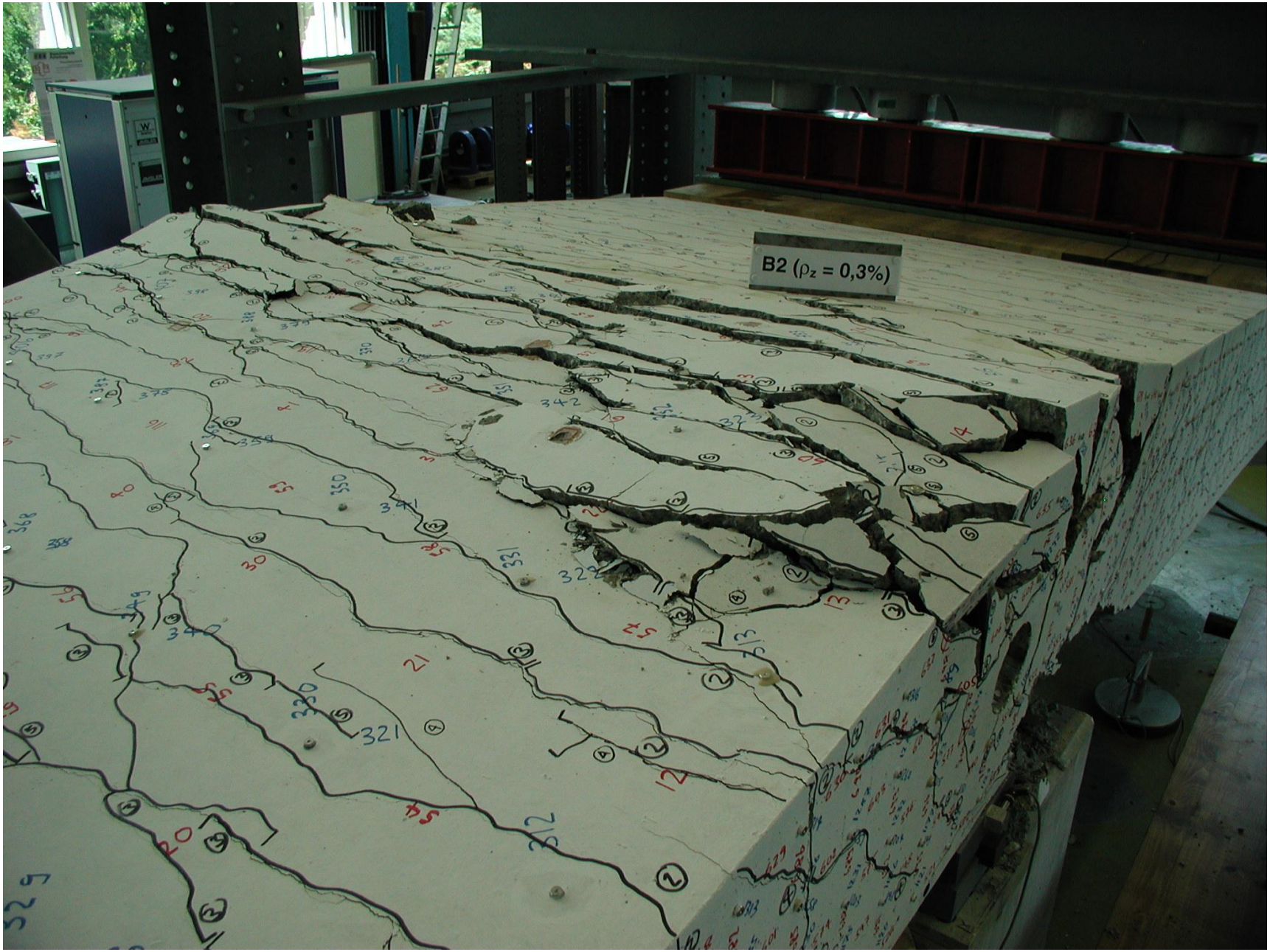


Experimental results

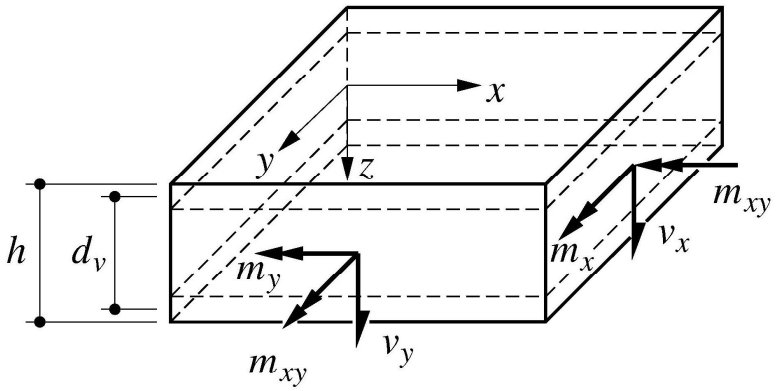


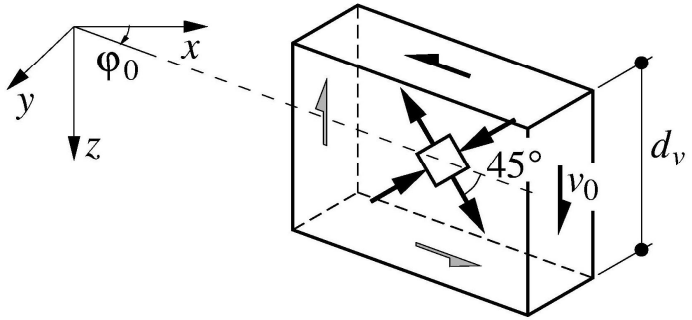

B1 (ρ_z = 0)

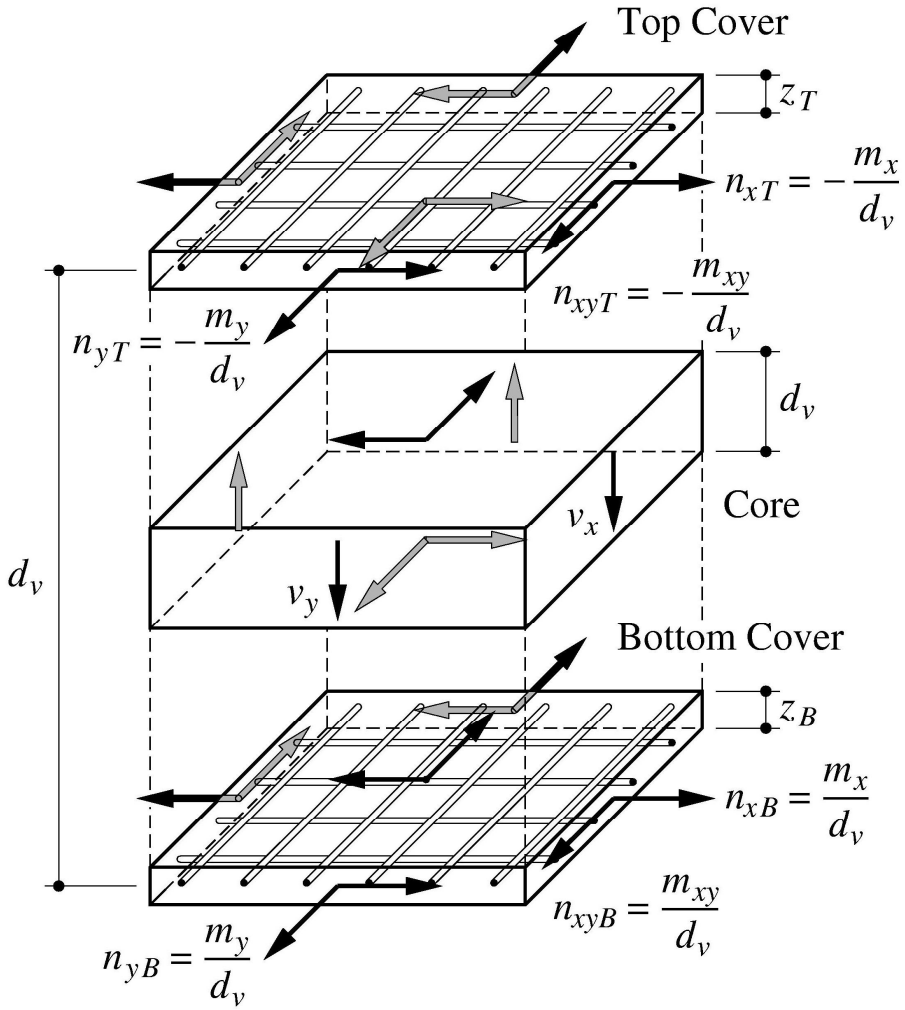

B2 (ρ_z = 0,3%)


B2 (ρ_z = 0,3%)

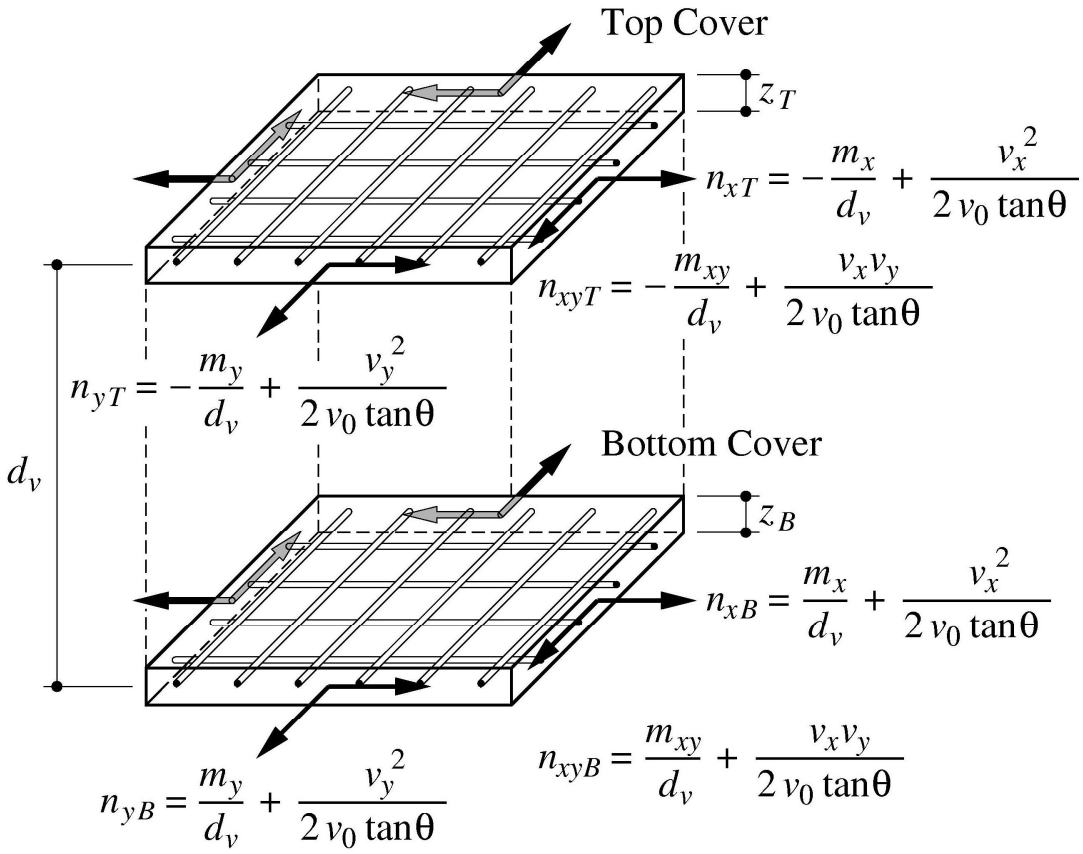
Sandwich model – uncracked core

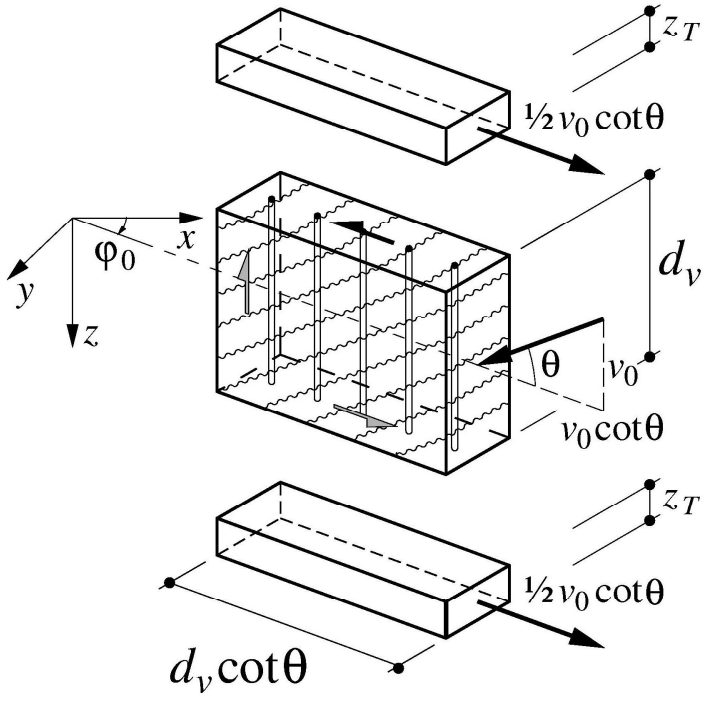




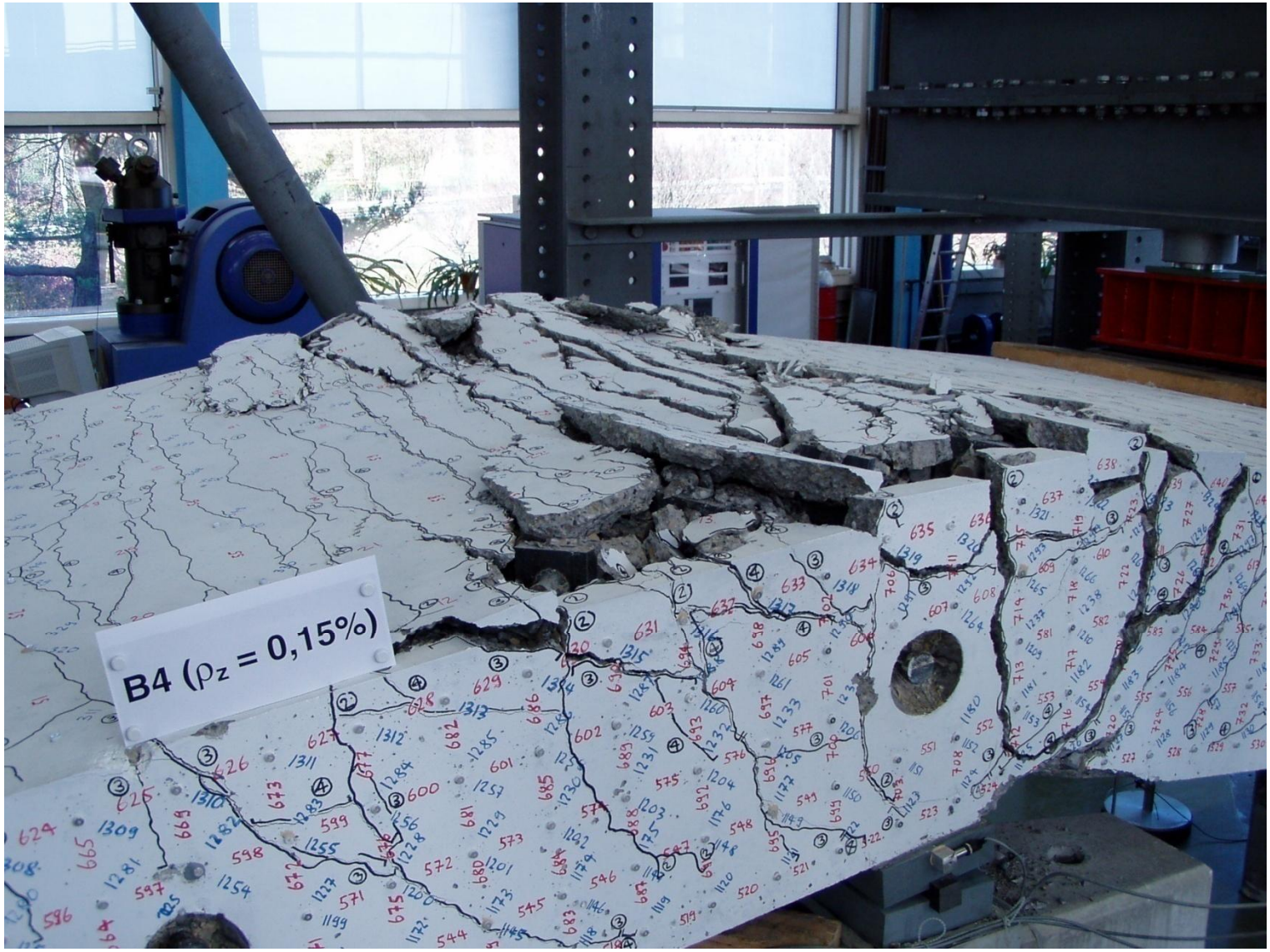


Sandwich model – cracked core

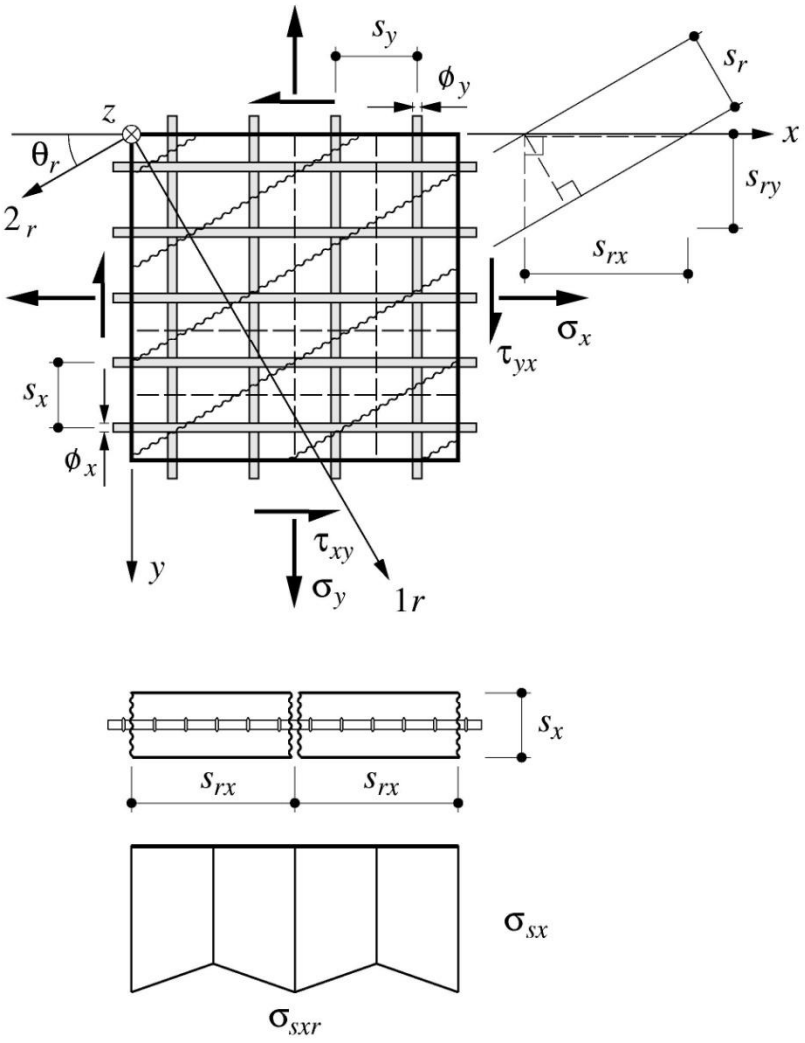


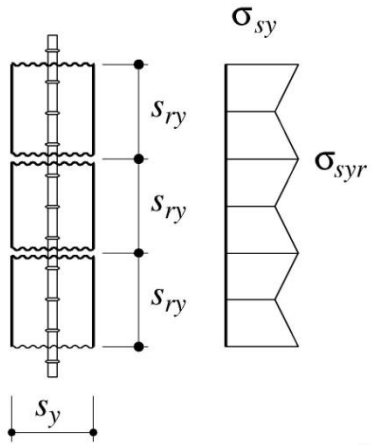


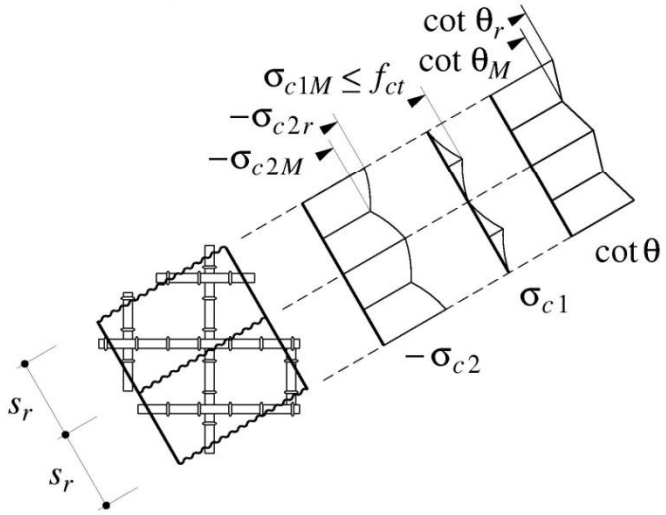
Flexural Behavior of RC Slabs



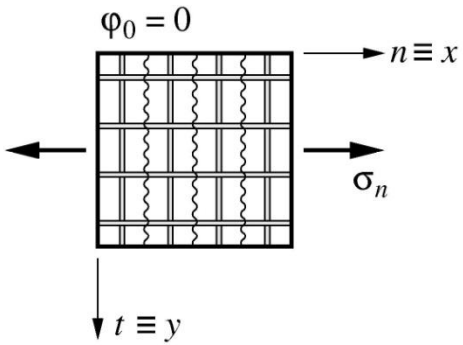
Cracked membrane model

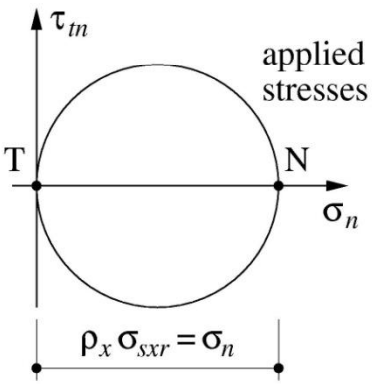


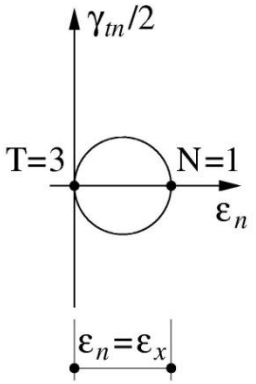




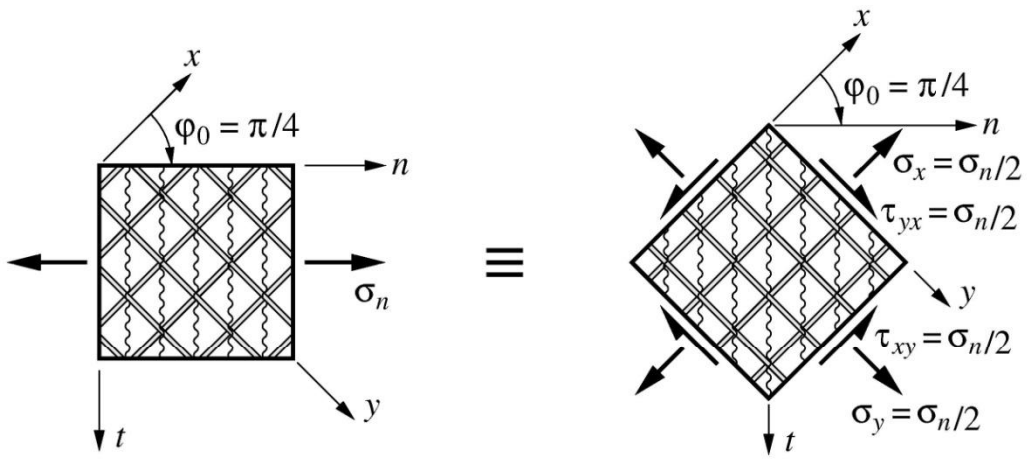
Top cover: $\varphi_0 = 0$

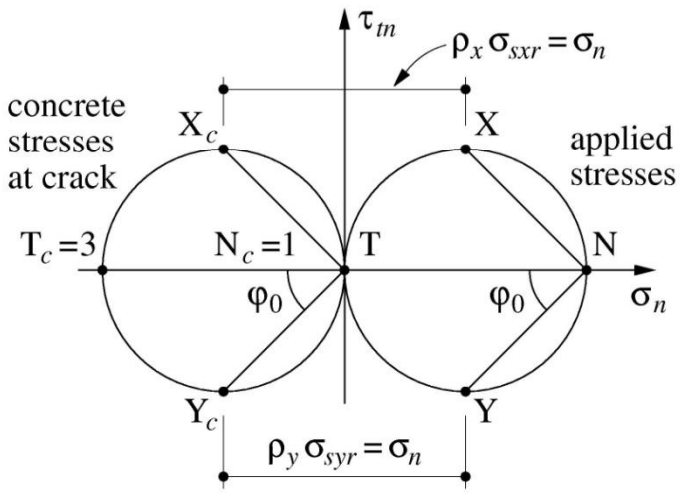


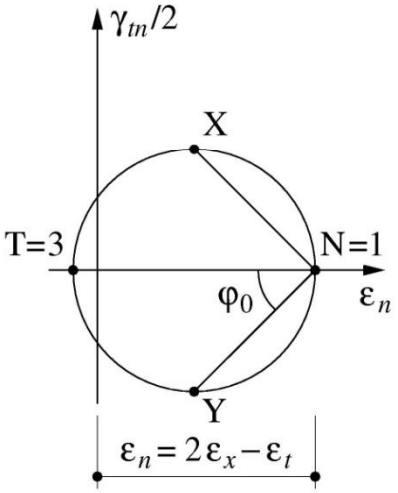




Top cover: $\varphi_0 = \pi/4$







Simplified stress-strain-relations

Assumptions:

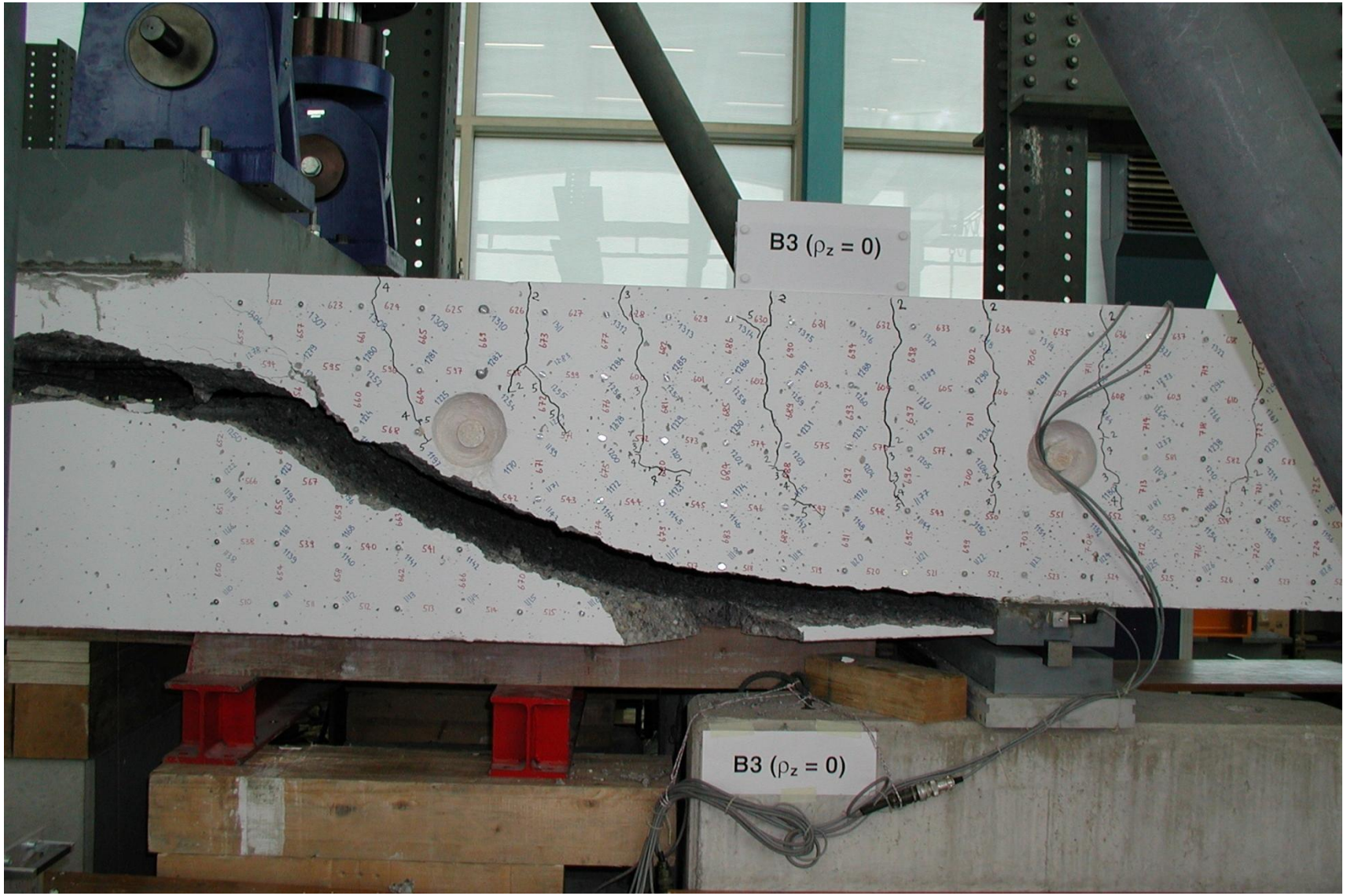
- **Reinforcement linear elastic**
- **Concrete rigid:** $E_c = \infty$
- **Principal strain direction *n***
- **Cracks perpendicular to *n*-direction**

$$\varepsilon_n = \frac{\sigma_n}{E_s} \cdot \frac{1}{\rho_n}$$

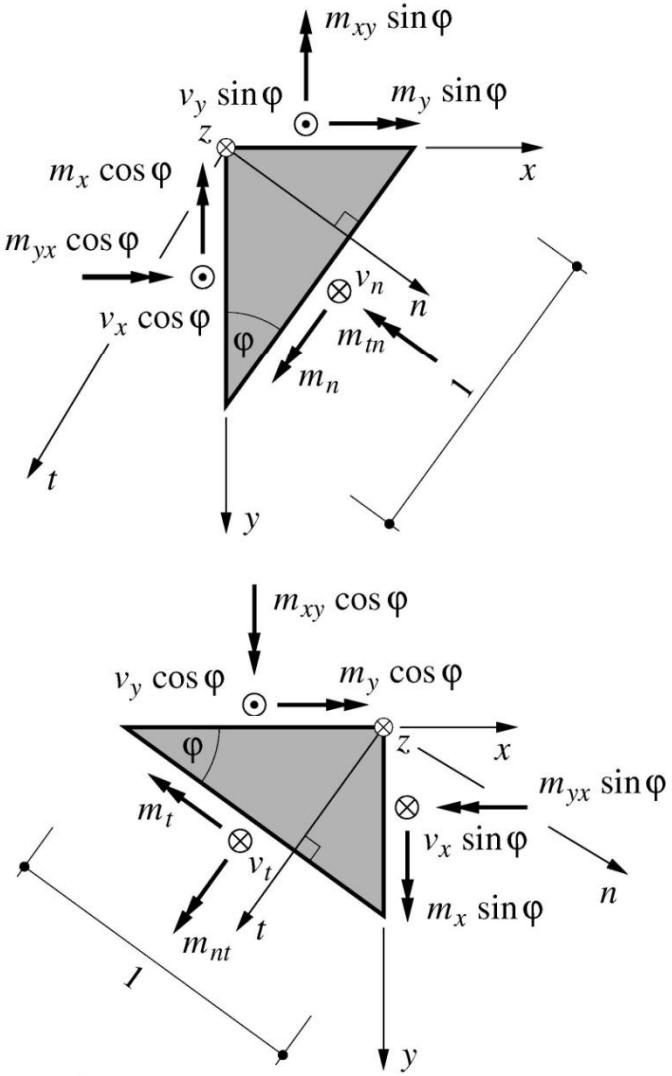
$$\rho_n = \rho_x \cdot \cos^4 \varphi_n + \rho_y \cdot \sin^4 \varphi_n$$

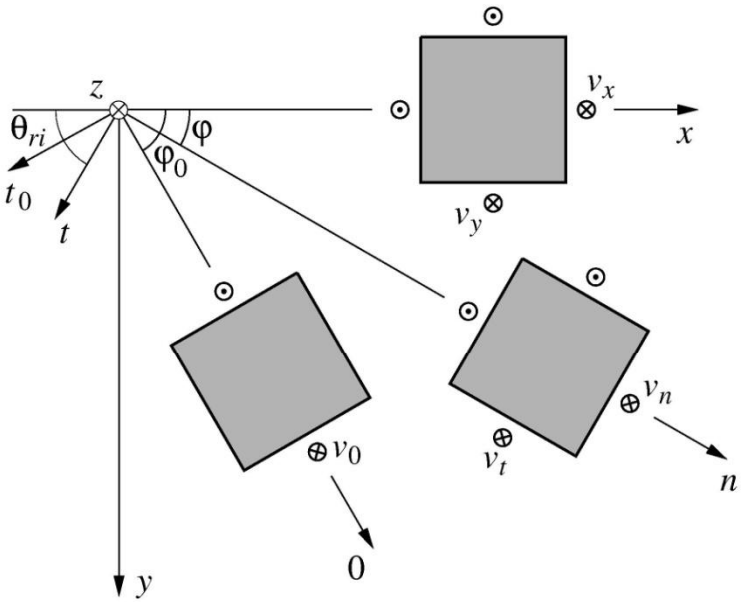
ρ_n ÷ **fictitious reinforcement ratio**

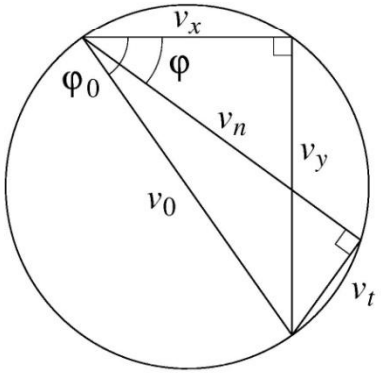
Shear Strength of RC Slabs



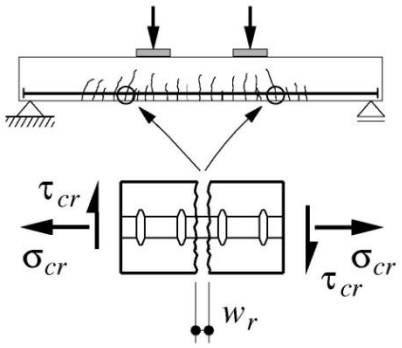
Shear transfer

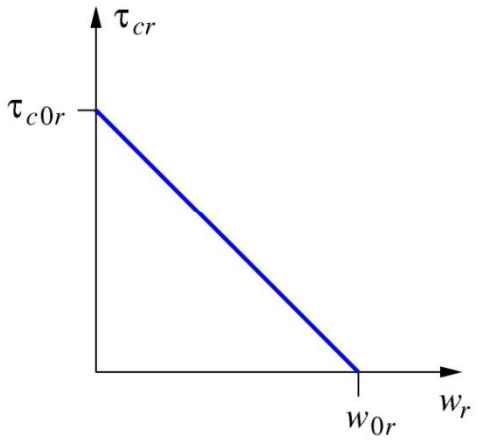


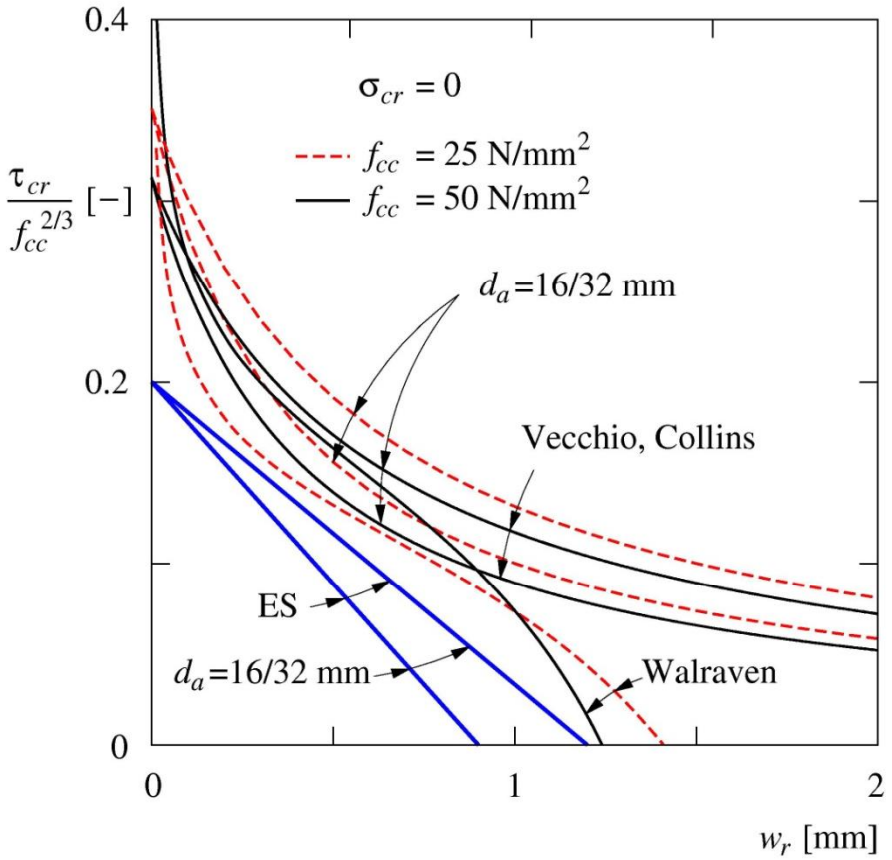




Aggregate interlock – shear strength

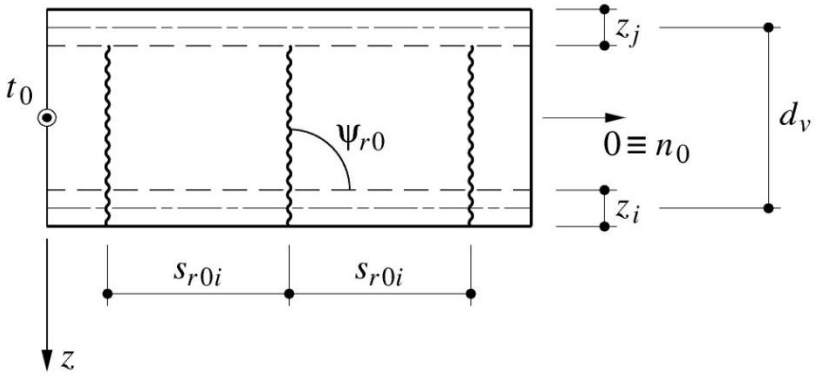






Crack inclinations in the core

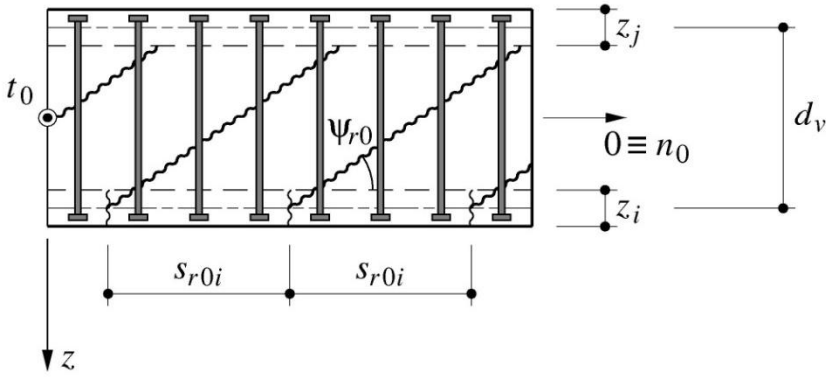
$\rho_z = 0$:



"fixed cracks"

$\cot \psi_{r0} = 0$

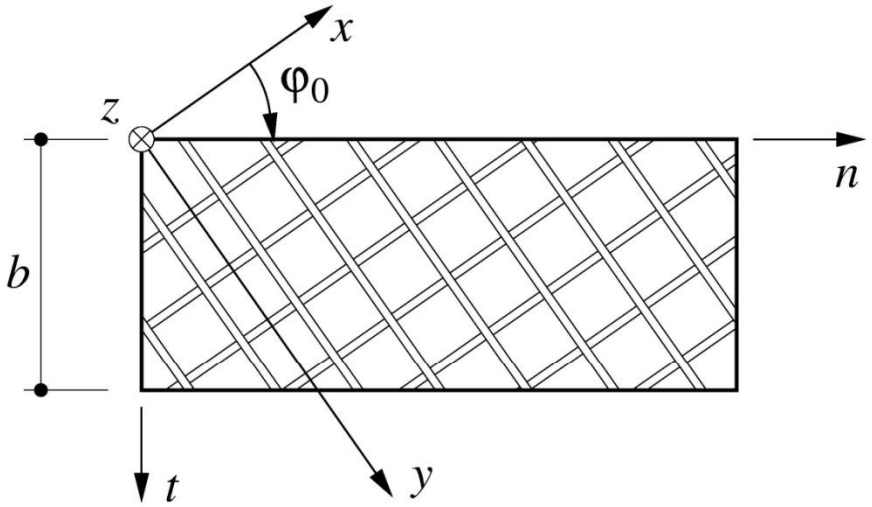
$\rho_z > 0$:

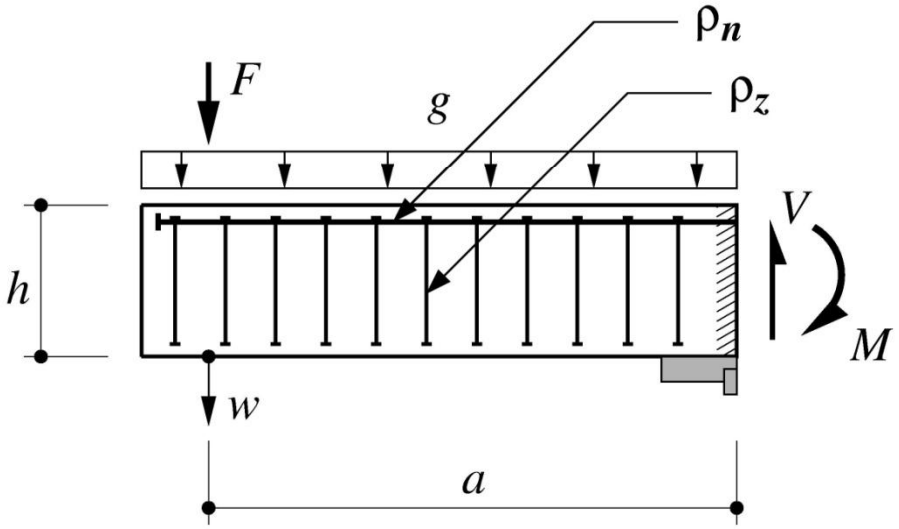


"rotating cracks"

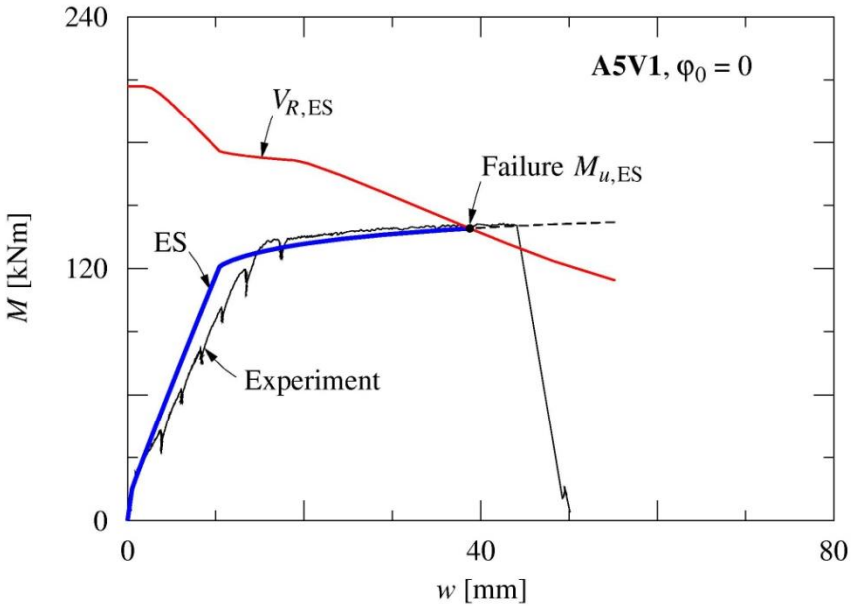
$0 \leq \cot \psi_{r0} \leq 1.75$

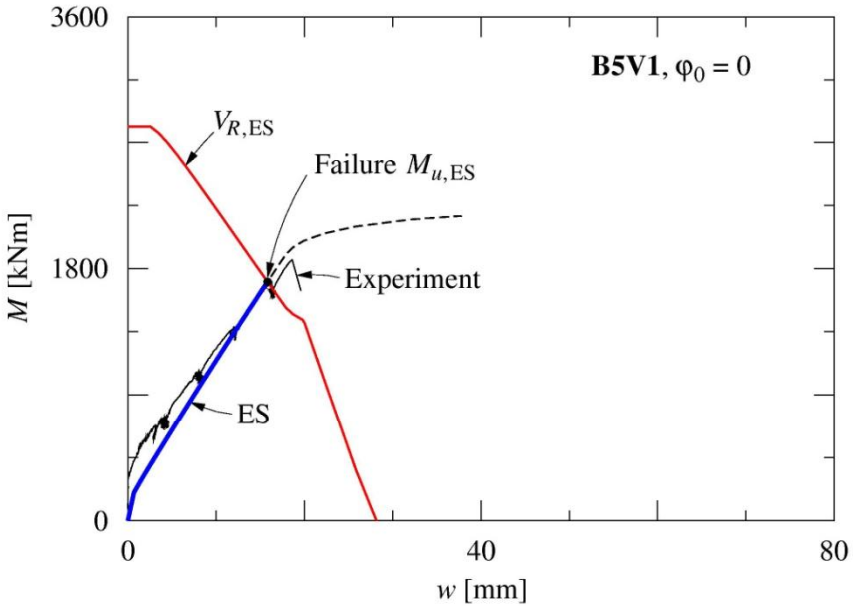
Comparison with experiments



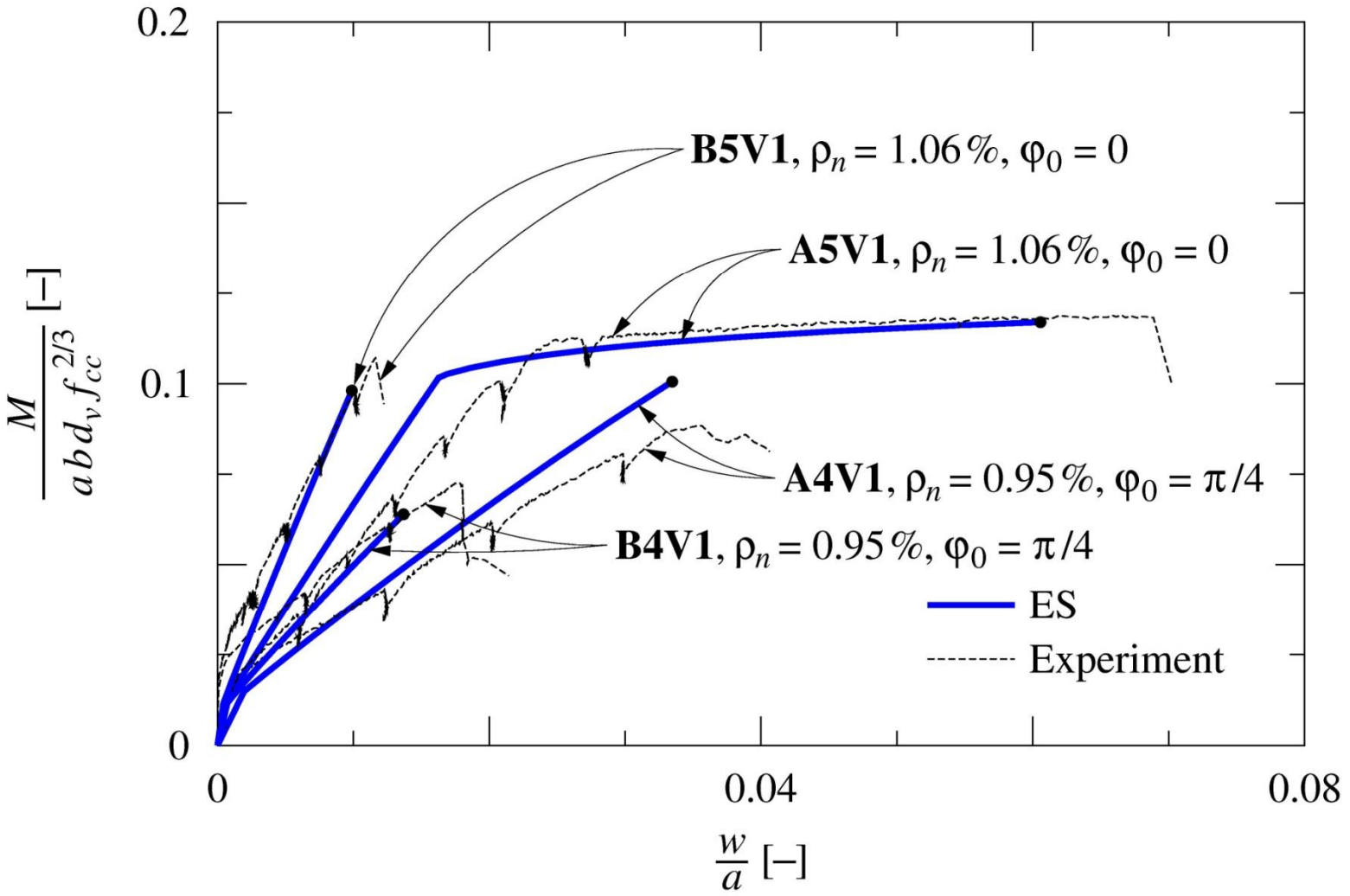


Comparison with experiments

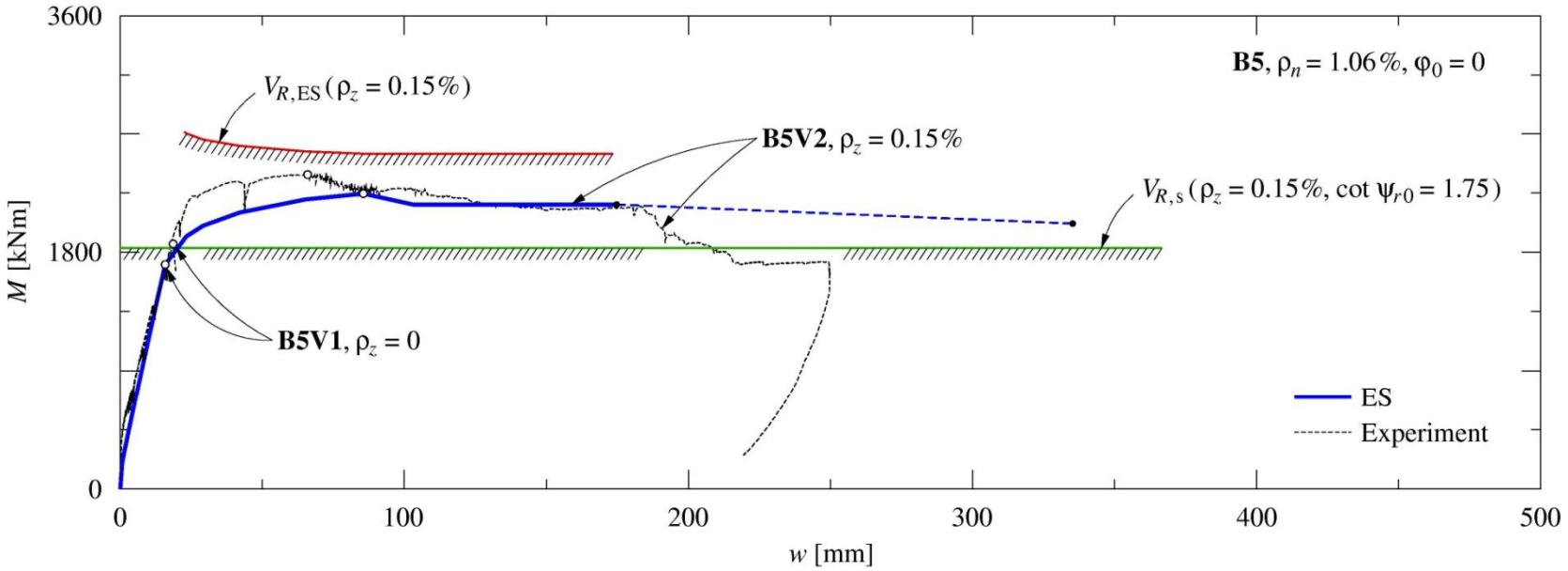




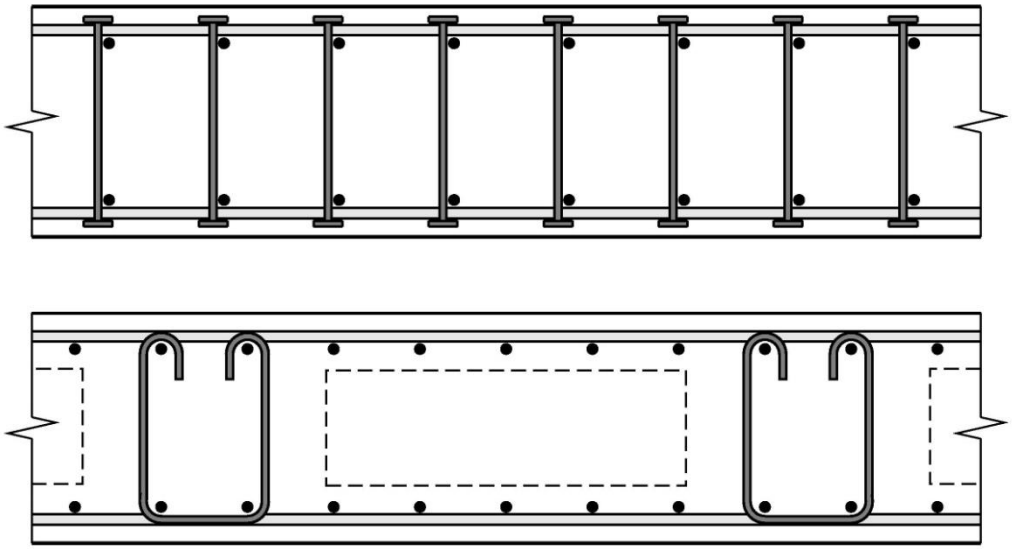
Comparison with experiments

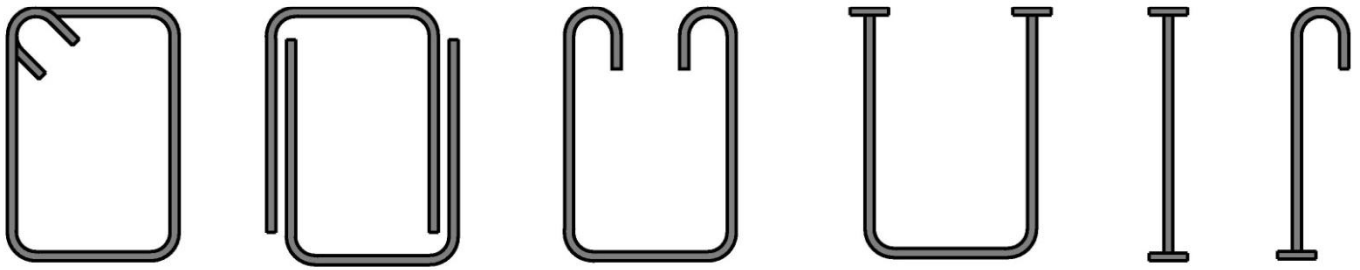


Comparison with experiments

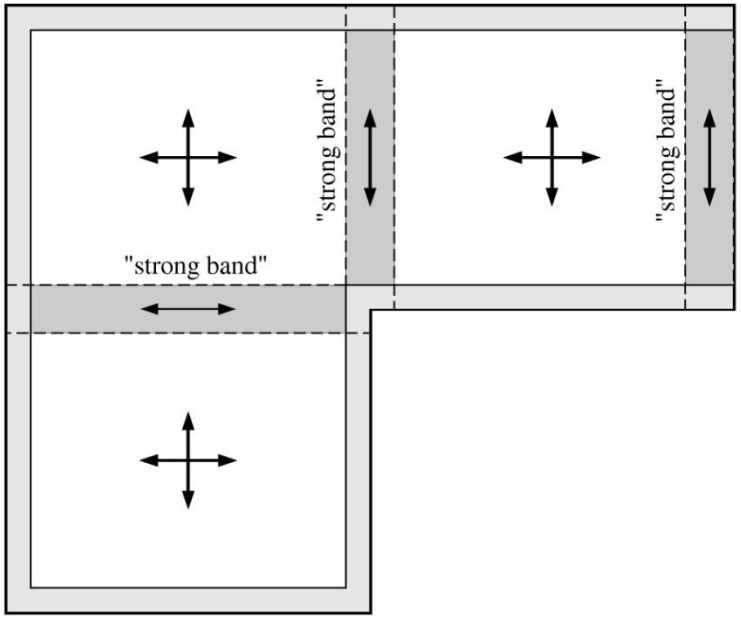


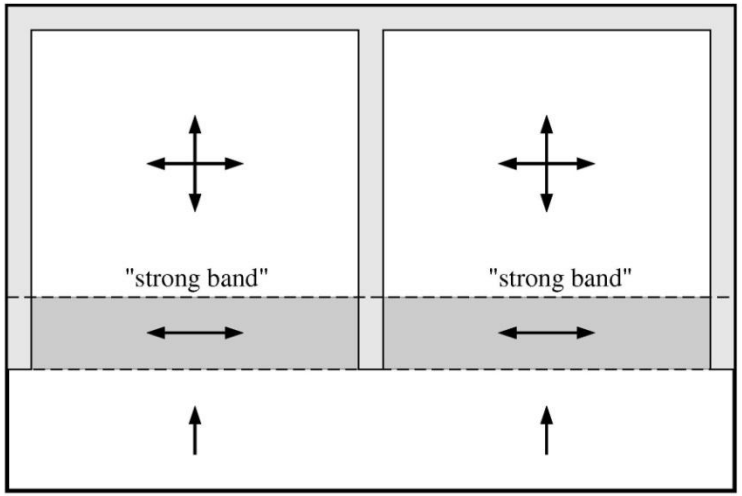
Detailing

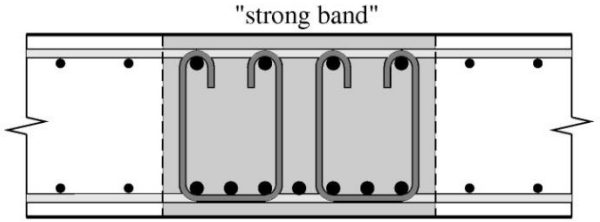


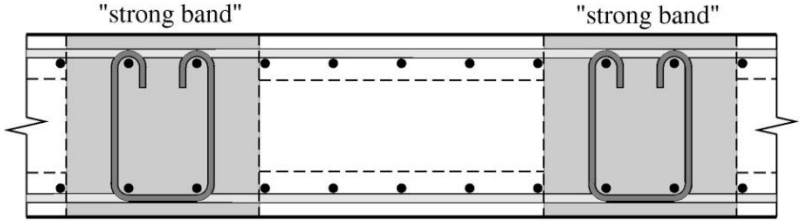


Detailing – strip method example



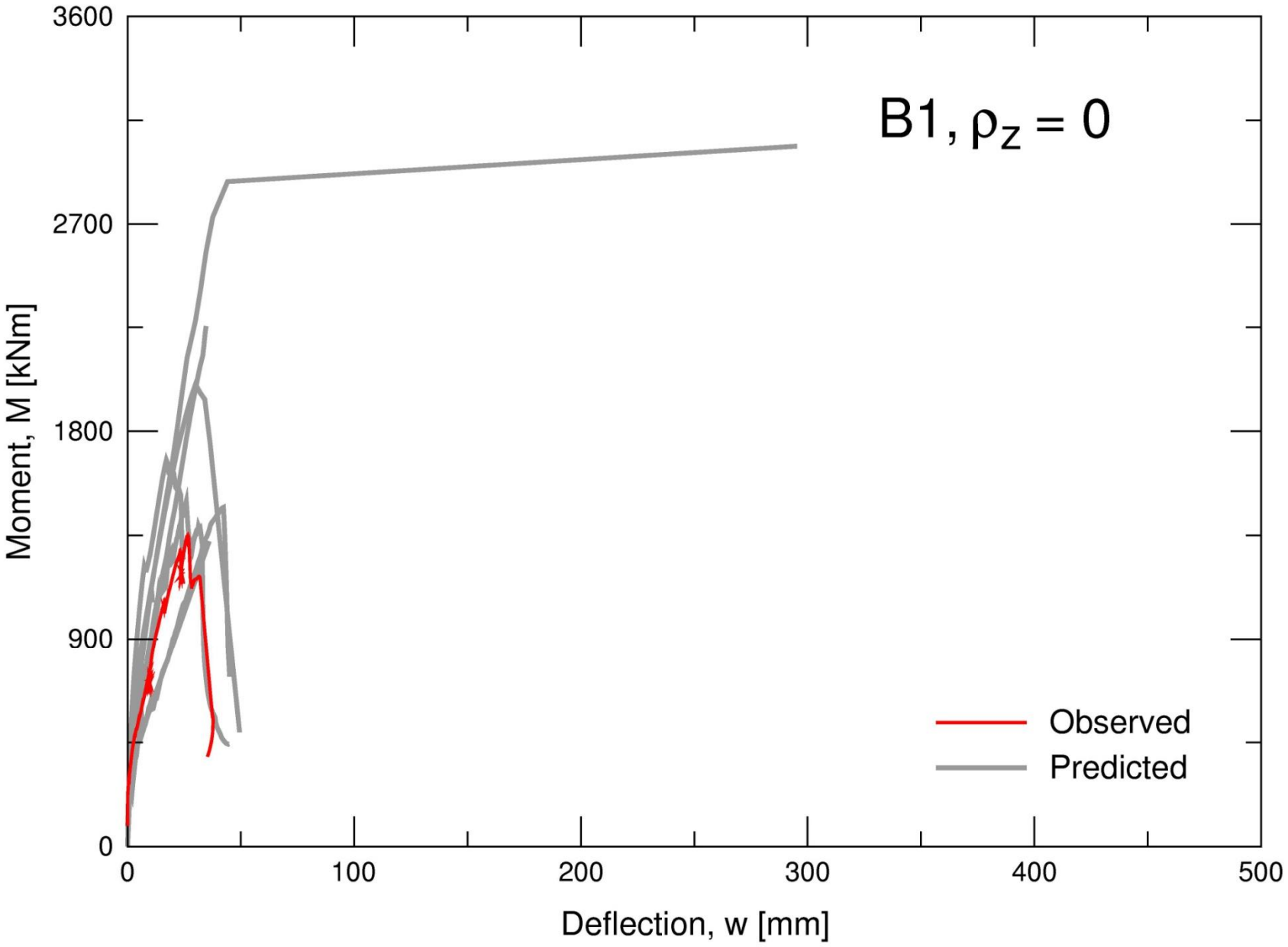


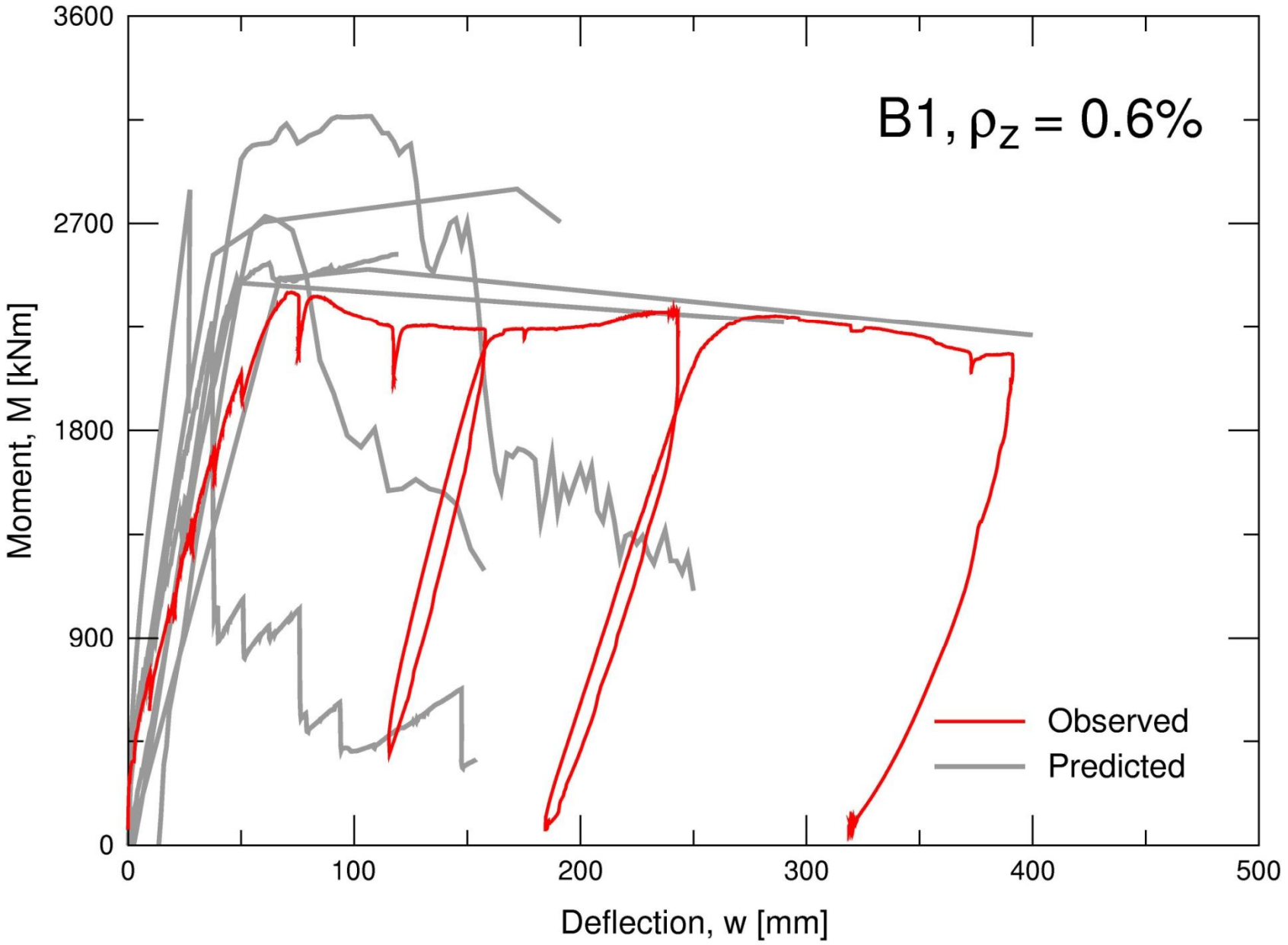




RC Slab Shear Prediction Competition

- **International Announcement**
- **Information**
  - **Test concept**
  - **Test specimens**
  - **Material properties**
- **Submission**
  - **M-w-diagrams**
  - **Crack pattern at peak load**
  - **Description of predicted response**
  - **Description of analysis method**


B1, $\rho_z = 0$
Moment, M [kNm]
Deflection, w [mm]
0
900
1800
2700
3600
0
100
200
300
400
500
Observed
Predicted


B1, ρ_z = 0.6%
Moment, M [kNm]
Deflection, w [mm]
3600
2700
1800
900
0
0
100
200
300
400
500
Observed
Predicted

Prediction results – deviations per test