

Advanced Structural Concrete

(101-0127-00L)



Felsenau bridge (C. Menn, 1975), O. Monsch

- Content:**
- In-plane loading: (i) walls and beams (stress fields, compatibility and deformation capacity); (ii) membrane elements (yield conditions, compatibility and deformation capacity).
 - Slabs (Equilibrium solutions, yield conditions, shear and punching shear)
 - Numerical modelling (in-plane loading and slabs).
 - Other topics (Long-term behaviour, fire behaviour, fibre-reinforced concrete).
- Learning objectives:**
- Deepen the understanding of structural concrete models and apply them to general design problems, including existing structures.
 - Enhance the knowledge about the load-deformation response of reinforced and prestressed concrete structures.
 - Evaluate the long-term behaviour and the behaviour under fire conditions.
- Lecture:** Tuesday, 11:45 – 13:30, HIL E 3
 Start: Tuesday, 15th September 2026
- Exercises:** The exercises refer to the material covered in the lectures and serve to enhance the understanding of the discussed topics. It is recommended to solve them independently and continuously. Questions can be discussed with the assistant during the consultation hours. The exercises can be found on the teaching website (<http://concrete.ethz.ch/asc/>).
- Consultation hour:** Tuesday, 14:00 – 15:00, HIL E 42.1
 Start: Tuesday, 6th October 2026,
 sign-up: cedric.wenger@ibk.baug.ethz.ch
- Assistant:** Cedric Wenger, Antoine Binggeli, HIL E 41.3
- Literature:**
- [1] Lecture notes W. Kaufmann, SB I-II (<http://concrete.ethz.ch/>)
 - [2] Marti, P., “Theory of Structures” , Ernst & Sohn / Wiley, 2012
 - [3] Structural design norms SIA 260/261/262
 - [4] “Tragverhalten von Stahlbeton”, vdf Hochschulverlag, 1999.
 - [5] “Design of Concrete Structures with Stress Fields”, Birkhäuser, 1997
 - [6] Nielsen, M.P., Hoang, L.C., “Limit Analysis and Concrete Plasticity”, CRC Press, 2010.
 - [7] Lecture notes P. Marti, SB I-II (kaufmann.ibk.ethz.ch/education/bachelor/archiv/)
 - [8] Kaufmann W. et al., “Compatible Stress Field Design of Structural Concrete: Principles and Validation“, ETH Zurich & IDEA StatiCa, 2020.
 - [9] Lecture notes W. Kaufmann & J. Mata-Falcón, ASC (<http://concrete.ethz.ch/asc/>)

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Date	Time	Lecture (HIL E 3)	Exercises (Submission optional)
15.09.26	12-14	Introduction	
22.09.26	12-14	In-plane loading: walls & beams – Stress fields	
29.09.26	12-14	In-plane loading: walls & beams – Stress fields	
06.10.26	12-14	In-plane loading: walls & beams – Stress fields with prestressing	Introduction Exercise 1
13.10.26	12-14	In-plane loading: walls & beams – Compatibility and deformation capacity	
20.10.26	12-14	In-plane loading: walls & beams – Compatibility and deformation capacity	Introduction Exercise 2
27.10.26	12-14	Steel fibre reinforced concrete	
03.11.26	12-14	In-plane loading: membrane elements – Equilibrium, yield conditions	
10.11.26	12-14	In-plane loading: membrane elements – Compatibility and deformation capacity + numerical modelling	
(10.11.26)	16-18	Workshop “Compatible Stress Fields” (Room to be announced)	
17.11.26	12-14	Long-term effects – Basics	
24.11.26	12-14	Long-term effects – Application	Introduction Exercise 3
01.12.26	12-14	Slabs – Equilibrium, yield conditions	
08.12.26	12-14	Slabs – Shear and punching shear, Numerical modelling	Introduction Exercise 4
15.12.26	12-14	Fire behaviour	