

Master project in Civil Engineering / PDM CIVIL - 599

Fall Semester 2026-2027

PROJECT SUPERVISOR

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SUBJECT

Design and assessment of concrete slab bridges

DESCRIPTION

Reinforced concrete slab bridges represent a classic solution that remains widely used today. Design against shear and punching shear often governs the thickness of such slabs. Some common questions that arise when analysing them include:

- The transition between one- and two-way shear: numerous slab bridges rest on concentrated supports that are closely spaced in the transverse direction, representing a typical situation between one- and two-way shear. How this transition should be handled is a question that often arises during the design and assessment of such slabs against shear and punching.
- Arrangement of traffic loads: traffic loads are composed of uniformly distributed and concentrated loads. According to standards such as the Swiss Standard for Concrete Structures, shear and punching shear resistances depend on the state of deformation in the critical shear region. This requires the engineer to determine the most unfavourable location of the concentrated loads with respect to the demand-to-capacity ratio, rather than considering only the load arrangement that maximizes the shear force.
- Reinforcement orientation in skew slabs: in skew slabs, the reinforcement is often not aligned with the direction of principal shear. According to the codes of practice, this misalignment can lead to a significant reduction in the shear resistance.

During this master project, the candidate is expected to:

- Develop a deeper understanding of the behaviour of slab bridges.
- Study and understand how to apply the following design codes: the Swiss standard for concrete structures SIA 262:2025, the second generation of the European standard for concrete structures EN 1992-1-1:2023, and the *fib* Model Code 2020.
- Review the literature to identify relevant publications with experimental campaigns that allow for a comparison between codes of practice and experimental test results.
- Analyse the Swiss built road network to contextualize the range of parameters necessary to cover typical existing slab bridges in Switzerland.
- Perform parametric studies using different Levels-of-Approximation (from pre-design formulas to non-linear finite element analysis) to provide practical guidelines for daily engineering practice.

KEYWORDS

Reinforced and prestressed concrete, slab bridges, design and assessment, one- and two-way shear, concentrated supports, skew reinforcement

To register for the project, please send an email with your name to joao.simoese@epfl.ch.