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Advanced Structural Concrete – Exercise 4

(101-0127-00L)

Topic: Slabs   **Skew supported slab**

Hand out: 14. December 2023, HIL E 7

1   Dimensioning bases of the exercise

1.1   Introduction

In this exercise, a slab will be dimensioned and discussed at the ultimate limit state type 2 according to the structural design standards SIA 260 to 262 [1 – 3] focussing on skew reinforcement. This exercise examines a skew-supported bridge slab.

1.2   Geometry

The dimensions can be taken from Figure A1.

1.3   Material

For the construction of the bridge, concrete C30/37 and construction steel B500B are used.

1.4   Exposure classes

The skew slab is exposed to weather conditions as well as de-icing salts and is situated in an environment with changing humidity. The concrete cover is $c_{nom} = 55$ mm.

1.5   Loads

The slab is subjected to its dead weight, the self-weight of non-structural elements of $g_{1k} = 3$ kN/m², and a live load of $q_k = 15$ kN/m² (characteristic values, acting on the entire surface of the slab). The loads are to be combined according to SIA 261 [2].

2   Tasks

a)   Choose a reasonable slab thickness.
b)   Determine the minimum reinforcement of the slab and its bending and shear resistance.
c)   Dimension the slab using the strip method.
d)   Dimension the slab using an elastic FEM-calculation (e.g. with CEDRUS-7, [4]).
e)   Draw a reinforcement layout to a scale of 1:50 of the necessary bending / shear reinforcement.
f)   Determine an upper limit value of the ultimate load using the yield line method.
g)   Discuss the different methods from c) strip method, d) elastic FEM calculations and f) yield line method.

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3   Literature

[1]   Swiss society of engineers and architects (SIA), standards: SIA 260 Basis of Structural Design, 2003

[2]   Swiss society of engineers and architects (SIA), standards: SIA 261 Actions on Structures, 2003

[3]   Swiss society of engineers and architects (SIA), standards: SIA 262 Concrete Structures, 2003

[4]   FEM Software, CEDRUS-7, Cubus AG, Zürich

Appendix A - Figures

A1   Floor plan and side view of the skew-supported slab, dimensions in [m].