

Assignment A - Residential Block, Reinforcement

A residential block with a concrete structure is to be built. The concrete structure consists of walls, pillars, and of two slab floors with identical geometry. The lower concrete slab is shown in Figure 1.

The slab should be analysed in the ultimate limit state, and a verifying calculation at serviceability limit state of the concrete slab. Actual design codes should be used.

The computer code CALFEM is available for the calculations. Also comments concerning the modelling of the structure, the loads, the material and the boundary conditions should in an appropriate amount be added. The reinforcement drawings from which the structure is produced should be attached to the report.

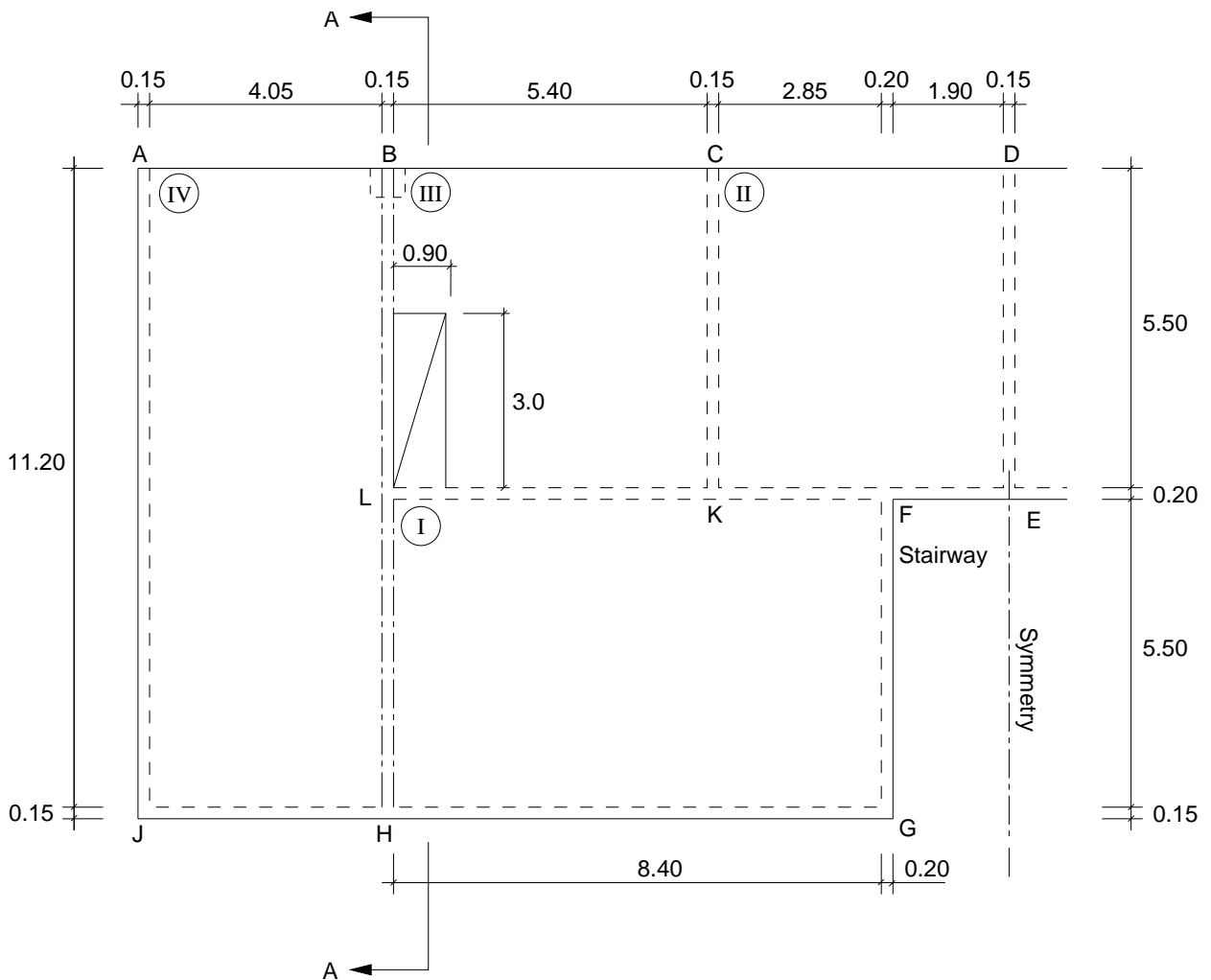


Figure 1: Drawing of the lower concrete slab.

Structural modelling

The residential block has two slab floors with identical geometry which are located straight above each other. The slabs have a free edge along A-D, and can be considered as simply supported at the remaining supports except at the stairway. At the stairway the plates are casted together with the 200 mm thick stairway wall. There is a $0.9 \times 3.0 \text{ m}^2$ large hole in part III of the slab as shown in the figure. The plate is 150 mm thick.

The reinforcement design is made in the ultimate limit state. The loading and reinforcement is determined according to EuroCode 1 and 2. The deformation calculation is performed in the serviceability limit state taking the duration-of-load effect into account. Safety class 2 is applicable for the slab and then $\gamma_d = 0.91$.

	Load	Partial coefficient (γ_f) Ultimate limit state
Selfweight	4.9 kN/m ²	1.20
Imposed load	2.0 kN/m ²	1.50

Part III of the plate is loaded by a concentrated load $P=4 \text{ kN}$ at the non-supported corner of the hole.

Material modelling

The structure is to be constructed of concrete C20/25 and of reinforcement B500B or equivalent.

Task

The slab should be designed in the ultimate limit state and verifying calculations at serviceability limit state. The computer code CALFEM is used for plate calculations.

Ultimate limit state

- Determine the reinforcement in the plate.

Serviceability limit state

- Determine the long-term deformations and the risk of cracking for the plate.

For a specific load and for a constant bending stiffness in the plate the section forces are independent of the value of the stiffness. The deflection is, however, dependent on the plate stiffness. In the serviceability limit state a reasonable value of the bending stiffness should therefore be chosen.

Computer codes and documentation

The report of this Assignment A as well as the later handed out Assignment B must be written in separate reports. The computer code CALFEM and the Mesh-module can be downloaded from the course homepage at the following adress.

<http://www.byggmek.lth.se>