



EPFL

RESSLab



Fire protection engineering

Exercise - part 3

Olivier Burnier, civil engineer HES-UTS
Fire protection expert with federal diploma

Exercise 3

Using the nomogram to EN 1993-1-2:2005, the SZS tables and MACS+ software, answer the questions below:

- Determine the required fire resistance for the sections indicated, based on the extract from AEAI guideline 15-15.
 - HEA 220 S 235 column, axis P1
 - Column HEB 240 S 235, axis P1
 - IPE 600 S 235 beam (non-mixed)
 - HEA beam 450 S 355 (unmixed)
 - IPE 360 S 235 beam (mixed), $b_{\text{eff}} = 1.80 \text{ m}$
- Determine the gypsum board protection (characteristics as per nomogram documentation) required to ensure the strength of the HEA 450 beam.
- Determine the minimum reinforcement required (based on available cross-sections as per documentation) to ensure edge field strength using the membrane method.

Extract from the usage agreement

A two-storey metal hall with an industrial use and a thermal load $q > 1'000 \text{ MJ/m}^2$. The first floor is used for the production of wood and PVC windows, while the second floor houses the company's offices.

The loads to be considered are as follows:

Roof

Dead weight of framework 0.50 kN/m^2

Dead weight of sheet metal 0.20 kN/m^2

Insulation + waterproofing 0.10 kN/m^2

Gravel 8-16 1.50 kN/m^2

Snow (alt. 600 m) 1.25 kN/m^2

Intermediate slab

Dead weight of structure 0.50 kN/m^2

Dead weight of 14 cm slab 3.50 kN/m^2

Shingles 0.50 kN/m^2

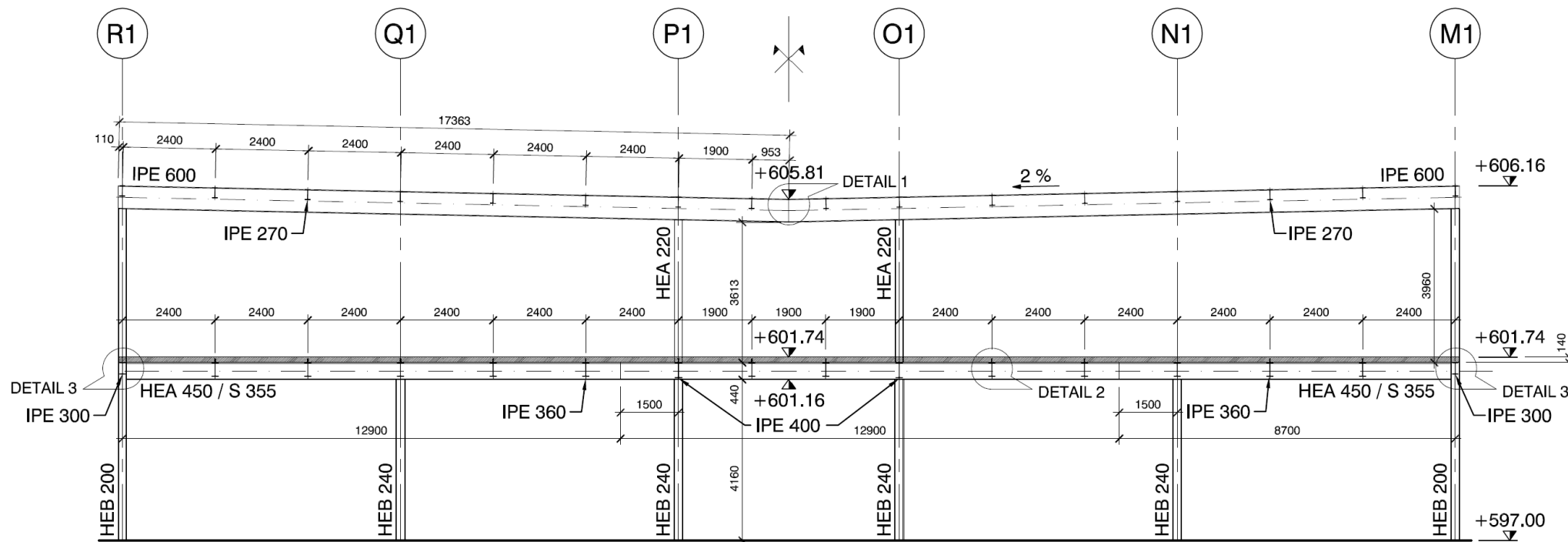
Screed + finish 2.50 kN/m^2

Payload for administrative areas 3.00 kN/m^2

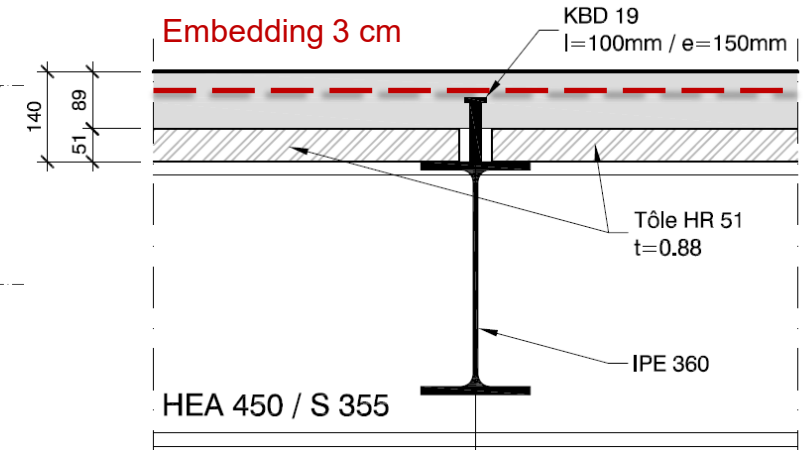
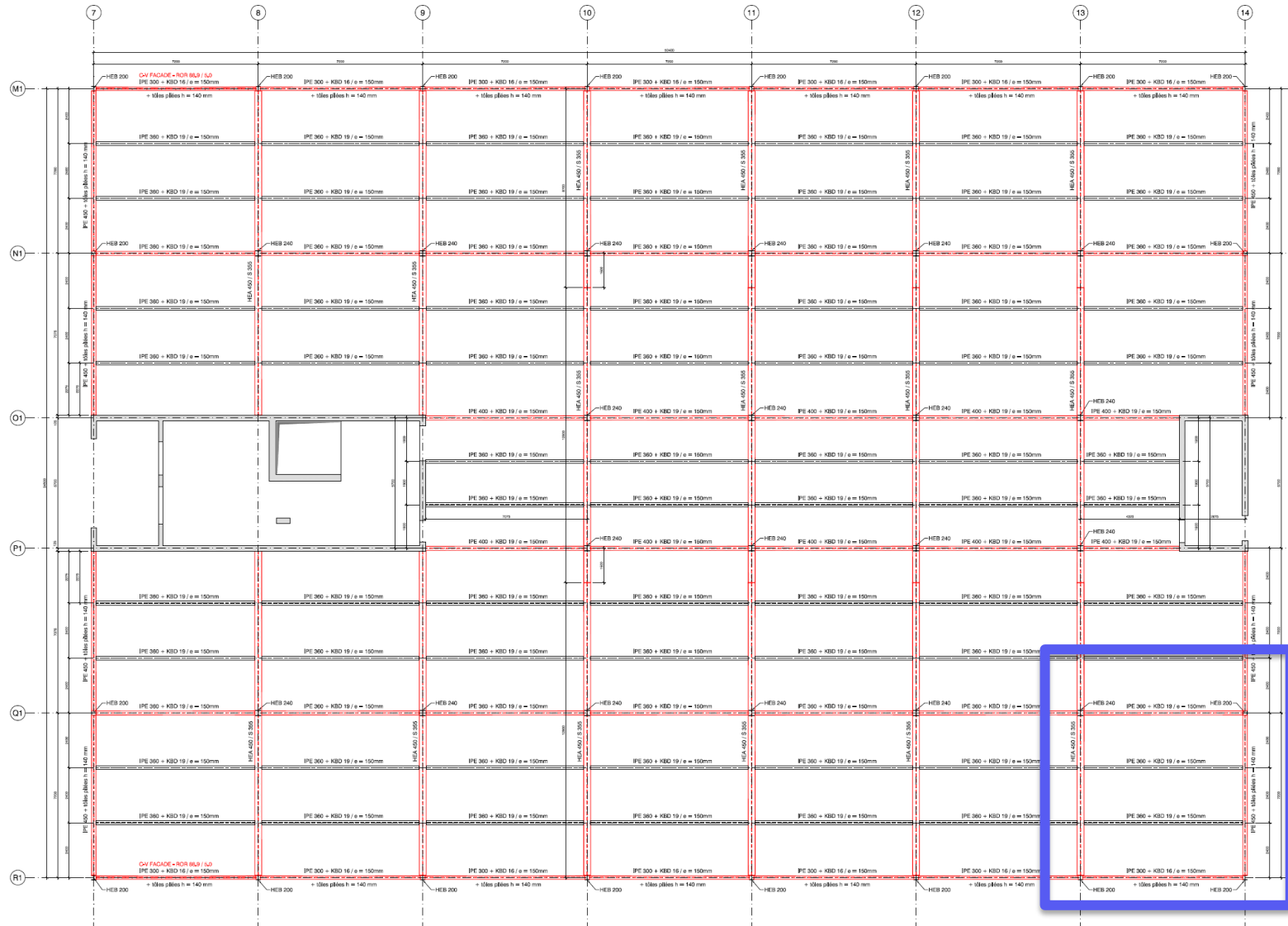
Principle cross-section

The static system is described below, and the hall is braced in both directions by reinforced concrete cores. Frame spacing is 7.20 m. For the columns, take a buckling length $l_{ky} = l_{kz} = l$. All columns are exposed to fire on 4 sides. The slope of the roof is not taken into account for the load lowering.

The load descent must be carried out with all surfaces loaded (no checkerboard loading), checking only normal forces (pillars) and bending forces (beams). Concrete C25/30.



Plan view and slab detail



Area to be checked