Structural fire engineering in building renovation

Application of Natural Fire and Heat Transfer Model to guarantee Fire Safety

Ir. Tom Molkens

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StuBeCo
Studiebureel voor berekening van constructies

Design considerations

- Belgian standards for school building IBN/BIN 1982
- Belgian regulations for low buildings R.D. 1997

Existing regulations

Scientific possibilities

- ISO834 + design following NBN-EN's = conservative
- Natural fire + interrogation commission = delay (5 months)

- Existing building constructed from 1881 till 1937 < 1982
- Transformation without building permit request
- Natural fire without interrogation
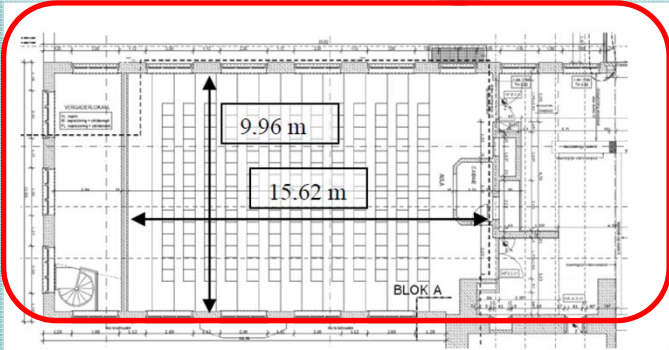
Approach, with use of software tools

Main reason for advanced study; conscience problem of local school authority, because of leak in regulations for existing buildings
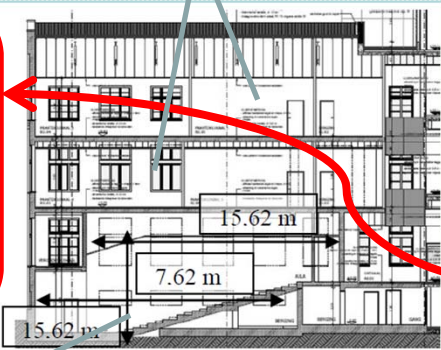
2

Description of case study

Geometry

1937

Class rooms

1881

2010

9.96 m

15.62 m

BLOK A

photo

15.62 m

7.62 m

15.62 m

Audience

Material properties

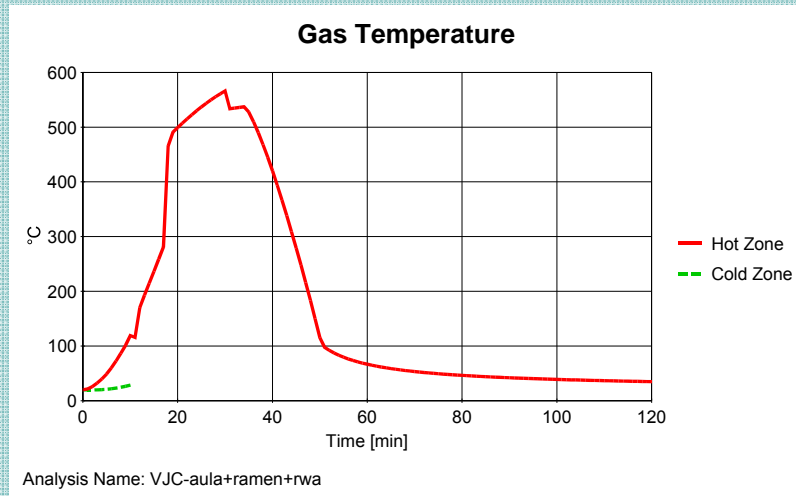| Material	ρ [kg/m³]	ΔL/L [mm/mK]	λ [W/mK]	c [J/kgK]
Masonry	1600	5	0,70	840
Concrete	2300	10*	1,60*	1000*
Steel	7850	12*	14,6*	450*

* At 20°C, temperature dependent following EN's

Fire load = 2-zone model

- Fire load due to EN 1991-1-2 = 347 MJ/m² for school building raised till 511 MJ/m² for wooden false ceiling in audience.
- Fire growth = medium, RHR = 250 kW/m², modification factors of 1; 0,87; 0,78 and 1,43 (danger of activation; heat detection; off site fire brigade and surface)
- Combustion efficiency factor = 0,80 and a constant ratio of at least 2% openings in relation to the vertical surfaces
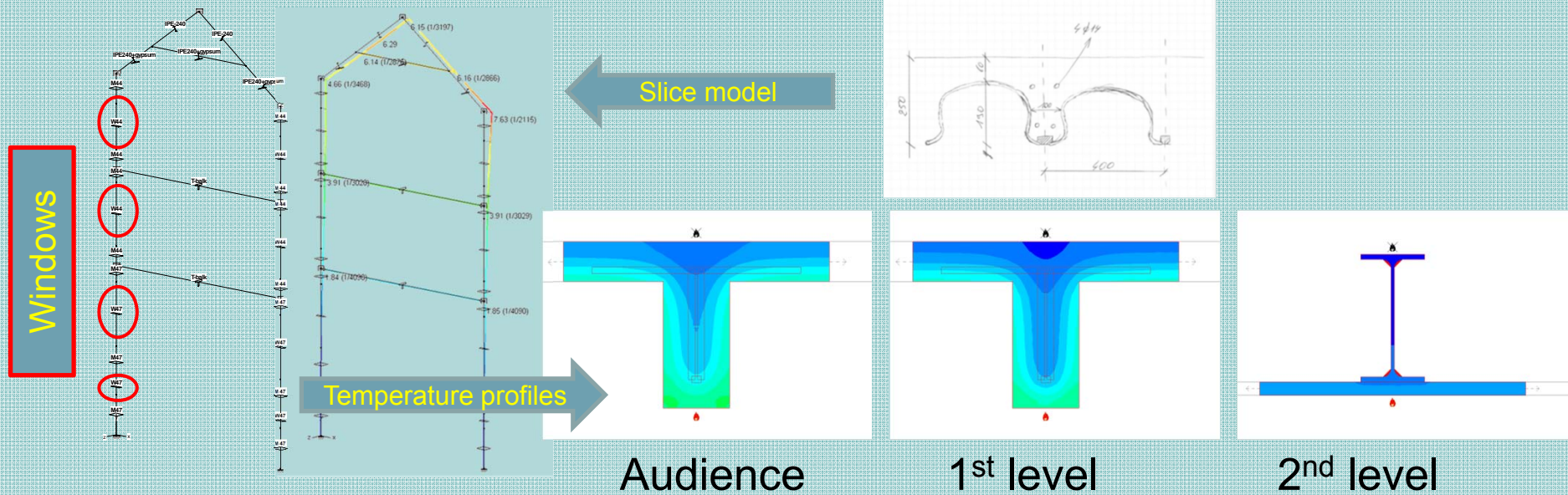
Audience, optimal situation

Audience, actual situation

Analysis Name: VJC-aula+ramen+rwa

Analysis Name: VJC-aula
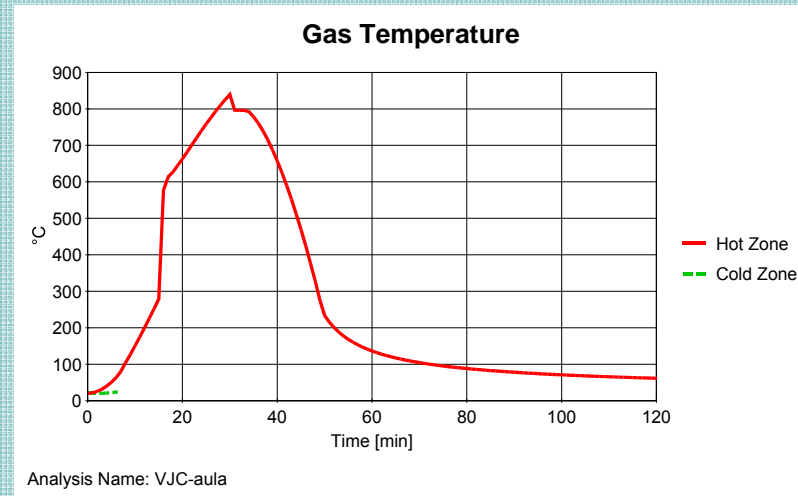
Mechanical response of structure

Audience   1ˢᵗ level   2ⁿᵈ level

Conclusions

- With the aid of easy to use 2-zone models possibility to build up a tailor made solution for this particular problem.

- The proposed solution is withhold by the school authority and executed without delay in execution time.