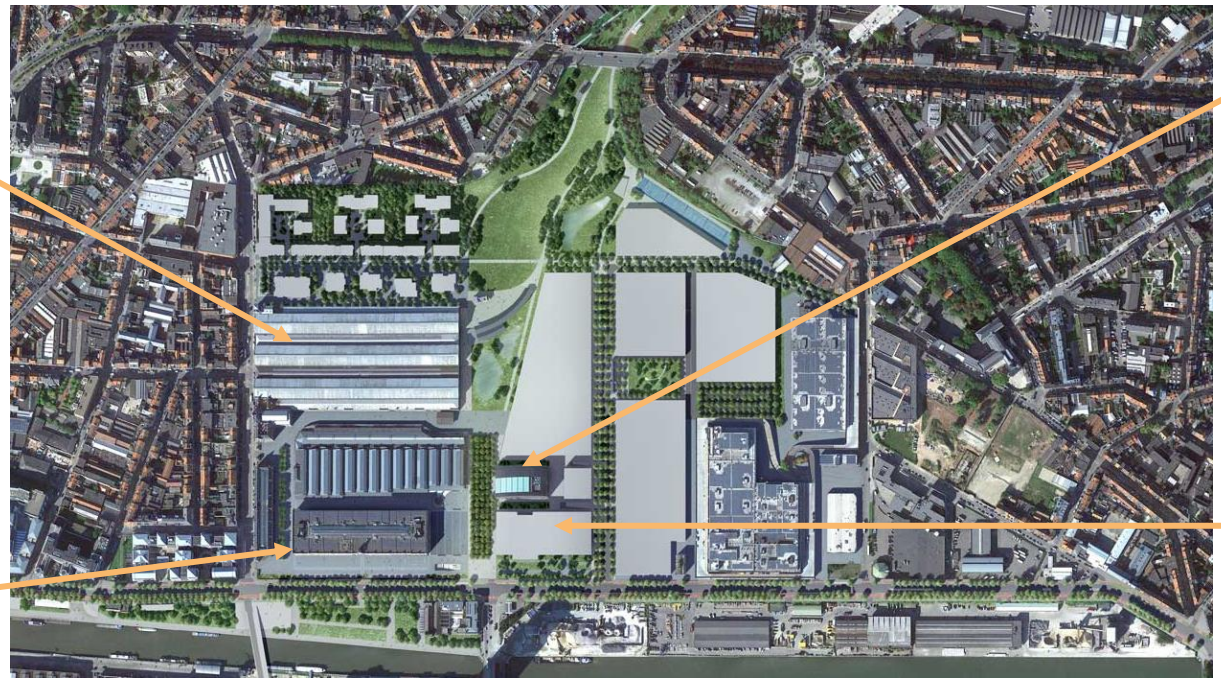
Towards Climate Neutral Buildings – Case Study of Positive Building in Brussels: Gare Maritime

Nassim Jamali – Building Performance Consultant

Gare Maritime



Bruxelles Environnement

L'Entrepôt royal

Flemish government building – Herman Teirlinck

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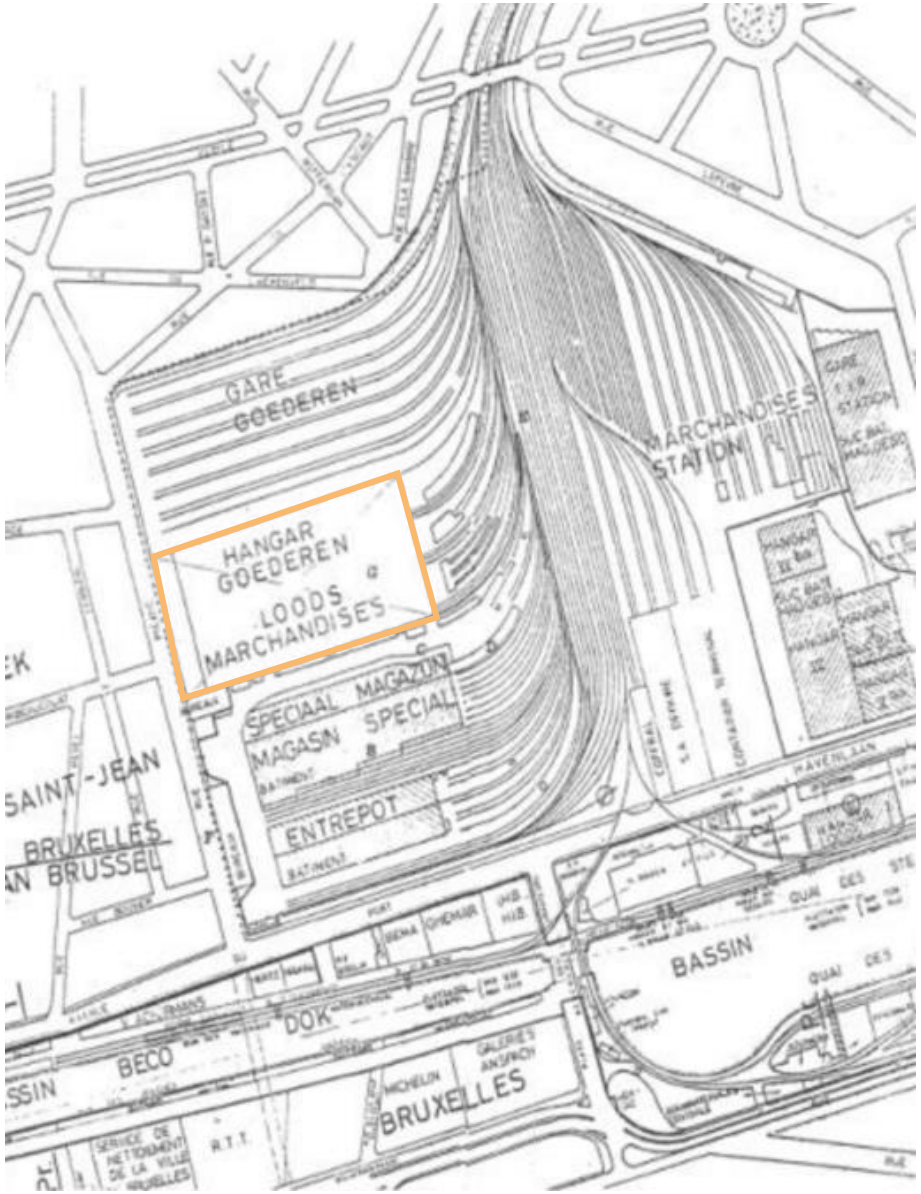

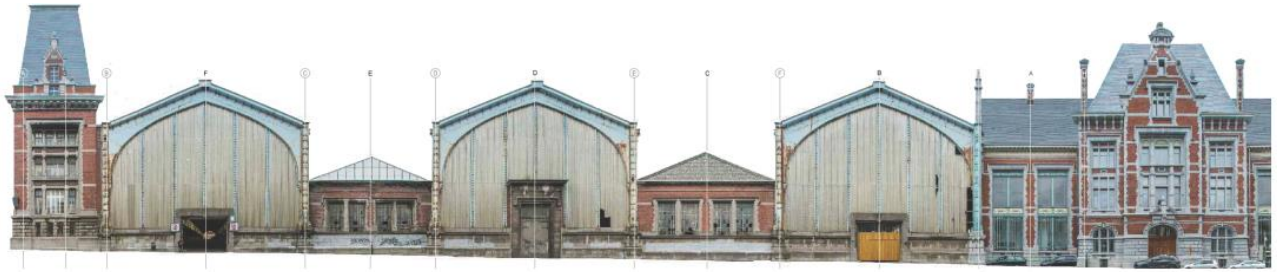

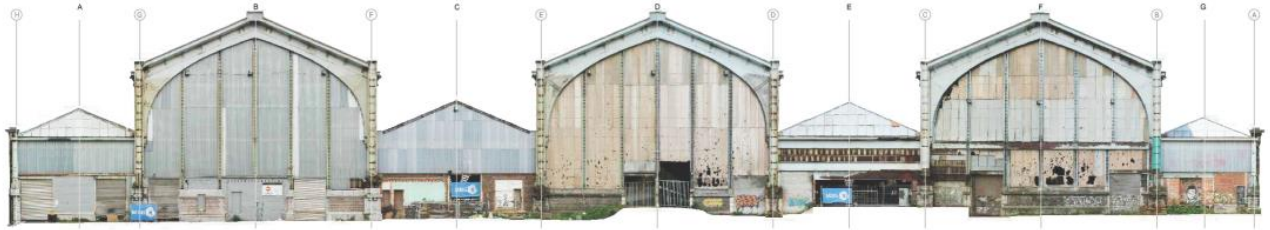

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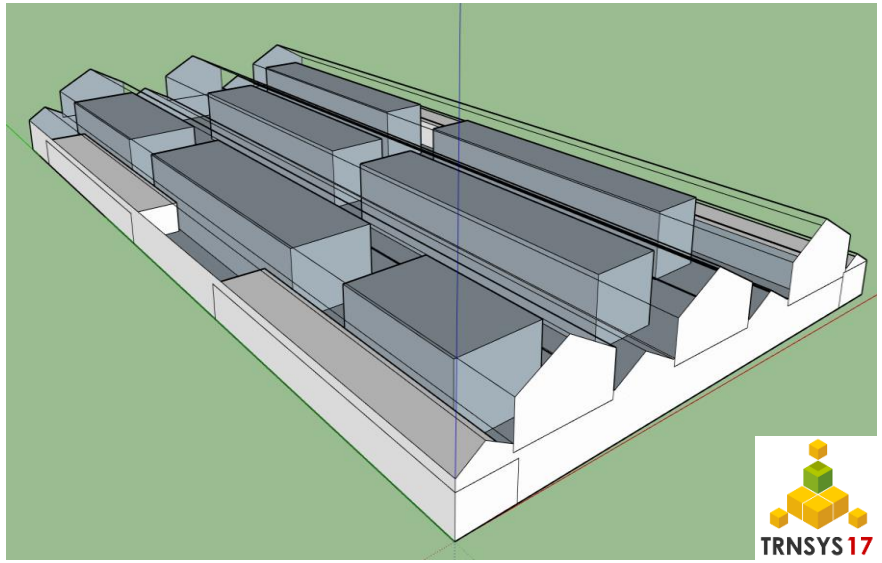
MAIN QUESTIONS

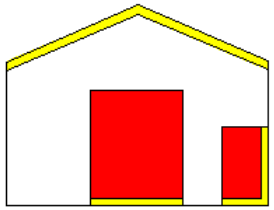
1. What comfort levels can be achieved in this hall, and how can this be accomplished
2. Is it feasible to create a comfortable situation without excessive energy use
3. To what extent is the freedom to design hampered in the hall
4. How can the energetic approach be reconciled without compromising heritage value

COMFORT ?

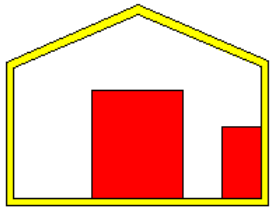
- Temperature (summer & winter)
- Visual (light & views)
- Building Physics
- Program requirements (what will make this location into an interesting workplace)
- Other (acoustics)

Temperature

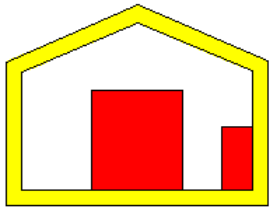




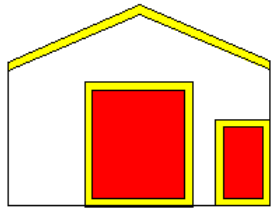
Minimal Insulation for renovation works



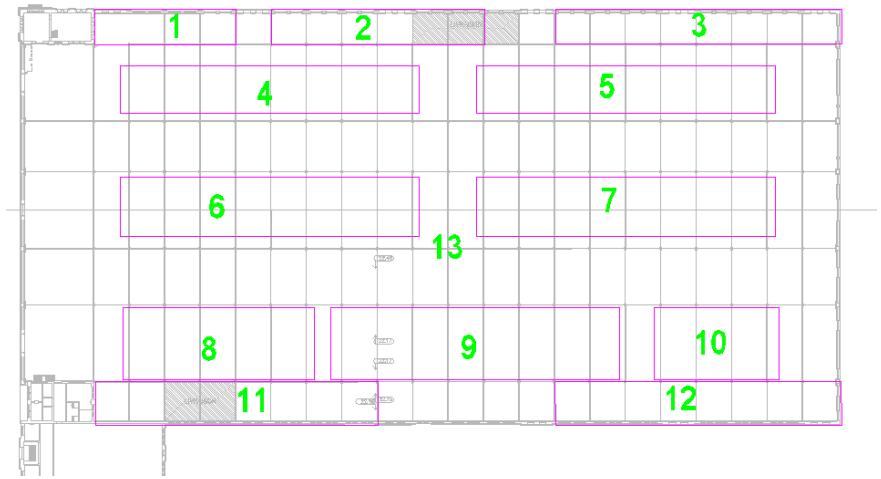
Insulation of the hall in accordance with minimum EPBD values (new construction)

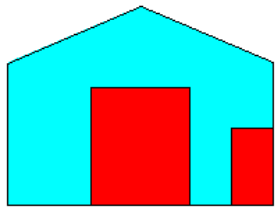


Heavy insulation package for the hall

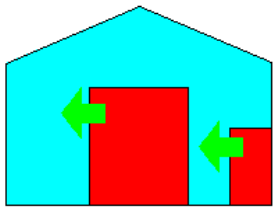


First option + built-in volumes are insulated per se according to minimum EPBD values

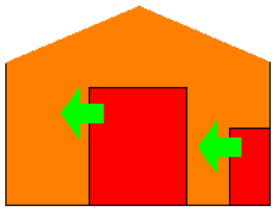




Hall as an industrial space
Not heated
Not ventilated



Hall as an unheated space, but serves as an extraction plenum



Hall as a heated volume

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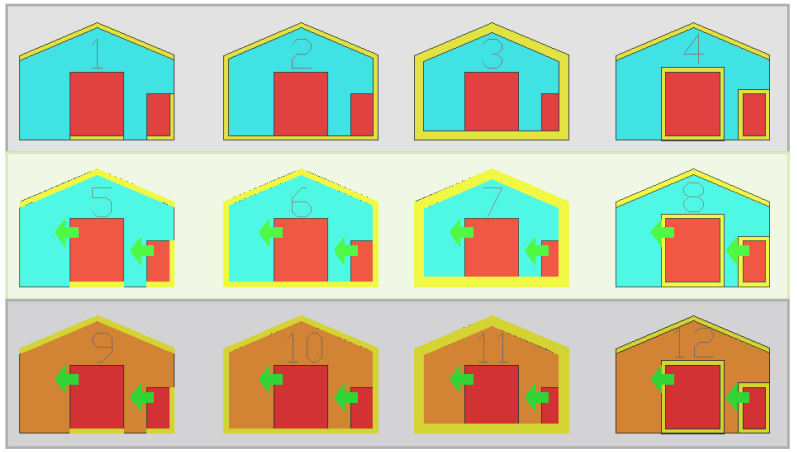
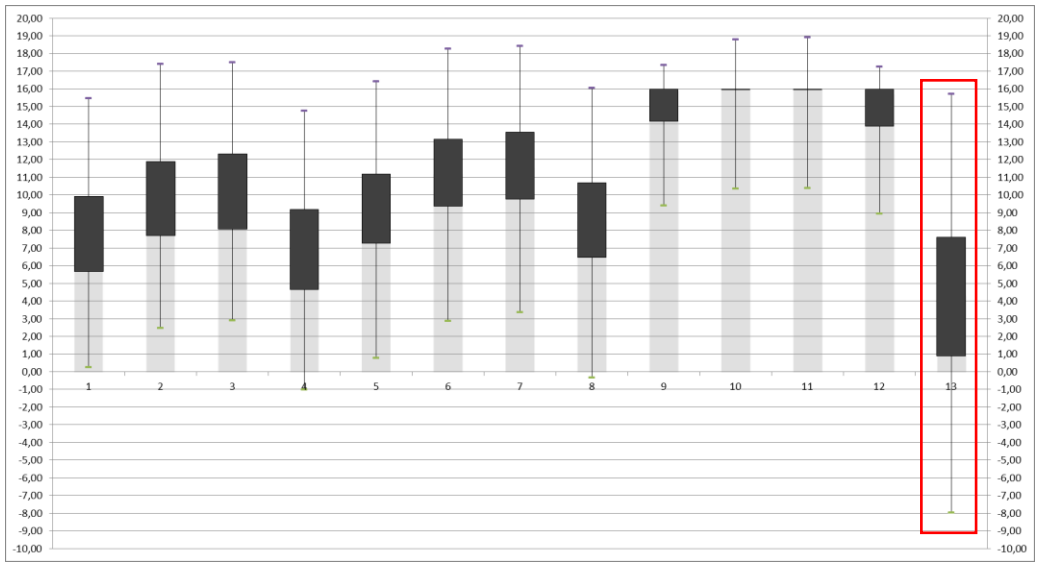
Temperature



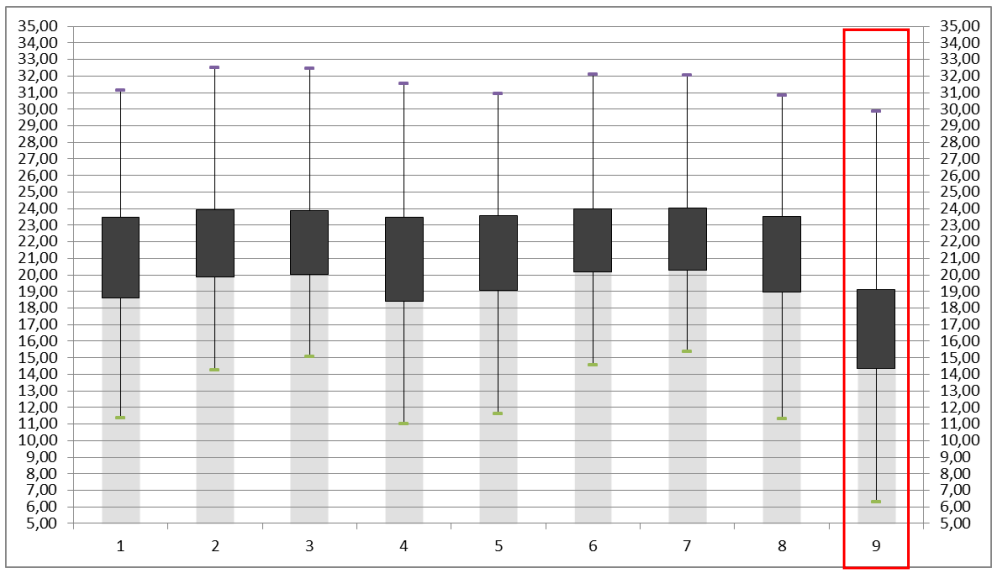
Temperatures in the hall, period November - February



763	561	429	262	1081	767	623	650	3379	[illegible]	1424	3337

Consumptions for heating hall + boxes [MWh/year]

Temperatures in the hall (June-September))



690	655	781	1041	701	674	803	1049

Consumptions for cooling boxes [MWh/year]

Important increase of the consumption in comparison to the added value => heating of the entire hall is eliminated as an option.

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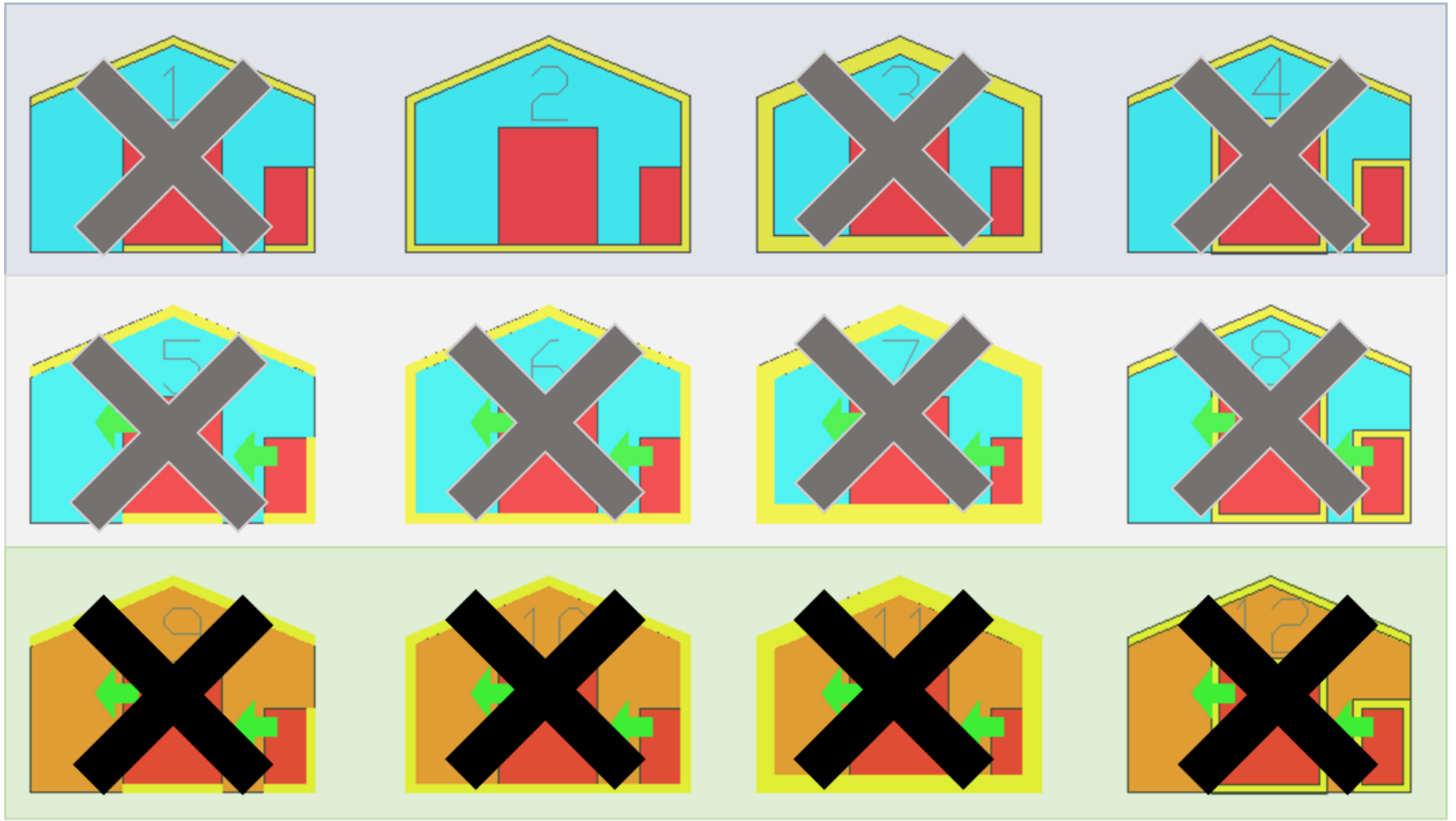

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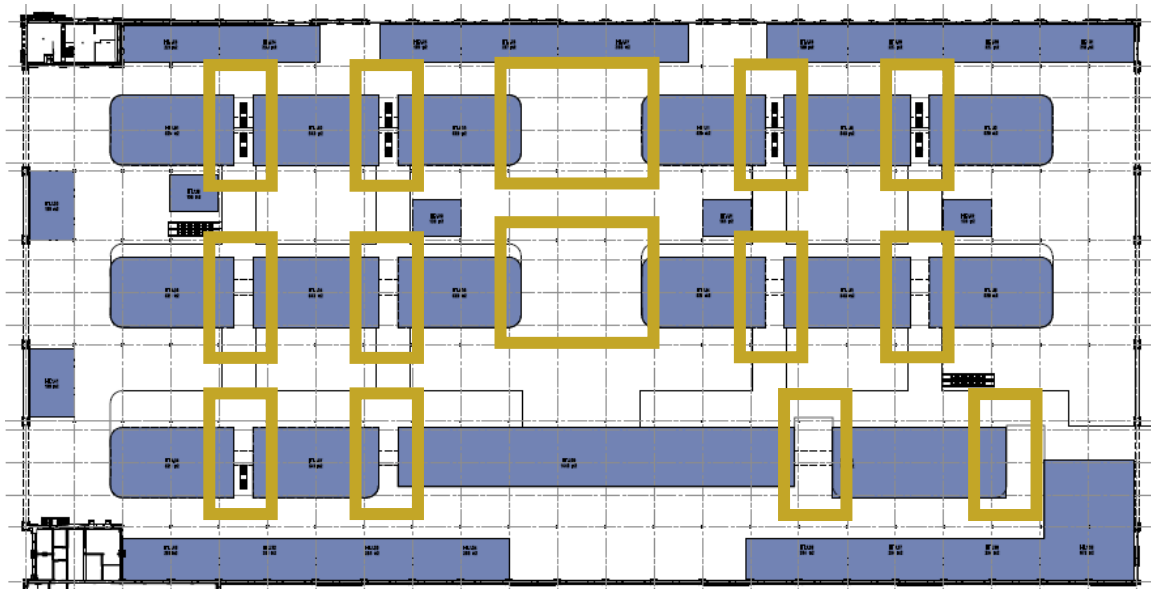
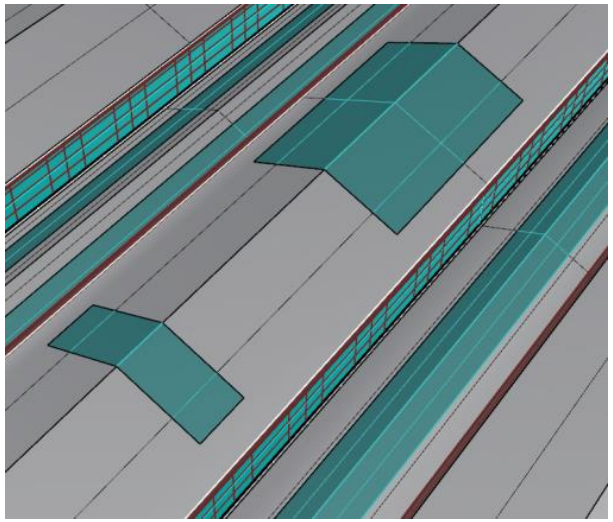
Daylight





Final Result: Defining the enclosure of the free design zone in function of BREEAM HEA01

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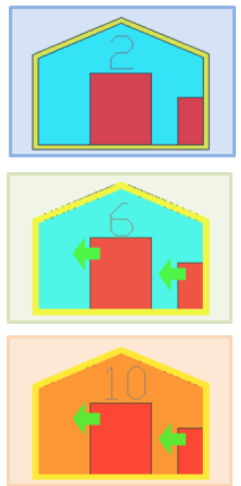
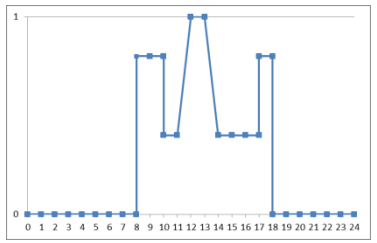
Building Physics

Having a simulation model assists in providing answers to a number of detailed problems with better precision.
A little reverse engineering makes it possible to establish a maximum temperature factor for different cold bridge solutions.

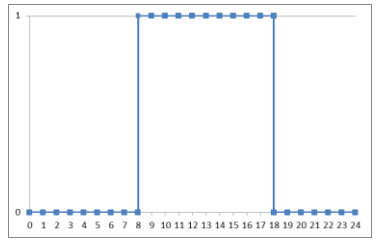
	A. Base case		B. Occupation in the hall (3)		C. Full occupation in the hall (4)	
	Winter(1)	Summer(2)	Winter	Summer	Winter	Summer
2	f≥0,23	f≥0,28	f≥0,41	f≥0,28	f≥0,60	f≥0,28
6	f≥0,24	f≥0,28	f≥0,33	f≥0,28	f≥0,42	f≥0,28
10	f≥0,17	f≥0,29	f≥0,22	f≥0,29	f≥0,25	f≥0,29



(1) Winter= November-February
(2) Summer= June-September
(3) Occupation: 1pers/5m², 8h-18h, see occupation profile 1
(4) Occupation: 1pers/5m², 8h-18h, see occupation profile 2



Profile 1



Profile 2

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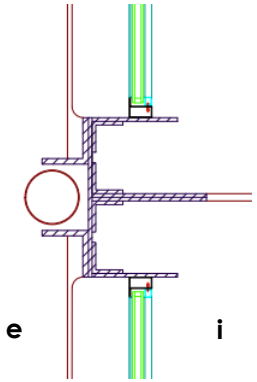
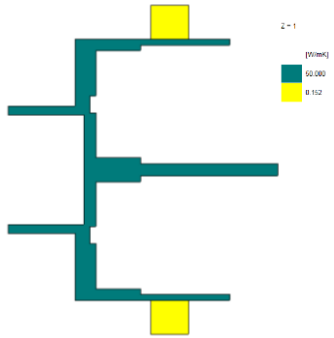
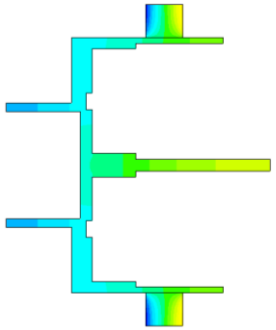
Building Physics

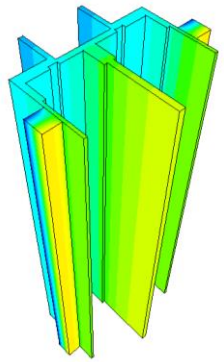
Basic Simulation

f = 0,271





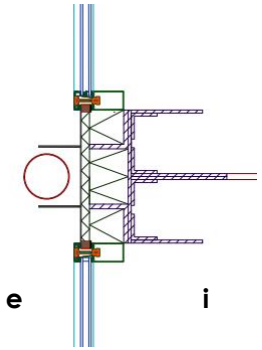


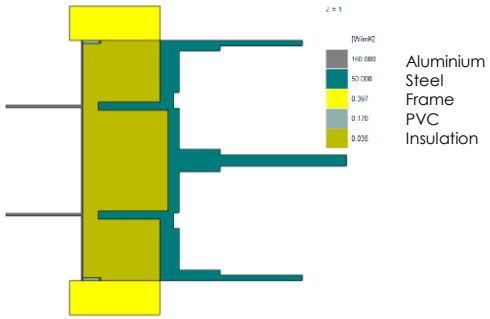


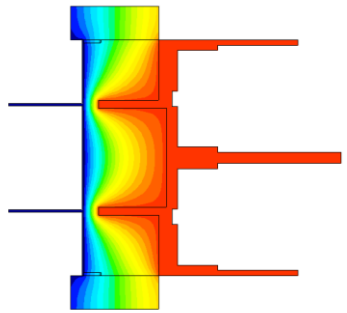
U_frame = 2 W/m²K
(in all simulations)

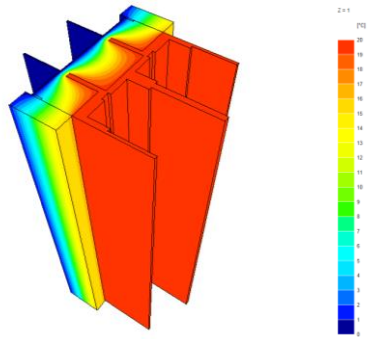
Example Solution

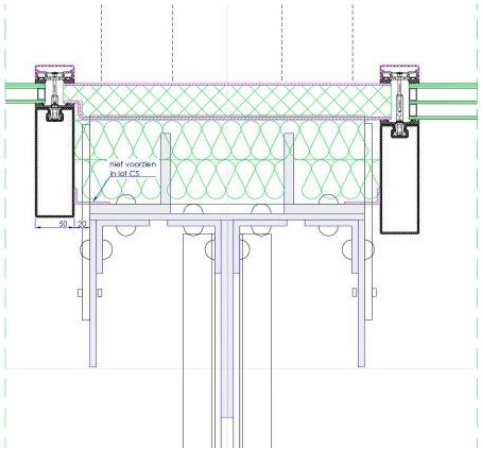
f = 0,762 > 0,7



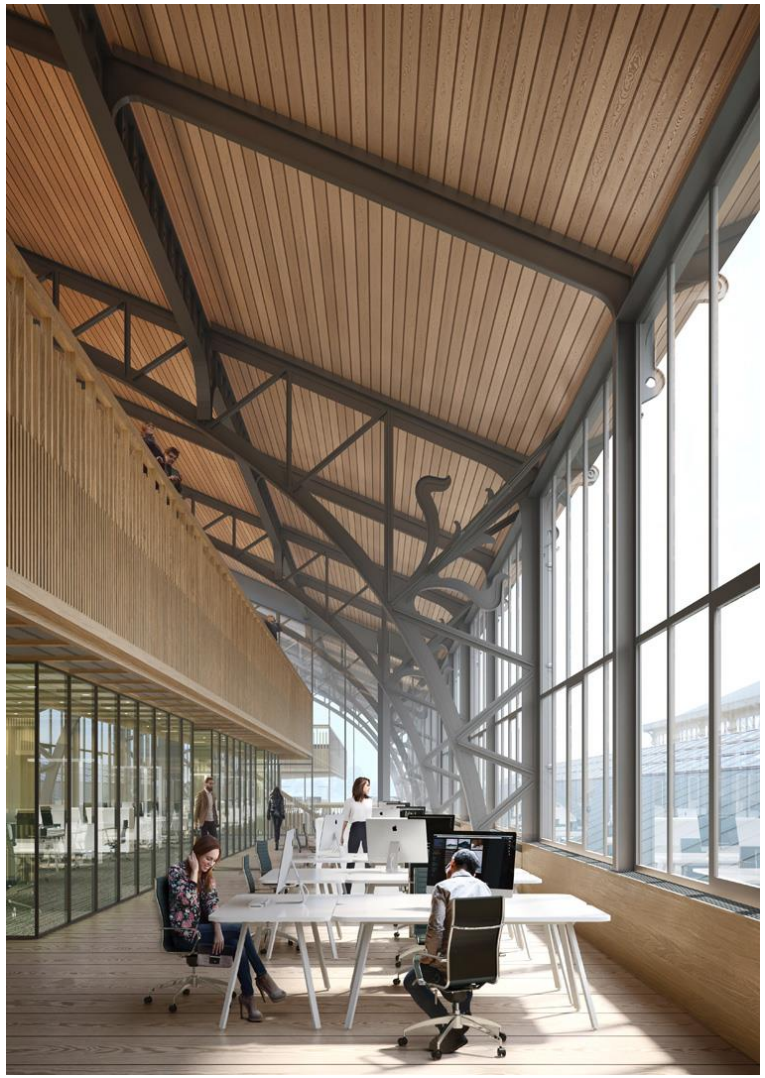








Design of In-Built Volumes



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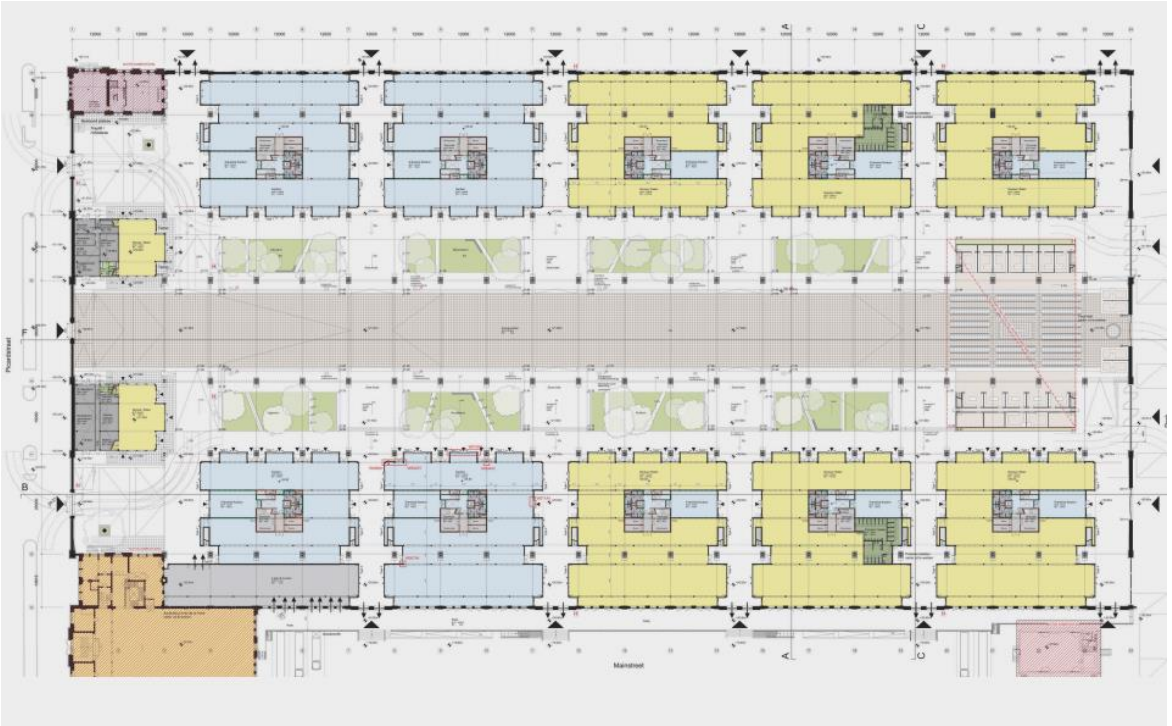
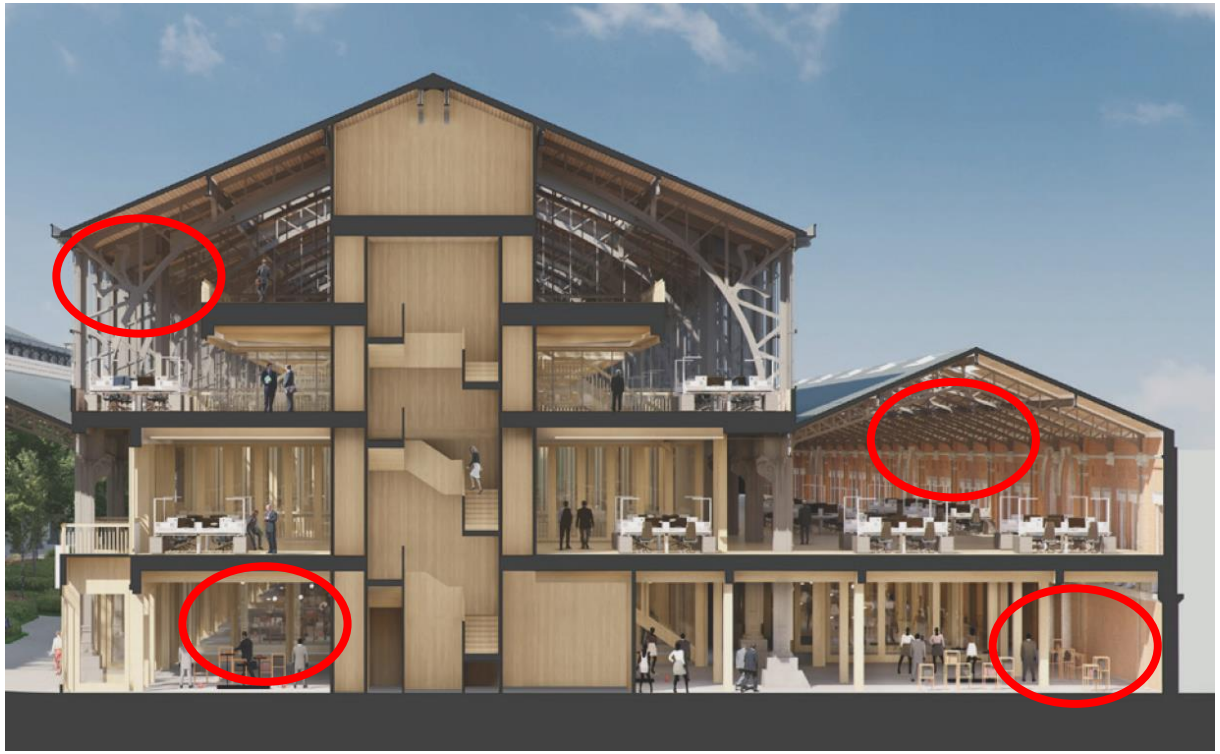
Design of In-Built Volumes





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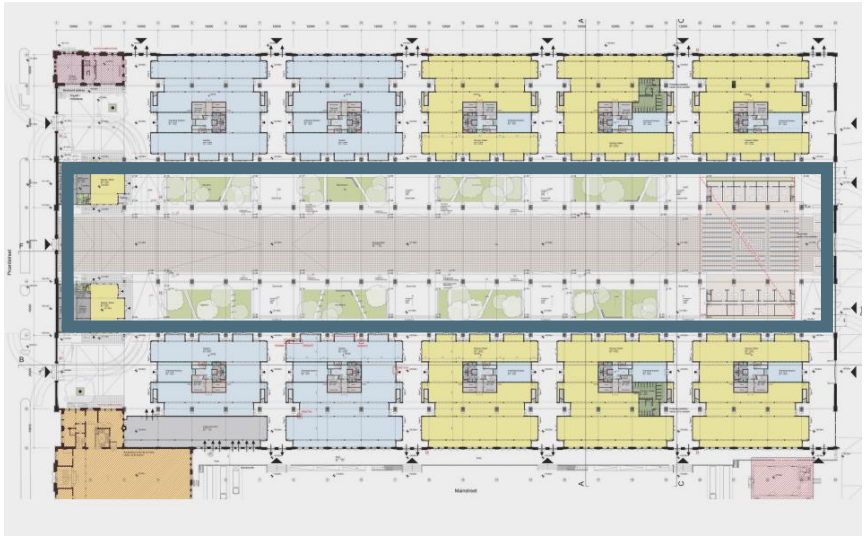
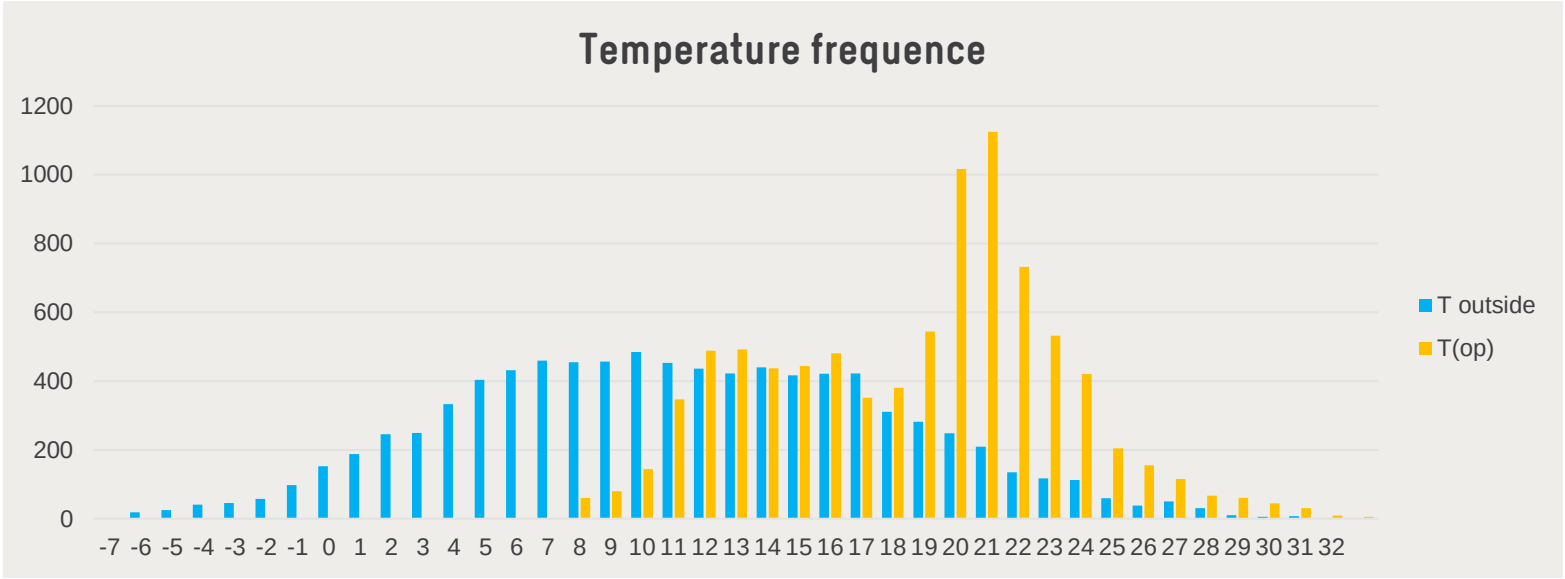
Design of In-Built Volumes

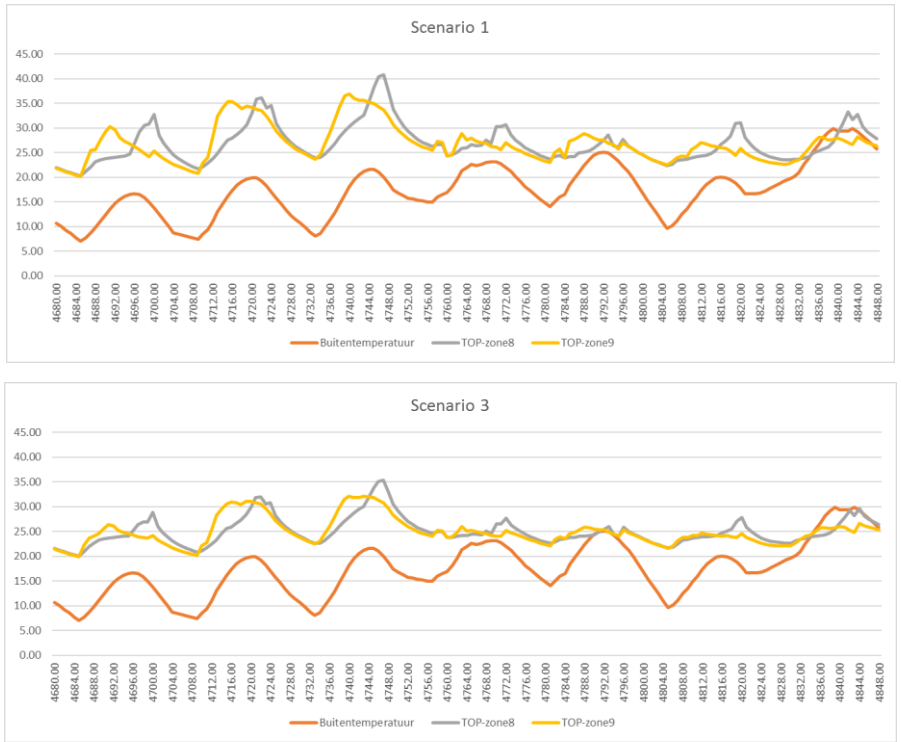


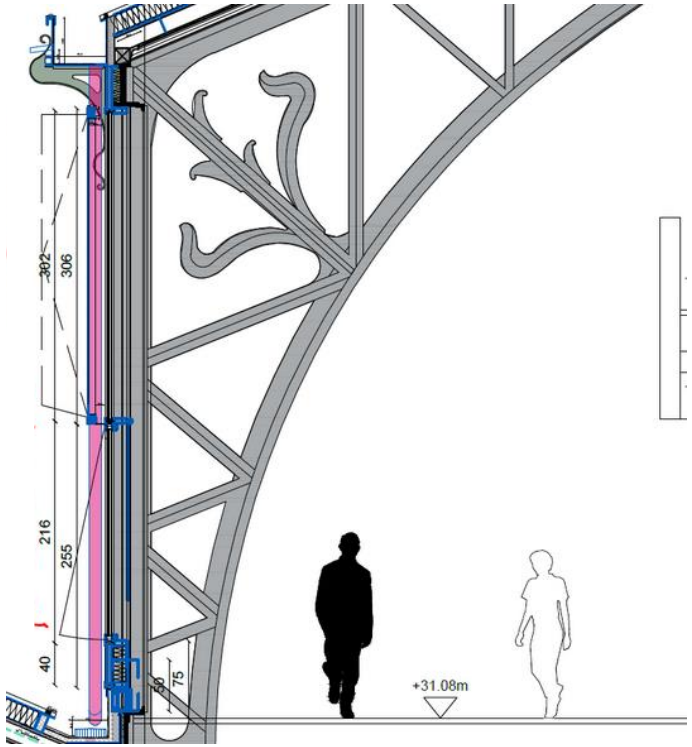


Design of In-Built Volumes

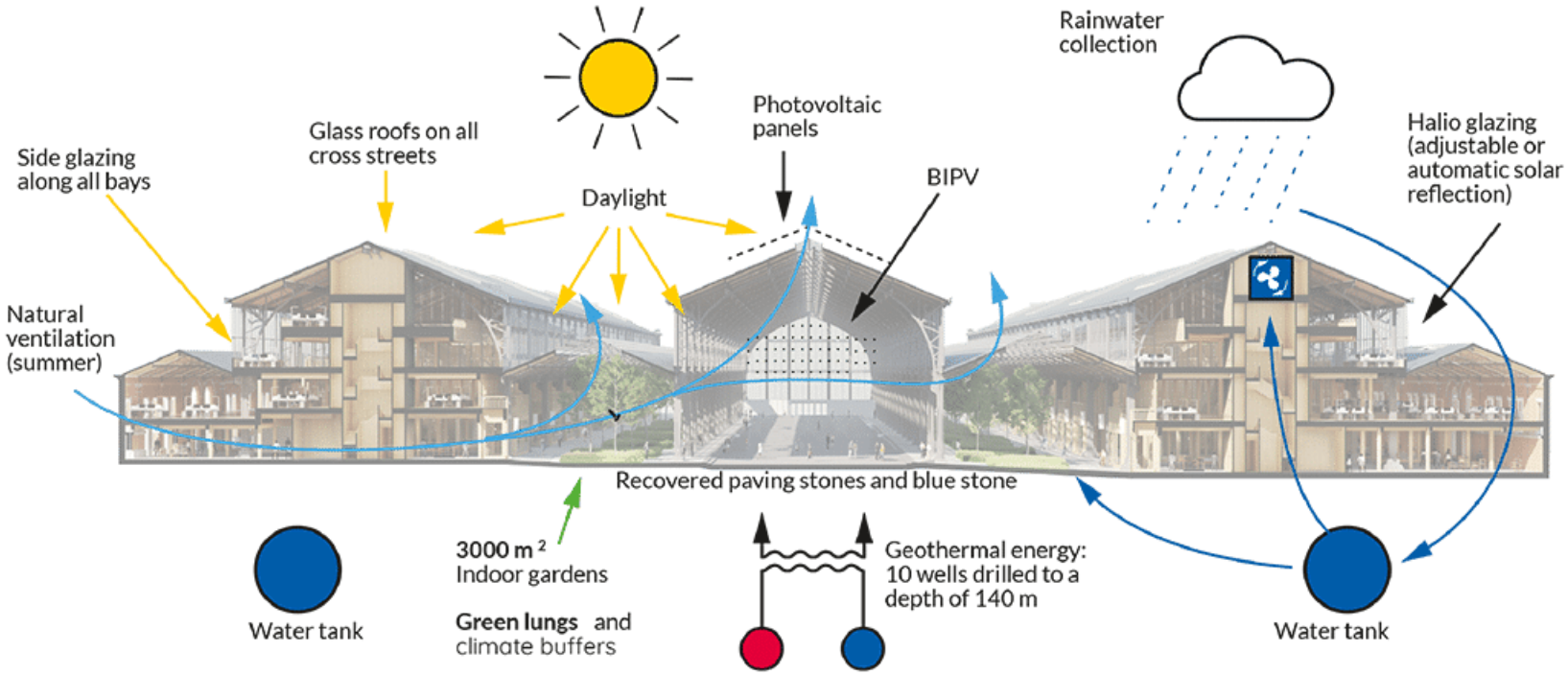
The connection of the built-in volumes up against the high window did however, present a risk of overheating. Solar radiation on the 6m high glazed facade is of course significant

Installation of external solar protection is necessary

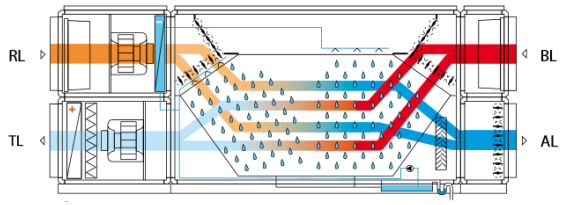


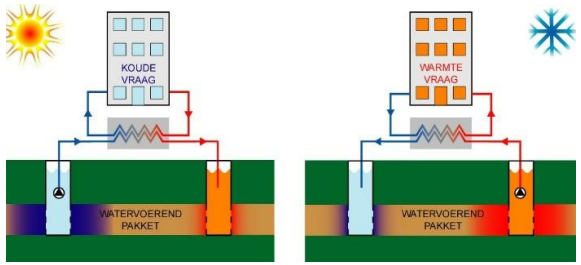


Overall Concept



Breeam Excellent





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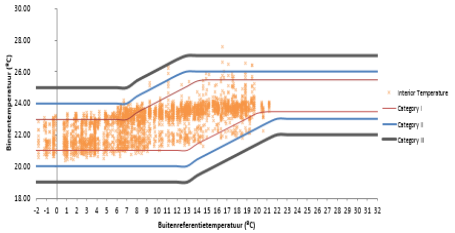
Reconciliation Energy vs Heritage?

Existing brick walls remain visible from both sides

Structural steel frontal side remain visible from both sides

Floor slab of the large hall – perimeter insulation

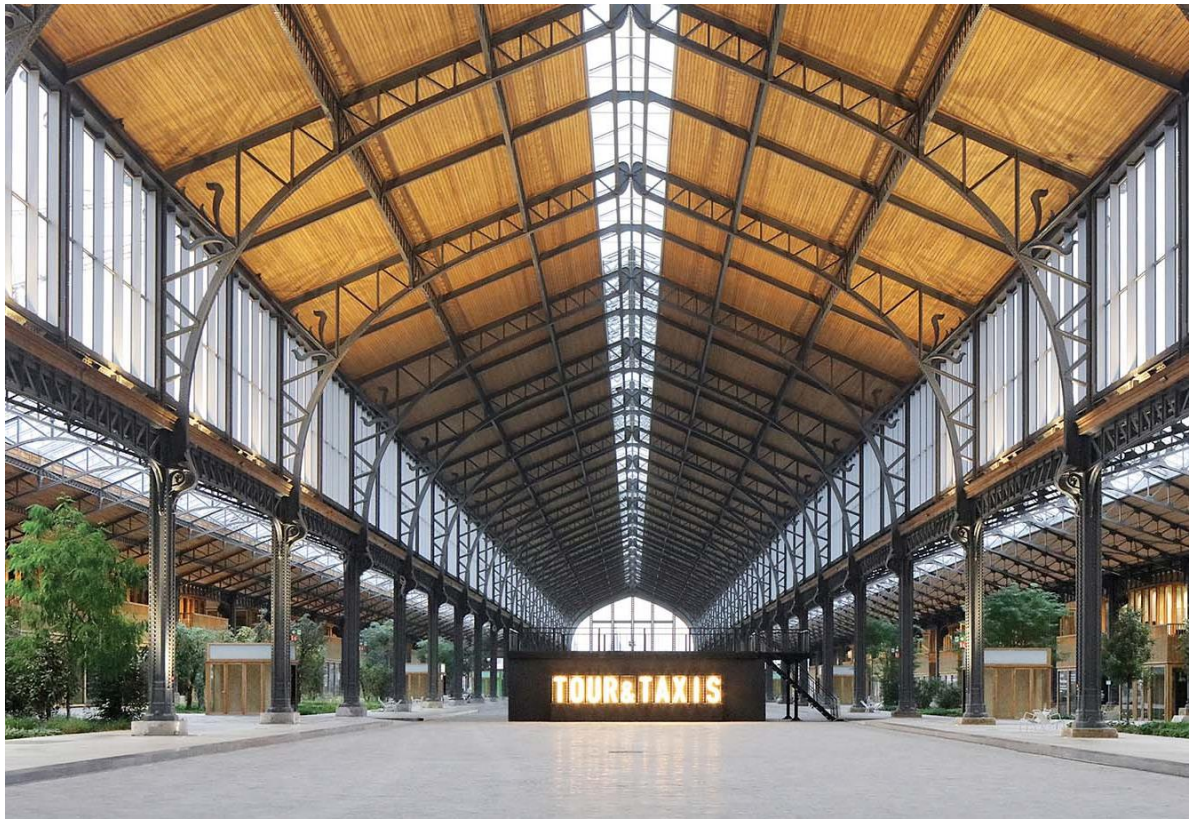


Comfort in the workspaces and retail optimally

BREEAM fully certified – Shell & Core Outstanding

In accordance with the stringent Brussels 2017 'passive' requirements

Positive energy building



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Transforming society together