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

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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**
Temperatures in the hall, period November - February

Consumptions for heating hall + boxes [MWh/year]

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

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

<table>
<thead>
<tr>
<th>A. Base case</th>
<th>B. Occupation in the hall (3)</th>
<th>C. Full occupation in the hall (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter(^{(1)})</td>
<td>Summer(^{(2)})</td>
<td>Winter</td>
</tr>
<tr>
<td>2</td>
<td>(f \geq 0.23)</td>
<td>(f \geq 0.28)</td>
</tr>
<tr>
<td>6</td>
<td>(f \geq 0.24)</td>
<td>(f \geq 0.28)</td>
</tr>
<tr>
<td>10</td>
<td>(f \geq 0.17)</td>
<td>(f \geq 0.29)</td>
</tr>
</tbody>
</table>

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

\[ f = 0.271 \]

Example Solution

\[ f = 0.762 > 0.7 \]

**U\_frame** = 2 W/m²K
(in all simulations)
Design of In-Built Volumes
Design of In-Built Volumes
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

- Side glazing along all bays
- Glass roofs on all cross streets
- Photovoltaic panels
- Daylight
- Rainwater collection
- Skylight glazing (adjustable or automatic solar reflection)
- Natural ventilation (summer)
- Recovered paving stones and blue stone

Water tank

3000 m² Indoor gardens
Green lungs and climate buffers
Geothermal energy: 10 wells drilled to a depth of 140 m

Water tank

BREEAM Excellent

© boydans engineering
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
Transforming society together