Ullevål hospital - Administration Building

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The administration building of Ullevål hospital was completed in 1924. The building has 4 storeys. There are about 160 employees in the building, occupied mainly office type work in the 120 cellular offices.

The building is situated in the centre of Oslo, with a busy road just in front of the building and a garden at the rear side.
Building presentation (2)

Building characteristics:
- All main building are of masonry or concrete constructions
- The building has a high thermal mass: exposed ceilings, heavy internal walls…
- No heat insulation (old building)
- Coupled windows (two panes of single glazing), which are old and leaky
- Manually controlled awnings and Venetian blinds for sun protection
- Generally large rooms, with room height of 3,3 m
Specific design issue

The building design is typical for its period (1920 to 30):

- Ventilation system - The building has a passive stack ventilation system, with vertical shafts from each office.

- Ventilation control - The occupants can not really control the ventilation. The ventilation openings of the passive stack system are not adjustable. (The occupants can only control the openable windows).

- Heating system - The heating system is based on hot water circulating in radiators below the windows

- Heating control - The occupants control the temperature individually by adjusting valves on the radiators.
The building concept (1...)

Passive stack ventilation

Air extract grilles are located high on back wall in each office.
The grilles are connected to vertical extract shafts in the walls.
The building concept (2)
Passive stack ventilation

Air supply

Remark: The air supplies have low noise attenuation
The indoor climate was monitored several offices in 1st and 3rd floor in a winter period (12 to 21 February) and a summer period (28.8 to 5.9.1997).
Winter monitoring (1...) measurements in office W2 (South)

The indoor temperature is mostly acceptable. It is sometimes too high (>25°C). This due to the control system of the radiator: ordinary valves instead of thermostatic valves.

The Indoor Air Quality is acceptable: the CO₂-concentrations are never higher than the limit of 1200 ppm.
Winter monitoring (2)

conclusions

- At first sight the ventilation rates seem to be adequate: the IAQ is acceptable.
- However,
  - People complain about draughts. This problem is due to the poor performance of the inlet openings.
  - Moreover, neither the inlet openings in the exterior walls, nor the extraction openings to the chimneys can be adjusted. Hence the ventilation is continuous. This causes unnecessary ventilation and ventilation losses when the offices are unoccupied.

- The energy use in the building is quite high (170 to 220 kWh/m² for room heating). This could be reduced by:
  - Placing a new temperature control system with thermostats
  - Placing new air tight windows
  - Placing radiators with modern heating elements
  - Placing controllable ventilation inlet openings (to reduce ventilation losses).
The indoor temperature is quite high (27°C): the room faces North and the maximum outdoor temperature is only 25°C.
Summer monitoring (2...) conclusions

Thermal comfort:
- The internal temperatures are too high. The offices on the South side of the building have particular overheating problems.

Ventilation:
- **The ventilation rate (4ACH) is much lower than in winter time. This is normal: the driving force, the temperature difference between outside and inside, is much lower.**
- Hence the IAQ is lower than in winter time: the CO$_2$-concentration often exceeds the limit of 1200 ppm. People complain about the IAQ in summertime.
- Moreover the air changes are certainly far too low to cool down the thermal mass of the building.
In order to reduce heat loads in summer and keep temperatures down a number of improvements could be made:

- Installation of new windows with automatic solar control

- Installation of new, energy efficient lighting equipment (i.e. HF neon tubes), possibly with automatic control for daylight compensation. Reducing the internal gains has a positive effect on the summer comfort.

- Increasing the ventilation. The thermal mass of the building can be cooled down by means of intensive ventilation. As the stack effect in summertime is too low, intensive ventilation could be introduced by installing an assisting extract fan. This fan could be switched on whenever Tint goes above a critical limit and Tint > Text.
The main conclusions from the monitoring programme are:

- The air flow rates are acceptable in winter: the IAQ is acceptable. However they can’t be decreased outside the office hours.
- The air flow rates in the summer are too low: the IAQ is no longer acceptable and the air flow rate are too low to cool down the building.
- The offices have problems with overheating in summer
- Air inlet grilles can cause draught and noise problems

The current ventilation system has shortcomings. Possible improvements:

- Install new grilles in the façades with filter and sound attenuation
- Install an assisting, central extract fan with ductwork in existing ducts to realise intensive ventilation during the summer
- Install new automatically controlled solar shading devices.
This building is one of very few large office buildings in Norway that is still is equipped with a traditional, Scandinavian, passive stack ventilation system. As such, the building is of interest to NATVENT.

Unfortunately, the building has technical shortcomings concerning inlet grilles, windows, heating system and general furnishing. The building in its present state is not ideal, this has been confirmed by the measurements and the questionnaire data.

However, it is of interest to see that the stack ventilation system can ensure a sufficient air flow rate during the heating season. Further, significant improvements to the ventilation of the building could be achieved simply by placing new advanced inlet grilles and an assisting extract fan system.
Find more information on the PROBE building in the following documents:

\Reports\Monitoring Reports\Summary Reports\no1summ.pdf
- global presentation of the buildings (±4p./building)
- contents: building description - ventilation strategy and technology - winter and summer monitoring results - conclusions

\Reports\Monitoring Reports\Detailed Reports\no1det.pdf
- detailed reports of all 19 monitoring campaigns (±20p./campaign)
- contents: monitoring set up - analysis of results - conclusions

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