Designing natural ventilation for thermal comfort in buildings

Energy Use In Buildings

Source: Baker and Steemers
HOUGHTON HALL

PASSIVE VENTILATION AND SOLAR CONTROL TECHNIQUES

Trickle vents
Concrete soffits

©Breathing Buildings
Building designed for outflow through stacks

Complex Spaces – Houghton Hall
Atrium peak temperatures follow exposure to sun.

Region near/within atrium hotter than desk area under exposed concrete → benefit of thermal mass.

Main floor temperatures less than outside and buffered by thermal mass… but still rather warm mid-July.
23 July - 14 August average temperatures

- Warm inside again in early August

15 August - 10 September average temperatures

- Cooler after mid-August
Survey Results

Can we improve performance?

23July-14Aug average temperatures

©Breathing Buildings
Time Lags

Range of time lag for building to reach max or min temp

Buffer for max temp 1-3 hours
Maximising Effectiveness of Thermal Mass

Air Flow Results

- Hot and still day (06/08/03)
- Fans are operating all day
- All windows open
Air Quality

Measurements show fresh air supply well in excess of minimum required

Night Time Operation

- Limited number of trickle vents open
1. Opportunity to use cool air from outside during night even more effectively to reduce building temperature

2. Reduce window openings during summer day to maximise benefit of thermal mass
Contact Theatre, Studio

Belvoir High School

**BB101 Standards**
- **120 hours** for which \( T_{room} > 28^\circ C \)
  - \( (T_{room})_{max} = 32^\circ C \)
  - \( (T_{room} - T_{external})_{max} = 5^\circ C \)

**Belvoir High School**
- **0 hours** for which \( T_{room} > 28^\circ C \)
  - \( (T_{room})_{max} = 27.5^\circ C \)
  - \( (T_{room} - T_{external})_{max} = 2.3^\circ C \)
**Internal Comfort**

**Priority School Building Programme**
Making sense of the new Priority School Output Specification from the Education Funding Agency. How is the output specification different from previous guidelines, how do the standard school designs meet the output specification and how Breathing Buildings can help you model the ventilation system energy use in IES.

**Hybrid Designs**
Summary

- Natural ventilation low energy
- Exposed thermal mass
- Fan driven ventilation not “free cooling”