natural ventilation in the real world
synopsis

- why bother
- design rules that count
- pushing the boundaries...but keep it simple
why bother

- reduced HVAC costs
  - Nat vented - 4.5 £/m² (HVAC)
  - Displacement - 150 £/m² (HVAC)
  - Fan coil - 250 £/m² (HVAC)

A reduced construction cost

- Displacement - 3%
- Fan coil - 5.5%
why bother

- reduced energy costs
  - Nat vented - 1.98 £/m²
  - Displacement - 2.34 £/m²
  - Fan coil - 3.06 £/m²

- reduced maintenance costs
  - Nat vented - 0.8 £/m² (HVAC)
  - Displacement - 6 £/m² (HVAC)
  - Fan coil - 7.5 £/m² (HVAC)
passive design

“A Coherent Sustainable Strategy”

whitbybird
added value

1: The initial capital cost of an office building
5: The cost in use of an office building
200: The value of the business done in over 20 yrs

From the Royal Academy of Engineering, 1999
**design rules that count**

- Increase internal design temperatures
  - Internal temps to exceed 25degC 5% annually.
    - Maximum heat gain of 65W/m²
  - Internal temps to exceed 28degC 1% annually.
    - Maximum heat gain of 78W/m²
design rules that count

- Reduce internal heat gains (difficult to achieve)
  - Reduce small power
    - Laptops 17Watts / PC 120Watts
  - Reduce lighting
    - Daylight Factor of 4 reduces lighting load by 35%
**design rules that count**

- Reduce solar loads (maintain daylight)
  - External Shading (couple with light shelving)
  - Then mid pane blinds (couple with light shelving)
  - Then solar control glass
  - Never internal blinds
design rules that count

- Increase opening areas
  - Maintain window restrictors
  - Achieve 5% (Part F) TFA openable area
  - Cross vent to stack
  - Then cross vent to openable window
  - Then single sided
design rules that count

- Suitable fenestration design
  - Windows high in room elevation
  - Trickle ventilators/night purge vents at high level
  - Simple operation
  - Cleaning with tilt and turn
  - High and low level openings to be kept maximum distance apart
design rules that count

- Exposed mass
  - First 25mm of slab contributes to 75% of heat transfer
  - Achieve 5% (Part F) TFA openable area
  - Cross vent to stack
  - Then cross vent to openable window
  - Then single sided
design rules that count

- Optimisation starting point
  - Glazing (Low-E)
    - North Façade 30%
    - South Façade 40% (shaded)
    - East/ West Façade 35% (shaded)
  - Shading system
    - South Façade Horizontal shading
    - East/West Façade vertical shading
  - Internal loads kept to 65 W/m²
  - Trickle vents and window openings to Part F and BS
  - Exposed soffits
    - Acoustic treatment to 25% of surface area
  - Indoor air quality
    - CO₂ levels below 1500 ppm in winter without heat recovery
design rules that count

- Who owns the perimeter zones? This affects operation of windows and blinds, sense of occupant control and connectivity with outside world
- Ensure that there is no conflict between operation of blinds and windows to avoid physical clashes and obstructions to air flow
- Is security an issue? This affects night cooling strategy
- Is privacy an issue? This determines degree of cellularisation and operation of blinds
- Is noise transfer an issue? Consider acoustic absorption, partial partitions and sound-reflecting window configurations
- How will airtightness be achieved in practice?
- Indoor air quality – what fresh air rates are we talking about
Keep it simple
Edinburgh schools - transform
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bed zed

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Eastgate - Zimbabwe