

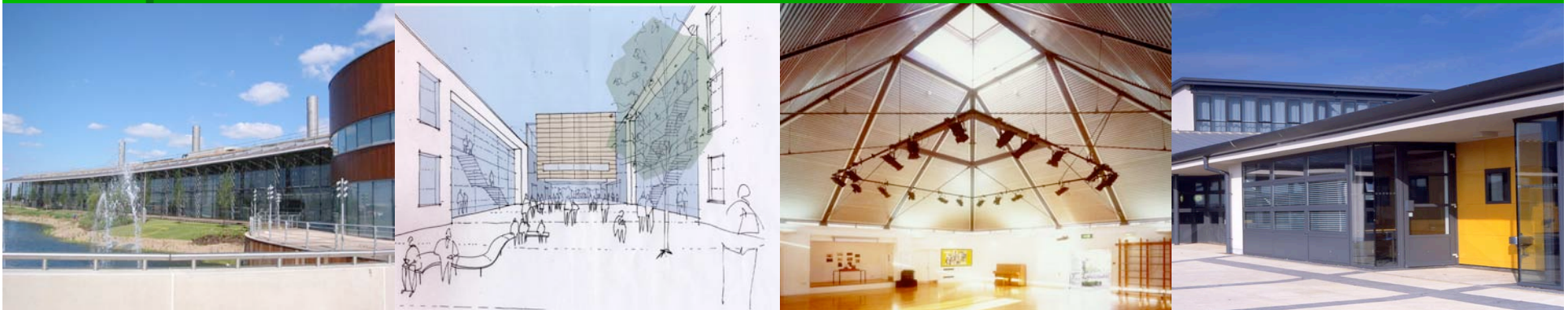
natural ventilation in the real world



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synopsis

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



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why bother

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

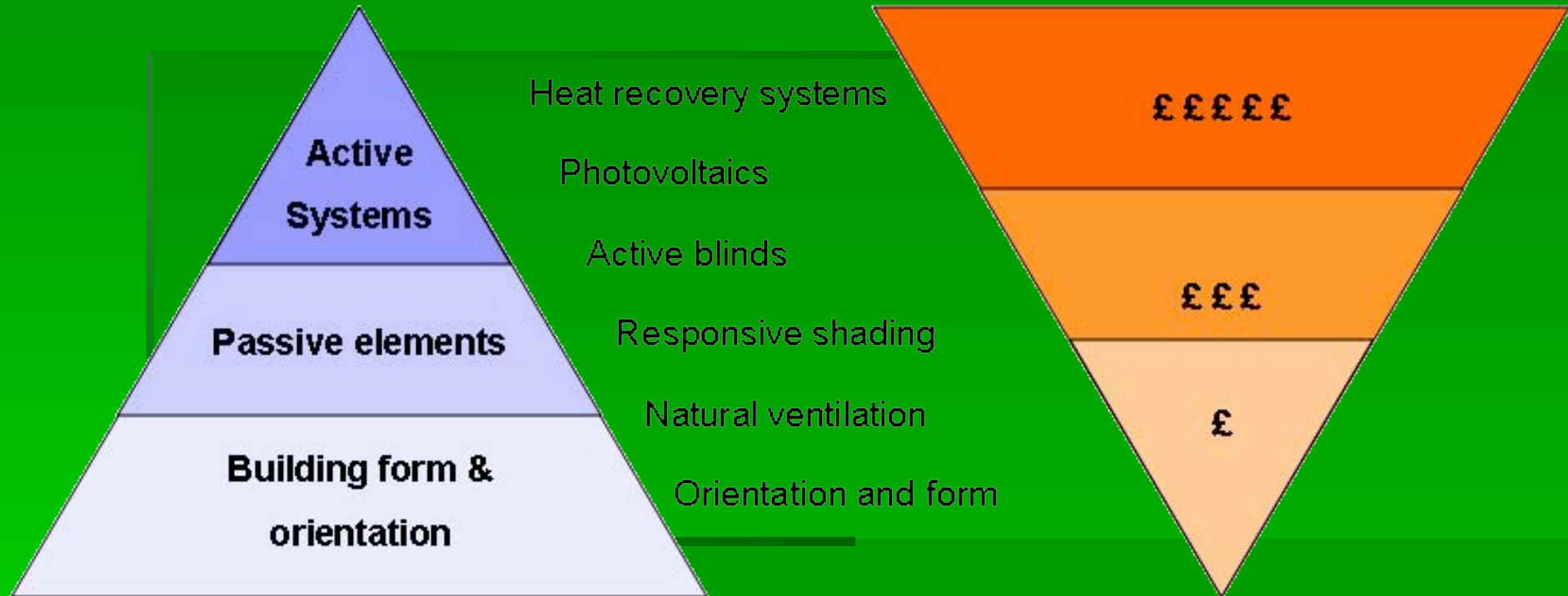
A reduced construction cost

- 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”

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

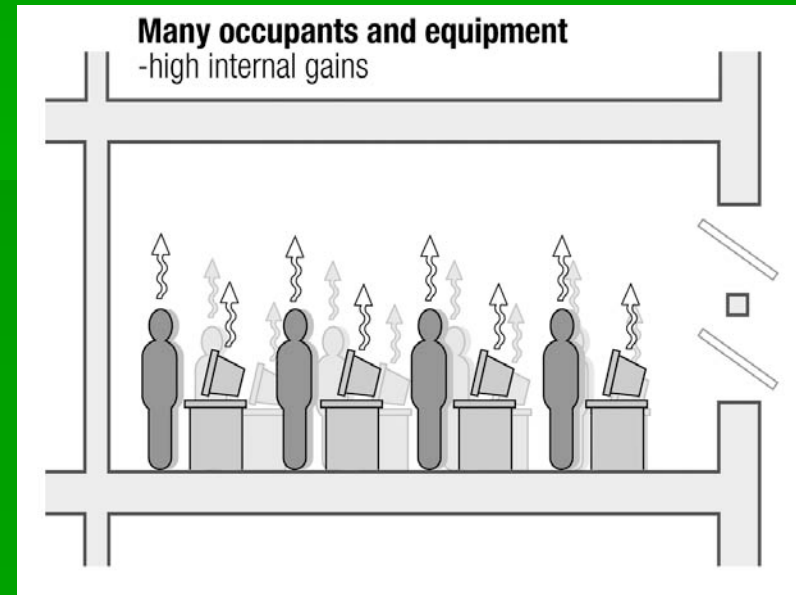
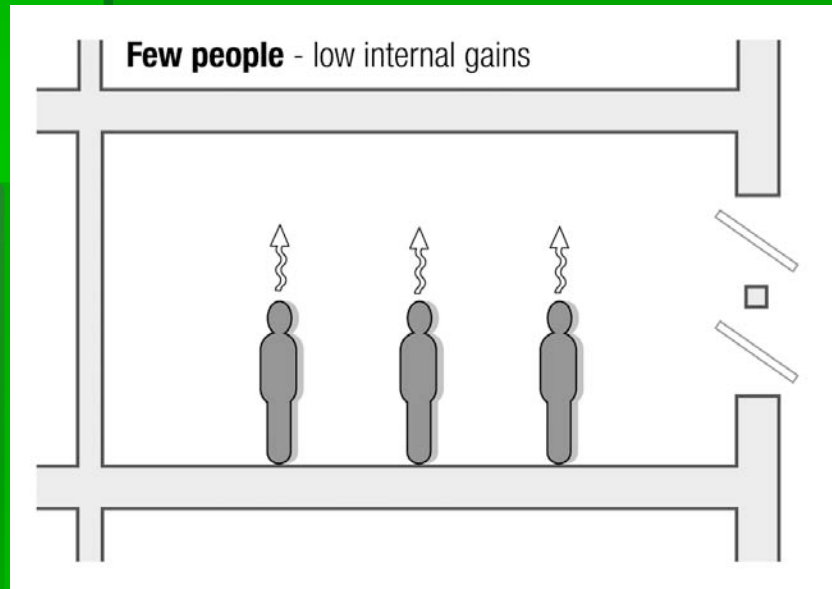
From the Royal Academy of Engineering, 1999

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

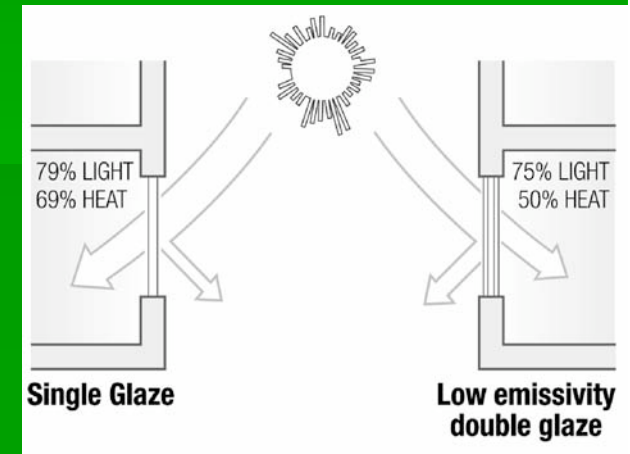
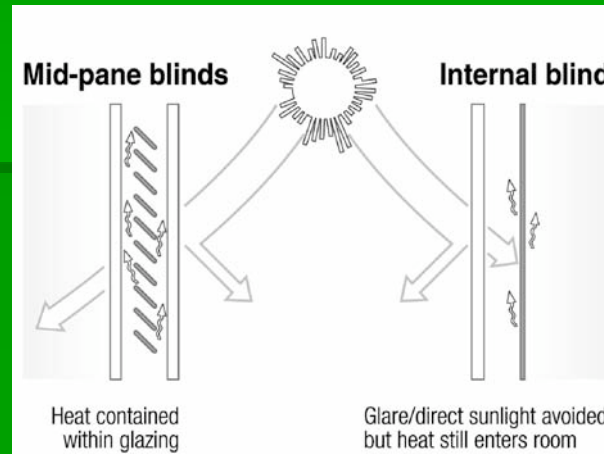
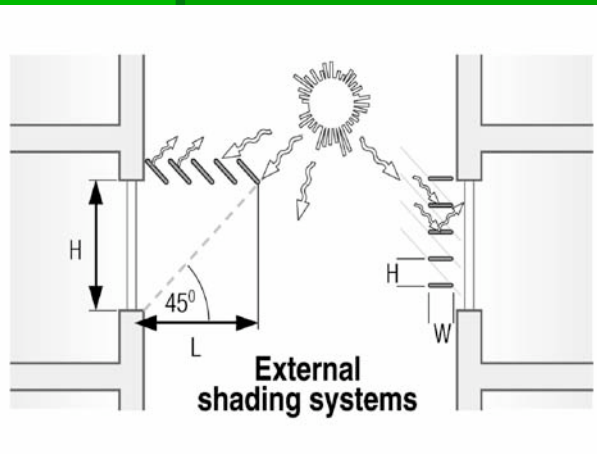
design rules that count

- 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%



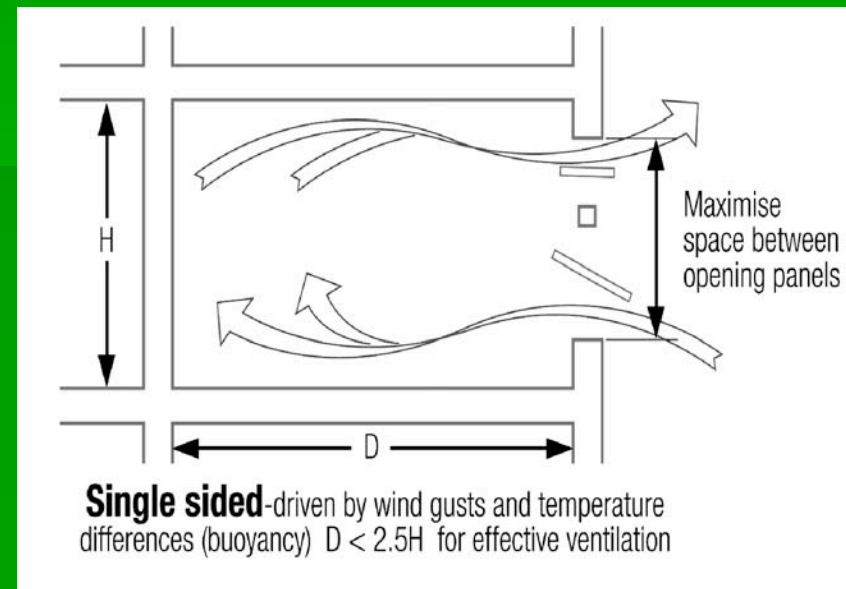
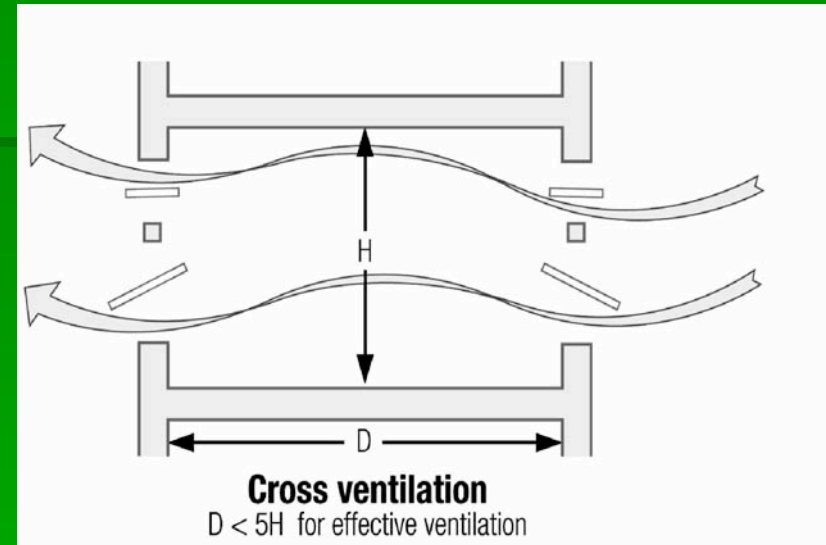
design rules that count

- 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



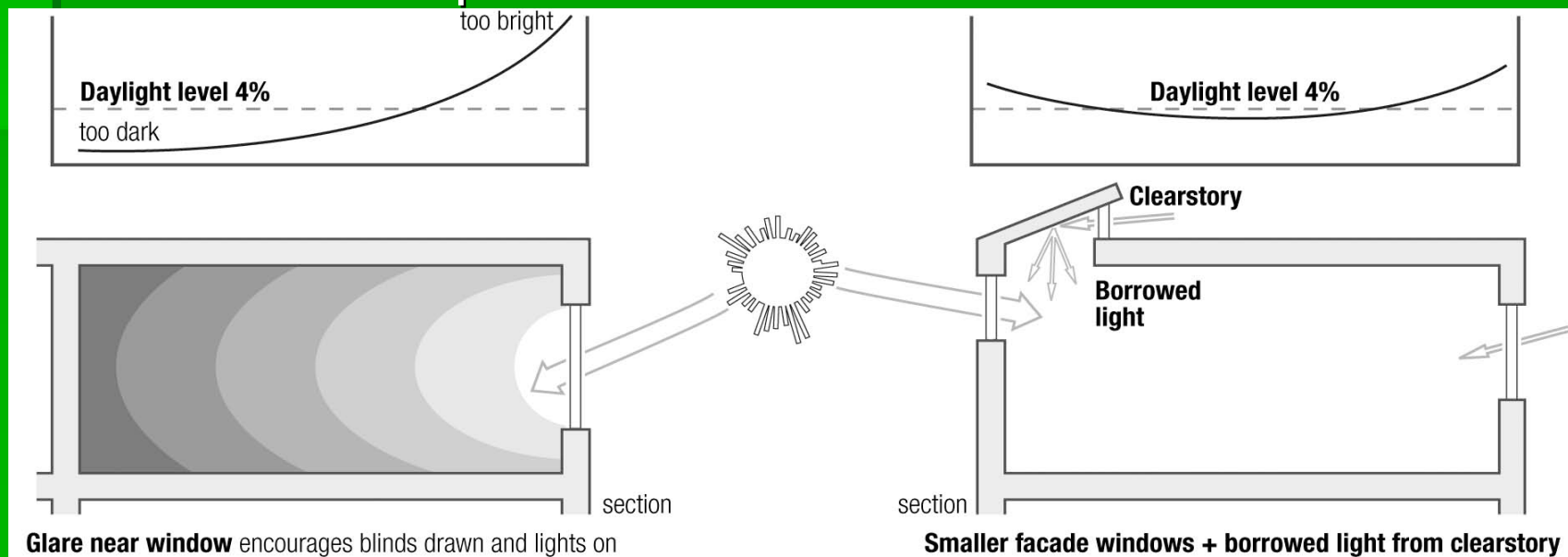
design rules that count

- 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



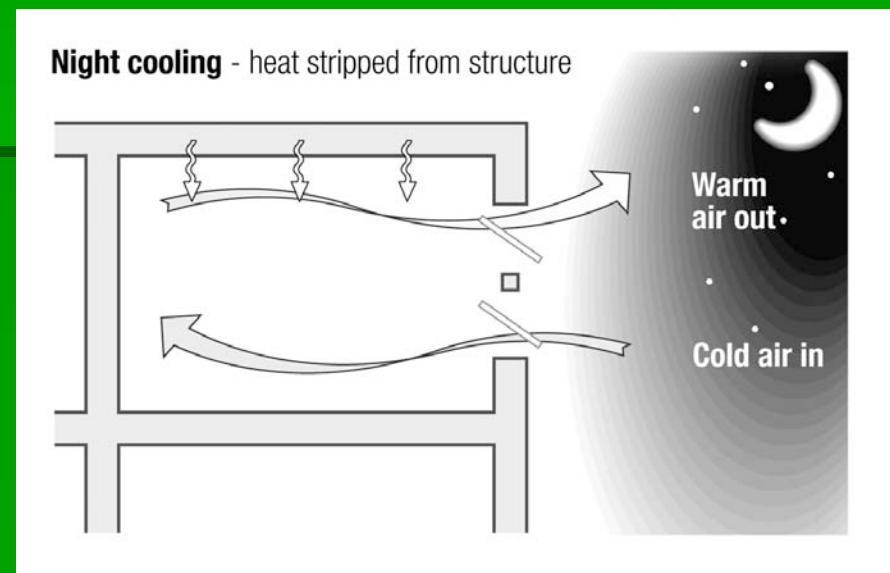
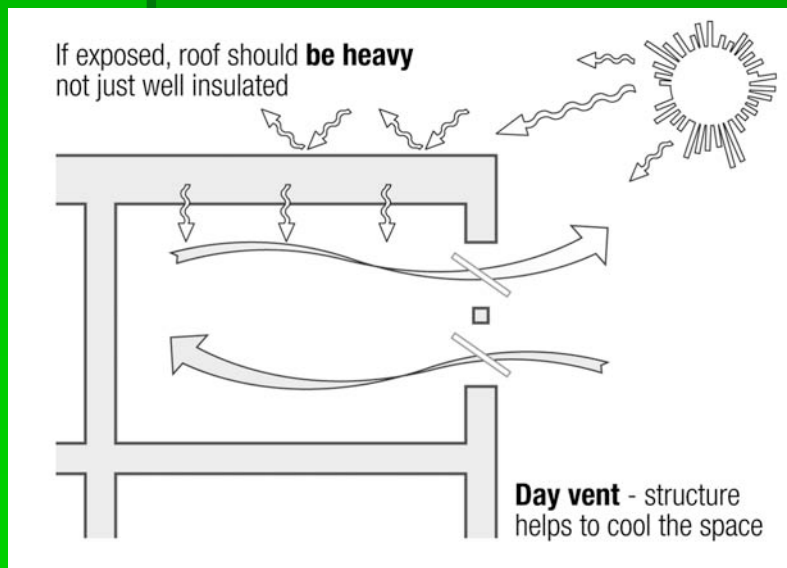
design rules that count

- 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



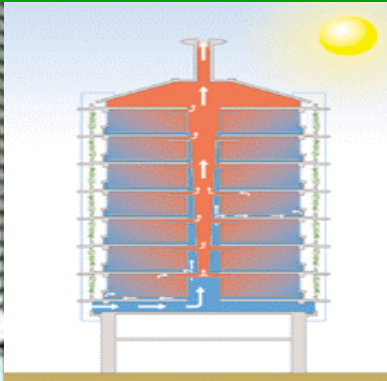
design rules that count

- 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 1500ppm in winter without heat recovery

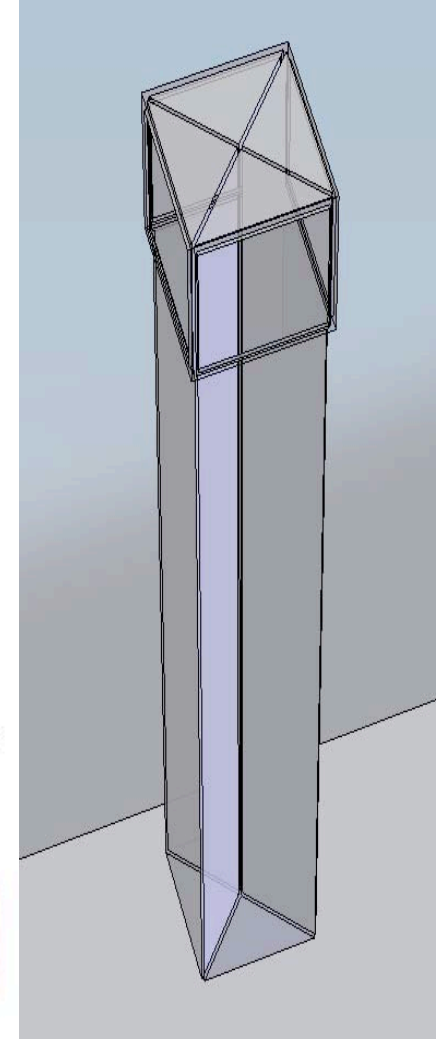
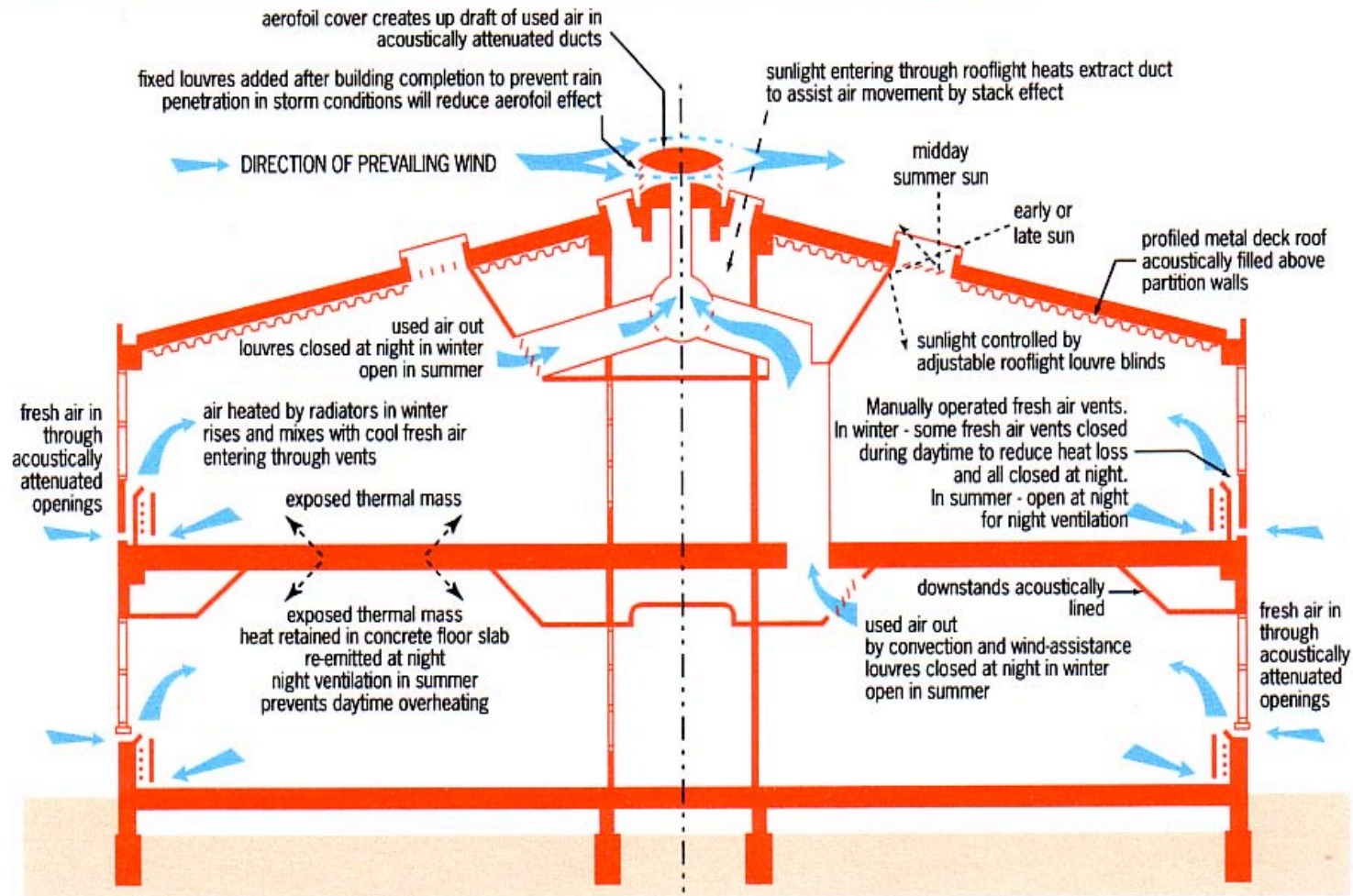
design rules that count

- **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**

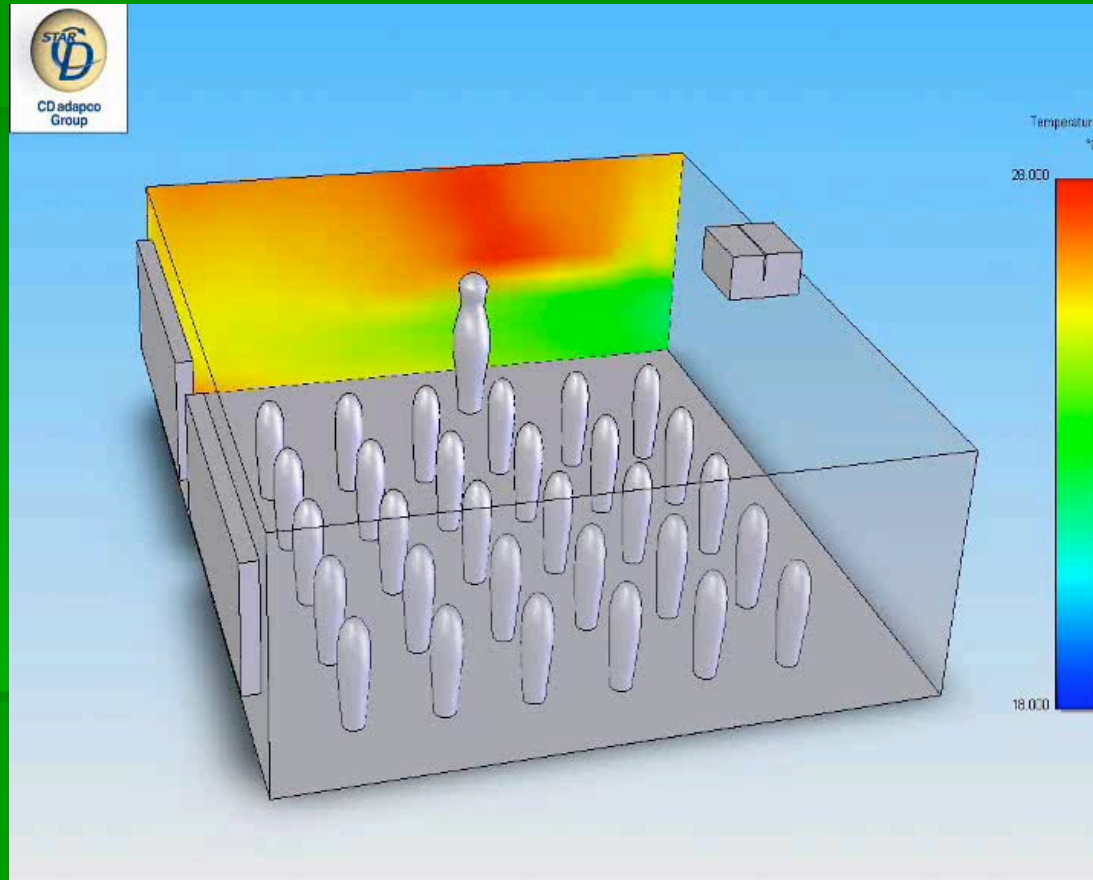
Keep it simple



Edinburgh schools - transform

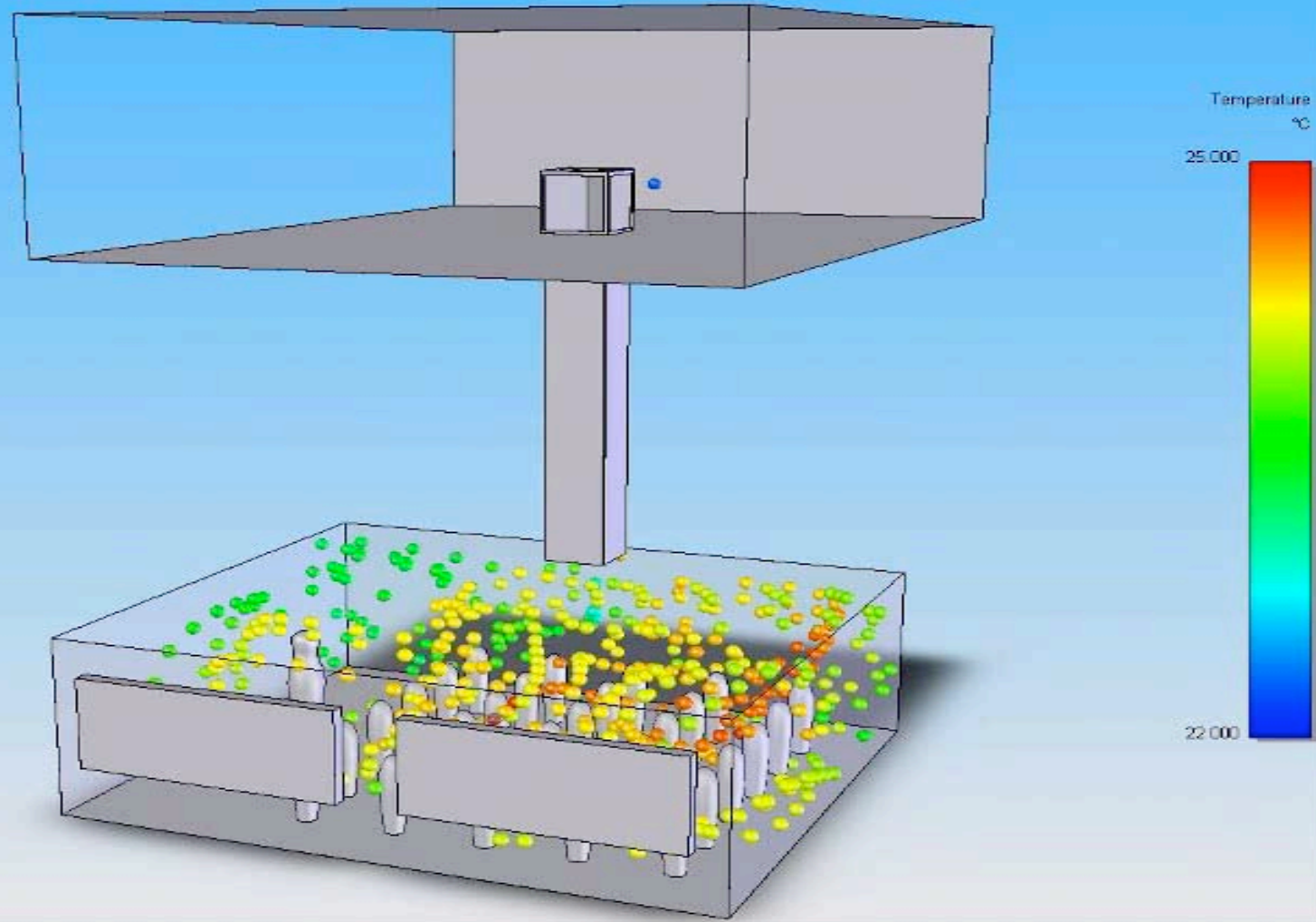


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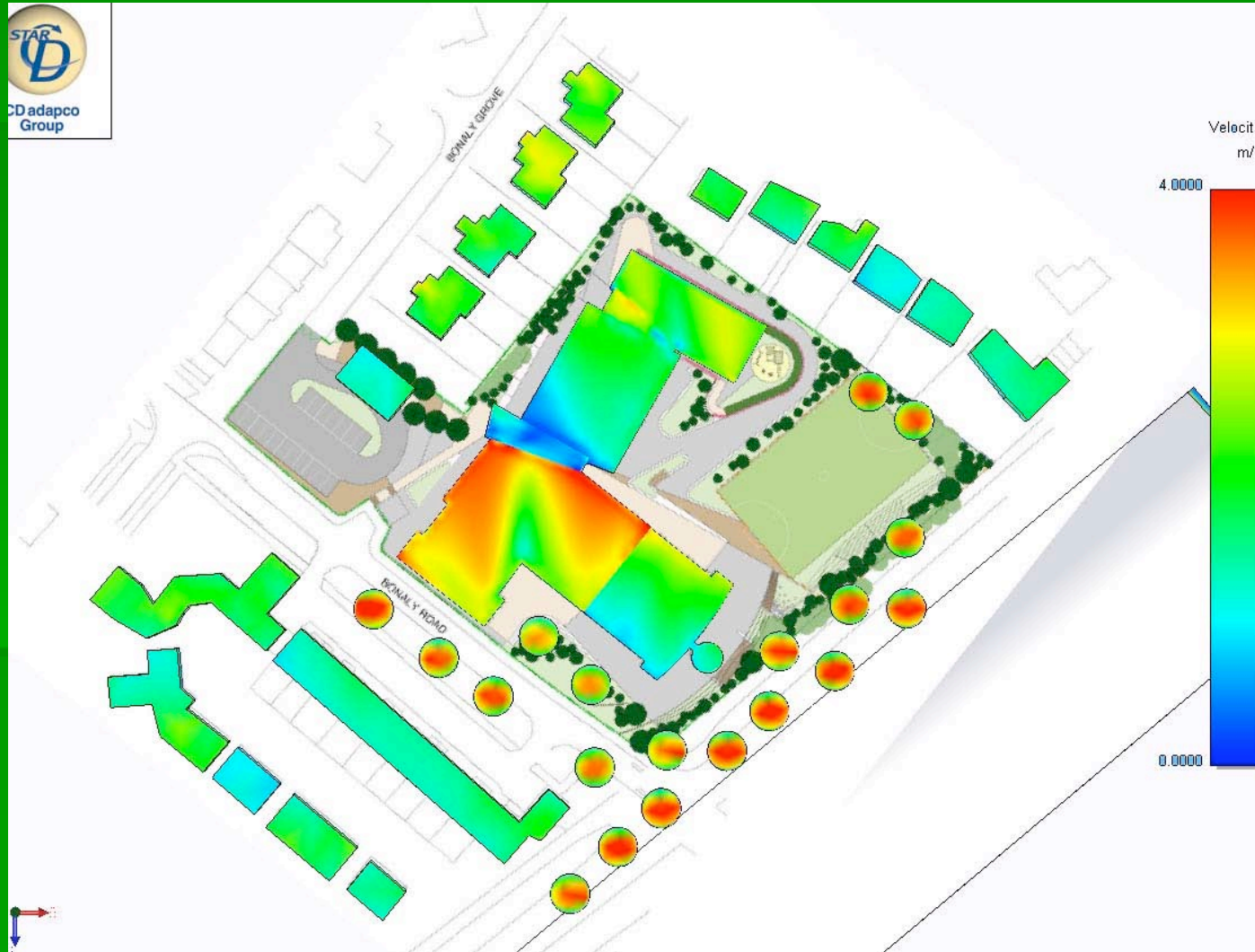
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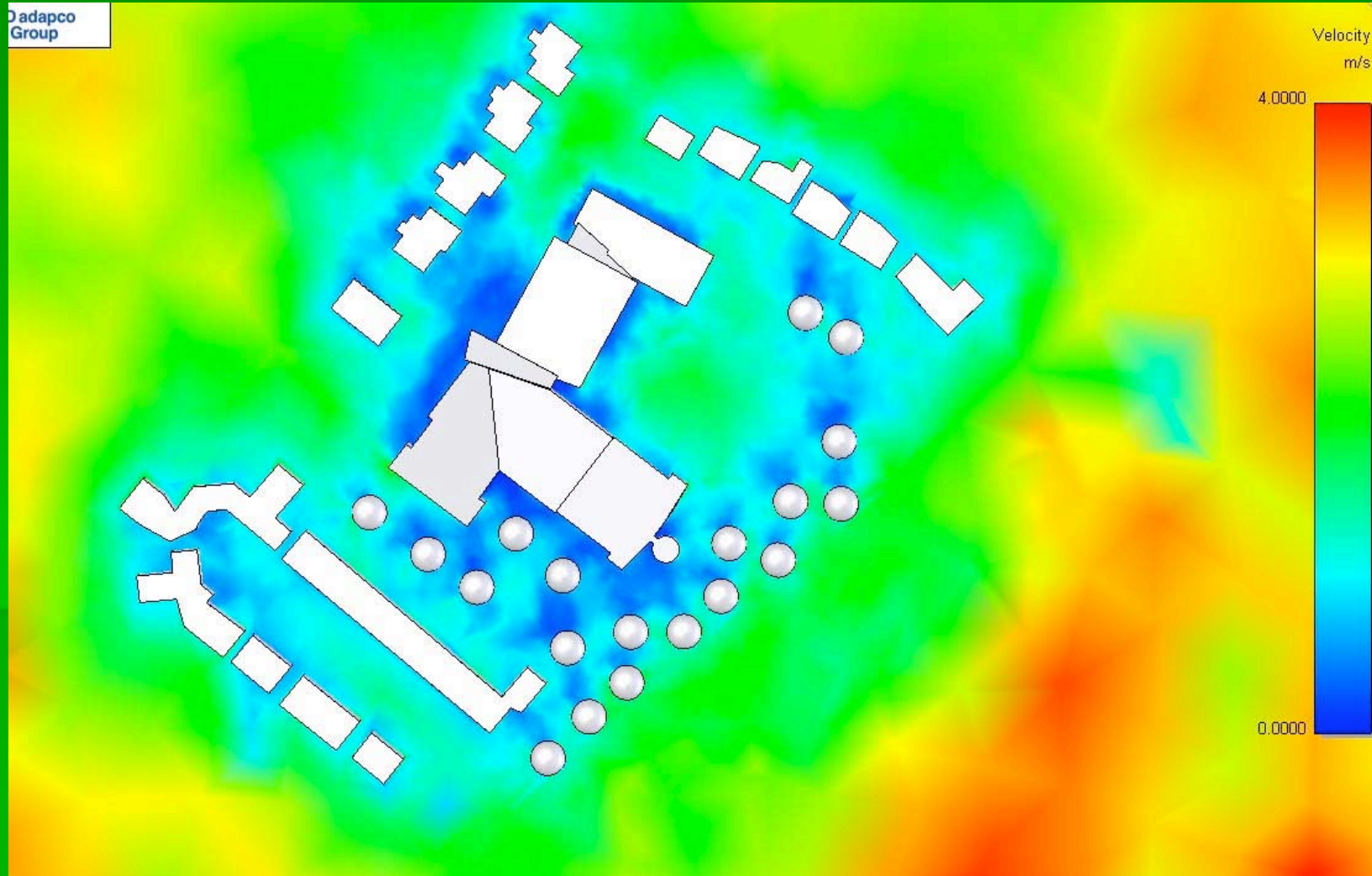
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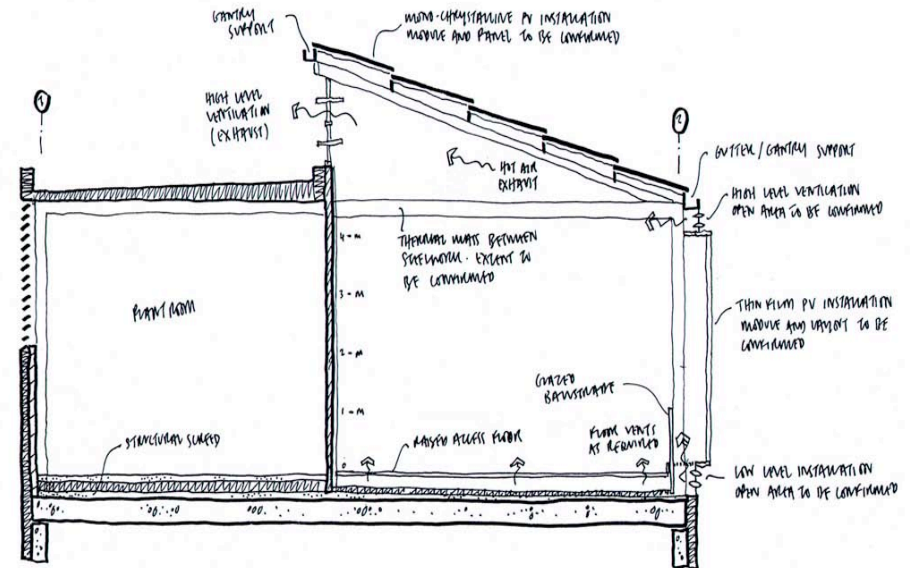
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Edinburgh schools - transform



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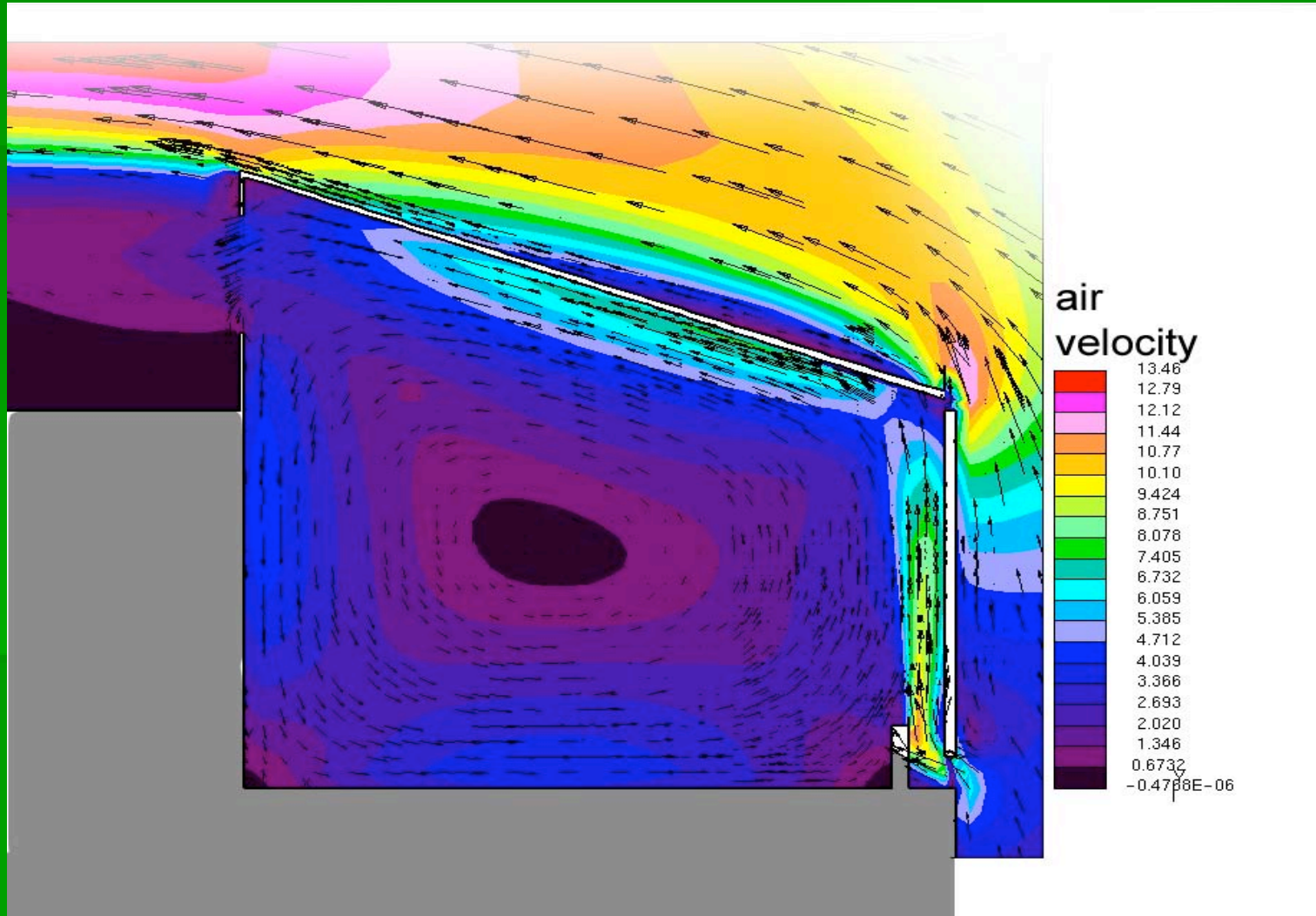
Zicer - UEA



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Zicer - UEA

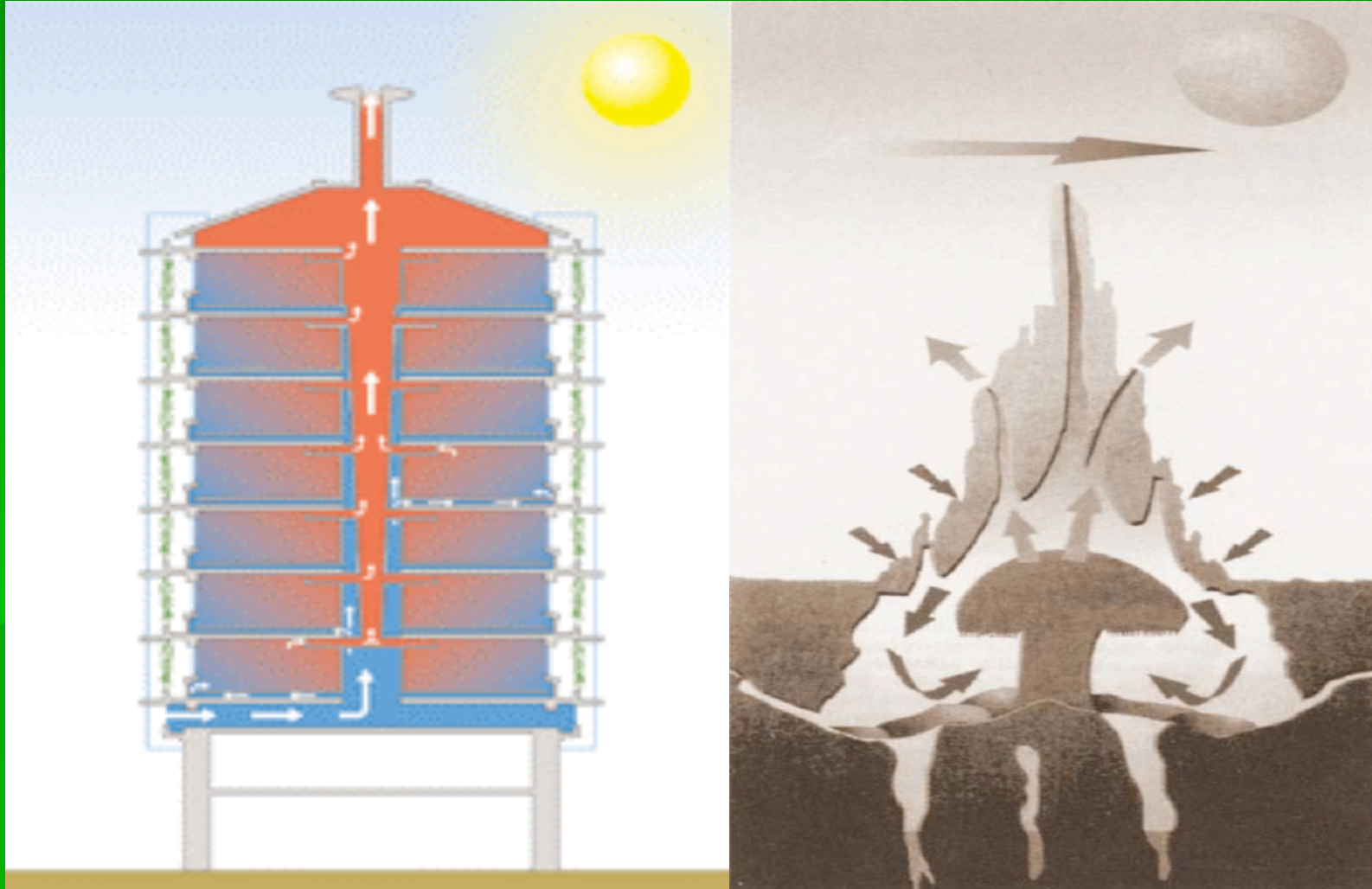


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Eastgate - Zimbabwe



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