

Welcome

International workshop on Resilient Hospital Design

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Research at Brunel

Our research is focused around Brunel's interdisciplinary research institutes, university research centres and departmental research groups.

Our Research Institutes are:

[Institute of Communities and Society](#)

[Institute of Digital Futures](#)

[Institute of Health, Medicine and Environments](#)

[Institute of Materials and Manufacturing](#)

[Institute of Energy Futures](#)

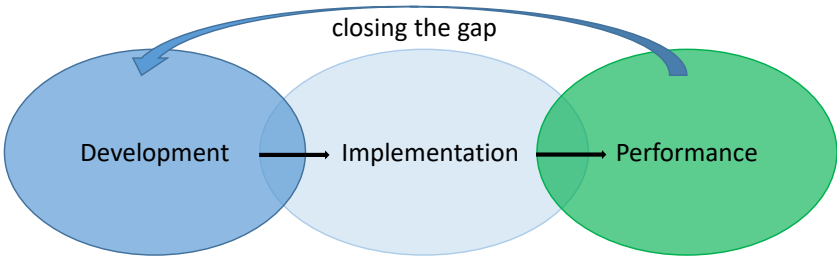
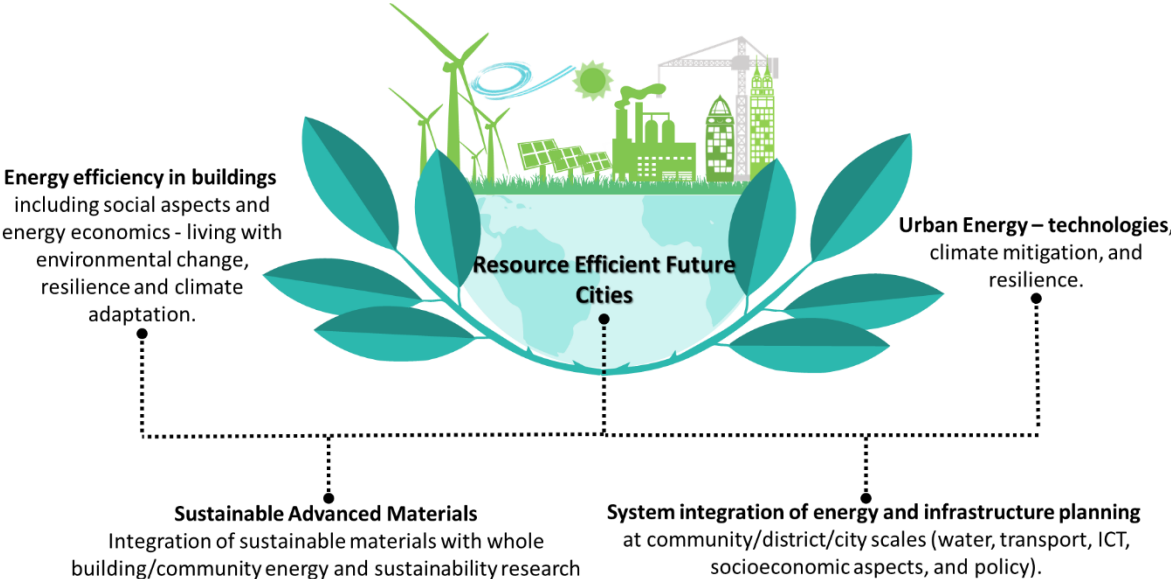
Resource Efficient Future Cities - REFC

REFC University Research Centre is within the Institute of Energy Futures (IEF).

IEF brings together researchers from a range of disciplines to investigate and develop innovative energy efficient technologies and processes to address societal needs and greenhouse gas emissions targets whilst taking into consideration the influence of human behaviour.

REFC's research activities are within the 'Resource efficiency & resilience' and 'sustainable Infrastructure' priority areas which fits to Brunel's 'Sustainability' Strategic Challenge area and the Government's 'Clean Growth' Grand Challenge.

REFC Research areas



BUILDING

ENERGY

Air
Quality

Visual
Comfort

Thermal
Comfort

Acoustical
Comfort

USERS

INSTALLATIONS



Ventilation is an important aspect of environmental quality in buildings with increased importance because of COVID19

Why measure ventilation?

Measurements during commissioning to:

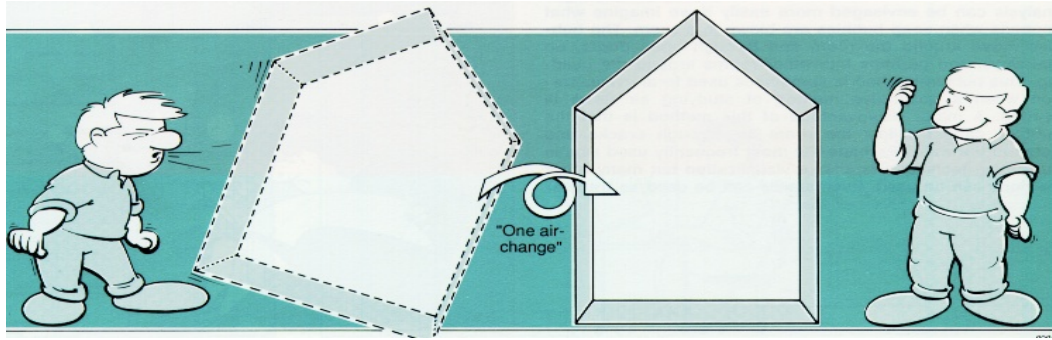
- > check the correct operation of the new system
- > set controls and dampers
- > locate faults

Post-occupancy measurements to detect to:

- > detect possible malfunctions
- > to relate reported problems to ventilation or not

What parameters to measure

- Air change rate - a measure of the bulk movement of air into and out of a space

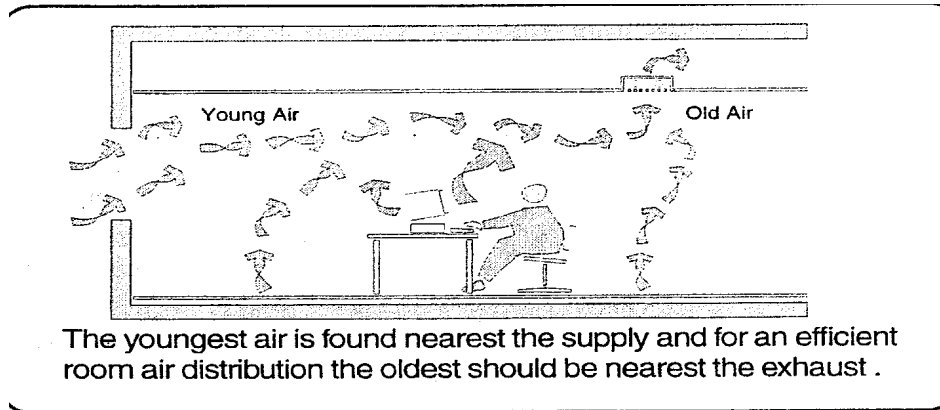


- Multi-zone air flows - a measure of air travelling from room to room
- Air leakage characteristics
 - > of a building
 - > of a ventilation system

How to characterise the ventilation of a single space

Ventilation effectiveness - the fraction of fresh delivered air that reaches the occupied zone (ideally 100%)- measured by

- > Ventilation efficiency $E=C_e/C_i$
- > Age of air - the amount of time air has been in the space



Ventilation measurement methods

Tracer Gas Methods

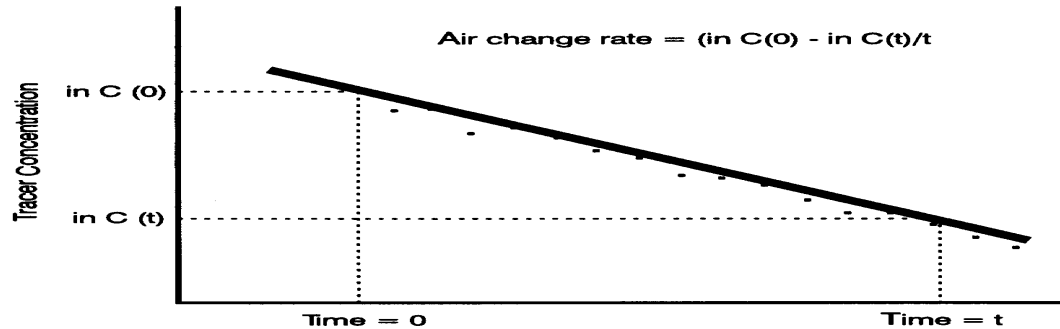
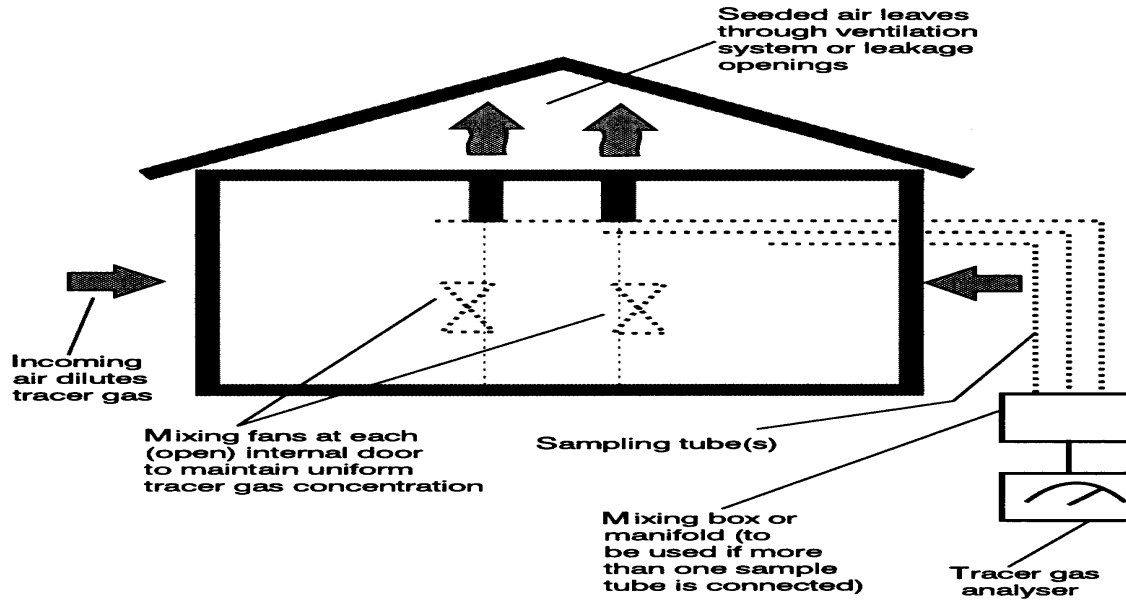
- > Decay
- > Constant concentration
- > Constant emission

Pressurisation Methods

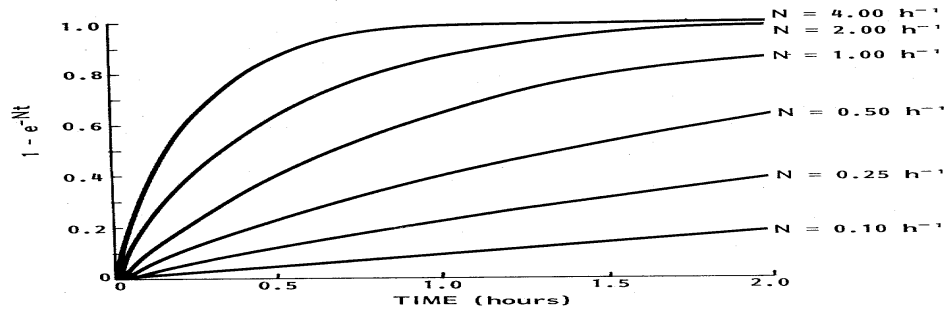
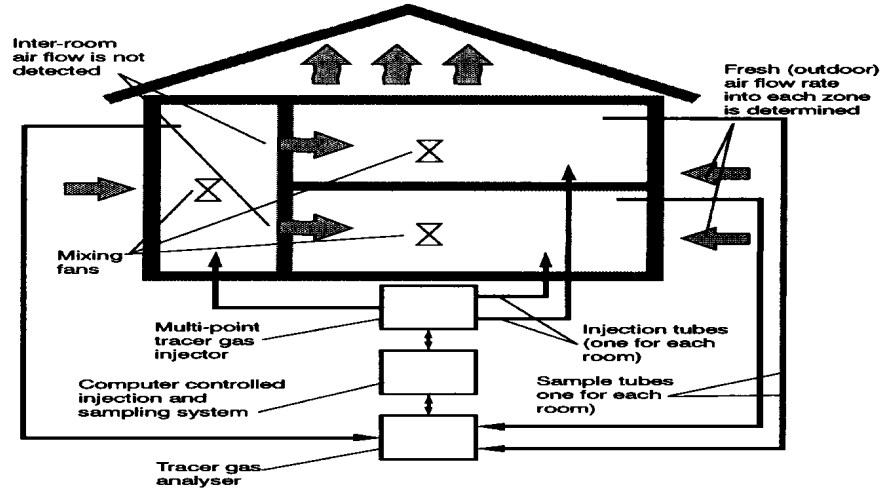
Component Air-tightness Testing

Flow Visualisation usually using smoke

Decay method



Constant emission method



Estimating air change rate from occupants' metabolic CO₂ emissions

ASHRAE Standard 62

Using a simple mass balance equation

$$V_o = \frac{N \times P}{C_s - C_o}$$

V_o is the outdoor air flow rate in L/s

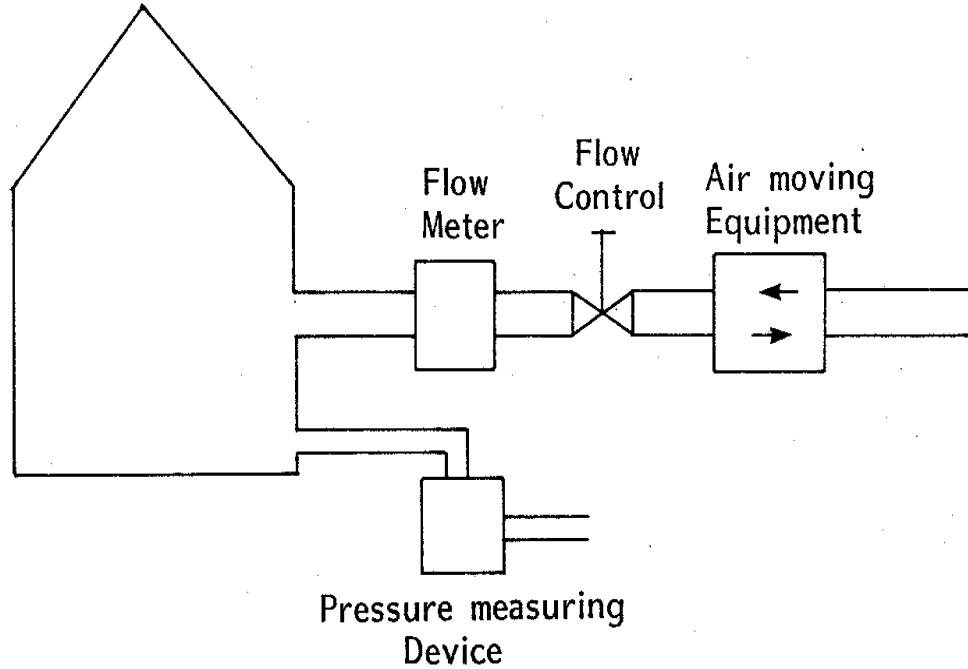
N =CO₂ generation rate per person in L/s

P = number of people in the space

C_s =CO₂ concentration in space in ppp (parts per parts of air)

C_o =CO₂ concentration in outdoor air in ppp

Air permeability: Pressurisation tests





Once again, I welcome you to today's international workshop and looking forward to the presentations

Next Dr Kangkang Tang will introduce some work on the topic of this workshop 'Resilient Hospital Design'