HBF Technical Conference

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Lessons from Stamford Brook:

Achieving air permeability below 3m³/(h.m²) @ 50Pa

leeds metropolitan university

STAMFORD BROOK

THE NATIONAL TRUST

Bryant Homes

REDROW

Department for Communities and Local Government

UCL

constructionskills

NHBC

CONCRETE BLOCK ASSOCIATION

Vent-Axia

leeds metropolitan university

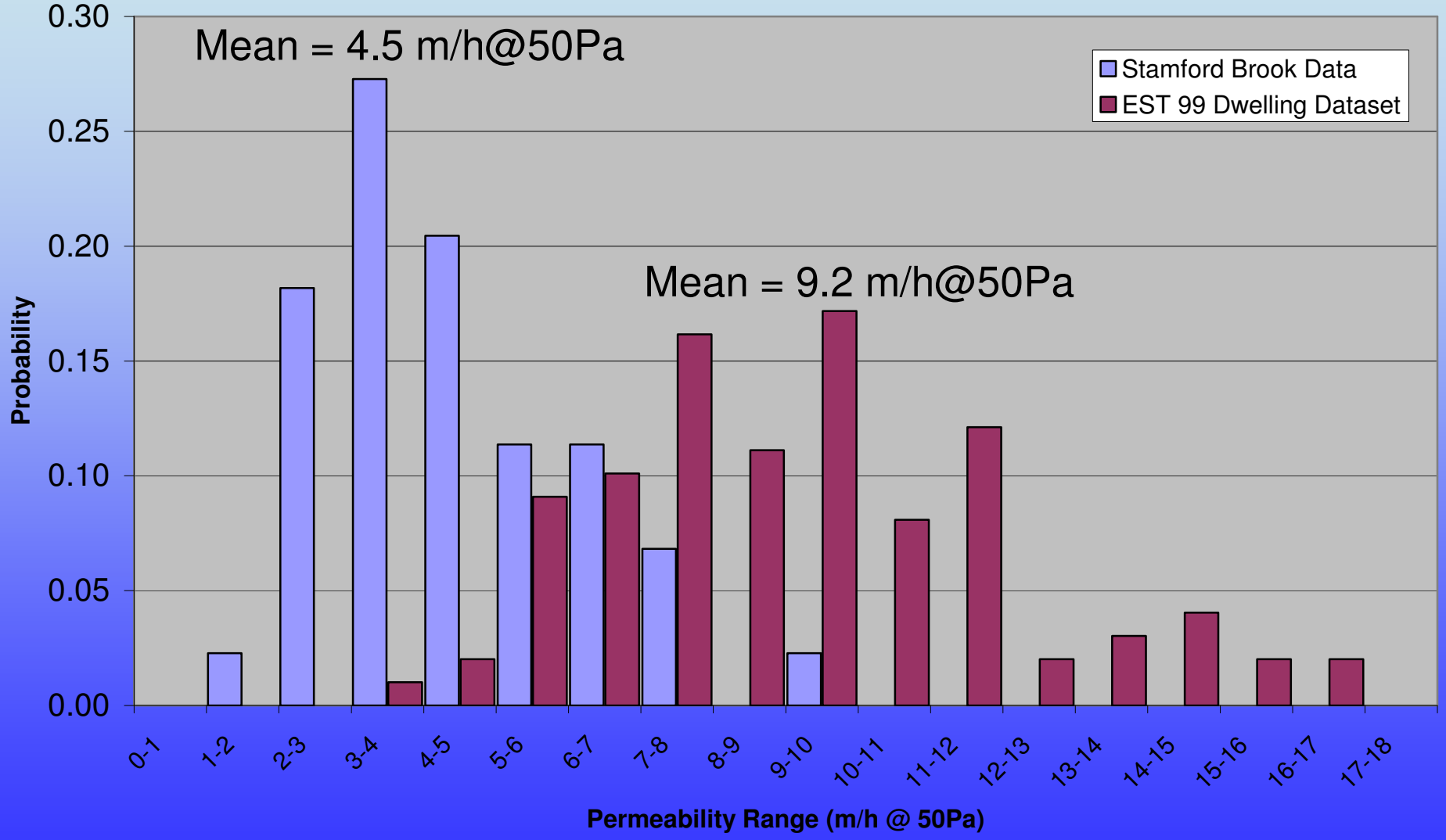
Air Permeability

- Basics
  - What is it ?
  - Why is important ?
  - What and where is the air barrier ?
  - What is the target ?
  - How is this to be achieved ?
- Simple questions
  - Need to be asked at every stage of the construction process

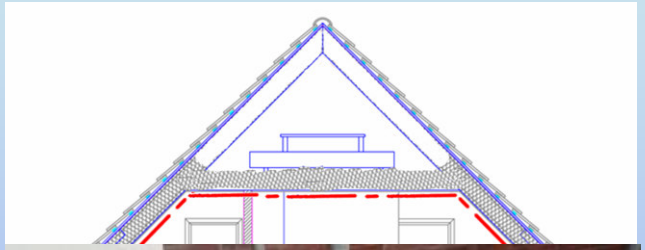
Target

- EPS08 (Lowe & Bell, 2001)
  - St Nicholas Court pilot
  - Target 5 $m^3/(h.m^2)$ @ 50 Pa
- Starting point
  - EST 99 dwellings – mean 9.2
  - L2 project – Phase 1 mean 12.84 (masonry houses only)
    10.63 (masonry houses & flats)
    Phase 3 mean 7.88 (masonry houses only)
    7.31 (masonry houses & flats)
- Is the target achievable ?

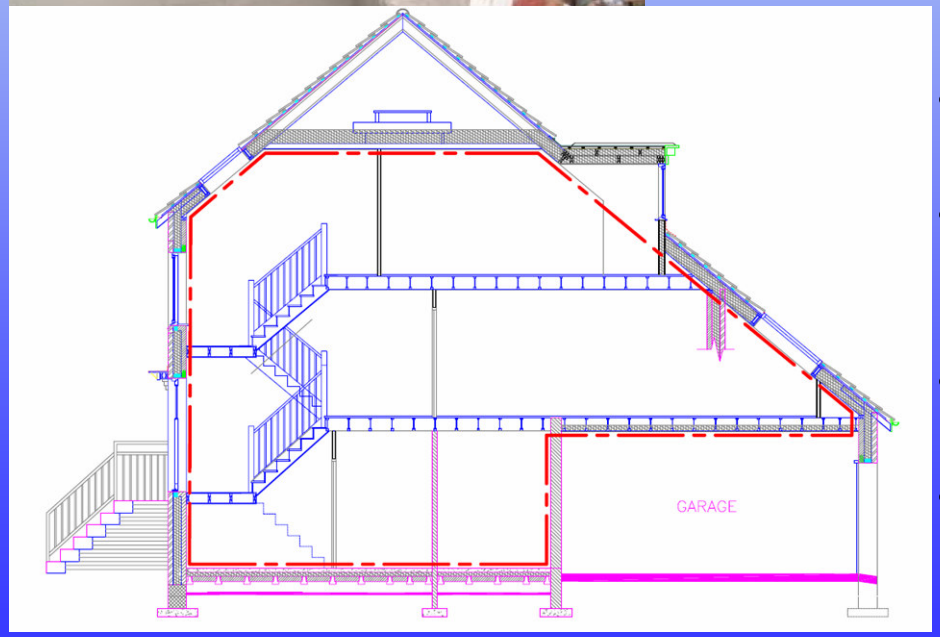
Results


Mean = 4.5 m/h@50Pa
Mean = 9.2 m/h@50Pa
Stamford Brook Data
EST 99 Dwelling Dataset
Probability
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0-1
1-2
2-3
3-4
4-5
5-6
6-7
7-8
8-9
9-10
10-11
11-12
12-13
13-14
14-15
15-16
16-17
17-18
Permeability Range (m/h @ 50Pa)

Primary Air Barrier

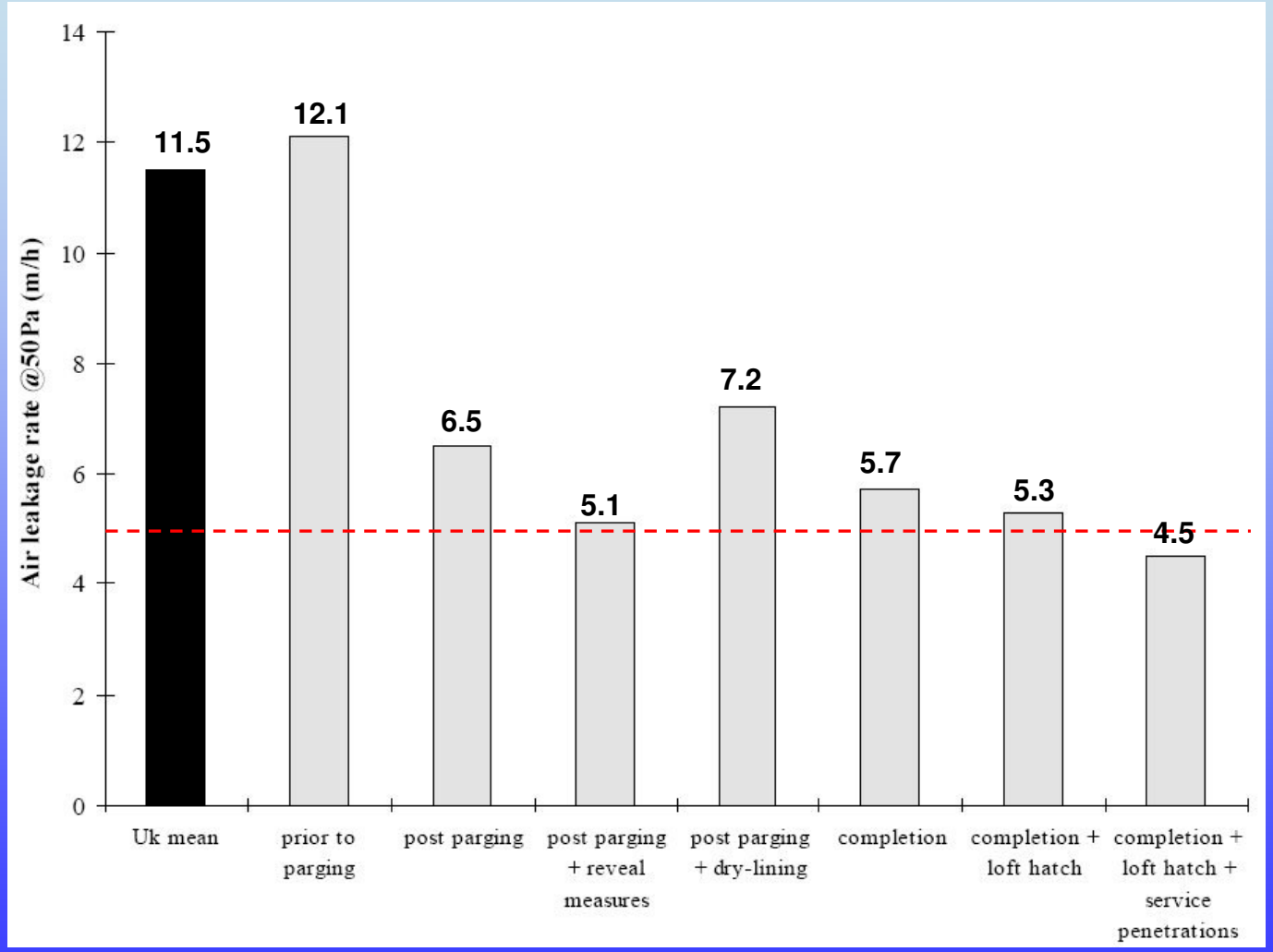


- Floor – concrete/screed
- Ceiling – plasterboard
- Walls – parging layer



- Specify location of primary air barrier at design stage
- Ensure primary air barrier is continuous around external envelope (pen-on-section test)
- Minimise penetrations though primary air barrier
- Avoid secondary sealing - it is difficult to achieve, costly and generally ineffective

Parging Trial - 2003

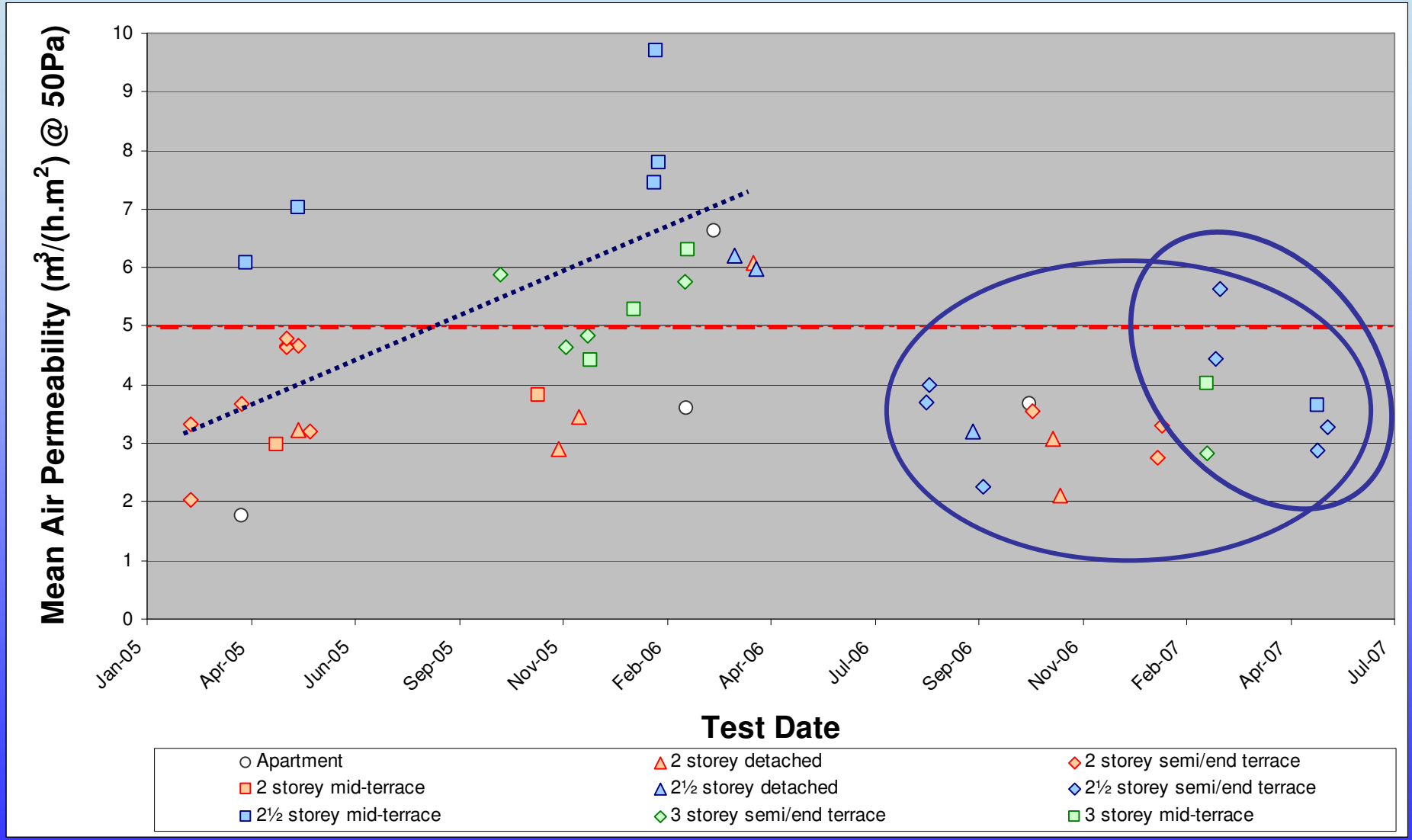


Target

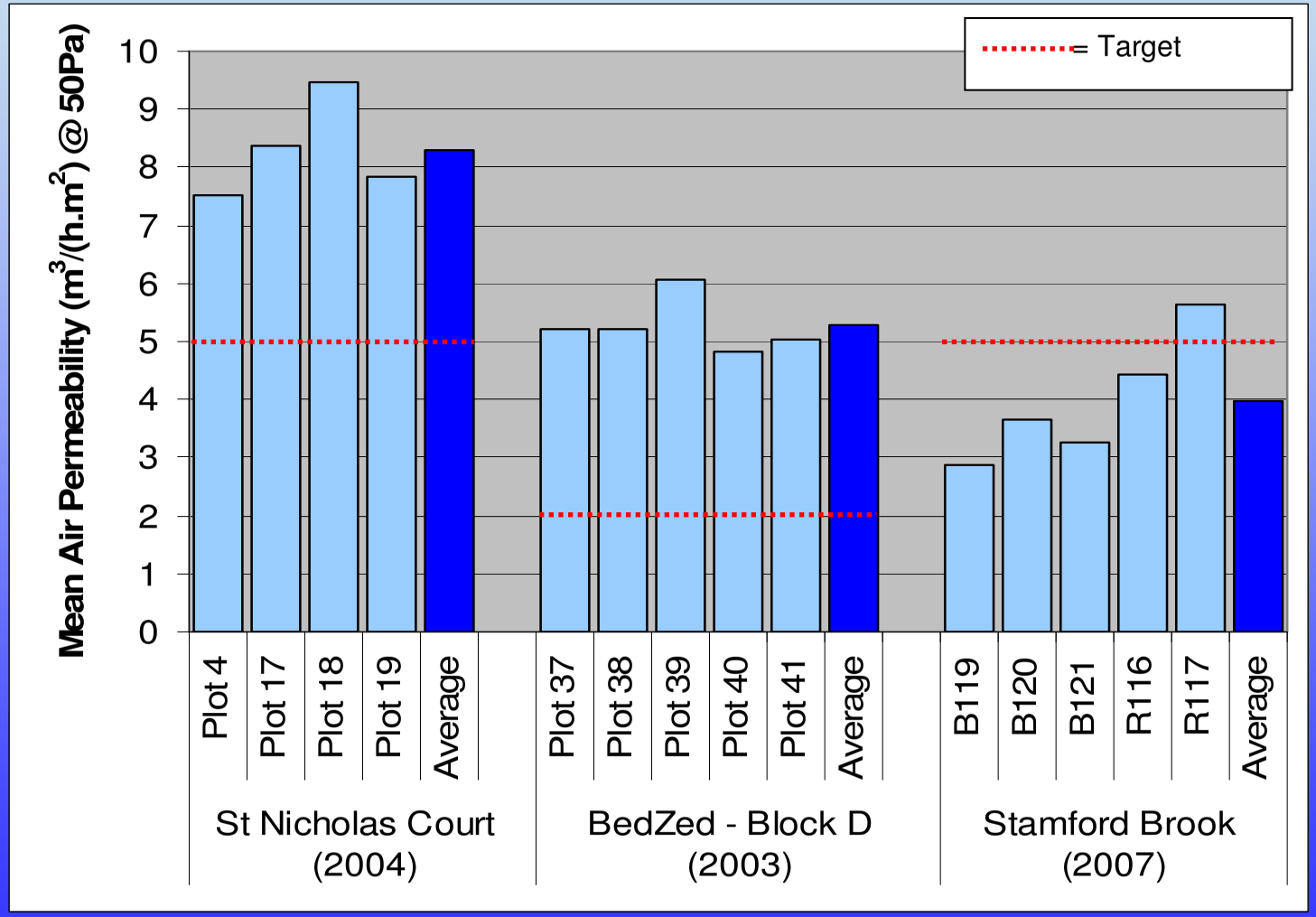
5 $m^3/(h.m^2)$ @ 50Pa

Roberts, Johnston, Isle (2005) *A novel approach to achieving airtightness in dry-lined load-bearing masonry dwellings.* Building Services, Engineering, Research & Technology, 26 (1), pp. 63-69.

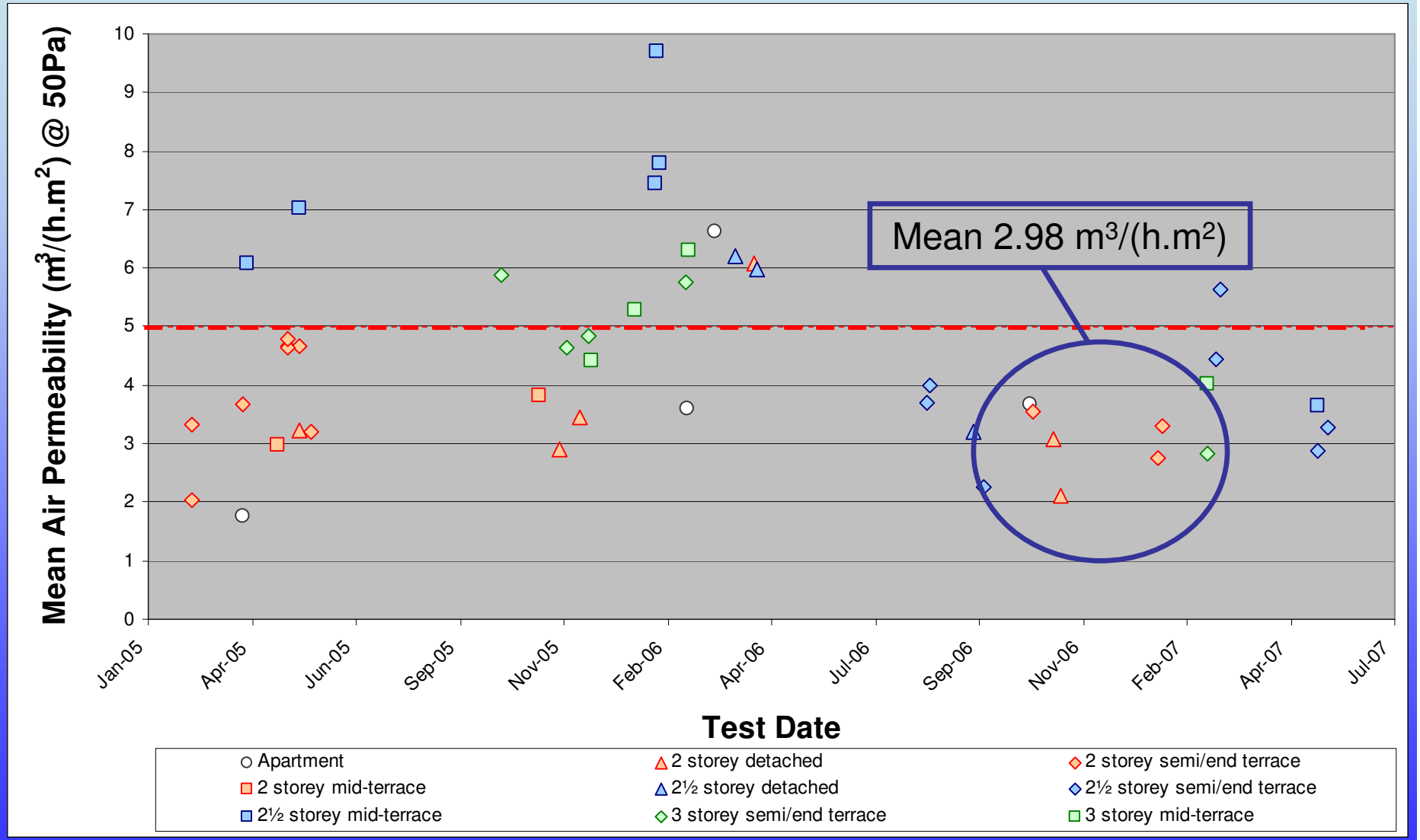
Results in context



Results in context



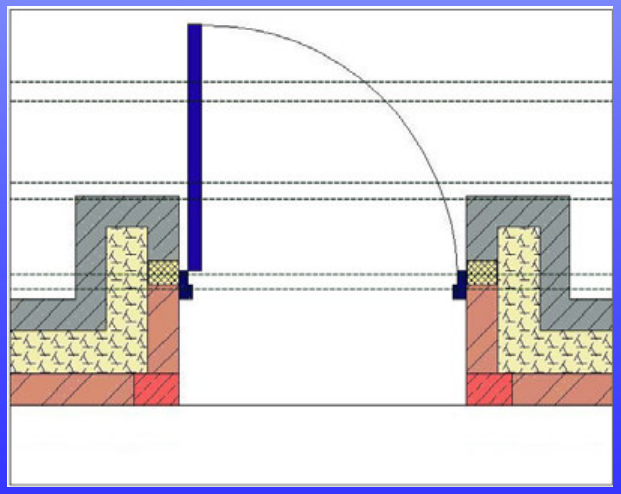
Results – 3 $m^3/(h.m^2)$

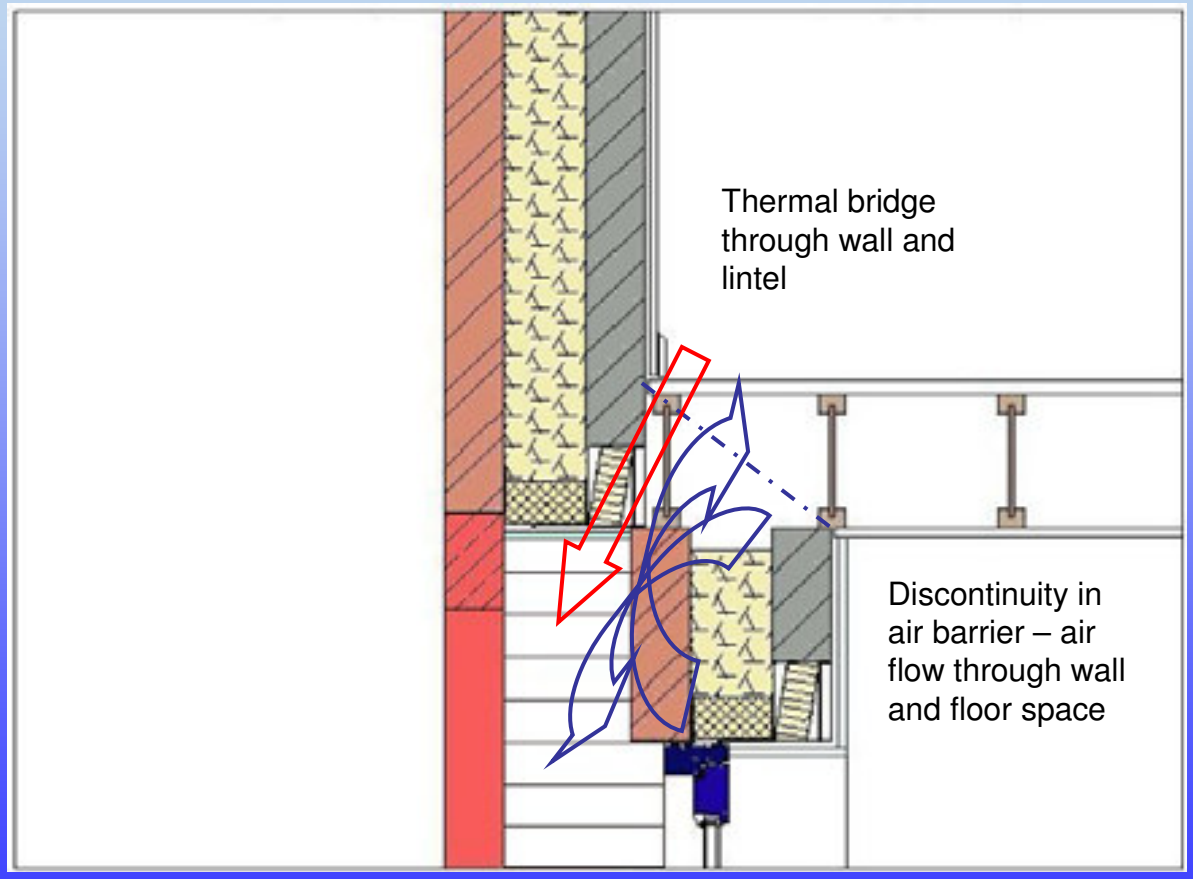


Getting below 3 $m^3/(h.m^2)$

- Success achieved, but issues remain:
  - Design
  - Quality Control
  - Workmanship
  - Training
  - Materials/Components
  - Sequencing
  - Communication

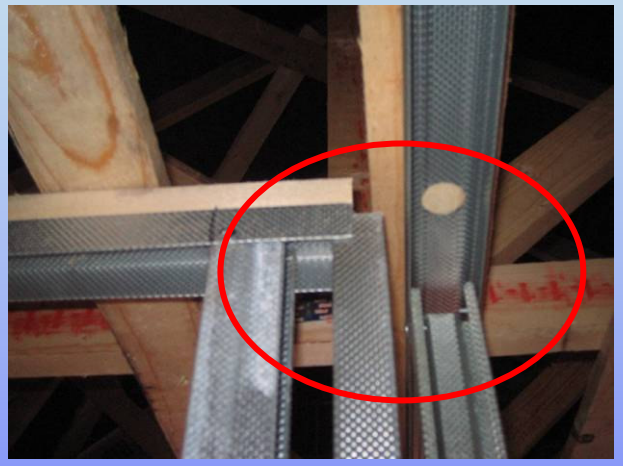
Getting below 3 $m^3/(h.m^2)$





Getting below 3 $m^3/(h.m^2)$

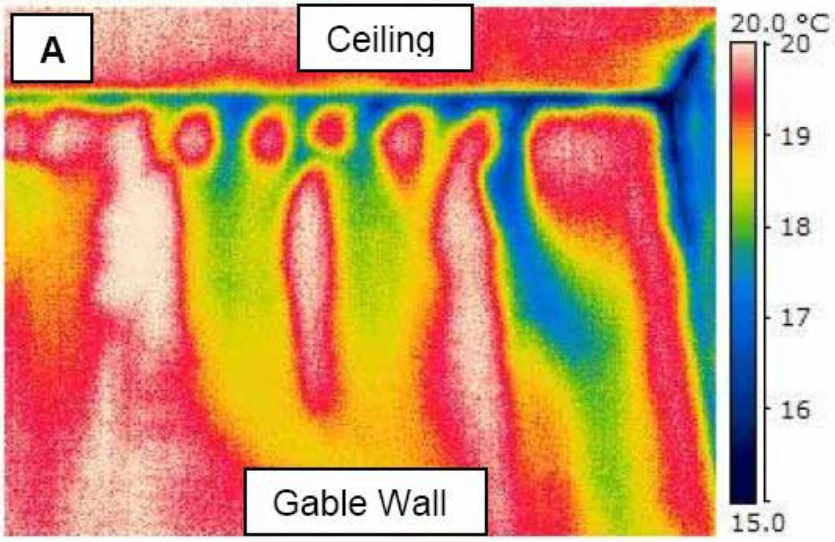
Partitioning erected prior to boarding ceilings

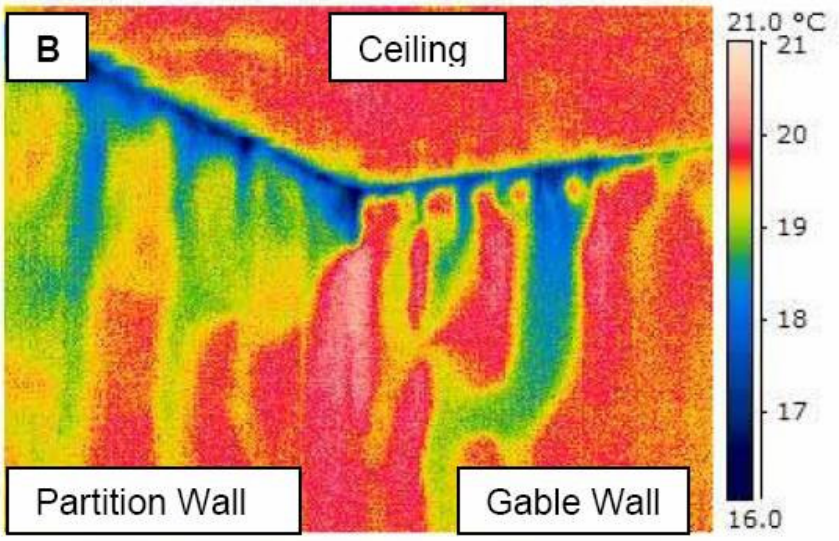




Fully boarded ceilings prior to partitioning


Getting below 3 $m^3/(h.m^2)$

Ceiling – wall boundary





Getting below 3 $m^3/(h.m^2)$

Dry lining relies on continuous ribbons of plasterboard adhesive being successfully applied

Continuous ✓

Solid ✗

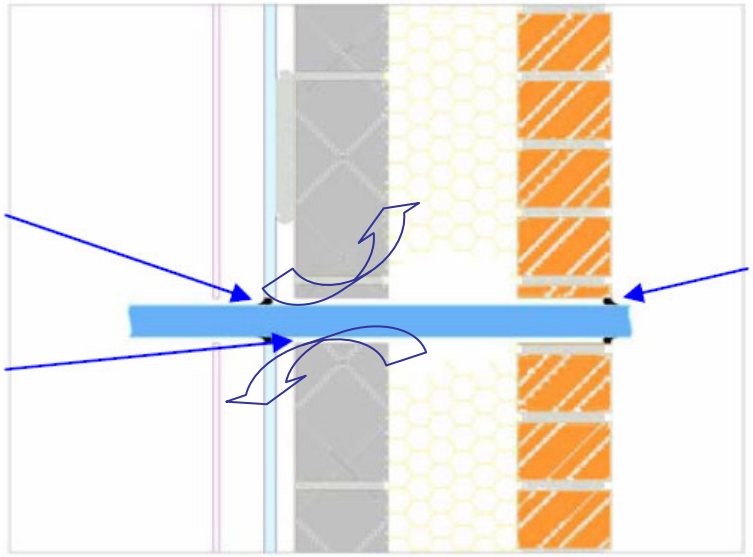
However:

If the primary air barrier is continuous (floor/parging/ceiling) gaps in the perimeter ribbons should not matter

Getting below 3 $m^3/(h.m^2)$

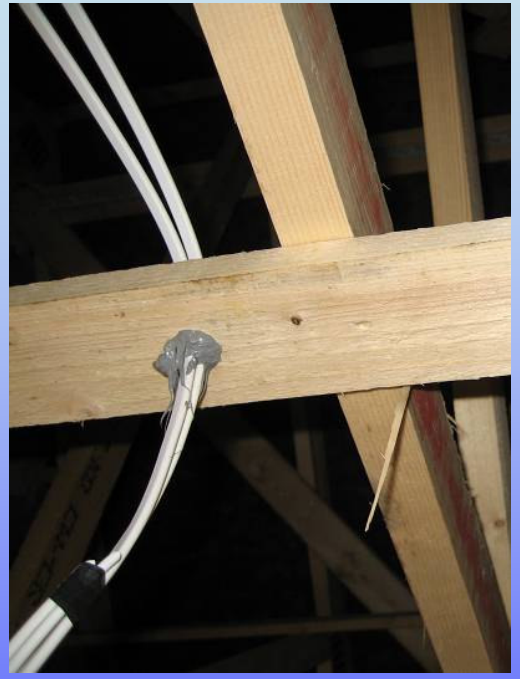
Internal sealing at dry lining rather than at the air barrier

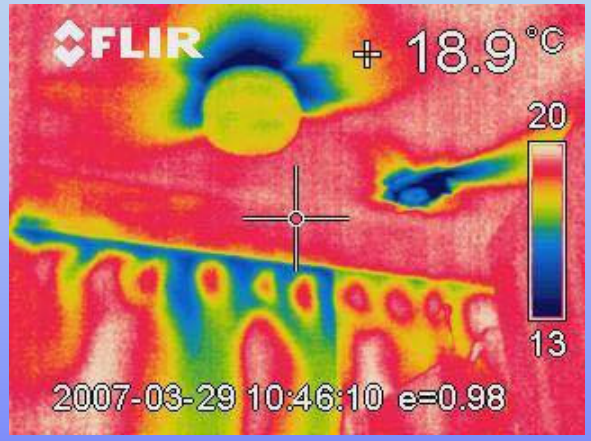
Gaps remaining between penetration and the primary air barrier



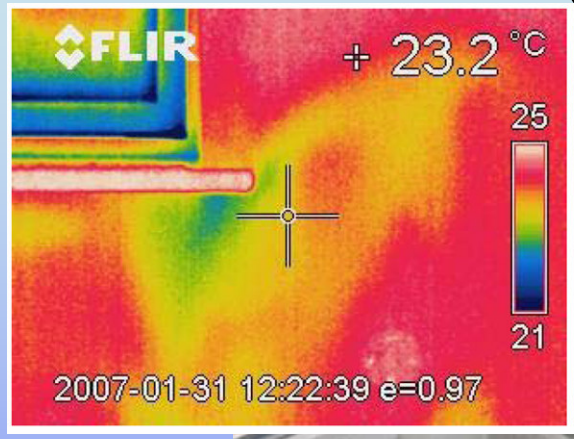
Sealant applied externally to prevent water ingress

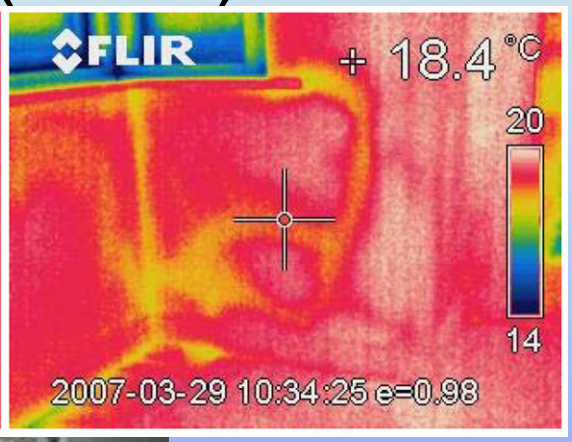
Getting below 3 $m^3/(h.m^2)$





Getting below 3 $m^3/(h.m^2)$





Getting below 3 $m^3/(h.m^2)$

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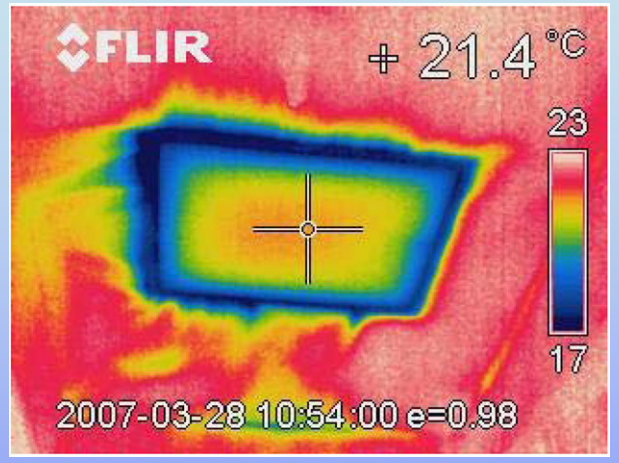
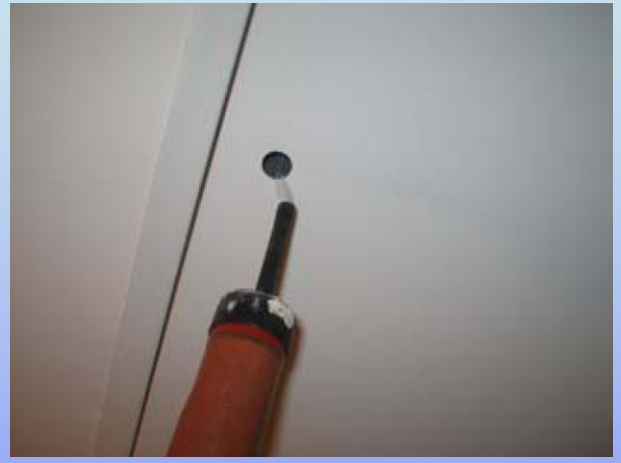
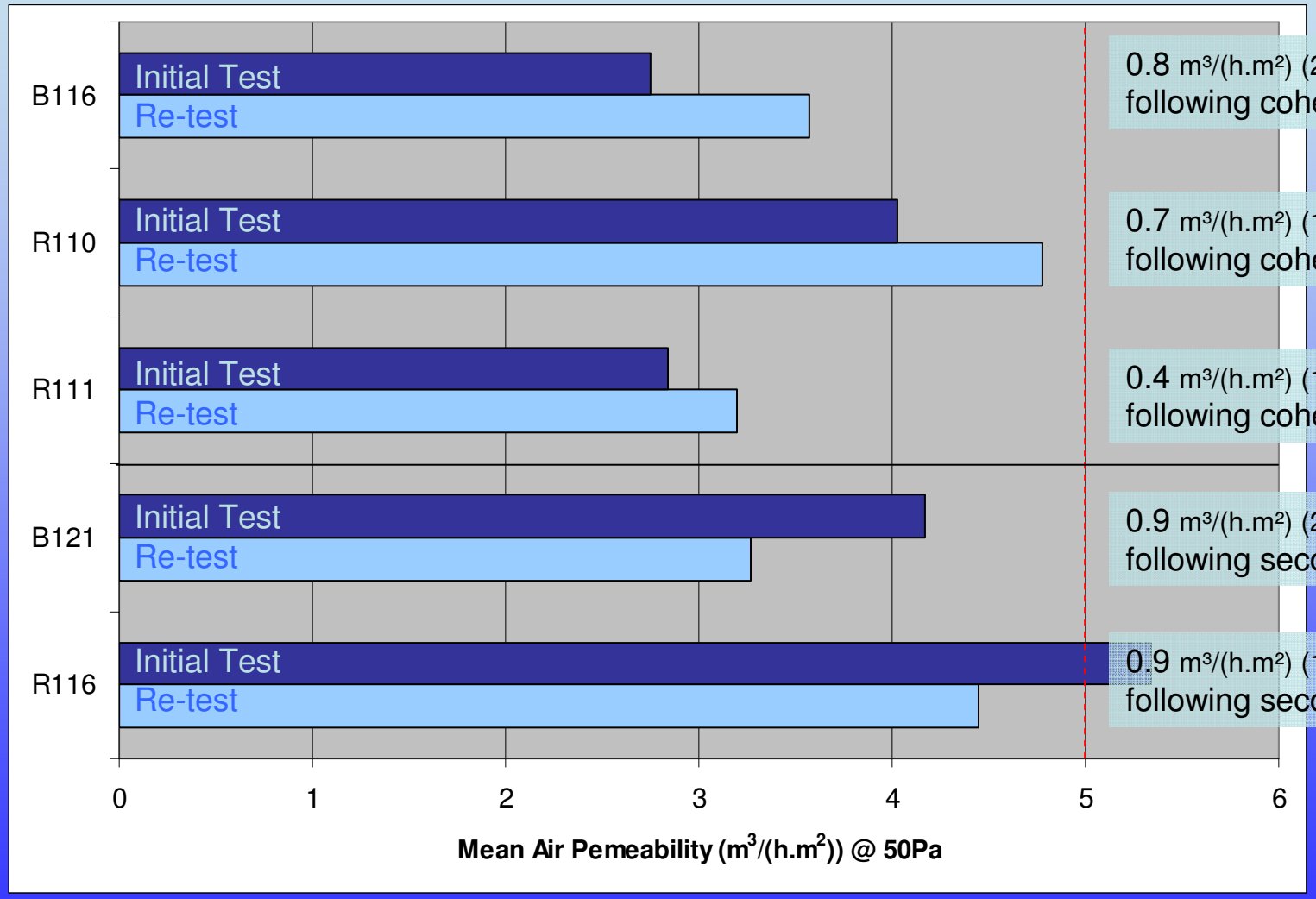




Secondary Sealing

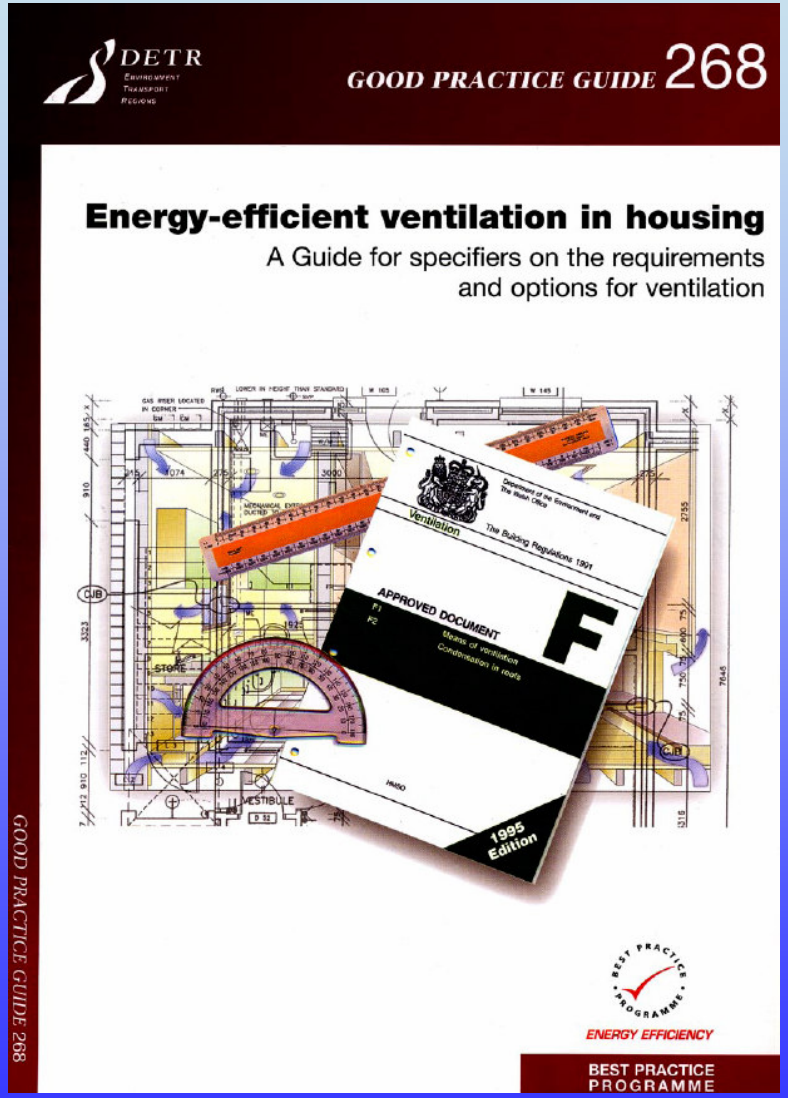


Airtightness Deterioration

Test Date	Air Permeability ($m^3/(h.m^2)$ @ 50Pa)	
23 February 2005	2.0	3.3
14 December 2005		4.2
22 March 2006		4.9
07 July 2006	3.1	4.1

Considerations

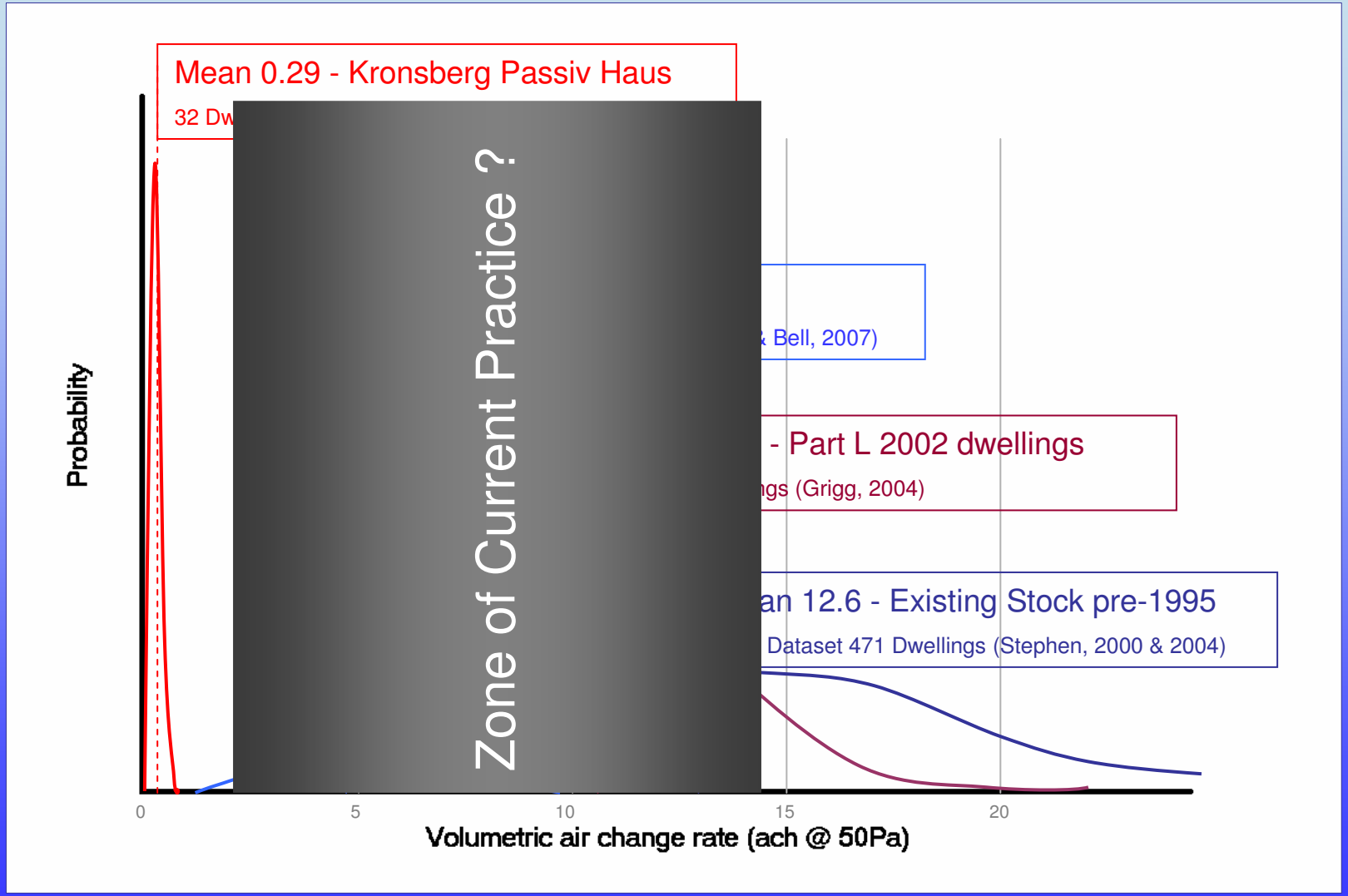
- GPG 268
  - Below 5 ach @50Pa natural ventilation & intermittent extraction may be insufficient
- Ventilation Strategy
  - MEV ?
  - MVHR ?



Summary

- Some lessons learnt from Stamford Brook:
  - Air permeability $< 3\ m^3/(h.m^2)$ @ 50 Pa is achievable in load-bearing masonry in UK mass housing.
  - To guarantee $< 3\ m^3/(h.m^2)$ the target should be $< 2\ m^3/(h.m^2)$.
  - Airtightness issues require consideration at **all** stages of construction.
  - Measurement (testing) necessary to see trends developing.
  - Feedback essential for improvement
  - Ventilation strategy
  - Airtightness longevity

And Finally…


Mean 0.29 - Kronsberg Passiv Haus
32 Dw
Zone of Current Practice ?
& Bell, 2007)
- Part L 2002 dwellings
ngs (Grigg, 2004)
an 12.6 - Existing Stock pre-1995
Dataset 471 Dwellings (Stephen, 2000 & 2004)
Probability
0
5
10
15
20
Volumetric air change rate (ach @ 50Pa)