

## Airtightness IS a design issue

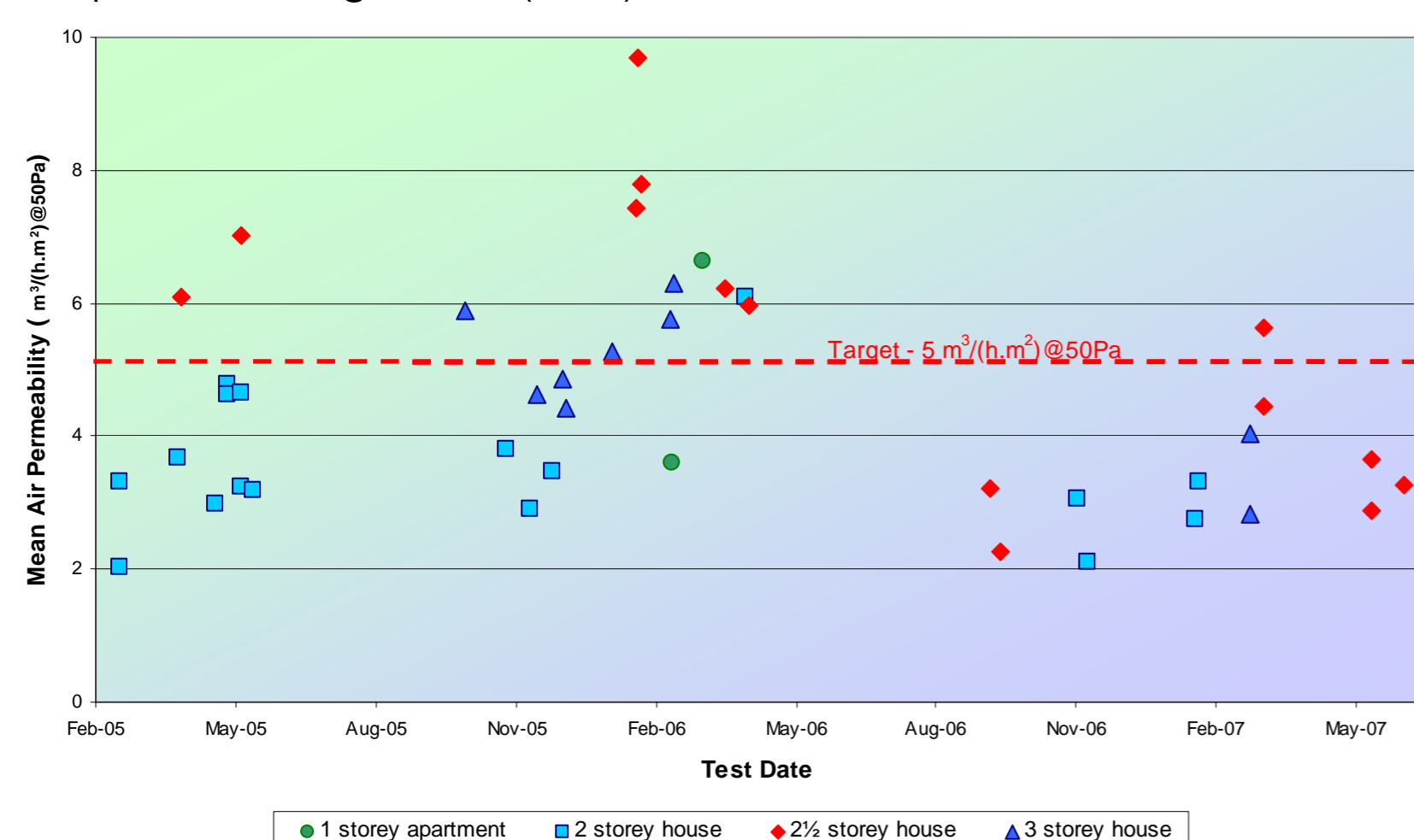
- Airtightness needs to be addressed at every stage in the design process. Designers should identify a continuous line through the envelope of the dwelling where the primary air barrier will be: a *pen-on-section* test.
- Designers need to ensure that information is available at the appropriate level of detail and that this information is communicated effectively to all construction staff, subcontractors and their operatives.
- Design information should include procedural specifications which clearly define the primary air barrier and treatment of it.
- It is the designers responsibility to ensure that components forming part of the air barrier can guarantee adequate airtight performance.
- Where sealants are used it should be ensured that they are of the correct specification, compatible with adjoining materials and that they have the required elasticity, or proprietary sealing products considered.
- Changes to design information (dwelling designs, products or procedures) should be communicated quickly, consistently and clearly. These should be recorded and appropriate design documentation reissued immediately.

## Primary air barrier - design it with CARE

- CARE** - Continuous, Accessible, Robust, Explicit.
- Continuous:** Air leakage may occur anywhere where there are discontinuities in the air barrier. Care must be taken at junctions of building elements and at penetrations to ensure its integrity is maintained.
  - Accessible:** The air barrier must be observable for inspection and reachable for maintenance and repair.
  - Robust:** The air barrier needs to be robust enough to withstand subsequent construction and to last the lifetime of the building.
  - Explicit:** There must be conceptual clarity for all staff (whether design or construction based) on what constitutes the air barrier, where it is positioned and how its continuity is to be maintained.

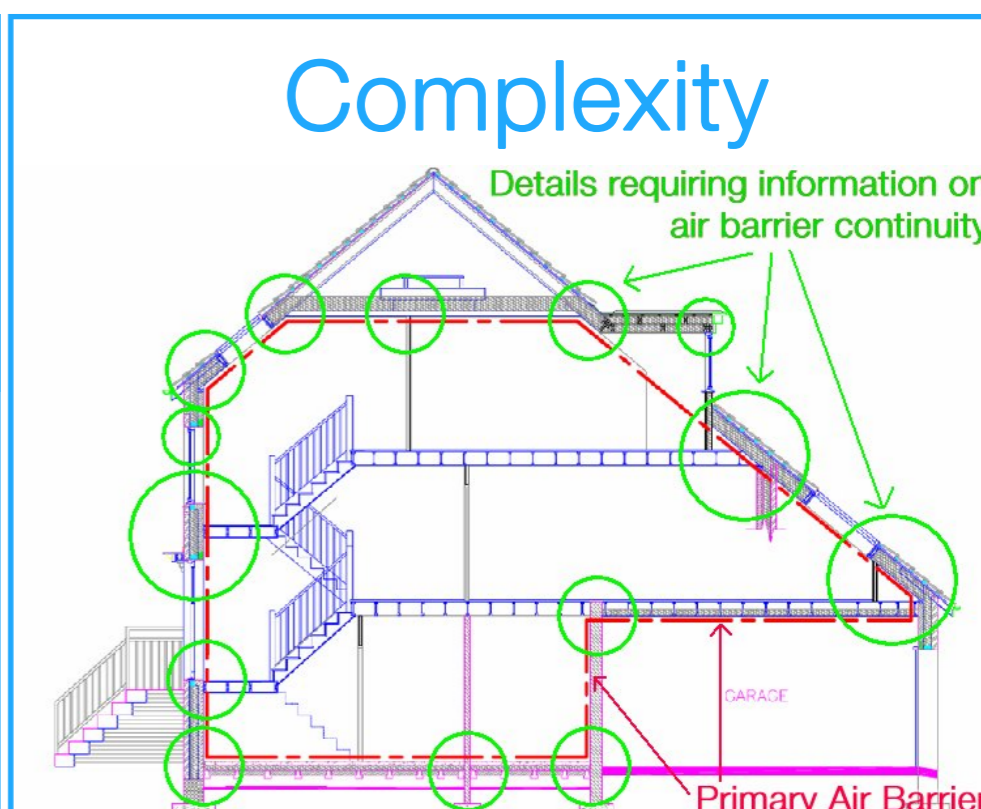
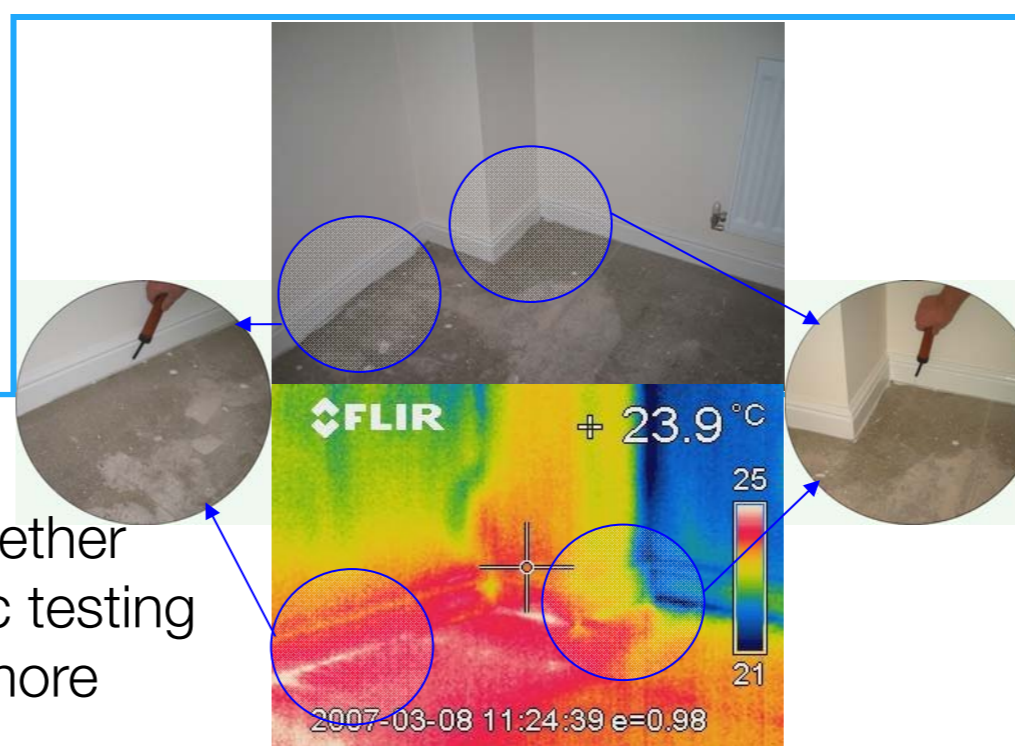
## Measurement and feedback

Regular measurement of the airtightness of dwellings is necessary to establish whether problems are occurring and if any trends develop. At Stamford Brook a systematic testing regime highlighted an upward drift in test results and possible problems with the more complex dwelling forms (below), which was acted on and resolved.



At Stamford Brook air testing was performed using a blower door with leakage detection carried out by smoke detection, thermal imaging (when possible) or preferably both (above). Results were discussed immediately with site staff and fed back to the design teams so that appropriate remedial action could be initiated.

Without adequate measurement and analysis it is impossible to determine how designs are performing and what additional measures need to be taken. A regular testing regime also heightens the awareness of all staff involved regarding airtightness issues.



Increasing the design complexity also increases the number junctions and details where continuity of the air barrier may be awkward.

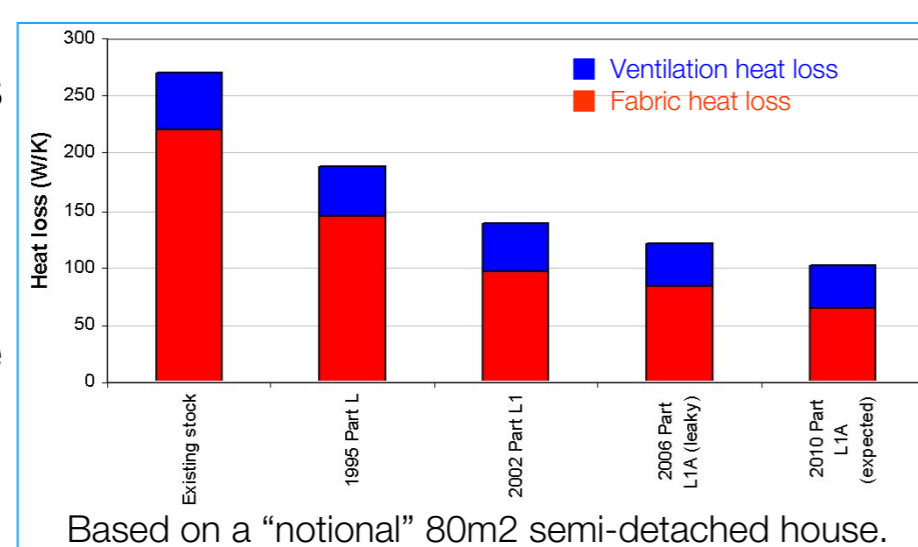
It is simpler to design an uncomplicated geometric structure with a very basic airtight and thermal barrier in contact to avoid thermal bypassing. Any additional architectural detailing can be supplemented to this basic airtight design, with due consideration given to airtightness, thermal bridging and thermal bypassing.



## Airtightness and emissions

Airtightness is crucial to improving the energy performance of dwellings. Air leakage is uncontrolled background ventilation additional to the purpose-provided ventilation, and can dramatically increase the dwelling's heat loss. This has resulted in the CO<sub>2</sub> emissions from air leakage becoming increasingly important over time as building fabric has improved to meet regulatory standards.

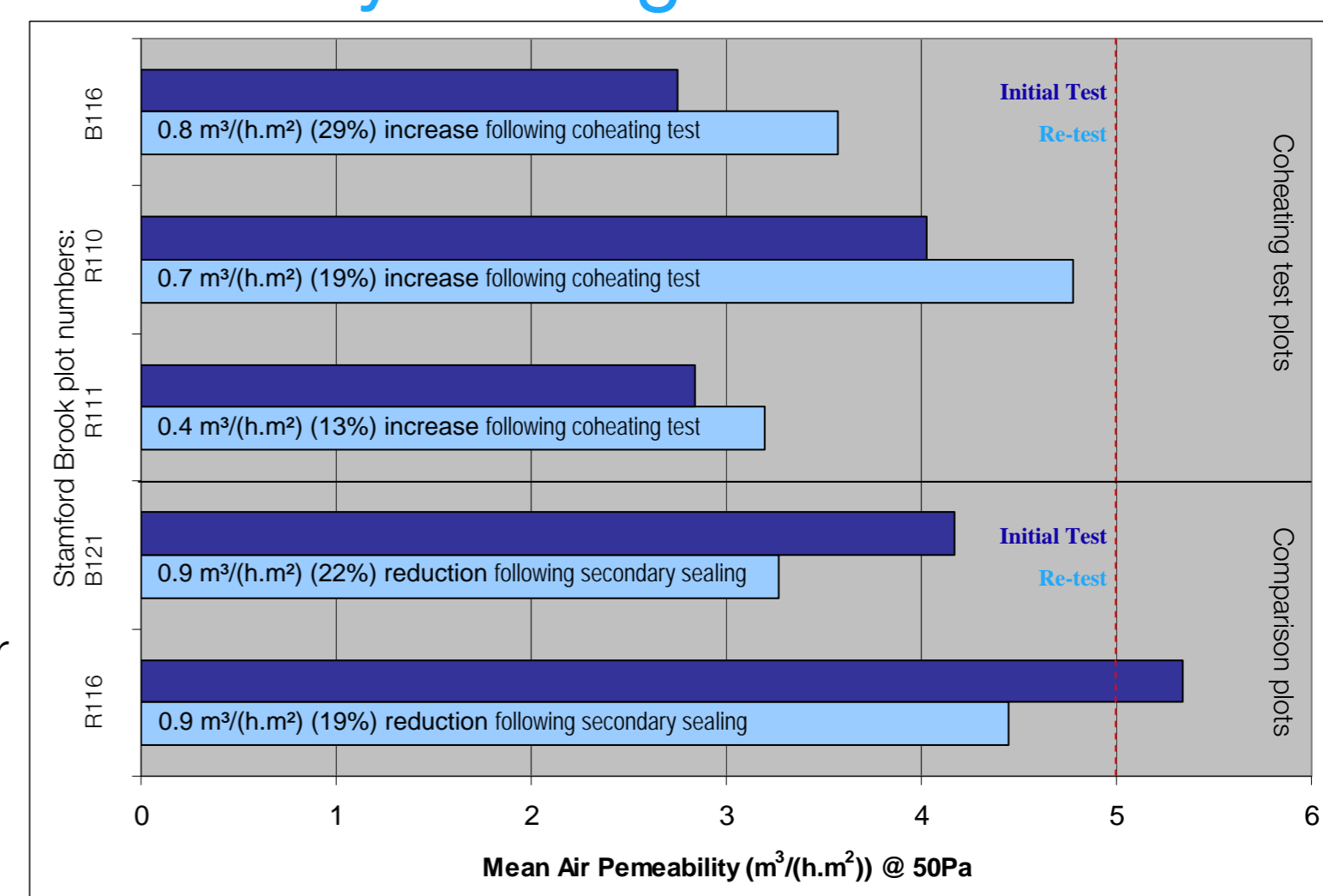
With designers striving to achieve the lowest possible DER's, it is imperative that an airtightness strategy is included in the designs with a target that is attainable, and enough information included to enable it to be achievable.



Secondary sealing involves plugging gaps in surface finishes using mastics, caulks and foams in an attempt to limit air movement, in the hope that this will inhibit overall air leakage.

The coheating tests at Stamford Brook provided a unique opportunity to quantify this by providing accelerated drying and shrinkage, causing partial failure of the secondary sealing. The difference being comparable to that observed in other dwellings before and after sealing. Historically, guidance has placed an over-importance on secondary sealing, which is only beneficial in the very short term (i.e. for an individual test) but is not a robust long term solution.

## Secondary sealing



## Designing airtight dwellings - Some guidelines for consideration

- Ensure that design prioritises the identification and location of the primary air barrier and that there is no reliance on secondary sealing.
- Avoid complexity and minimise the number of service penetrations. Where complex details are unavoidable, provide additional detail specifically identifying how continuity of the air barrier is maintained.
- Ensure that all drawings prepared by third parties include information on the air barrier and treatment of penetrations through it.
- Simplify the primary air barrier by avoiding or minimising changes of plane and the number of different materials used.
- Minimise gaps by addressing different construction processes varying tolerances, ensuring that conflicts are resolved before construction.
- Multiple components, particularly where a higher specification single component would suffice, create detailing difficulties where they penetrate the air barrier.
- The air barrier needs to be capable of inspection and robust enough to repair prior to being covered by later construction.
- Performance testing of airtightness both during and after construction should be undertaken to provide formative feedback as well as being part of a formal quality control process.
- Specify a ventilation strategy flexible enough to cope with the entire range of likely levels of airtightness.