



***Delivering EnerPHit  
Airtightness on 32  
Maisonettes***

**Paul Jennings**

**Aldas**

**July 2014**

# *Paul Jennings:*



- **Testing since 1987 – courtesy of Ken Livingston & the GLC!**
- **Certified PassivHaus consultant**
- **From the first PassivHaus & EnerPHit projects:**



**Y Gaol, Machynlleth**



**DVFP, Machynlleth**



**Grove Cottage, Hereford**

# Getting to now:



Derby  
EnerPHit



## ***Co-Presenters***



- **Liam Schofield & Chris Dawson**
- **Two of the four members of the on-site airtightness team**
- **Liam was previously Airtightness Champion on Lancaster Co-Housing**
- **With Mike Neate, delivered 44 newbuild Passivhaus dwellings**
- **Chris is a trained joiner, with no previous experience of airtightness**

# *The Site*

- 32 Maisonettes in 2 blocks
- Largest EnerPHit in the UK
- Originally planned to do works with tenants in situ
- Package:
  - New windows & doors
  - New roof
  - External insulation, to walls & below ground perimeter
  - Airtightness



# What has been achieved?



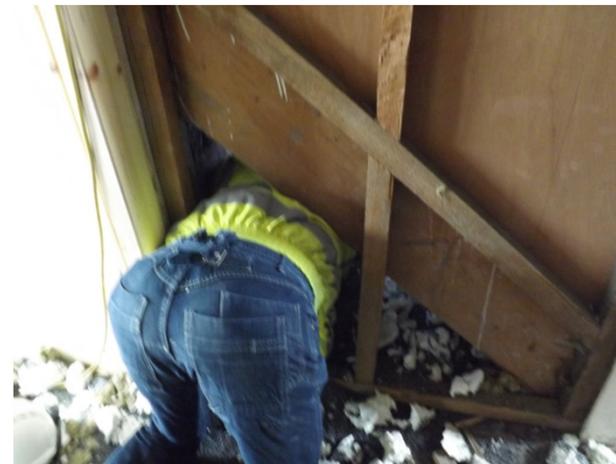
				0.78	Stairs	0.67	0.86	1.10	0.78	0.82
0.85	0.83	0.60	0.49	0.94		0.63	0.64	0.56	0.54	0.54

0.88	0.63	0.81	Stairs	0.70	0.92	0.92
0.83	0.83	0.94		0.93	0.69	0.92

**Average  
0.76 AC/hr  
@ 50 Pa**

- 27 of 32 Maisonettes have achieved preliminary EnerPHit airtightness
- 5 plus 2 stairwells yet to be fully sealed
- All require a final Acceptance test

# *Airtightness Team*



# *Acceptance Testing*



- **PHI requirements much more onerous than Building Regulations**
- **The dwelling must be complete, i.e.:**
  - **Doors & windows finished & adjusted – no taping**
  - **All plumbing services sealed by water in a trap**
  - **No temporary sealing e.g. to electrical sockets**
  - **All ducts, cables & pipes fitted, no additional services to be installed**

***Concerned that project management team  
have relaxed too soon, problems ahead?***

# ***For acceptance testing***



**No taping of electrical sockets or switches**

**All plumbing & wastes complete, sealed by water in traps**



**No taping of doors – and must pass the “little old lady test”**

**All windows must work, ironmongery fitted**



# ***How were such good results attained?***



- **Good airtightness does not happen by accident**
- **Planned for, prepared for, investment made in training & development, staffing**
- **But, not brain surgery either – mostly about attention to detail**
  - **In design**
  - **In delivery**

# ***Delivering EnerPHit Airtightness***



**Fundamentally, a management process**

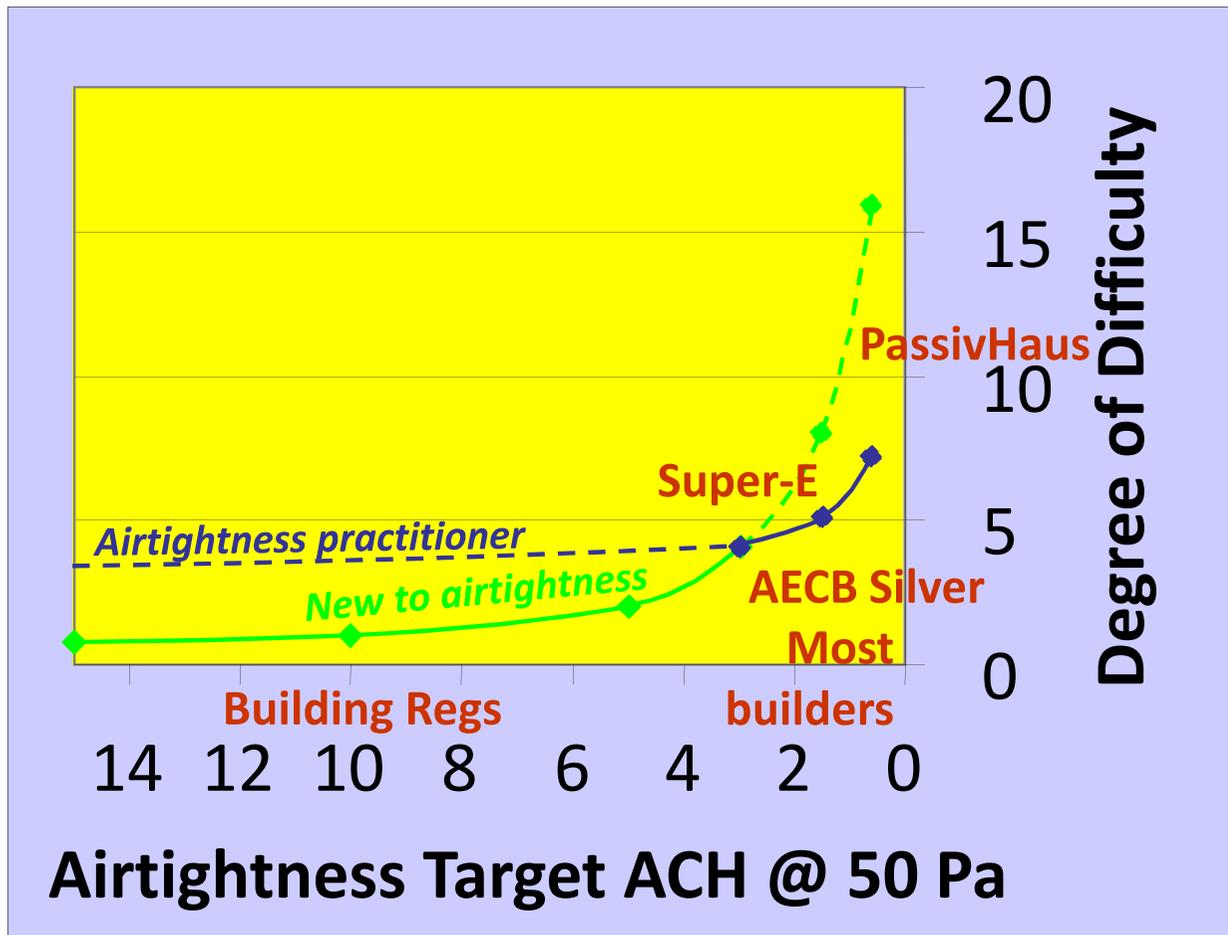
- **Airtightness Design, researched, checked**
- **Air Barrier Strategy clearly formulated, then communicated to the site team**
- **Delivery:**
  - **Are the correct materials supplied**
  - **Are they correctly fitted**
  - **Is the Air Barrier Strategy followed**

# How Hard is Passivhaus Airtightness?



Factors affecting the delivery of good airtightness:

- Size
- Complexity
- Voids
- Forethought
- Experience



# ***Delivering Airtightness***



**For several years, have been advocating**

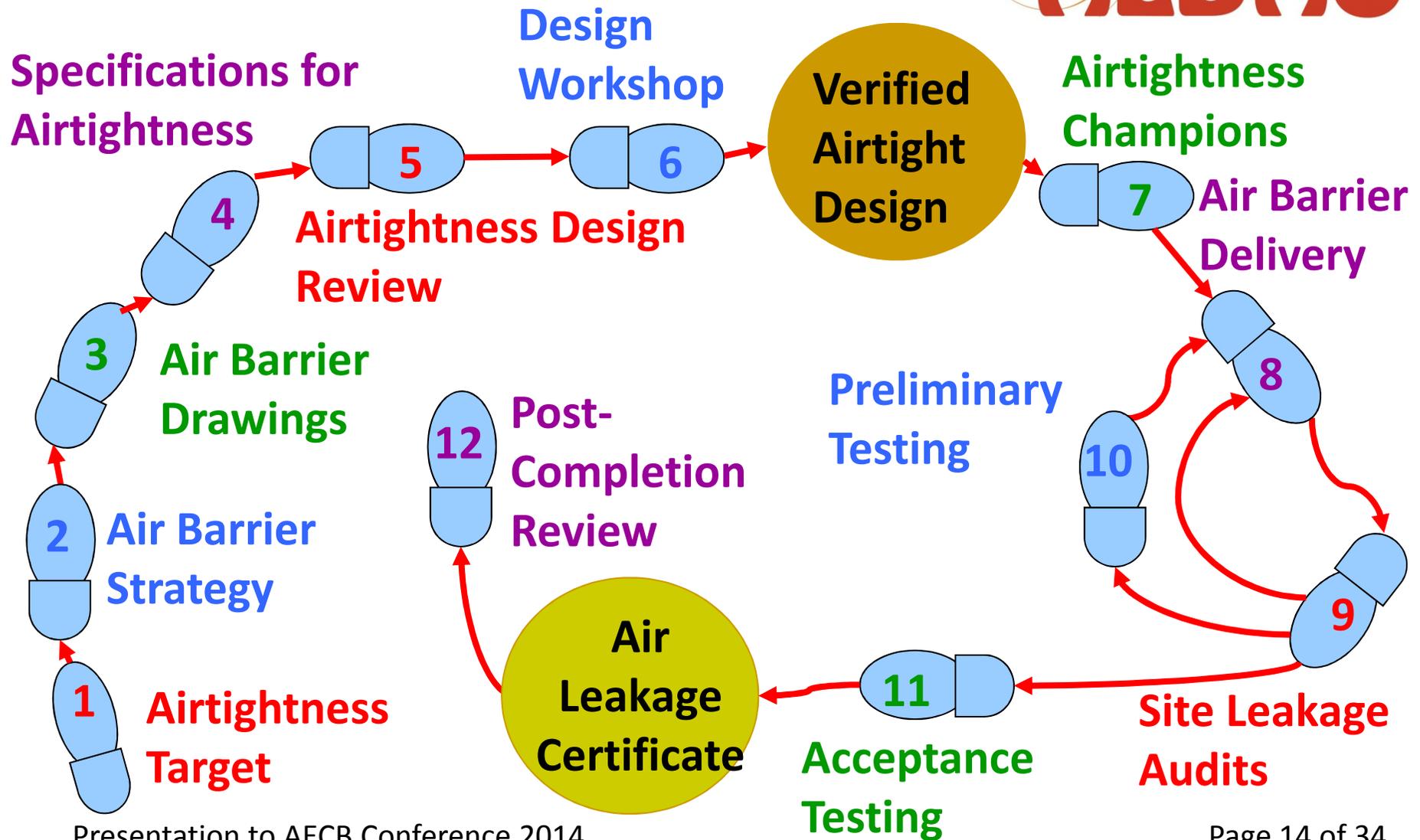
## ***12 Steps to Airtightness***

**As being:**

***A repeatable process to deliver  
airtightness***

- **Verified airtight design**
- **Support systems for effective airtight construction**

# 12 Steps - Summary



# 12 Steps - Documentation



## Delivering Airtight Buildings: A 12-Step Program

To effectively and efficiently deliver buildings to high degrees of airtightness, such as the Canadian Super-E standard for dwellings ( $\leq 1.5 \text{ ACH}^1 @ 50 \text{ Pa}$ ), and particularly the German PassivHaus standard ( $\leq 0.6 \text{ ACH}^1 @ 50 \text{ Pa}$  for newbuild,  $\leq 1.0 \text{ ACH}^1 @ 50 \text{ Pa}$  for refurbishment), the UK construction industry needs to adapt and change, otherwise contractors and others will continue to face significant difficulties, delays and additional costs.

Here we outline a 12-step program for contractors and design teams to consider. The diagram below summarises this approach, which is explained in more detail on the following pages:



*Paul Jennings*

Paul Jennings,  
Air Leakage Specialist  
ALDAS, February 2013

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Aldas is a trading name of Jennings Aldas Limited, Co. Reg 8409614

Director: Clare Corley  
Air Leakage Specialist: Paul Jennings, BSc, MSc [doorfanman@hotmail.com](mailto:doorfanman@hotmail.com), M: 07866 948200

- Aldas 7-page detailed explanation of 12 Steps to Airtightness approach
- Provided as pdf alongside presentation
- Also on AECB web site
- Contact ALDAS for further information

# 12 Steps to Airtightness



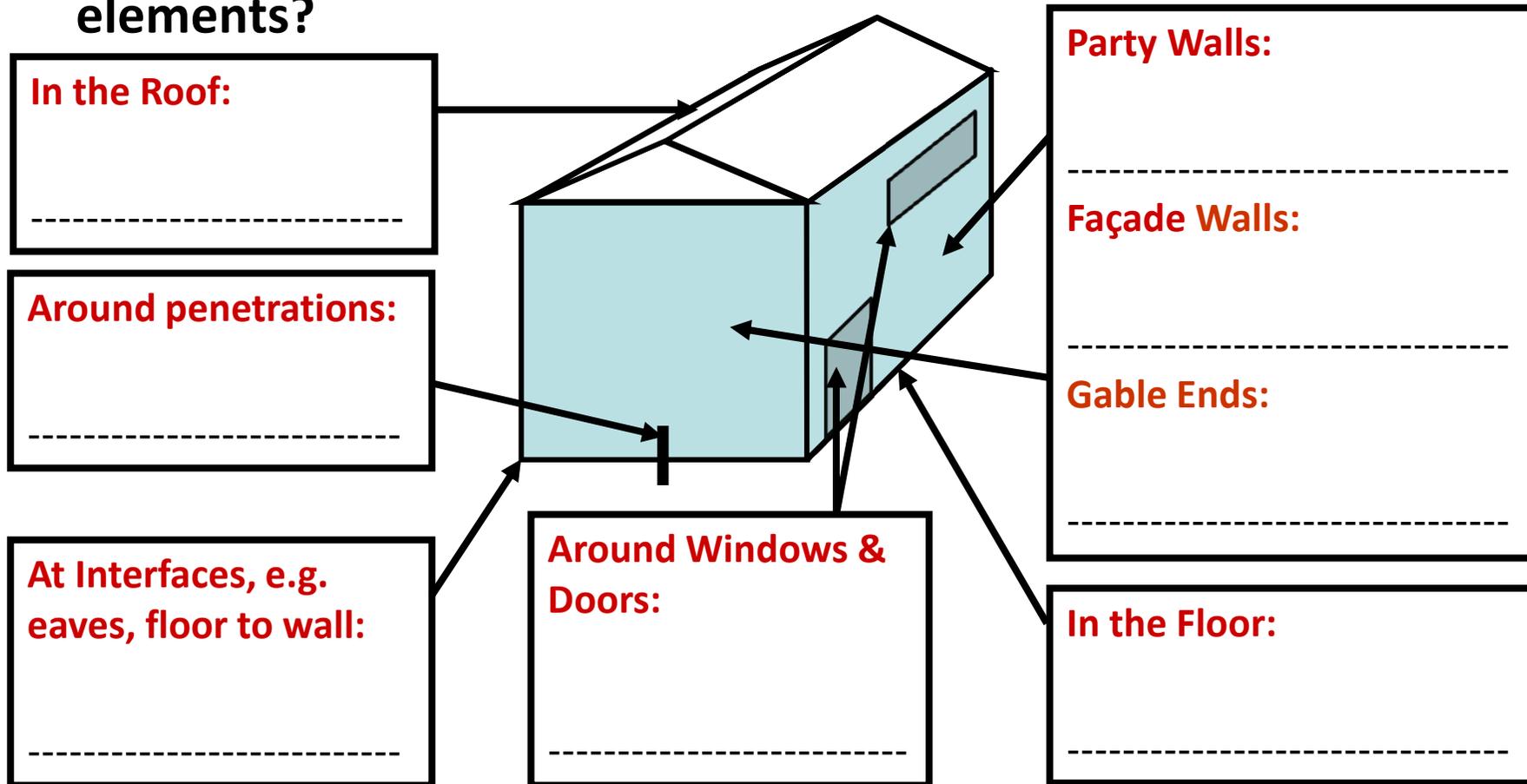
## Steps 1 – 6, Design



# Air Barrier Strategy?



- What forms the airtightness details for each of the different elements?



# ***For this project***

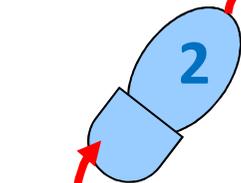


- **Eric Parks, PHPP Consultant, developed airtightness strategy**
- **Extensive early airtightness details**
- **But, cost saving & contractual issues**
  - **Wasn't able to modify in response to site discoveries of airtightness issues**
  - **Very little time on site for QA**
- **Hence devolved onto site airtightness team**

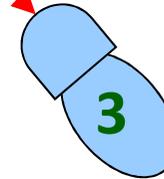
# 12 Steps to Airtightness



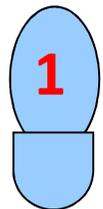
Steps 1 – 6,  
Design



Develop Air  
Barrier  
Strategy

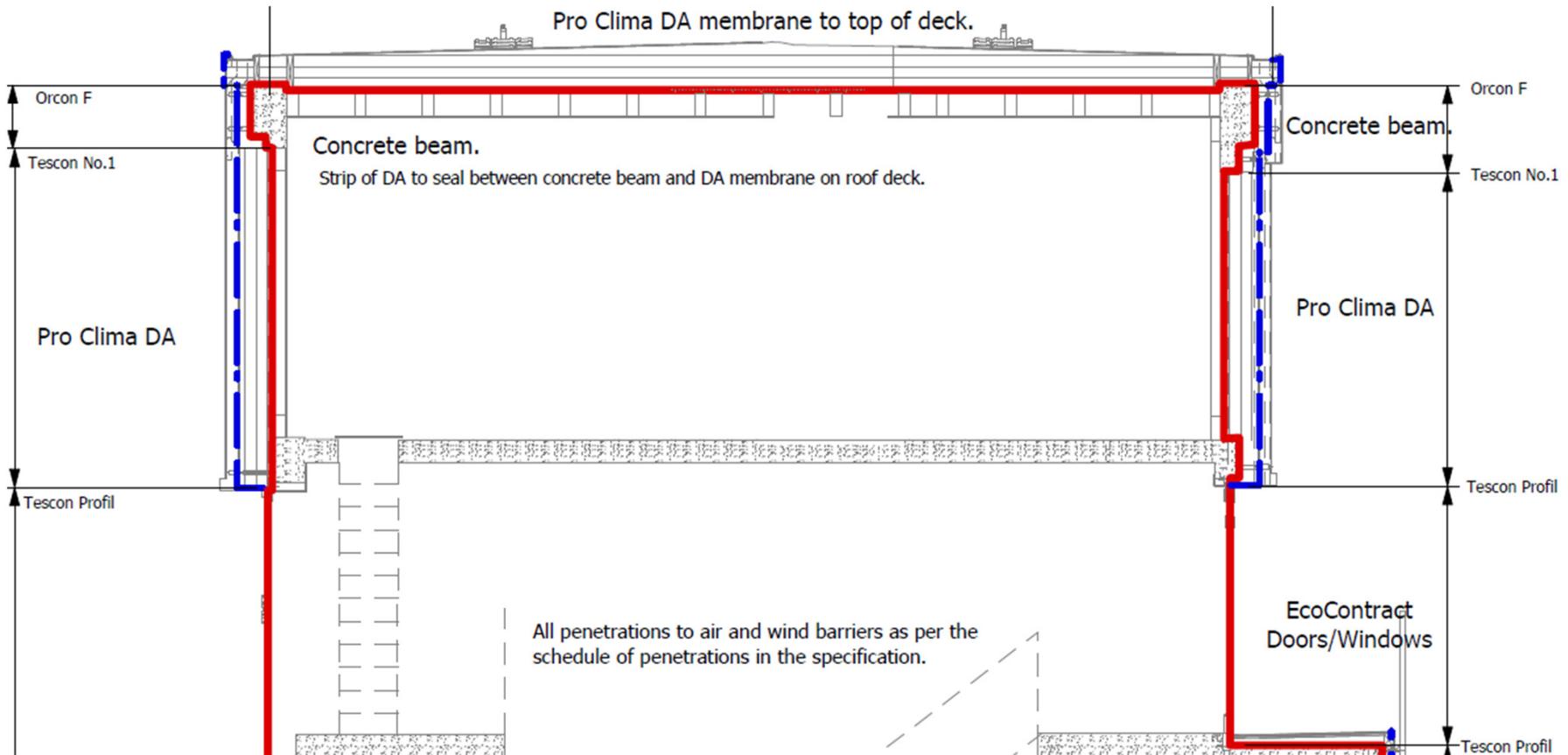


Prepare Air  
Barrier  
Drawings



Set Airtightness  
Target

# Detailed Airtightness Drawings from Eric Parks



## *Through upper communal stairs*

# *Specifying Airtightness*

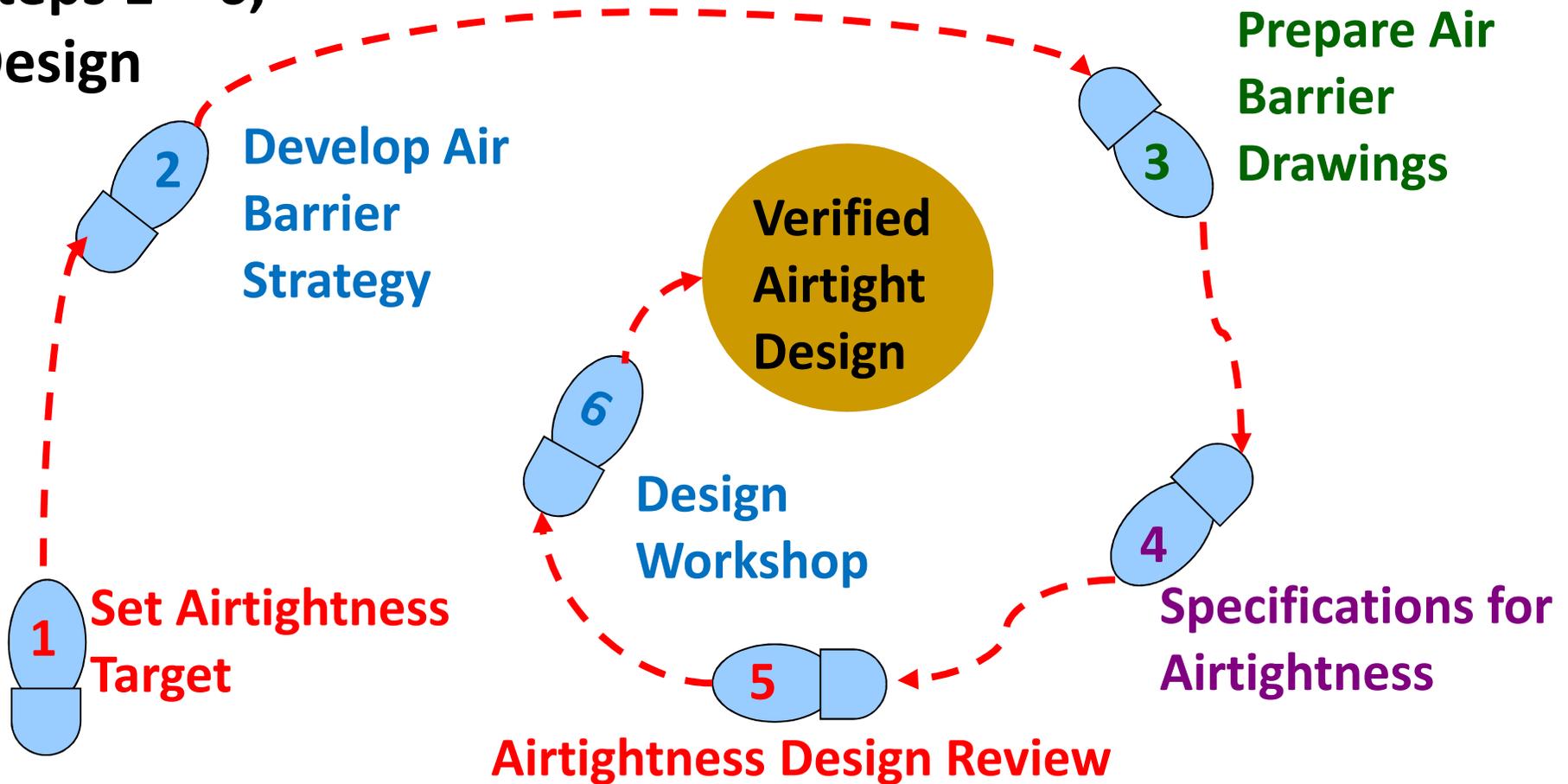


- **Specify the target – easy, EnerPHit**
- **Questions & clarifications – e.g. What about the stairwells?**
- **Have to specify the process**
  - **Airtightness Champions Training required?**
  - **How many site Leakage Audits, if any?**
  - **Preliminary testing – target?**
  - **Acceptance testing**
  - **Reporting & certification**

# 12 Steps to Airtightness



Steps 1 – 6,  
Design



# ***Step 7: Airtightness Champions***

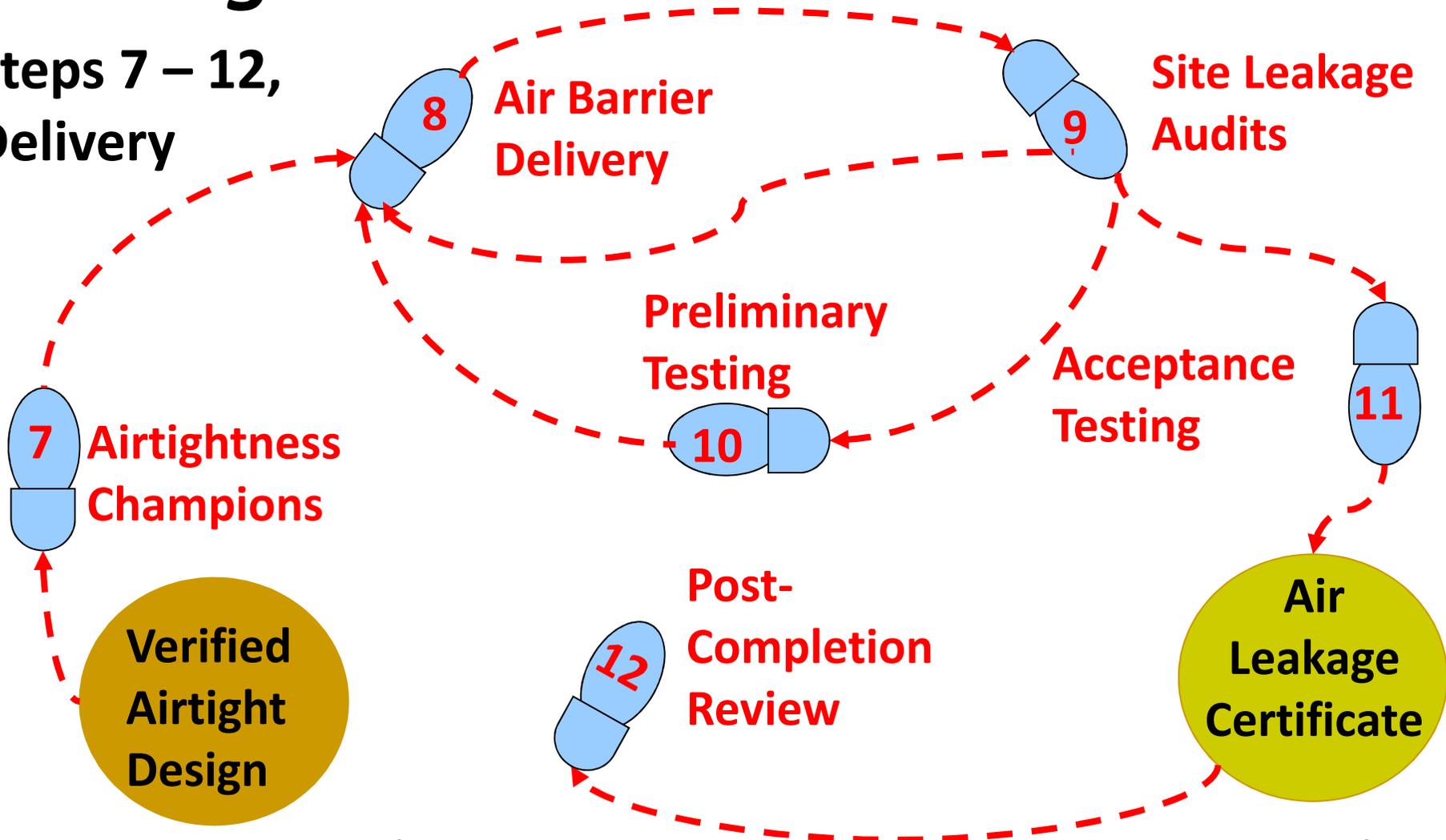


- **The key role in ensuring the timely and efficient delivery of airtight buildings, often backed up by a Clerk of Works**
- **Included**
  - **undertaking remedial works**
  - **responding to holes made by other trades**
  - **using an uncalibrated fan for leak location**
- **Must have sufficient authority to prevent their sealing being breached by later works**

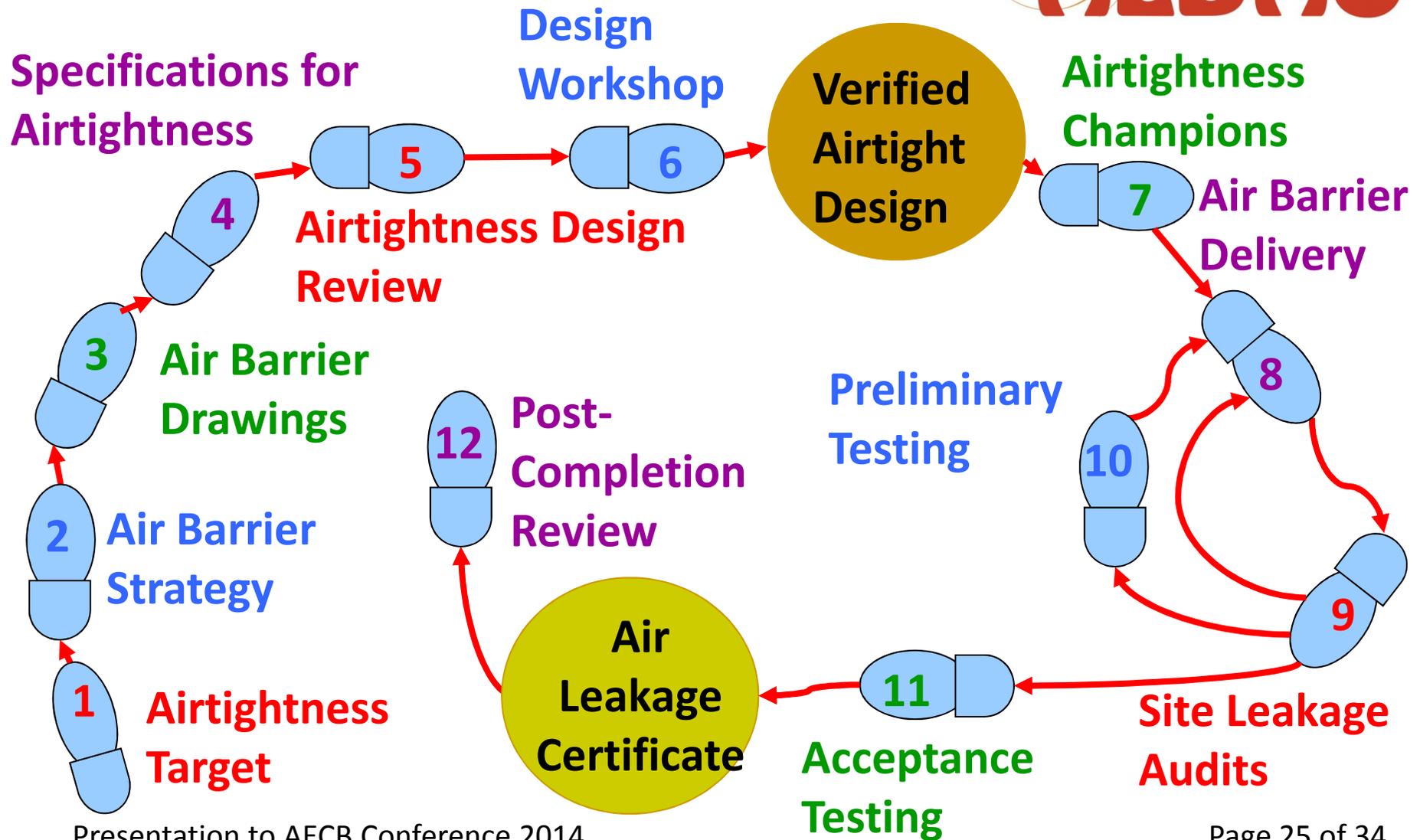
# 12 Steps to Airtightness



Steps 7 – 12,  
Delivery



# 12 Steps - Summary



# ***Aldas involvement***



- **The builder got advice from Ecological Building Systems & also contacted Aldas**
- **Commissioned to provide a 2-day Airtightness Champions training course**
  - **Late September 2013, held on site**
  - **Entire senior site team, plus Eric & Liam**
  - **Included a demonstration test – 4 AC/hr @ 50 Pa**
  - **Lots of leaks found**
- **A transforming experience for the builder!**

# *Immediately*



- **Builder appointed a second site manager, Simon Moseley, to co-ordinate airtightness**
- **Approached Liam to work for them**
- **Purchased a Leakchecker fan from Aldas**
  - **An uncalibrated fan**
  - **Enables leakage sites to be identified**
  - **Then verifies leaks eliminated**
- **Commissioned Aldas to carry out investigative testing with the site team**

# ***Results***



- **Builder already knew the initial survey was inadequate**
  - **e.g. a concrete roof slab was revealed to be a concrete ring beam and Strammit board**
- **Investigative testing found further problems**
  - **Extensive air in the voids between OSB sheets forming the new façade walls**
  - **Substantial air leakage through the supposedly solid brick party walls**

# *On Site*



- **Site airtightness team developed and tested solutions on the roof**
- **All brickwork in party and gable walls had to be parged or plastered**
- **Including connections to internal partition walls – Paramount partitioning very leaky**
- **Extensive use of “stitching” – injecting foam through surface materials to seal voids**

# *Over to Liam & Chris*



- **As two of the four people who formed the site airtightness team, Liam & Chris will give much more detail about the remedial works**
- **Not forgetting Simon & Erol, who couldn't be here today**
- **But before that, some lessons I have drawn from this project:**

# ***Future EnerPHits***



- **A good survey & early research is essential**
- **Ideally carry out Airtightness Testing of existing buildings before works starts**
  - **May include co-pressure testing to quantify leakage through party walls & floors**
- **Informs the design, helps to achieve a robust Air Barrier Strategy**
  - **Early investment reduces delays, risk & cost over-runs**
- **Emphasize airtightness during inductions**

# Example for Induction:

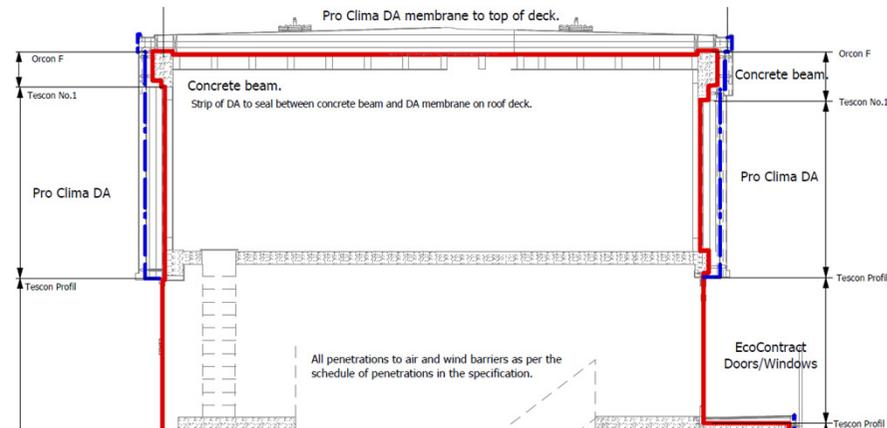
These dwellings will be tested for air leakage before handover, for Passivhaus approval.

*Your work could significantly affect the result!*



*Small fan test kit ready to blow air out of Passivhaus doorway*

Presentation to AECB Conference 2014  
© Paul Jennings, Aldas



*Air barrier drawings & details are provided – follow them!*



*If you spot actual or potential leakage sites – report them!*



# *Timings*



- Passivhaus/EnerPHit takes longer;
- Cannot muddle through;
- Fundamental cause of many problems on major UK Passivhaus projects to date is:

*program steamrollers quality, &*

*quality*



*gets  
broken*

# *Aldas Services*



- **Air Leakage Design Reviews**
- **Site Leakage Audits**
- **Airtightness Testing, preliminary & acceptance**
- **Airtightness Champions Training**
- **Supply of Leakchecker Fans**



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