IN-USE PERFORMANCE OF VENTILATION SYSTEMS IN NEW HOMES

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Project method

- Background
- DvAB
- Project aims – why happening? Map process
- Project method
- Site analysis – detail method - 1\textsuperscript{st} fix, 2\textsuperscript{nd} fix, completion
- What we will find out? Outputs.
- Solutions to prevent this happening?
Background

- There is increasing evidence that ventilation systems in new build homes are not performing, leading to:
  - Compromised Indoor air quality
  - Building fabric impacts
  - Occupant health impacts
  - Increased energy use
Zero Carbon Hub – Performance Gap

• The government has challenged industry to reduce the gap between the design and the completed performance of buildings

• Many independent studies have shown this gap to be from 60%-120% more energy use than predicted.

• The Zero Carbon Hub has been researching this throughout 2013-14, with evidence gathered from 22 sites, and more than 200 plots.
What did we find out?

- There is a significant performance gap – 10% - 50% higher than design with conservative calculations
- No sites had the same window specification as SAP
- Unaccounted thermal bridging is prevalent
- Overheating is not considered
- Part L accredited details not used correctly
- Ventilation systems not installed correctly
DvAB – Ventilation findings

- Ventilation systems not commissioned
- Domestic Ventilation Compliance Guide checklist not used
- Number of extract fans incorrect on 38% of sites
- Incorrect ductwork, fans, terminals compared to design
- Trickle vents incorrectly sized, door undercuts incorrect
- The performance gap can be attributed to a large number of small errors throughout the design and construction process

Conclusion – there is a significant issue with on site performance. But why?
Common issues on site

Improvised construction – a short piece of flexible ductwork used to negotiate a difference in levels. Due to a lack of coordinated design information, the rigid ductwork runs below the top of the internal partition.
Common issues on site

Unsupported flexible ductwork used to connect with MVHR fan unit below ceiling. Ductwork routing has been ‘improvised’ on site.
Flexi Ductwork instead of Rigid
Conclusion – there is a significant issue with on site delivery. But why? How can this be gap be reduced?
The Ventilation project 2015 - aims

- Process – understanding why?
- Process mapping. Map procurement of ventilation systems. Who is responsible?
- What are the common errors? How can they be reduced?
- Performance snapshot – are flow rates achieved? Are fans noisy? Tracer gas test / air flow rate
- Are the systems meeting part F?
### Objective
The project will identify why ventilation delivery related issues are occurring and what needs to happen to improve them.

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<td>Background ventilators and intermittent extract</td>
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- **What happens in practice?**
- **What can go wrong?**
- **What is the impact?**
- **Who takes responsibility for assuring performance?**
- **New-build (domestic initially)**
- **Practical Recommendations**
Examples of what we will learn (1)

- Who in the supply chain is taking decisions on the type of ventilation systems a development will use? What factors inform their decision? Are the strategies appropriate for that kind of unit, location etc?

- Are the products and systems being installed in line the designs/specs? If yes, what process is enabling this? If no, where are things going wrong? What is the role of the procurement team? What is the impact of the product substitution on energy performance etc?
Examples of what we will learn (2)

- Who is installing the systems? Why that profession? Are they a member of a competent persons scheme? What did they have to do to qualify?

- Are systems being correctly commissioned?

- Does the team have a plan for maintenance? Who has the responsibility for this? Does the customer have the information they need in terms of maintenance?
Site Review process and Initial Findings

- 15-20 sites earmarked for site review – All 4 systems

- Site walkthroughs - 1st fix, 2nd fix, completion and occupied

- Interviews of all parties involved
Stage 1 of process – Desktop review

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<th>Drawing or Specification required</th>
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<tr>
<td>As-Built SAP and EPC for completed plots</td>
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<tr>
<td>ACD/APA Check lists if applicable</td>
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<tr>
<td>DVC/CG Installation and Commissioning checklists for Ventilation system</td>
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<td>DHCG Installation and Commissioning checklists for Heating system</td>
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<td>MCS installation and checklists for LZC technologies</td>
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<td>Air pressure test results</td>
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<th>Number</th>
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<tbody>
<tr>
<td>1</td>
<td>Design SAP Assessment (full worksheet and XML file)</td>
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<tr>
<td>2</td>
<td>As-Built SAP and EPC for completed plots</td>
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<td>3</td>
<td>Construction Specification</td>
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<td>4</td>
<td>Workmanship and Materials Specification</td>
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<td>5</td>
<td>Internal fit out specification</td>
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<tr>
<td>6</td>
<td>1:50 plans indicating the substructure and associated details up to DPC level</td>
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<tr>
<td>7</td>
<td>1:50 General Arrangement floor plans for each floor indicating wall types, extent of cavity in external and party walls, block types/strengths, insulation types and thickness</td>
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<tr>
<td>8</td>
<td>1:50 elevations at 90° for every face of the building(s) from top of foundation up to roof</td>
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<tr>
<td>9</td>
<td>1:50 General Arrangement sections through the main profiles of the building from top of foundations up to roof</td>
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<tr>
<td>10</td>
<td>1:50 service drawings showing hot and cold water services</td>
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<td>11</td>
<td>1:50 service drawings showing heating layout and components</td>
</tr>
<tr>
<td>12</td>
<td>1:50 service drawings showing ventilation ductwork and components</td>
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<tr>
<td>13</td>
<td>Window and door schedule indicating window types, sizes, glazing, trickle vent areas etc.</td>
</tr>
<tr>
<td>14</td>
<td>Developer's Trade Conditions</td>
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<tr>
<td>15</td>
<td>Developer's Scope of Works used in Tender</td>
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Design Review – Example questions

- M&E Engineer or Architect, Planning or Design Manager
  - What is your role in the project? Is it a typical project? And from your point of view, how did everything go?
  - Was there any other requirement from the LPA (e.g. aesthetics, conservation, window design, chimneys) which impacted on the building’s ventilation design?
  - Who was responsible for supplying and installing the system?
  - Was the ventilation strategy known at the design stage?
Stage 2 of process – site walkthrough

The second phase - is the site visit, and this started with interviews, both formal and informal of Site Agent, Installers and Residents

1- The installation process was key to understanding the issues that had arisen and the steps taken to overcome any problems, that may have occurred

2 - We were able to interview everyone involved, directly or indirectly with the ventilation system. E.g. 2\textsuperscript{nd} fix carpenter with regard to door undercuts

3 - Feedback from the end user was key, and we managed to interview a home owner on how they use their ventilation system and if they understood air quality
While the interviews and site inspection was taking place, testing of a finished dwelling was carried out:

- Trace gas tests
- Fan speed measurements
- Db ratings
- Finish floor door undercut
- Trickle vents

Site photographs were taken at all stages of construction, on all aspects of the ventilation system
Rigid duct installation – difficult to co-ordinate with 4 people installing on site – carpenter, electricians x 2, site manager
Process and Initial Findings

Excessive flexi duct in loft

Trickle vents in bathrooms
Process and Initial Findings

Inconsistent door undercuts
5mm - 18mm
Process stage 4 – follow up and feedback

- Following the site visit, telephone interviews have been carried out with the members of the design team, who were unable to be present at the site visit, and the results collated.

- These have taken the form of a 45 minute informal, but structured, interview. The form has followed the same structure as the onsite interviews.

- The site team will then produce a report with photos and test results and have a feedback meeting with the developer.
What we will find out in the study

- Process mapping. Map procurement of ventilation systems. Who is responsible?

- What are the common errors? How can they be reduced?

- Performance snap shot – are flow rates achieved? Are fans noisy? Tracer gas test?

- Are the systems meeting part F?
NEXT STEPS

Continue with site reviews – up to 20 sites around UK
Process mapping
Recommendations for Industry and Government
End of Term Report November 2015
Questions? Answers?

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Questions? Answers?

1. Who is responsible for Ventilation Design and installation?

2. What is the most appropriate system for future homes?
   - System 1 - extract fans, trickle vents
   - System 2 – Passiv-Stack
   - System 3 – MEV – continuous extract
   - System 4 – MVHR, Mechanical Ventilation Heat Recovery

3a. Do you projects meet part F in practice?
3b. Do your projects provide good Indoor Air quality?
THANKYOU!

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