THE PERFORMANCE GAP PROJECT

Closing the Gap Between Design & As Built

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PURPOSE AND STRATEGIC OBJECTIVES

Facilitate the mainstream delivery of low and zero carbon homes working across boarders

- Provide leadership and create confidence
- Reduce risk
- Disseminate information
THE PERFORMANCE GAP
MOVING FORWARD

Government
Industry WG Structure

Core Work Groups
- WG0: Process
- WG1: Concept & Planning
- WG2a: Design
- WG2b: Tools
- WG3a: Materials & Procurement
- WG3b: Procurement
- WG4: Construction
- WG5a: Verification
- WG5b: Testing
- WG5c: CJDs

Industry Executive Committee

Steering Group

Assured Performance

Delivery Approaches
- Design and Build
- Speculative Housebuilder

Services

Further Research
Interim Report

The Problems!
CROSS-CUTTING THEMES

- KNOWLEDGE & SKILLS
- RESPONSIBILITY
- COMMUNICATION
Literature Review

- State of the industry (*aggregated data*)
  - NHBC, LABC, SAP software providers, professional institutions, house builders, manufacturers

- Compliance processes
  - As-built SAPs, ACD/ECD use, Air pressure tests, commissioning

- Field trials
  - TSB Building Performance Evaluation, EST Heat pump trials

- Academic studies
  - Stamford Brook, Elmtree Mews, Temple Avenue

- “Secret” knowledge
  - Manufacturers, Universities
Housebuilding Process Review

- 21 sites analysed
- Over 200 units
- Completely anonymous
- Identified many issues
Evidence Review

The truth behind the myths.
Prioritisation of issues

- 15 Priority for Action
AND cross-cutting themes

Knowledge & Skills
Responsibility
Communication

Evidence Review Report
<table>
<thead>
<tr>
<th>Category</th>
<th>Stage</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept Design &amp; Planning</td>
<td>P2</td>
<td>Limited understanding of impact of early design decisions on energy performance</td>
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<tr>
<td>Detailed Design</td>
<td>D1</td>
<td>Inadequate understanding and knowledge within detailed design team</td>
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<tr>
<td></td>
<td>D2</td>
<td>Lack of integrated design between fabric, services &amp; renewables</td>
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<tr>
<td></td>
<td>E1B</td>
<td>Issues around use of U-value and thermal bridging calculation procedures</td>
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<tr>
<td></td>
<td>E1M7</td>
<td>Concern over competency of SAP assessors</td>
</tr>
<tr>
<td>Procurement</td>
<td>PR2</td>
<td>Inadequate consideration of skills and competency at labour procurement</td>
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<tr>
<td>Construction &amp; Commissioning</td>
<td>C5</td>
<td>Product substitution on site without consideration of energy performance</td>
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<tr>
<td></td>
<td>C15</td>
<td>Poor installation of fabric</td>
</tr>
<tr>
<td></td>
<td>C9</td>
<td>Poor installation or commissioning of services</td>
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<td></td>
<td>C13</td>
<td>Lack of site team energy performance knowledge &amp; skills</td>
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<td>C6</td>
<td>Lack of adequate energy performance related QA on site</td>
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<tr>
<td>Verification &amp; Testing</td>
<td>T3</td>
<td>Concern over consistency of some test methodologies &amp; interpretation of data</td>
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<td></td>
<td>EM4</td>
<td>As-Built SAP not reflective of actual build</td>
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<td></td>
<td>V2</td>
<td>Lack of robust energy performance related verification, reliance on third party information</td>
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<tr>
<td></td>
<td>V5</td>
<td>Lack of clarity over documentary evidence for Part L &amp; Part F compliance</td>
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</tbody>
</table>
Inadequate Understanding & Knowledge within Design Team

Impact on:

- Buildability
- Compatibility of systems, materials and services
- Thermal detailing

Typical examples:

- Details into which insulation is impossible to fit
- No detail on support of screed at ground floor perimeters
- No consideration of thermal bridges for rooms over garages
- Etc....
Reality:

- Wall ties ✓
- Compressed edge seal ✗
- Insulation ✗
2. Concern over Competency of SAP Assessors

Problems with:

- Accuracy of inputs
- Following conventions
- Validating assumptions
- Evidencing assessments

Massive impact where they are giving design advice
How is the u-value calculated?

Can’t assume same thickness across entire roof

Reduced space above joists makes installation of full insulation thickness impossible despite this being assumed in SAP calculation

500mm roof insulation specification on 18° roof pitch
Lack of Site Team Energy Performance Related Knowledge and Skills and/or Care

Literature Review -

- “The lack of proper training of the workforce......resulted in significant construction faults, unplanned design solutions and wrong system commissioning”

  Oxford Brookes University, Understanding the Gap between As Designed and As Built Performance, 2013
Windows located in front of design positions

- Insufficient overlap with cavity closer
- **All** sites visited had the window in the wrong place
4. Product Substitution On Site

Literature Review -

○ “The most striking observation about the application of materials and components were the number of occasions on which materials intended for one location were used in another”

Leeds Metropolitan University, Lessons from Stamford Brook, 2008
INDUSTRY RECOMMENDATIONS
INDUSTRY RECOMMENDATIONS

- Performance Assessment R&D
- Skills and Knowledge Development
- Construction Details Scheme
- Continued Evidence Gathering
GOVERNMENT RECOMMENDATIONS

Signal Clear Direction
Stimulate Industry Investment
Strengthen Compliance Regime
Support Skills & Knowledge Development
ROUTE MAP TO 2020

The challenge ahead
How to address the Performance Gap?

- Provide a good practice guide in simple, clear format
- Use with on site toolbox talks, site manager training, builder’s merchants, building control, designer awareness, specifications, warranty providers.....disseminate lessons to the industry!
Site posters

**Cavity Wall**

**Problem to Avoid:** Gaps in insulation

1. **Problem to Avoid:** Gaps in insulation
2. **Problem to Avoid:** Air gap

**Good Practice:**
1. Protect cavity and insulation from mortar droppings
2. Smooth mortar joints to allow insulation board tight against block
3. Install insulation tightly batted with no gaps
4. Cut insulation tight to cavity closures, trims and cavity trays

**What to Do?**

1. **What to Do?**
2. **What to Do?**
3. **What to Do?**
4. **What to Do?**

**What to Do?**

- Install rigid insulation behind steel leaves, cavity trays, meter boxes and sudfifer vents or any other elements bridging cavity
- Blown or injected insulation, ensure this reaches the whole wall with no gaps
- Adjust drill pattern for tight spots, cavity trays and inject below DPC

**Good Practice**

- Use preformed tray around complex junctions

Please print and use in your site office, for further information www.zerocarbonhub.org
The 7 Brothers; Guiding SME’s

1. Builders’ Book - Masonry
2. SAP Untangled
3. Thermal Bridging Guide
4. Design Guide
5. Cost Efficiency Handbook
6. Services Simplified
7. Builders’ Book - Timber Frames
THE FUTURE
ZCH
OVERHEATING PROJECT
An interesting time for new build homes...

EPBD Article 2, NZEB definition:
[...] ‘nearly zero-energy building’ means a building that has a very high energy performance [...]. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby.[...]

NZEB System Schematic:

- On site
- Nearby
- Distant

- Exported energy nearby
- Delivered energy nearby
- On site RE (Renewable Energy)
- Total energy use of the building
- System boundary of energy use

Carbon Compliance

Zero Carbon

On site RE (Renewable Energy)

Fabric Energy Efficiency

On site RE (Renewable Energy)
THANK YOU

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