Design vs As-built Evidence Review

Ian Orme
Sustainable Construction Group
BSRIA
Evidence Gathering

Aims

• Understand where the gaps in the development process occur,
• Reflect performance issue for dwellings constructed to meet current Regulation requirements,
• Review different scale developments and developers,
• Develop a prioritisation matrix to help focus and prioritise possible solutions
Evidence Gathering

- Literature review
  - 100+ reports and documents reviewed to date
- Housebuilding process review
  - Nine developments covering 1,000 plots
  - On-going work
- SAP audits and questionnaires
  - Review of as-designed and as-built SAP
Literature Review

• State of the Industry
  – Aggregated data from NHBC, LABC, professional institutions, house builders, manufacturers

• Compliance Processes
  – As-built SAP ratings, Air Permeability tests results, use of ACD/ECD, Commissioning Test Results

• Field Trials
  – EST Heat Pump report, TSB BPE programme
Literature Review

- **Academic Studies**
  - Stamford Brook, Elmtree Mews, Temple Avenue
- **“Secret” knowledge**
  - Manufacturer’s field trial data, unpublished academic work
- **Anecdotal**
Literature Review

- Guidance: 45%
- Manufacturers: 35%
- Field Trials: 10%
- Academic Studies: 5%
- Site visits (inc TSB): 5%
Housebuilding Process Review

• Approach
  – Information gathering followed by semi-structured interviews
  – Design review
  – Construction site walkthroughs

• Developments volunteered by housebuilders
  – Nine completed to date
  – Have tended to be volume builders, but ‘pot’ is increasing
SAP Review

• Three stage approach:
  – Review of original design stage assessment as provided by the developer,
  – Recalculation of the design stage based on the design information provided for the process review,
  – Calculation of as-built SAP based on site inspection and interview findings. Comparison with developer provided as-built SAP, if available.
Synthesizing the Findings

• Approx. 50 issues identified across the Working Groups
• Frequency with which each issue occurs in the dataset
• Nature of the source data: peer reviewed academic paper; journalistic article, ‘hear say’
• Evaluation by review group of impact across a range of deliver models (volume, small scale and traditional contracting)
Literature Review -
Number of Sources Referenced by Issue Area

- Concept & Planning
- Detailed design
- Procurement
- Construction
- Verification
- Testing
- Energy Modelling Tools
- Overarching
- Good Practice!

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The Matrix

Impact on the Performance Gap

Evidence

- **NONE**
  - Low Impact
  - Priority for research
- **EMERGING**
  - Medium Impact
  - Retain a watching brief
- **CLEAR**
  - High Impact
  - Priority for action
- **HIGH**
  - Immediate action

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Impact on the Performance Gap

Evidence

NONE  EMERGING  CLEAR

HIGH  MEDIUM

PRIORITY FOR ACTION
CROSS-CUTTING THEMES

- KNOWLEDGE & SKILLS
- RESPONSIBILITY
- COMMUNICATION
### AS-BUILT PERFORMANCE - PRIORITY FOR ACTION

<table>
<thead>
<tr>
<th>Concept Design &amp; Planning</th>
<th>D2</th>
<th>Limited understanding of impact of early design decisions on energy performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Inadequate understanding and knowledge within detailed design team</td>
<td></td>
</tr>
<tr>
<td>D2</td>
<td>Lack of integrated design between fabric, services &amp; renewables</td>
<td></td>
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<tr>
<td>E1</td>
<td>Issues around use of U-value and thermal bridging calculation procedures</td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>Concern over competency of SAP assessors</td>
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#### Procurement

<table>
<thead>
<tr>
<th>Procurement</th>
<th>P2</th>
<th>Inadequate consideration of skills and competency at labour procurement</th>
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#### Construction & Commissioning

<table>
<thead>
<tr>
<th>Construction &amp; Commissioning</th>
<th>C5</th>
<th>Product substitution on site without consideration of energy performance</th>
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<tbody>
<tr>
<td>C15</td>
<td>Poor installation of fabric</td>
<td></td>
</tr>
<tr>
<td>C9</td>
<td>Poor installation or commissioning of services</td>
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<tr>
<td>C13</td>
<td>Lack of site team energy performance knowledge &amp; skills</td>
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<tr>
<td>C6</td>
<td>Lack of adequate energy performance related QA on site</td>
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#### Verification & Testing

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<thead>
<tr>
<th>Verification &amp; Testing</th>
<th>T3</th>
<th>Concern over consistency of some test methodologies &amp; interpretation of data</th>
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<tbody>
<tr>
<td>EM4</td>
<td>As-Built SAP not reflective of actual build</td>
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<tr>
<td>V2</td>
<td>Lack of robust energy performance related verification, reliance on third party information</td>
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<tr>
<td>V5</td>
<td>Lack of clarity over documentary evidence for Part L &amp; Part F compliance</td>
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## AS-BUILT PERFORMANCE - PRIORITY FOR RESEARCH

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<th>DETAILED DESIGN</th>
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<tr>
<td><strong>E18</strong></td>
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Illustration of Findings

• Integration of design
  – Focused on architectural layout and optimisation of space
  – Increases complexity of geometry with ‘knock-on’ impact to structural requirements, increasing thermal bridging
  – A near complete absence of an engineering approach to services design with resulting problems in installation and commissioning
Summary

- Evidence review has established 15 clear issues that are demonstrated to impact the performance gap
- These encompass, knowledge and skills, communication and responsibility for the energy performance
- Broad themes and findings similar to wider TSB BPE work
- Developing strategy for Priority for Research in next phase of project
Design vs As-built Evidence Review

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