Innovate UK
Building Better Buildings
London

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Zero Carbon Hub
THE PERFORMANCE GAP PROJECT

Closing the Gap Between Design & As Built

15th Feb 2016
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

ZCH
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!
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
CONCEPT DESIGN & PLANNING
Limited understanding of impact of early design decisions on energy performance

DETAILED DESIGN
- D1: Inadequate understanding and knowledge within detailed design team
- D2: Lack of integrated design between fabric, services & renewables
- EM8: Issues around use of U-value and thermal bridging calculation procedures
- EM7: Concern over competency of SAP assessors

PROCUREMENT
- PR2: Inadequate consideration of skills and competency at labour procurement

CONSTRUCTION & COMMISSIONING
- C5: Product substitution on site without consideration of energy performance
- C15: Poor installation of fabric
- C9: Poor installation or commissioning of services
- C13: Lack of site team energy performance knowledge & skills
- C6: Lack of adequate energy performance related QA on site

VERIFICATION & TESTING
- T3: Concern over consistency of some test methodologies & interpretation of data
- EM4: As-Built SAP not reflective of actual build
- V2: Lack of robust energy performance related verification, reliance on third party information
- V5: Lack of clarity over documentary evidence for Part L & Part F compliance
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 ❌

Diagram:
- Fully insulated party wall
- House 1
- House 2
- Thermal bridge

Compressed edge seal and insulation difficult to install and omitted on site.
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

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

GOVERNMENT RECOMMENDATIONS
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

- Insulation not tight to wall face due to rough surface
- Gaps between adjacent boards
- Heat loss

**What to do?**

1. Protect cavity and insulation from mortar droppings
2. Smooth mortar joints to allow insulation board tight against block
3. Install insulation tightly butted with no gaps
4. Cut insulation tight to cavity closures, lintels and cavity trays

**Good Practice**

1. Use preformed tray around complex junctions

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**Cavity Wall**

**Problem to Avoid**: Missing insulation

- Missing insulation behind meter box
- No insulation behind meter box

**What to do?**

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

**Good Practice**

- Use preformed tray around complex junctions

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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.[...]

Zero Carbon
Carbon Compliance

Fabric Energy Efficiency
On site RE zero carbon heat and power
Variable energy savings

NZEB System Schematic
Total energy use of the building
On site production plant
Nearby export
Delivered energy nearby
Exported energy nearby
System boundary of energy use
On site Nearby Distant
THANK YOU

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