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Knowledge Gaps and Cost Consequences: A Case Study of PAS 2035 Implementation

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Introduction

The built environment directly contributes to 25% of the UK's total carbon footprint, crucial for the transition to Net Zero. Energy used to heat buildings accounts for around 23% of the UK's total carbon emissions. A BRE Trust study found that the UK has the oldest housing stock in Europe, with 75% of buildings built before 1980. The UK's 28.6 million homes are among the least energy-efficient in Europe, losing heat up to three times faster than those on the continent, making residents poorer and colder.

In late 2021, the UK Government published a Net Zero Strategy, outlining a 10-point plan for a green industrial revolution. This includes phasing out gas boilers and supporting heat pump installations through a £450 million Boiler Upgrade Scheme. By 2030, all fuel-poor homes must meet an EPC Band C rating, with funding from the Home Upgrade Grant and the Social Housing Decarbonisation Fund.

Studies indicate that UK infrastructures are ill-equipped for the transition from gas boilers to heat pumps and achieving 100% EPC C by 2030 involves high costs. Deep retrofitting is necessary, but existing schemes like the Energy Company Obligation (ECO) have weaknesses. Successful standards such as Passivhaus and Energiesprong offer valuable lessons. Companies like Energiesprong UK are developing strategies for mass retrofits, showing promising results.

The PAS2035 standard, issued by the BSI, aims to become the UK's future home retrofit standard, supporting nearly net zero retrofit design. It expands on the framework of PAS 2030, introducing further standards and a new role, the Retrofit Coordinator, responsible for overseeing projects from start to finish and ensuring quality assurance. Adherence to PAS 2035 is mandatory for domestic retrofit projects participating in government energy efficiency schemes.

While extensive studies have explored retrofit design, delivery, and post-occupation evaluation, a notable gap exists in understanding the implications of PAS 2035 for various stakeholders. This research aims to assess the effectiveness of PAS 2035, highlighting its benefits and challenges according to different stakeholders.

A case study approach was adopted to achieve the objective of this research. The Case Study Project DORIC is being delivered by Aberdeen City Council in Scotland (UK). The main criteria for selecting this case study are that the project has been delivered to the PAS 2035 standard, and the involved stakeholders have agreed to participate in the interviews. The five participants interviewed were part of the design team involved in DORIC; Architect, Architectural Officer, Quantity Surveyor, Retrofit Coordinator and Trainee Site Manager.

Results

After analysis of the interviews, 3 themes of lessons learned from PAS 2035 implementation have been identified: knowledge of PAS 2035, detailing challenges, and cost aspects.

Knowledge about PAS 2035

The initial knowledge of PAS 2035 among project participants was limited. Many had little to no familiarity with the retrofit standard before the DORIC project. This lack of awareness posed significant challenges during the early design stages. Some participants acknowledged the need for Continuing Professional Development (CPD) sessions to improve design team efficiency before construction. These sessions could have helped identify minor challenges, such as adjusting boundaries for External Wall Insulation (EWI), relocating satellite dishes, and moving gas meters.

Effective team resourcing before site works began was crucial to the project's success. Regular in-person meetings with the design team, including the architect, quantity surveyor, contractor, retrofit coordinator, and contract administrator, were instrumental in ensuring compliance with PAS 2035. These meetings facilitated the review of details and sequence of work from the contractor's perspective, enhancing the overall understanding and execution of the project.

The retrofit coordinator, who is required

to have a Level 5 Diploma in Retrofit Coordination and Risk Management, also faced challenges due to the general lack of knowledge about PAS 2035 among other team members. The interviewees highlighted that funding targeted towards Council and Housing Association staff to gain base knowledge on retrofit roles is essential. Initiatives like the West Midlands Combined Authority's collaboration with the Retrofit Academy, offering funded courses, are steps in the right direction to increase the number of professionals in the field.

The DORIC project team eventually gained substantial knowledge and experience with PAS 2035, but their initial unfamiliarity led to delays and cost implications during the design process and site works.

Detailing Challenges

Several detailing challenges were encountered during the design and construction stages, which had budgetary implications. These included:

Installing External wall insulation (EWI) Below Ground

Installing EWI below Damp-Proof Course (DPC) added significant costs due to the necessary excavation of groundwork to move rainwater gullies (see figure 1). Participants noted that adhering to PAS 2035, which initially required EWI below ground, was costly and complex. Although subsequent revisions allowed for stopping EWI 10mm above ground, previous studies indicated potential condensation risks if the DPC remained uninsulated when EWI was installed. PAS 2035 promotes best practices to address these issues, emphasizing the importance of ensuring waterproof junctions.

Image:
Repositioning of Drainage,
Skye Elizabeth Chatburn

Extension of Eaves

Ensuring precise detailing and execution during retrofitting is crucial to prevent failures. Extending eaves and verges to cover EWI properly (see figures 2 and 3) was a significant challenge, as low-cost solutions like flashing were not viable under PAS 2035. Poor detailing at eaves junctions in previous projects such as the Disastrous Preston retrofit scheme [8] led to issues like damp and mould growth, underscoring the importance of strict compliance with the standard. While extending eaves is costly, it effectively prevents thermal bridging and water ingress, resulting in a neater facade.

Party Walls

The extension of EWI to prevent cold bridging encroached on neighbouring properties, requiring additional permissions and incurring extra costs. To address this, a strategy involving the installation of 800 mm of Internal Wall Insulation (IWI) was suggested. This approach, planned as part of a medium-term improvement strategy, allowed for gradual improvements to achieve zero carbon performance over 20-30 years. Conducting thermal surveys post-completion helps detect thermal bridging, informing the timing of IWI installation.

Public Utilities

Managing public utilities, particularly gas meters, was a common challenge. The responsibility of tenants to communicate

Images:
Top: EWI & Eaves Detailing at DORIC
Bottom: Drain detailing at DORIC,
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Images:
Gaps in External Wall Insulation (EWI) at DORIC
Skye Elizabeth Chatburn

with gas providers for meter removal caused delays and uninsulated gaps in walls, posing potential damp-related issues (see figure 4). Better foresight in future projects, including arranging gas meter removal dates before commencing site works, is necessary to mitigate these challenges.

Cost Aspects

The DORIC project faced high costs, partly due to the lack of appreciation for the retrofit coordinator role, leading to oversight in data collection and on-site coordination. The baseline cost per property was £51,000, but the actual cost was £100,000. The limited knowledge of PAS 2035 among the design team and contractors contributed to these heightened costs.

The shortage of accredited contractors familiar with PAS 2035 standards also exacerbated cost issues. The learning curve for contractors and the lack of competition due to the limited number of accredited professionals increased project costs. Financial incentives and government support for training and certification could help mitigate these costs by increasing the number of accredited contractors and enhancing competition.

Conclusion

The DORIC project highlights several critical insights into the implementation and challenges of adhering to PAS 2035. Initial unfamiliarity with the standard among project participants posed significant challenges. Despite this, the team recognized the importance of understanding PAS 2035 to achieve net-zero ambitions. The retrofit coordinator's role was crucial in ensuring compliance, despite the learning curve faced by the broader team.

Detailing challenges, particularly with installing EWI below ground, extending eaves, managing party walls, and public utilities, added complexity and costs to the project. Adhering to PAS 2035 promotes best practices, but innovative solutions and pragmatic approaches are necessary to balance compliance and feasibility.

The cost implications of the DORIC project were significant, with actual costs per dwelling almost doubling the baseline estimate.