Retrofit for the Future Final Phase Report
ZA522P
Appendix 3
Minutes and report from Wash-Up meeting

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FLASH project

Draft Hindsight Review – ZA522P-Hounslow Passivhaus Retrofit– V 1.0

Institute for Sustainability

European Union

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Investing in your future

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1 Project Description

Hounslow Passivhouse is a north-south facing semi-detached property which was deemed to have an abnormally high energy demand as assessed using the Passivhaus Planning Package (PHPP). The main objective of the retrofit project was therefore to demonstrate that deep-energy cuts are achievable within the social housing stock. The retrofit strategy makes use of mechanical ventilation to achieve minimal heat loss. Specific heat energy requirements will be reduced by 95%, while also minimizing primary energy use. (source: http://retrofitforthefuture.org).

2 Project participants

Project lead	Bere:architects
Client	Hounslow Homes
Architect	Bere:architects
Mechanical & electrical consultant(s)	Alan Clarke
Energy consultant(s)	Alan Clarke
Structural engineer	Galbraith Hunt Pennington
Quantity surveyor	e Griffin Consulting
Contractor	Hounslow Homes

3 Meeting Attendees

Represented Organisations	
Project Lead/Architect	Bere:architects
Client	Hounslow Homes
Contractor	Hounslow Homes

4 Findings from the Hindsight Review Meeting

The following provides an overview of the main findings of the hindsight review meeting that was undertaken for the project. The meeting format involved the use of a pre-prepared agenda listing all aspects associated with the project as a guide for discussion.

4.1 Project Aims

This section summarises the aims of retrofit project as stated by each of the organisations involved. The most important overall findings that came out of the discussion were:

- This project was to dramatically reduce energy consumption and create a much healthier environment for the residents who had reported various issues. Lowering fuel bills was considered to be a key aspect in protecting the ability to pay the rent, thus protecting the organisations income as well as the council's rental receipt.
- The project aimed to find cost-effective ways to address the issues that occurred throughout their stock to improve the lives and health of their tenants.
- This project was also considered to be an education for the rest of the organisation, as there was no big push for this type of work from other parts of the organisation.

The various organisations involved and their specific aims can be summarised as:

Bere: architects

- The context of the project was that it was a Retrofit for the Future project which aimed to provide 80% emissions savings on single dwellings. The architects were introduced to Hounslow Homes through IfS, who thought that they would be interested to collaborate on a project together. A couple of houses were initially assessed and the current property selected to go forward to the first stage of the competition.

- As an organisation, bere:architect's interest in undertaking this project was to dramatically reduce energy consumption and create a much healthier environment for the residents who had reported various issues. Since the residents both had serious illnesses, higher than average temperatures and good IAQ were required to maintain their comfort and health. This project aimed to provide internal air quality which was better than the external air quality. The Passivhaus approach used was a perfect match to the requirement and achieved good energy and monetary savings as well as huge health benefits for the residents.

- This project was therefore viewed as an opportunity to redress the current thinking that focuses on energy saving measures in terms of the monetary benefit without considering the importance of the health benefits that could be achieved as a result.

Hounslow Homes:

- The client had been involved on a number of projects with IfS that looked into achieving carbon reductions and alleviating fuel poverty for tenants and were therefore very keen to participate in the R4TF project when the opportunity presented itself. Several proposals were submitted with various architects and this project was selected to go forward.

- The project was viewed as an opportunity to attack all the issues that were being considered within the organisation and apply solutions to their stock (approx. 16,000 units) as a whole. The properties that were selected were therefore particularly challenging and illustrated most of the issues (each in a different way) that required addressing throughout their stock in many similar units.

- It was also important to consider that around 60% of the tenants are on benefits and therefore are struggling to meet various financial commitments and pay fuel bills. Lowering fuel bills was therefore considered to be a key aspect in protecting the ability to pay the rent, thus protecting the organisations income as well as the council's rental receipt.

- The aim of their involvement was to therefore try to find cost-effective ways to address the issues that occurred throughout their stock to improve the lives and health of their tenants. In general, all the measures applied to this particular project were considered to be applicable to a large number of the client's stock, however not all were considered to be cost-effective

- This project was also considered to be an education for the rest of the organisation, as there was no big push for this type of work from other parts of the organisation. This is an area that needs to be developed internally as well as from the side of the local authority who have not supported other initiatives pursued outside of the TSB competition. This project was viewed to be a potential catalyst for driving this agenda both within the organisation and within the local area (support had decreased with change of the local council leaders).

- The competition focussed on "fabric first" approaches which might have lead to other more novel approaches not being considered.

4.2 Design Challenges

This area of discussion aimed to discuss the design challenges and assess what worked well or less well, provide an understanding of why this occurred and possible routes to improve future projects. This was undertaken through the discussion of the design concept that was developed and the spatial alterations that were carried out.

The main design challenges associated with this project are:

a-Occupant Health : In this case, the ill health of both occupants was a main challenge as well as a design determinant of the project. The Passivhaus approach adopted addresses this through the provision of comfortable and healthy indoor environment throughout the year. In particular, various measures (such as the heat recovery system which filters airs) were adopted to provide high quality IAQ in both summer and winter.

b-Resident In-Situ retrofit: The main design challenge set by the client was the requirement that the retrofit be implemented with residents in-situ. This was an important aspect for the client who aimed to find a replicable way to retrofit their stock.
This impacted the project in the following ways:

- The participants were chosen to reflect the general population inhabiting the clients stock, they were financially strained and were willing to participate (as opposed to another 2 properties that were initially considered). The fact that they had health issues was considered to be a bonus.
- The tenant engagement process involved initial contact made through letters, followed by an interview and information session that aimed to inform the tenants of the project and asses their ability to change their habits.
- Other tenants approached failed to engage due to scepticism, lack of information and concern over possible disruption.

4.3 Retrofit Strategy

The various retrofit strategies and measures employed for the building fabric and M&E services installed and the challenges associated with their installation were discussed in an aim to find possible routes to improve future projects.

4.3.1 Building and Fabric

The retrofit strategy adopted a “fabric first approach” to achieve the most energy reduction. The solid wall construction of the property affected the selection of fabric materials as follows:

a-Wall Insulation Strategy

Approach:

- The insulation strategy involved primarily applying external insulation render systems, which were considered to be the more convenient option which avoided condensation build-up problems which can sometimes occurred with internal insulation.
- External insulation is regarded to also be a less disruptive option to undertake if residents are not decanted and does not result in the reduction of internal space.
- External insulation can also be used to improve the external appearance of properties in need of a “facelift”, results in a new build look. External insulation also significantly reduces future maintenance intervals.
- This should be considered in evaluating the cost of retrofit (cost of installing external insulation vs. potential future maintenance savings).

Materials:

- Two types of extruded polystyrene (EPS) solution were used for the external wall insulation .
- The first type was generally used for most walls, while the second (denser) type was used below ground level to prevent water penetration.

Process:

- The insulation extended down to the footing of the building to try to create a thermal bubble beneath the house.

b-Floor and Loft Insulation Strategy

Approach:

- The floor insulation strategy proposed initially involved removing the floor slab to lay down an insulated floor slab. The roof insulation strategy proposed also involved the removal of the roof.
- Due to the practicalities of undertaking the retrofit with the tenants in situ, these strategies were replaced with much less disruptive options.

Materials:

- For the floor insulation, a simple approach using a geotextile membrane was used. This was draped between the floor joists to allow 150 mm mineral wool insulation to be placed between them. This allowed the timber underneath to be ventilated.
- The loft was insulated using 450 mm of loft insulation. This was placed across the ceiling.

Process:

- The use of the geotextile membrane simplified the floor insulation process and allowed the insulation to be implemented on a room by room basis. The membrane maintained ventilation of the hardwood floor boards New OSB boards with taped joints achievied the target airtightness rates.
- The mineral wool was not the most efficient material available, but was considered to be more buildable, sensible and cost-effective.
- An alternative option of using rigid board insulation and spray foam insulation was considered but was deemed too complicated.
- For the roof, the strategy employed only required that the first 5-6 of tiles to be removed (as opposed to the original plan of removing the entire roof) and roof timbers replaced. This solution was implemented in conjunction the extension of the eaves which was required as a result of the external wall insulation. A rigid board (instead of a membrane) was used in this case to provide airtightness, this also provided an instant working platform for installing other equipment (HRV...etc).
- This joists was used for the first time and was viewed as something that could be widely applicable in the UK.

c-Windows and Openings:

- Triple glazed, Passivhaus certified windows were used. These are thermally broken, with laminate frame and insulation installed.
- Due to the thick window profile a novel window fixing solution was adopted to integrate windows with the wall and allow continuity of insulation. Extensive detailing and exact installation were employed.

- Further improvements to the window installation approach and the possibility of cost-effective wide-scale application were discussed.
- The process used for window installation aided in getting the windows in earlier as the frames helped determine the exact window sizes required.
- The thermal bridging was minimised by having the timber embedded within the insulation. This was confirmed through the undertaking of thermal modelling.

d-Airtightness Strategy:

- Due to the use of the Passivhaus principles, the airtightness strategy was carefully managed. This included measures to ensure airtightness targets (pressure test result =1.6 ach-1@50Pa) were reached in the floor insulation and airtight detailing for components such as windows.

e-Other works:

- The garage in the neighbouring property was occupied, this party wall was nevertheless partially consequently insulated as part of the projec,in order to prevent thermal bridging to the facades
- Some works were carried out in the rear facade to extend openings and maximise on solar gains in north-facing areas.
- A new kitchen and bathroom were installed , work to the garden was carried out (concreting of surfaces) and a new water main and drainage system were fitted.
- All the problems were identified beforehand through a discussion of the brief and consideration of the Replicability of works and were implemented prior to the retrofit work being carried out

The scope for future technical improvements in the process of upgrading the building fabric included:

- Various access issues were experienced in the implementation of the project due to pre-existing issue with the neighbours.
- There should be an effort to create a national supply chain and manufacturing base for building components. In addition to simplifying logistics, this would protect the industry from issues such as currency exchange rises (e.g. windows were sourced from Germany at a time when the exchange rate was not favourable).
- The final pressure testing carried out was viewed to be rushed and not as thorough as earlier tests.

4.3.2 M&E Services

This area aimed to assess the aspects related to M&E services and possible routes to improve future projects. This was undertaken through the provision of an overview of the environmental strategy and the assessment of heating and hot water services (heat recovery ventilation system, solar hot water), electrical services, and monitoring installation used. The main findings can be summarised as follows:

a- Systems:

Strategy:

- A heat recovery ventilation system was used. The unit has a three speed setting with a boost for the kitchen installed on the ground floor.
- Solar panels are installed on the south elevation on the roof with a solar tank installed on ground floor, in place of the previous hot water tank cupboard.

Installation:

- A heat recovery ventilation system was installed in the roof space.
- The duct work was carefully planned and incorporated beside the chimney breast to avoid encroaching into the rooms. Existing boxing was used to bring down the extract for the kitchen

b-Monitoring Equipment:

- The monitoring system involved the use of the standard EST-BSRIA kit. Additional solar thermal monitoring was installed.
- Pulse meters were installed on the various appliances these are sent to the BSRIA database.

The scope for future technical improvements in the process included:

- In Germany the ventilation system filters would not require to be changed except once a year, however high pollution levels in London require that this be done on a much more frequent basis (3 or 4 months).
- Even though maintenance access is provided, the maintenance of the installed systems is a potentially important issue particularly given that the occupants are elderly and in poor health.
- Various solutions regarding the issues of maintenance and control were proposed, these included that maintenance be undertaken by the landlord in such cases, or an easy access cupboard be installed (this might not be applicable in many retrofit properties where cupboard space is small).
- The issue of the space required to install the innovative and highly efficient, but relatively large systems was highlighted. In this case the loft space is now not a usable space.

- In addition the issue of communal plant rooms was discussed, this would simplify maintenance, but future right to buy issues would have to be considered.
- The scope of only fitting low energy light fittings originally proposed was expanded to a whole rewiring of the house when issues arose on-site. This is an example of unbudgeted, but essential work.
- A scope of additional work was carried out and discussions with tenants took place to ensure that the integrity of the building fabric was maintained (to avoid other people “punching holes into the fabric”).
- An airtight grommet that allows any electrical installations to be added later could be used. This is a German product (a long supply chain is involved). There is potential for this to be produced in the UK but there is currently little demand. A business opportunity exists in manufacturing this locally in the future as demand increases.

4.4 Client Review

This area of discussion included the review of the installation stage and final outcome of the project from the perspective of client and tenants. The main findings can be summarised as follows:

- The client was pleased with the outcome of project, which delivered more than what was expected due to the various enhancements that were added to the project.
- The residents were also very satisfied with the outcome and recognised the improved quality of the indoor environment and thermal comfort that was achieved through the retrofit.
- The program overrun was an issue that was understood by all partners, who recognised that extra time was needed to ensure that aspects such as the required airtightness targets and various plumbing and electrical works were properly implemented. 10 weeks were also required to address various issues with the next door neighbours.
- The good relationship between the client and their in-house contractor (the only sub contractor hired was the external insulation contractor) was a key element in this project, and one that was a departure from the antagonistic relationship that usually exists in traditional building contracts. This arrangement also helped to embed the learning.
- Throughout the project implementation phase engagement was maintained via the liaison officer who kept them informed on a day-to-day basis.
- The role of the liaison officer is key in the case of issues occurring on-site (which did not occur in this case). This gives tenants an independent person ("a focal point") to refer back to and address issues
- The tenants were very pleased with the outcome of the project as well as the project team. As a result of this involvement they had expressed an interest in being part of the "Old home, Super homes" program and were willing to open their house to visitors.
- The head of the team was very good with the tenants and other site team members were on hand to carry out the work. Some of the strategies employed were considered to be useful but not replicable on a wider scale.
- Organisation of works and daily clearing up were important to placate the tenants.
- The handover consists of a brief discussion with tenants and information is provided on 1 side of an A1 sheet which is given to tenants and mounted on a board. Small panels with information are also designed to be hung next to controls if necessary.

The scope for future technical improvements in the process included:

- In terms of program delivery, the project overrun what was originally planned and was delivered in 20 weeks. There were significant delays including a 6 week delay for negotiating access with the next door neighbour to construct the scaffolding required for the external insulation.
- The early engagement of neighbours was viewed as a key aspect and various strategies for this to be considered in future properties (especially in the case of possible mass-retrofit) were outlined to highlight and address the risks involved (incentives, early communication, involvement of social scientists...etc.).
- Various other methods of informing tenants were suggested (audio files, CDS...etc.)

4.5 Design information provided and installation stage

This section reviews information provided by the project partners and includes suggestions on how to improve information for costing and construction. The issues surrounding implementing design information and installation were also discussed and included a highlight of the practical challenges of retrofit (access, working with residents in-situ, interaction of trades etc), construction success stories and difficulties, co-ordination of trades and subcontractor performance. The main findings can be summarised as follows:

- Communication between partners took the form of initial meetings with the architect and client, then later meetings which included the site project team as a whole. This set the trend and there was continued good (face to face) communication throughout the project, mainly due to the contractor being an in-house group within the client organisation.
- Having an in-house team also meant that motivation and commitment from the contractor was different from usual set-ups
- Extensive detailing (junctions, windows, insulation...etc.) was considered to be essential to ensure that the high airtightness targets were achieved and was therefore provided for construction.

The scope for future technical improvements in the process included:

- The only sub contractor hired was the external insulation (render) contractor. There are plans that the client's in-house team become certified to carry this out themselves. This was to be extended to other aspects of the client's work (certification to carry out various installations) - this can be considered part of a "local knowledge, local interest, local communities" approach which was important given the current economic environment.
- It is expected that future retrofit projects be carried out with a small team of people with a strong working relationship and a small feedback loop (the first projects would be viewed as a learning curve).

4.6 Cost control

This section reviewed issues surrounding ensuring cost certainty and the reduction of the cost of retrofit. The main findings can be summarised as follows:

- The overall cost was higher than the original competition budget of £150,000, which was not considered to be realistic of what was generally available in the social housing sector as a whole. Individual measures that were applied in this project will therefore be assessed and the most cost-effective/economical ones applied.
- Mass retrofit (either on a company or national scale) was considered to be key in achieving cost-certainty and making measures more cost-effective. Both Government policy and engagement of manufacturers were considered to be a key element in achieving this.
- A future higher volume of work is expected to drive down the costs (through easier and quicker implementation and volume purchases). Savings of around 20 % are expected.

5 Meeting wrap up

The wrap up session aimed highlight the most important aspects of the project, through a process of summarizing and prioritising each meeting participant's individual feedback regarding the most and least successful aspects as well as the aspects that were viewed to be most applicable to mass roll-out of retrofit.

Successful aspects: What went well?

The most successful aspects of this specific project that were discussed included both fabric and mechanical installations, as well as the strategic processes and outcomes. These can be listed as:

- **External insulation:** This was deemed to be a successful solution to insulating walls without causing major disruption. The solution was also viewed to have the potential to be rolled at a mass scale.
- **Team structure/in-house team:** The implementation of the retrofit with a fully coordinated in-house team of contractors lead to good communication and strong working relationships.
- **Passivhaus approach/Whole house approach:** This was considered to be the best option to implement for elderly and vulnerable people.
- **Good level of communication:** The communication loop with architects/clients/tenants was considered to be successful.
- **Tenants and Tenant liaison:** The good relationship with the tenant and the use of a liaison officer to maintain this relationship was a considered to be a highly successful aspect.
- **System integration:** The overall impact of the solar panels/heat recovery/insulation were considered to be highly successful in achieving required goals.
- **Quality of design drawings:** High quality design drawings are essential in conveying the appropriate construction information and achieving airtighness targets.

Repeatable Aspects: What would be applicable to mass scale-retrofit?

The aspects of the project considered to be repeatable for retrofit on a mass scale were discussed. These can be listed as:

- **Combining retrofit with programmed works:** The combination of works e.g. Decent Homes was viewed to be a strategy that could be repeated to streamline works and resources.
- **Roof insulation strategy:** The plywood and OSB boards used in the roof for airtightness were consisderd to be a repeatable solution.

Less successful aspects: What did not go well?

The aspects of the specific project considered to be less successful can be listed as:

- **In-situ residents:** Despite this not being an major issue for this project,future retrofits should be planned to allow the implementation of works without in-situ tenants as this limits the choice of measures that can be implemented
- **Improve length of time on site:** The program time was too long and should be shortened to reduce disruption.
- **External sub-contracting practices:** These should be minimised as they proved to be less effective than the in-house team. Ext. Sub contractor less effective than in-house team
- **Problems with neighbours:** Adequate measures should be put in place to avoid any issues with neighbours that might affect construction and legal framework should be developed to define responsibilities, access rights during retrofit.
- **Window rebuilding and finishes:** Rebuilding the structure of the bay windows was not considered to be a successful aspect of the project. Different finish to windows (i.e. not painted) would have provided a more durable solution.

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