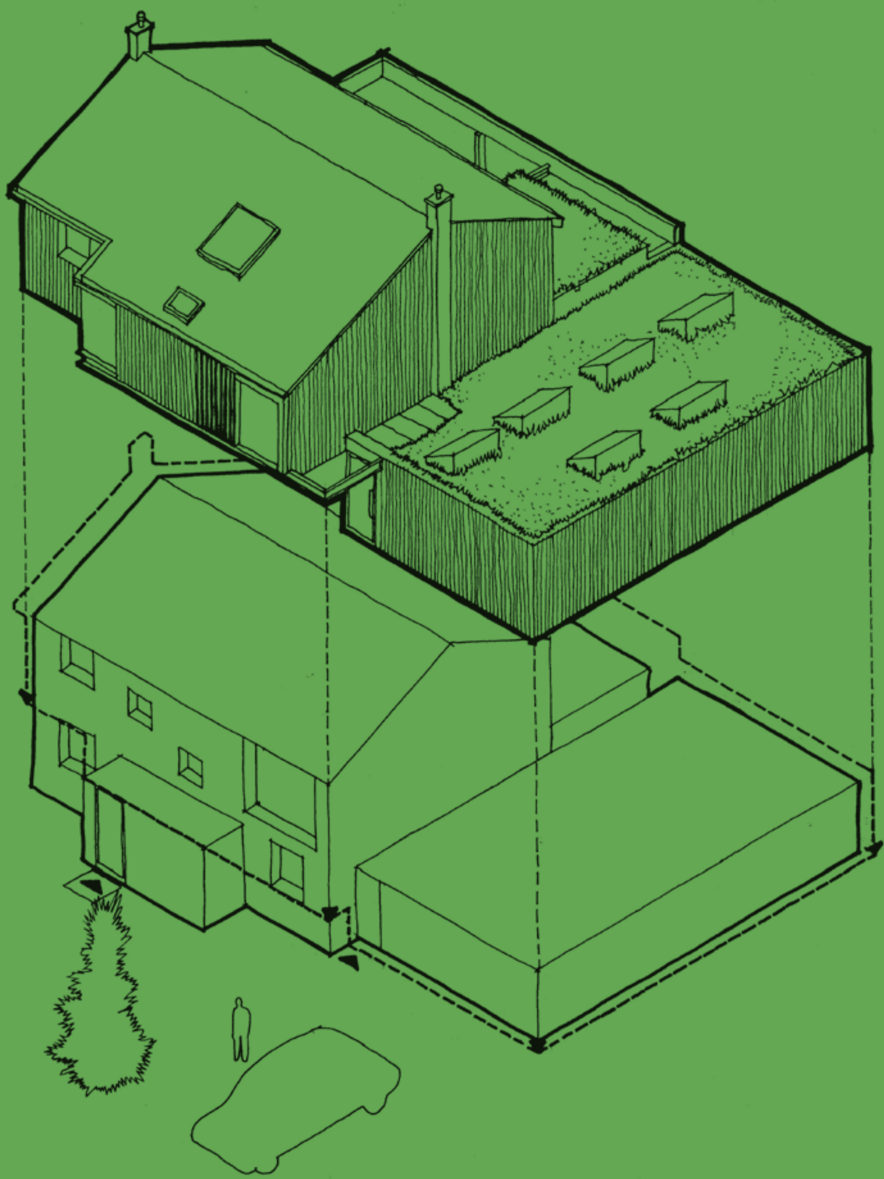
STRATEGIES FOR UPGRADING 1970S HOUSING

Barncroft Way, St Albans



SCOTT BATTY

UNIVERSITY OF WESTMINSTER
DESIGN RESEARCH FOLIO 2021

STRATEGIES FOR UPGRADING 1970S HOUSING

Barncroft Way, St Albans

SCOTT BATTY

Architect: *Scott Batty Architect*
Client/Funder: *Batty family*
Contractor: *PDCR Ltd*
Structural Engineer: *Morph Structures*
Cost: *£240,000 - £1,090/m²*
Location: *St Albans, Hertfordshire*
Date: *2018*

Fig. 1
Renovated and remodelled house, St Albans. Completed 2018
Photo: Matt Chisnall

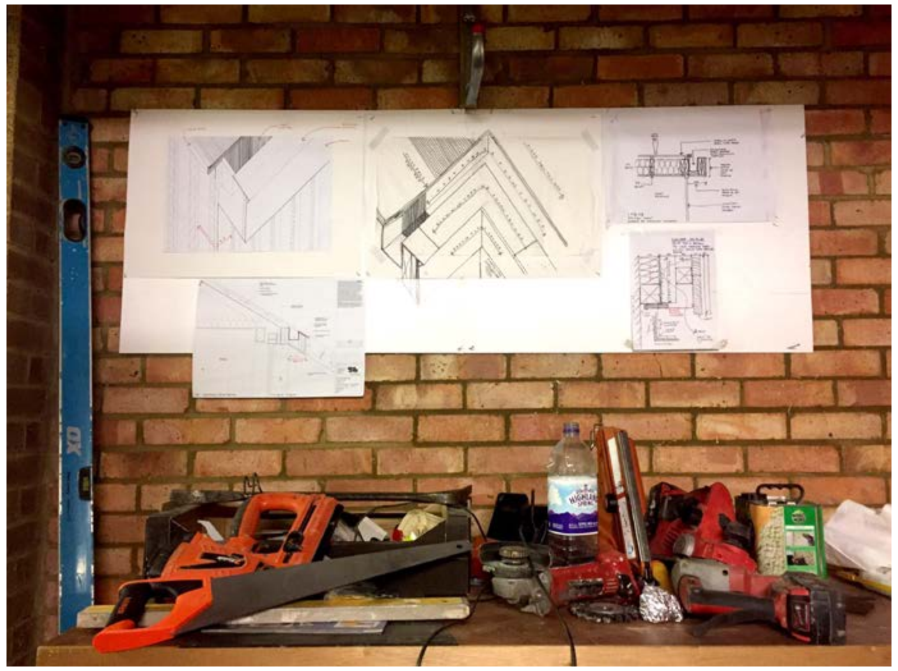


Fig. 2
'Agile' Contract Management on site. Drawings were issued and revised live on site only

ABSTRACT

This design for the environmental upgrade and remodelling of a suburban house was developed as an active and monitored research project. It has wide application for environmentally-conscious retrofits of a common building type – late-1960s to 1970s private developer housing which was built across the UK. This typology constitutes more than seven per cent of the UK's residential stock – some 1.7 million detached homes – and was normally built with large areas of single-glazing and cavity walls.

The research makes a detailed analysis of the existing and potential design and environmental qualities of the housing type to explore how these could be optimised. This included a two-year study of the family's occupation patterns. Batty took a 'lifetime design' approach to minimise demolition and rebuilding, enhancing positive qualities of the era's housing while promoting a use-model based on shifting patterns of family occupation through the day and night.

Drawing on aspects of his other published design projects, Batty developed a 'tea cosy' external upgrade approach that minimised disruption and costs due to client relocation. The result radically reduces energy consumption (an estimated 61 per cent of annual load for space heating). Monitoring continues using data loggers with an identical, unimproved house adjacent as a control. The research generated through this project thus forms an active model with widespread applicability for homeowners, architects, local authorities and developers. Dissemination is ongoing.

In a parallel research strand, the project explored methods to improve contract management for practitioners. Using a traditional contract, Batty developed a model that effectively does away with the issue of multiple revised drawings, in favour of daily meetings where revisions are agreed and signed on site, providing a useful administration model that reduces wasted work and conflict. This research is particularly applicable for small practices and sole practitioners working on local projects.

RESEARCH QUESTIONS

- What are the characteristics of 1960s-1970s UK developer housing that can most effectively and economically be optimised to improve their environmental performance while also enhancing their design qualities?
- How may one architectural design project be developed and tested as an optimal model for upgrading this common UK house type?
- How may a new approach to traditional contract administration eliminate the need for drawing revisions and reduce conflict?

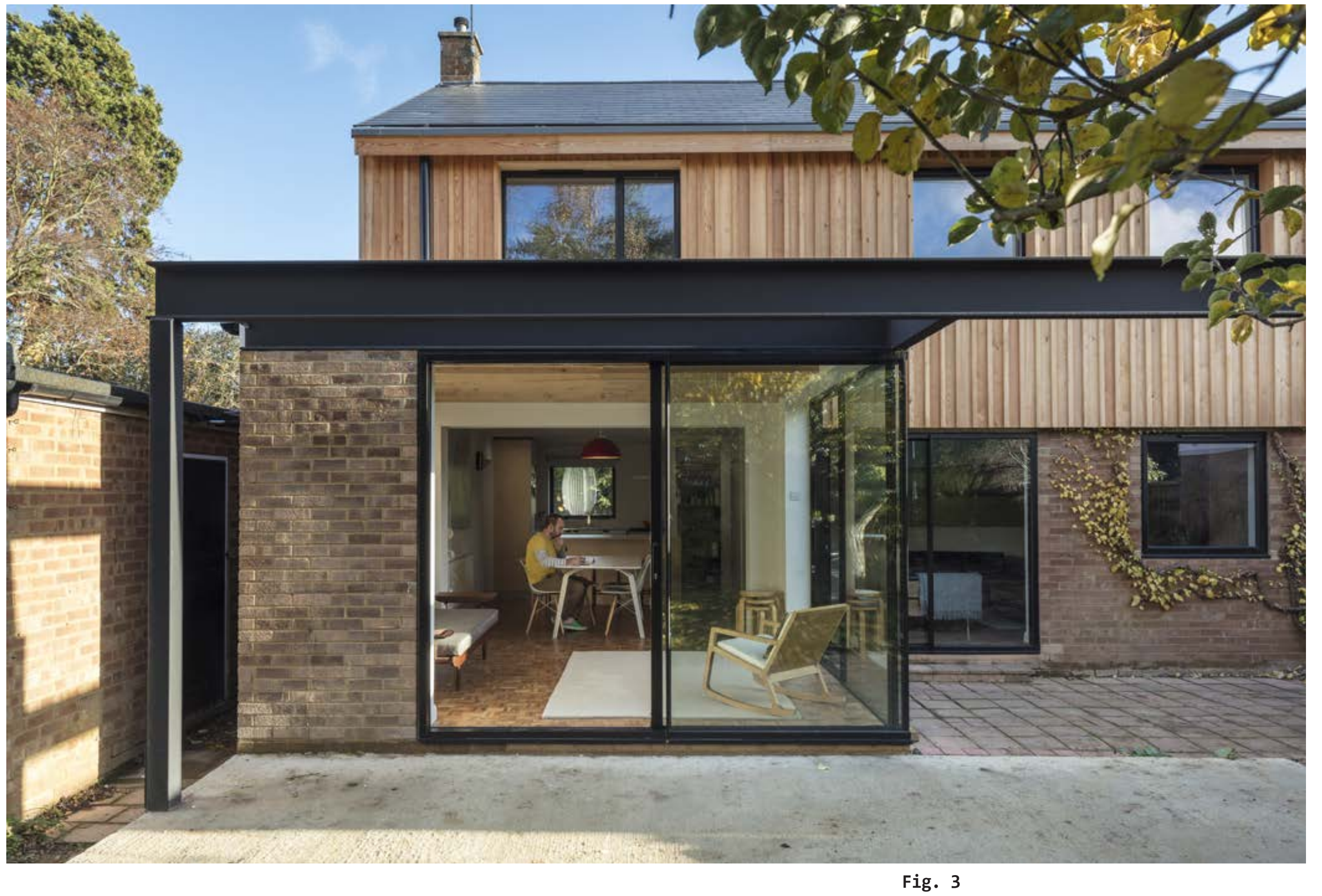


Fig. 3
Phase 1 house. Rear view showing timber overcladding at first floor and horizontal characterisation of a design intended to improve on the existing building's 1970s characteristics
Photo: Matt Chisnall

Fig. 4
Expressed detailing at front corner. Garage to be redeveloped in Phase 2
Photo: Matt Chisnall

GENERAL DESCRIPTION

The brief was for an environmentally, aesthetically and spatially upgraded, lifetime home, which updated and improved the 1970s architectural features of the building, remodelled their spatial qualities and reconnected it with the rural history of the site.

The design period had a two-year run-in allowing the monitoring of the family's existing use of the house and the development of a 'lifetime design' brief that minimised demolition and rebuild in favour of extension and upgrade, for economic as well as environmental reasons. It also allowed active lessons to be drawn from Batty's previous work at Peasmarsh and Longbury. An external, 'tea cosy' design approach was developed to concentrate construction works on the external envelope, which was also phased in order to reduce disruption and costs.

As well as improving thermal performance, the Phase I project brief included increasing the open-plan character of the ground floor where spaces could be reconfigured and using a minimum of new materials or waste, or demanding that the family move out (an immediate budget saving of approximately £25,000). An improved connection with the garden was created by the insertion of a glazed corner to the rear. A new corner 'sun space' at first floor front improved heat comfort levels at first floor. The concrete hanging tiles were replaced with a layered system of rigid insulation, membrane and ventilated larch rainscreen. Significantly, and confirmed by computer modelling, the insulation was only applied at upper storey; this optimised costs while focusing on the areas of greatest environmental performance uplift.

As part of Batty's ongoing testing of the findings of this project and their applicability as a model for other 1970s homes, the architect collaborated to create a dynamic (digital) model[1] of the house to test the energy outcomes with the use of an unimproved adjacent house of the same type as a comparator/control.

An 'agile' contract administration approach was developed in a conscious bid to minimise typical contractual arguments and disagreements and misunderstandings on site. Batty sees his approach as an 'analogue BIM', with one set of drawings held on site and updated collectively with the builders, in a 'little and often' approach.

This project is divided into two phases. The analysis/'action research' is covered in Phase 1 and featured in this folio. It includes design of both phases and construction of phase one. Conclusion of the reflection and dissemination will follow in phase two.

Total costs on completion of both phases is £240,000 (£1090/m^2). Phase 1 was £170,000 [including VAT and Fees]. Total floorspace (GIA) after both phases will be 220m^2, an increase of 10 per cent.

Fig. 5
Original house showing classic 1970s characteristics which were deployed in new ways in the refurbishment, including differentiation of first floor and strong horizontal characteristics

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Figs 6, 7
Other examples of classic 1970s UK housing displaying characteristics of box-forms, added porch, flat fronts etc
Photos © Alamy

CONTEXT

Upgrading 1970s Housing

The UK construction industry built more houses in the 1960s and 1970s than at any other point in the twentieth century.[2] Some 4.9 million owner-occupied homes were constructed between 1965 and 1980.[3] They make up approximately 7.35 per cent of the residential stock. The majority of these houses are still in use, many now more than 50 years old.

The private sector emphasis was on detached typologies on suburban layouts. Around 35 per cent of private sector houses of the period were of this type – either two-storey, bungalows, or, more rarely, townhouses. Little attention was paid to energy consumption and typically they were built with single-glazed windows in timber or metal frames as well as unfilled brick and block cavity external walls. Chimneys and open fires became rarer as central and storage heating (gas- or electric-fired) becoming the norm. Layout and orientation to optimise passive heating and cooling was not normally considered.

Many already have replaced single- for double-glazing (very often using poorly fitting uPVC frames as with the subject house) and filled cavities with insulation, but otherwise many have had very little improvement in their energy consumption performance. The period falls between the comprehensive 1965 Building Regulations review and the radical performance-based Building Regulations of 1985.

Aesthetically, they were normally box-like forms with pitched roofs and flat elevations with almost flush windows and minimal eaves overhangs. These houses were increasingly built by volume builders over the period to standard patterns that may only have had architectural involvement on their prototypes.

Large areas of glazing were used at ground floor while first floors often had applied decorative treatments such as weatherboarding or, as in this case, concrete tile hanging. Horizontal elements such as visual cantilevers (rather than functional) connecting with adjoining/integral garages and porches were common. Internally, the sitting room was the focus with semi-open plan arrangements the norm on the ground floor and separate bedrooms upstairs. Space standards were generous compared with current UK norms.

This stock is now between 50 and 60 years old and, in the context of the climate emergency, represent a considerable opportunity to reduce carbon emissions while improving accommodation. However, the housing stock of the period has been, relatively speaking, neglected in comparison to research into improving the environmental performance of nineteenth-century housing. Today, domestic buildings account for 30-40 per cent of primary energy use in the UK,[4] with space heating the largest component comprising some two thirds of usage.[5]

Typically, environmental upgrades and extensions are pragmatic, carried out by builders without the involvement of an architect and with little care for preserving positive stylistic qualities or a considered approach to energy conservation and waste minimisation. This project specifically takes the need for environmental performance upgrades as an opportunity to also improve the spatial and aesthetic qualities of the home, with passive energy performance and human occupancy patterns being integral to spatial design and environmental performance.

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Fig. 8
The project house and its neighbour were close to identical in terms of form, construction and orientation. This provided an opportunity to compare the two houses when the subject refurbishment was complete. Temperature/humidity data loggers were placed in equivalent rooms in both houses
Source: Google Earth

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Figs 9, 10
The subject house is part of a development of 1970s houses in the town of St. Albans, Hertfordshire, UK. Until the 1970s, the site was occupied by Cunningham Hill Farm (marked in orange in Fig. 10). The Grade I listed farmhouse can be seen on the aerial photograph (Fig. 9)
Fig 9: © Google Earth
Fig 10: © Digimap

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Fig. 11
The house was extended to the rear in the 1980s. Batty's refurbishment project changed the form of extension but did not extend its footprint any further

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Figs 12-16
House prior to renovation showing in numeric order: view from living room to garden; formal dining area in living room; kitchen; first floor box bedroom; living room with wall to kitchen behind; demonstrating typical small windows, darker conditions and tight spaces

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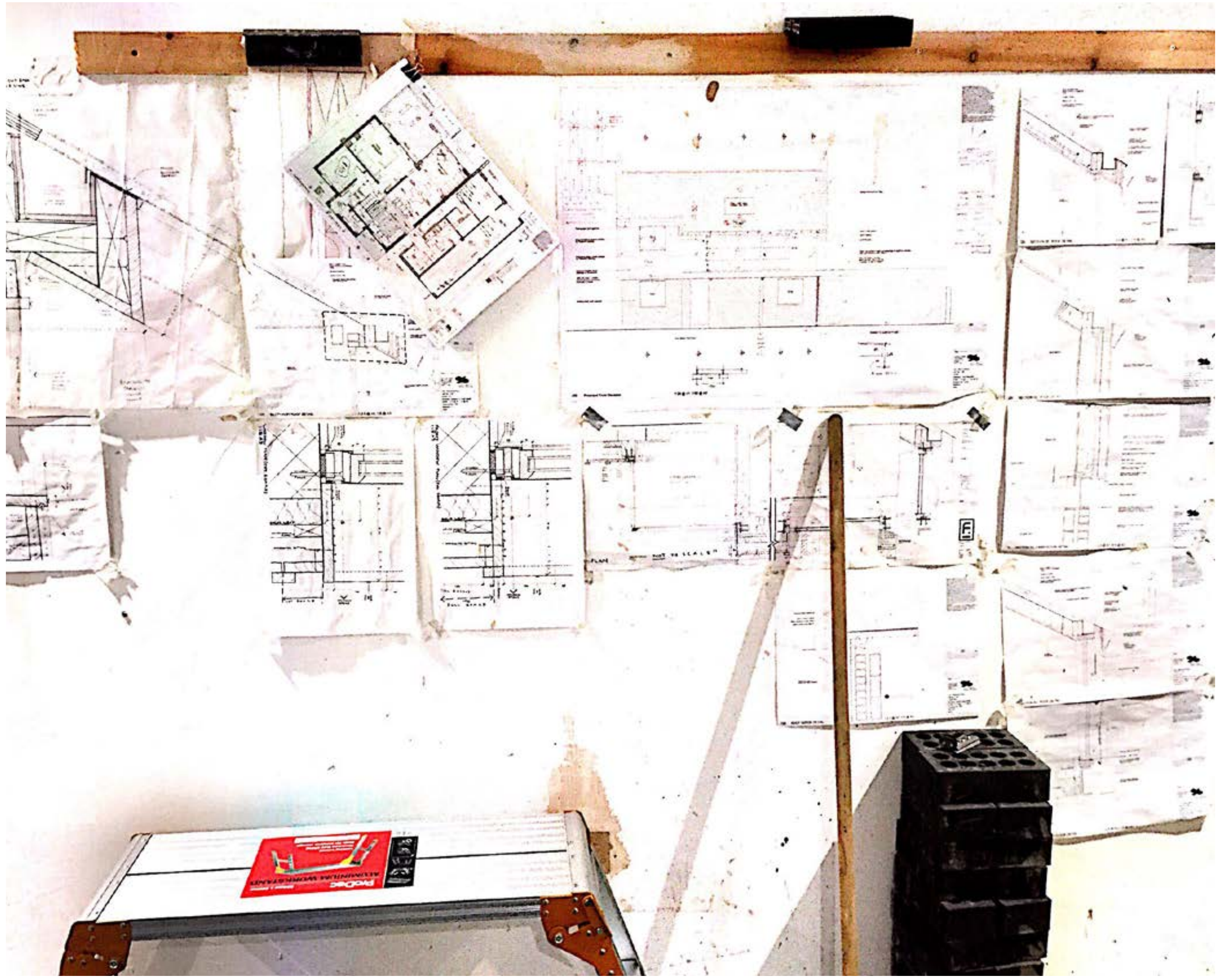
Precedent projects by Scott Batty.
Fig. 17:
Peasmarsh, 2006 is a remodelled 1960s bungalow in Surrey that also uses timber overcladding

Fig. 18:
Longbury, 2017 is a new build two-storey house in Suffolk which uses timber cladding on the top storey only
Photos: Matt Chisnall

Fig. 19
The live pin-up board for issuing and updating a single set of drawings on-site, avoiding the issue of multiple drawings



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Project Context

Up until the time of building in the 1970s, the site formed part of Cunningham Farm. The Grade I listed farmhouse remains in situ adjacent to the project site forming an important planning context, with the Local Planning Authority insisting on no additions in volume on the side to the farmhouse. The timber overcladding was also seen as reconnecting with this rural history.

The original project house was built in 1972 as part of a small private development of detached homes on a cul-de-sac in a semi-rural location in St Albans, outside London. It was built with single glazing and unfilled cavity walls (although uPVC double-glazing was in place at the project's outset). It addresses the street but did not have regard to solar orientation. Aesthetically, its tropes were those of developer housing of its period – pitched roof with concrete roof tiles and hanging concrete tiles at first floor and a horizontality to its composition.

Practice Context

Batty echoes Latham (see below) in arguing that much of this centres around the frequent revision and re-issue of drawings which were then not read or understood by the contractors. It was important for Batty, who works as a sole practitioner and as an educator with a focus on sustainability and design projects with research opportunities, to use this project to explore wider applicability in contractual, environmental and housebuilding fields.

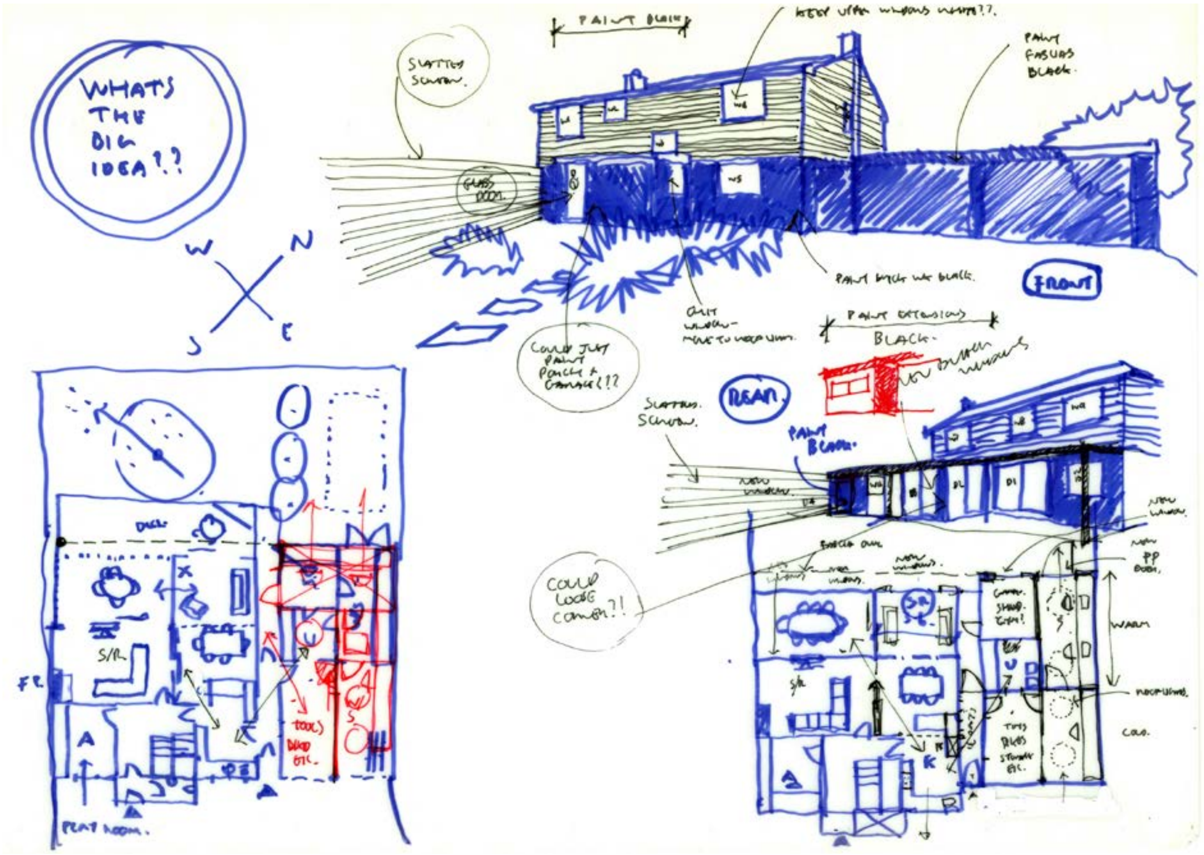
Contractual Context

The milestone Latham Report of 1994 pointed to an industry described as 'ineffective', 'adversarial', 'fragmented' and 'incapable of delivering for its customers'.[6]

In a recent report by the RIBA about half of contractors are dissatisfied with architects' ability to manage their work and the efficiency of the contract administration.[7] The report consistently found a significant gap in average satisfaction ratings on residential projects compared to all other types of client; for overall design and aesthetic ratings, the proportion of contractors rating 'very' or 'fairly' satisfied is about 10 percentage points less than other clients. The divergence grows to between 15 and 20 percentage points in ratings of architects' process management. Clearly, there is critical difficulty in the relationship between architects and contractors.

RIBA has identified that 86 per cent of UK architectural practices still frequently use a Traditional Procurement/Traditional form of contract.[8] This is often by SME or micro-businesses where the architect is also the contract administrator (CA) – a notoriously unprofitable and sometimes adversarial project stage for architects, and problematic in terms of managing quality.

This project also draws on two previous published house designs by Batty, Peasmarsh (2006), which was also a remodelling of a 1960s house with overcladding, and Longbury (2017), a new-build which tested improved details of larch cladding of the type used here. It also draws on Batty's experience as a principle of HÛT Architecture, and on his knowledge of contractual disputes which prompted the development of an optimised form of project management, and on his university role which also offers the opportunity to test and develop emerging environmental design findings.



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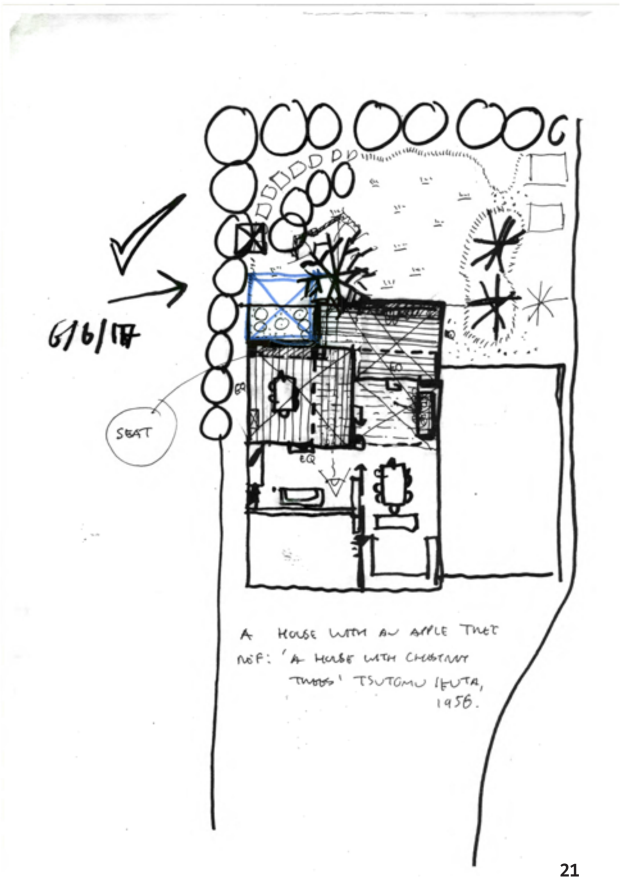

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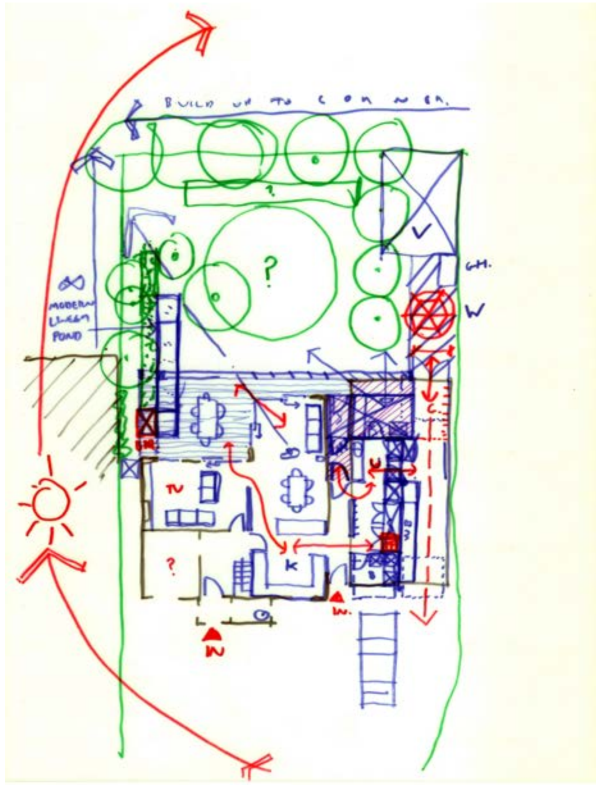

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Figs 20-22
Sketch plans. Scott Batty evaluated family patterns of occupation, human comfort and energy use for two years prior to works, developing 'lifetime of living' plans

AIMS AND OBJECTIVES

- To retrofit a 1970s house, preserving and enhancing its period qualities, while updating it as a flexible family home and optimising its environmental performance
- To develop and test a 'tea cosy' external works strategy to allow residents to remain in residence throughout
- To develop and test new models of contractual arrangement that reduce conflict and waste and raise quality thresholds

METHODOLOGY

Typological Research

The project began by an exploration of 1960s and 1970s private residential house typologies. Detached houses of the 1970s have common features including: box-like forms with a clear front, back and sides; flush elevations without protruding sills and minimal eaves' overhangs; two-storey height; and a differentiated first floor cladding, such as hanging tiles or timber cladding over a brick built ground floor. This inspired the over-cladding aesthetic used here. It provided a way to assess the likely extent of resulting transferrable knowledge and applicability to the wide stock of similar houses across the UK. Timber is in itself a common cladding material from the 1970s with predominantly cedar or painted softwood then used to highlight certain elements and echo vernacular housing styles.

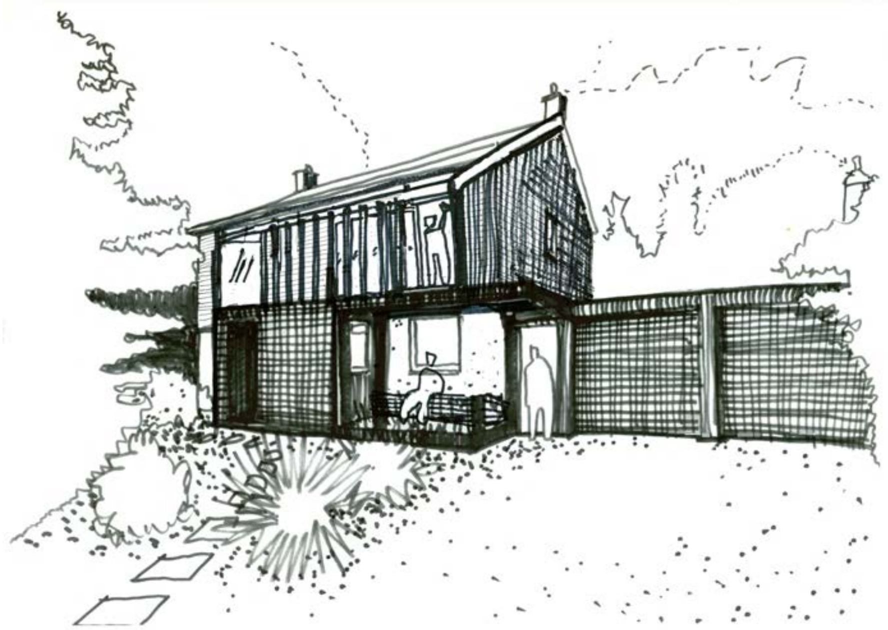
Briefing Development

A brief for the works was then developed over a two-year period following the family's existing use of the building and projecting this through the lifetime of the family. Before work started, family patterns of occupation, human comfort and energy use were assessed to help develop 'lifetime of living' plans that responded to these patterns.

Project Design Strategies

This approach was an evolution of earlier experiments in external wrapping by Scott Batty, including the 2006 refurbishment of a 1960s bungalow at Peasmarsh, Surrey that used a similar cladding approach. A new-build project at Longbury was also drawn on. This finessed earlier larch rain-screen junctions as well as timber fin details. At St Alban's, the concrete roof tiles were removed and replaced with fibre cement roof tiles. Although this is not a perfect choice environmentally (they are still a form of concrete), they are very thin and lightweight, meaning they are manufactured with significantly less material.

Much of the design was carried out with a 'details first' method, exploring junction details and the coordination of elements while larger scale decisions such as the plan form were still being decided. Working in this way embedded a high level of detail quality into the project.



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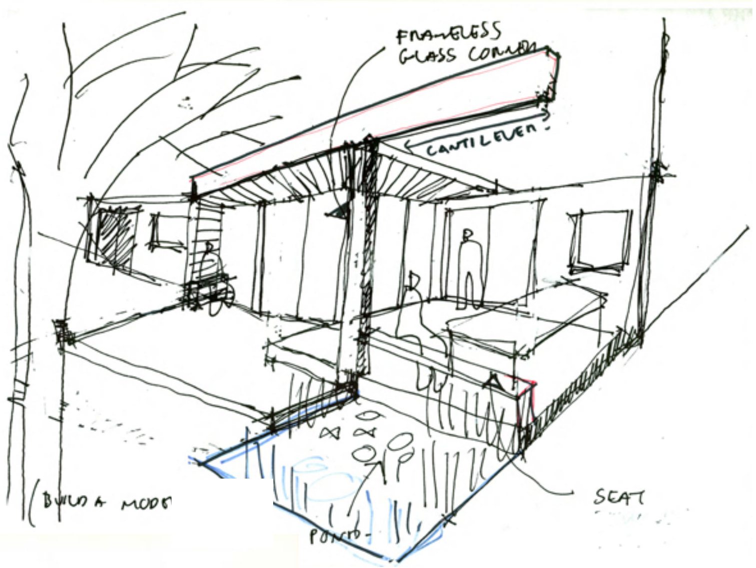

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Figs 23-25
Development sketch drawings exploring aesthetics of cladding, and the relationship of the internal and external spaces of the house

The works were divided into two phases: the first addressing the main home, the second the large adjoining garage and ancillary accommodation. The spatial changes were to be greatest at ground floor with some rooms including kitchen and dining room combined, and a sitting room that could be opened up or closed off in response to changing occupation patterns throughout the day and which optimised passive performance and enjoyment of the internal environment. Emphasis was on opening up and making better use of existing space.

Often the corners of 1960s and 1970s homes were the coming together of poor details of cladding, gutters, soffits and fascias. In this project, the corners were articulated with cleaner details with the corner window aligned to emphasise the approach to the house from the south.

Changes to the envelope included new double-glazed aluminium-framed windows (low E/argon filled) and the creation of glazed corners front (first floor) and rear (ground floor) to capture solar gain. Concrete hanging tiles at first floor were removed and replaced with an external layered treatment (60mm Kingspan rigid insulation boards, a Tyvek permeable membrane with a ventilated rainscreen in larch on the outer layer).

The existing roof joists to the flat roofed extension were exposed (i.e. ceiling removed) and new waterproofing and insulation fitted on top. This is an example of limiting new materials in and demolition materials out while visually exposing the fabric/ history of the house. The original parquet floor was also refurbished.

Externally, a black steel C-section is used to create a strong horizontal line between ground and first floor levels, including cantilevered sections that visually frame an outdoor area and echo the design approach of a typical 1970s house. The steel also ties together the original house and the garage extension. The original roofline continues over the new first floor extensions as a 'catslide' roof.

Figs 26-28
Thermo-syphoning sunspace and stairwell, demonstrating connection and isolation from main house to control heat levels.
26: Winter [no sun]; 27: Winter [sun];
28: Summer [sun/no sun]

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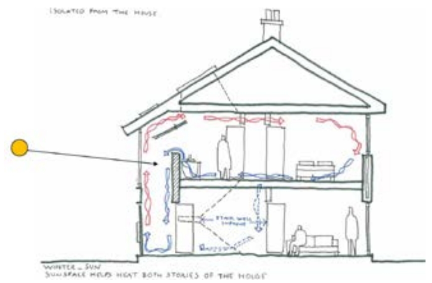

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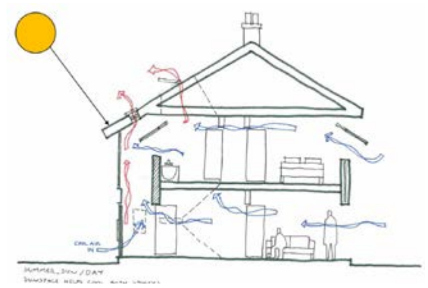

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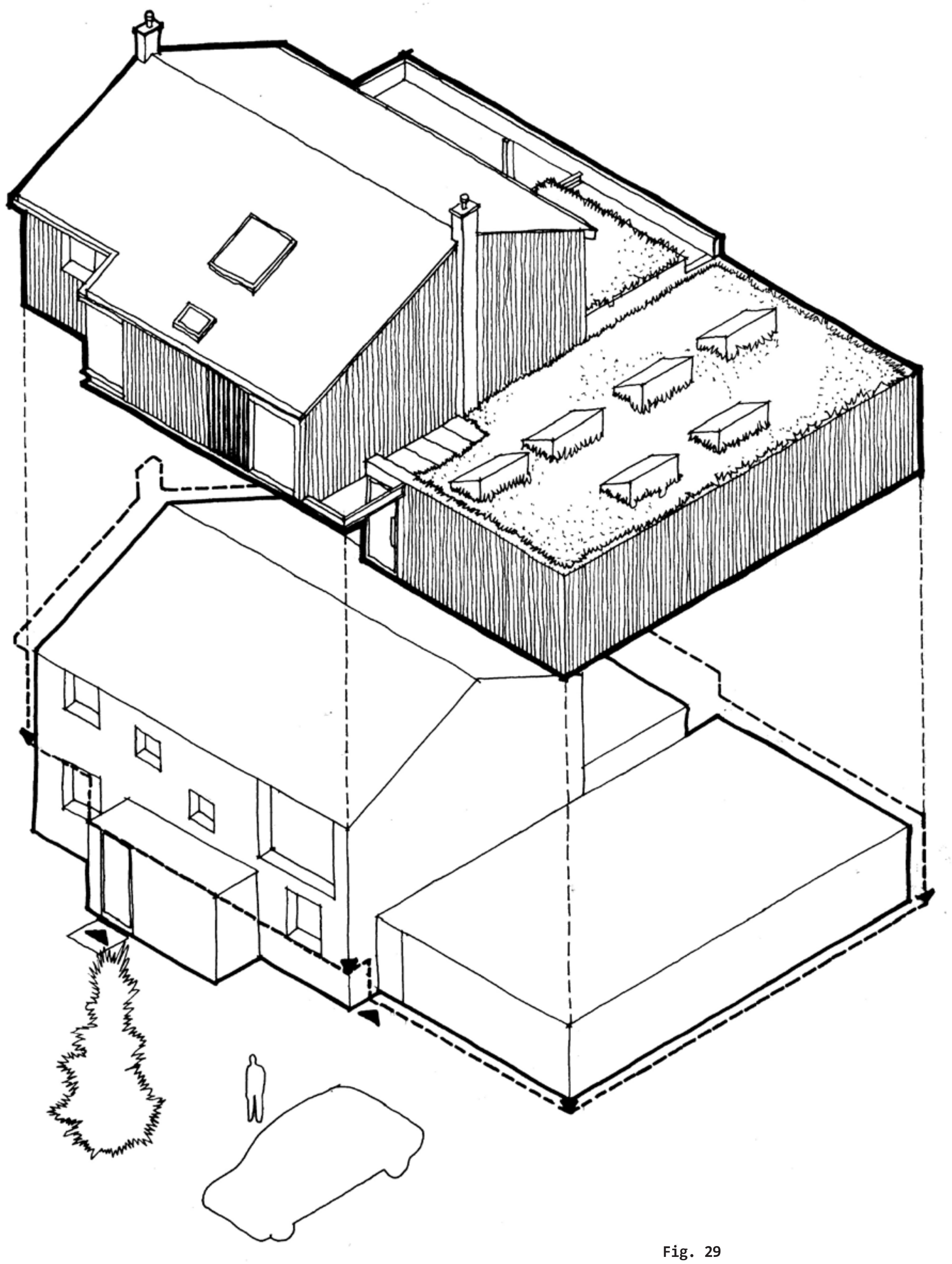


Fig. 29
'Tea cosy' overcladding diagram

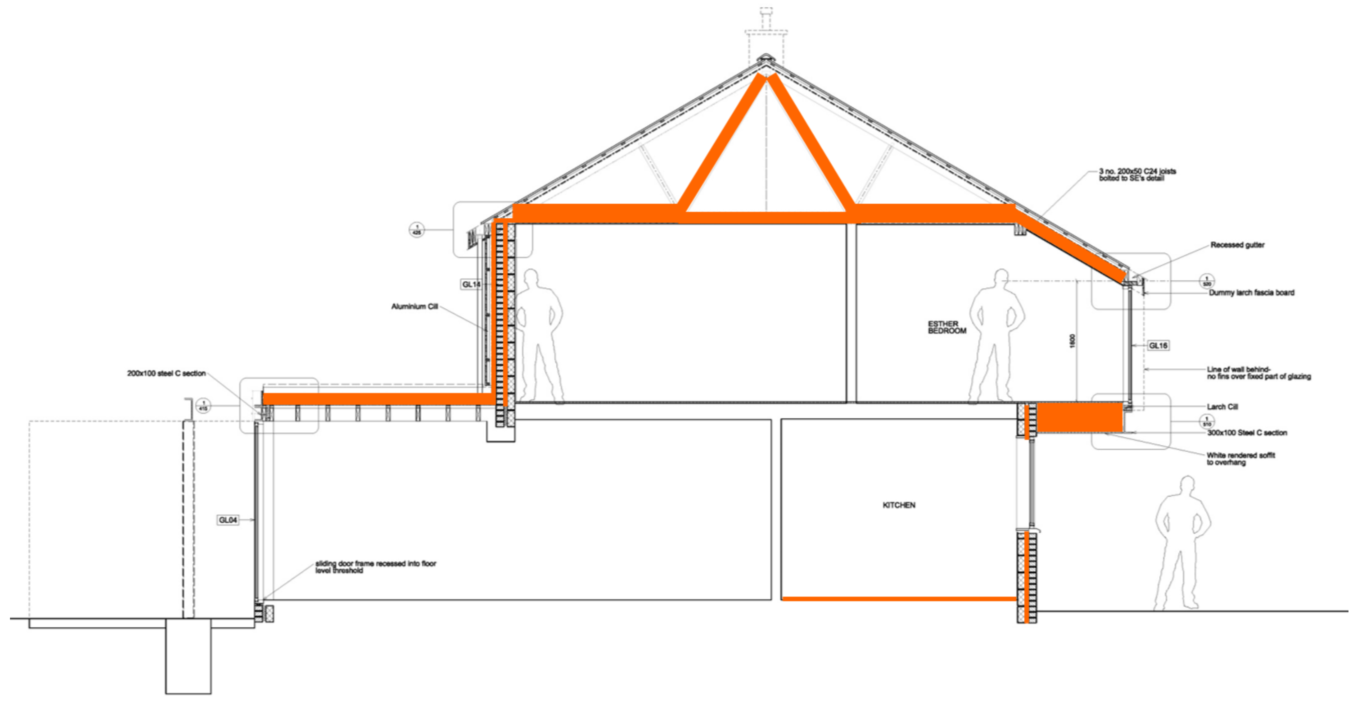
Tea Cosy Construction Strategy

During design development, Batty realised that such projects could be optimised by using a 'tea cosy' approach. This concentrates works on the outer envelope, phasing them so that construction can take place without the residents having to move out. This allowed a substantial saving in costs by removing the need for relocation and alternative accommodation. A 'tea-cosy' package could emerge out of this one-off project that could provide a systemic approach to refurbishing houses of the 1960s and 1970s as follows:

- Ensure scaffolding allows ground floor access to residents
- Strip off first floor cladding
- Strip off existing roof tiles
- New loft insulation
- New insulation around first floor
- New windows at first floor level
- Depending on orientation, enlarge ground floor windows to receive solar gain – shade with external louvres as required.
- Injected cavity wall insulation throughout
- New roof tiles
- New first floor cladding over insulation/ Tyvek membrane
- Make good new windows from inside
- Scaffold down
- Home owners in occupation throughout.

Expressing and drawing this as a 'tea cosy' idea helps communicate this approach to other clients, builders and architects.

Fig. 30
Section illustrating placement of insulation



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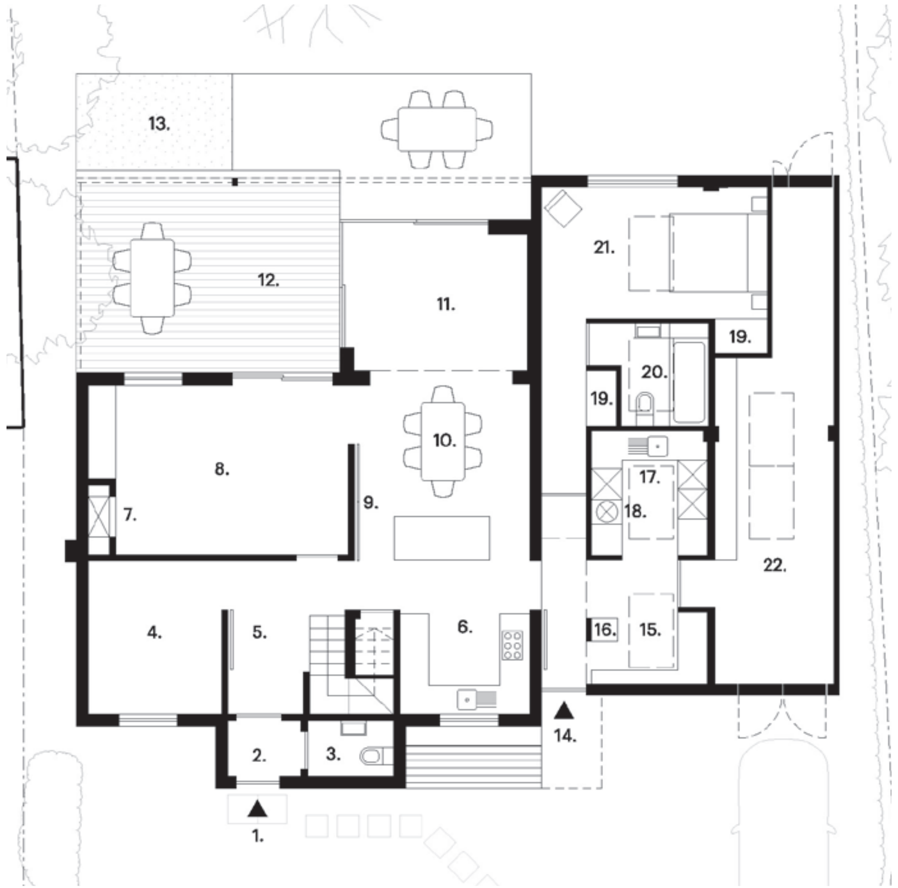

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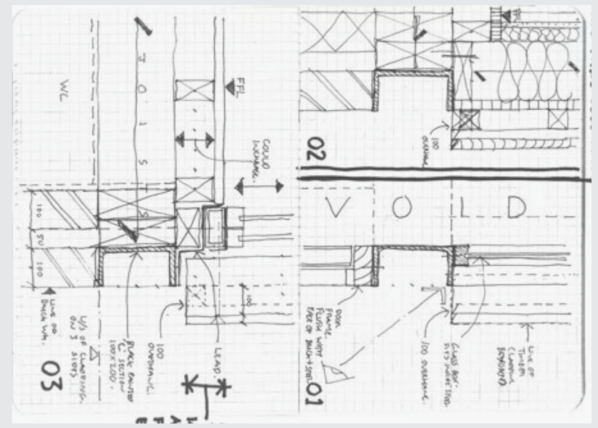
Plan as existing:
First (Fig. 31) and
Ground floor (Fig. 32)

Proposed plans:
First (Fig. 33) and
Ground floor (Fig. 34)

Figs 35-37
Pages from Batty's sketchbook
illustrating his 'details first'
methodology

Figs 38-41
Computer model views



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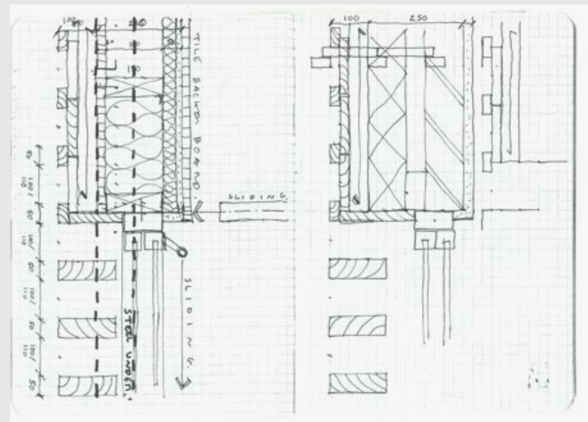

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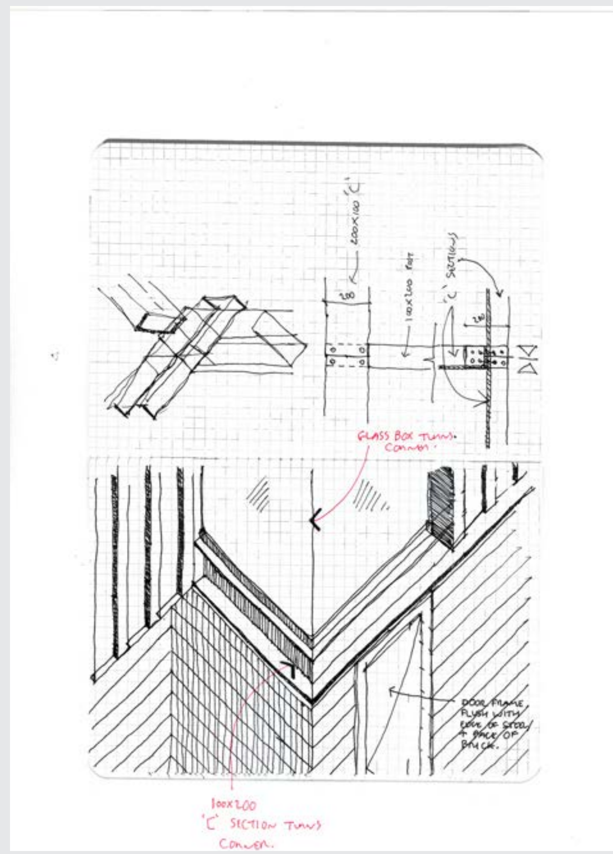

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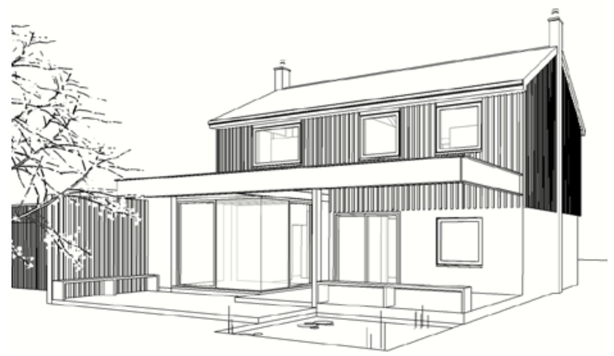

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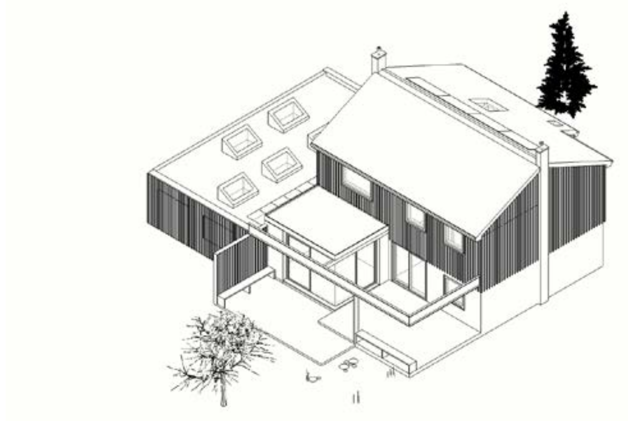

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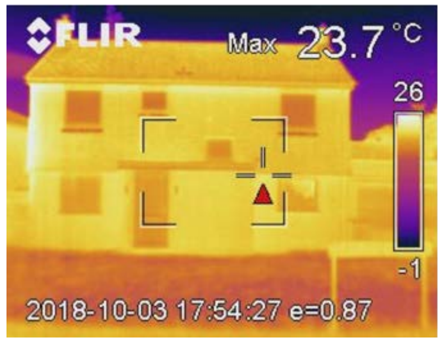

Fig. 42
Thermal imaging photo of house prior to works commencing


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Figs 43-48
Building works underway

Tea Cosy Environmental Strategy

The common theory for detached, two storey, pitched roof properties states that approximately 35 per cent of heat escapes through the external walls and 25 per cent through the roof, with the rest through gaps in and around windows and doors, even with cavity walls. However, this is not linked to the way houses are occupied.

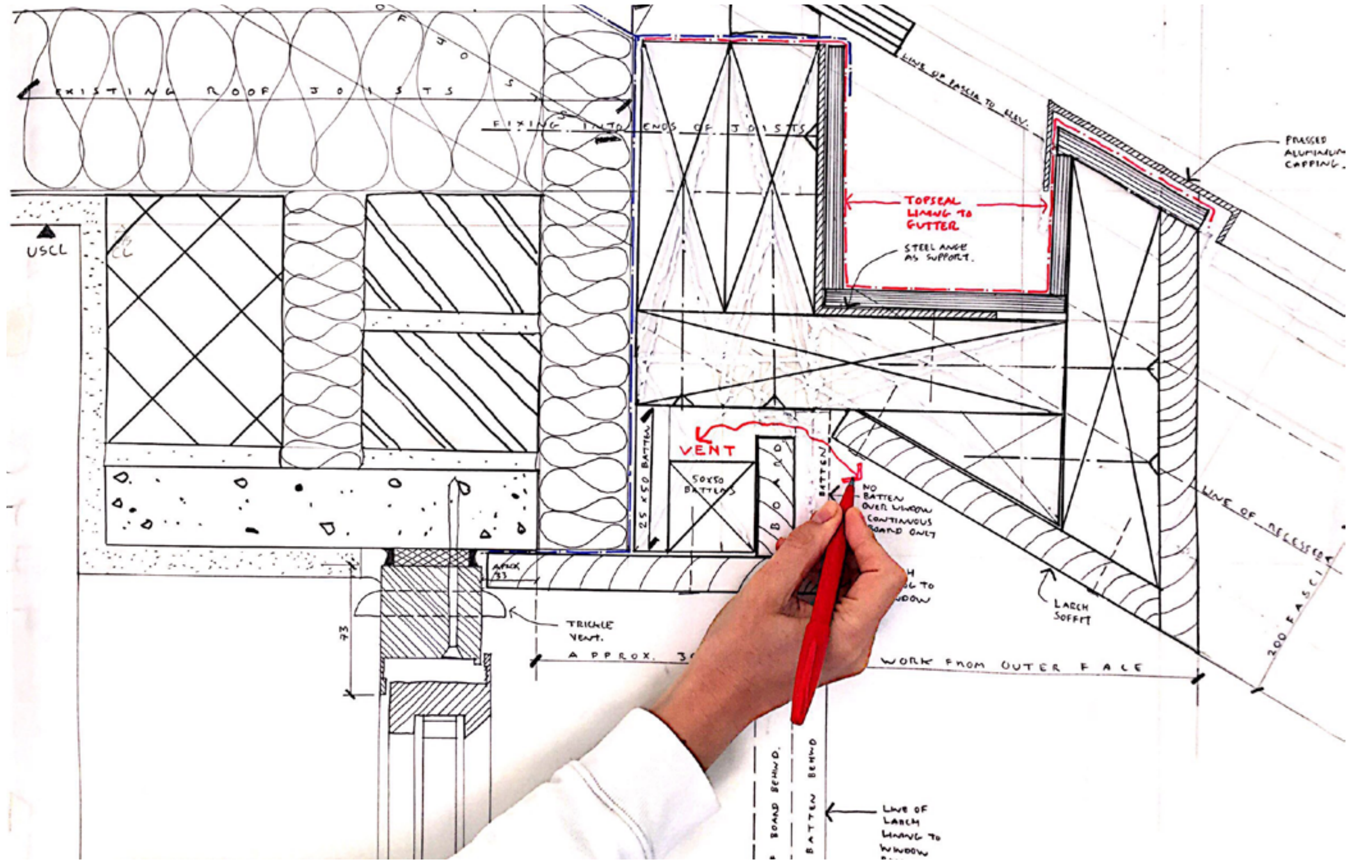
There is no differentiation in this theory between ground and first floor, different sizes and layouts of rooms, or how patterns of living and occupation within a space differ. While Batty opened up the ground floor into a much larger, open plan layout with its large areas of glazing, the first floor remained divided into smaller rooms. From a human comfort point of view, bedrooms are generally situated on upper floors, where occupants wear less clothes, and spend the most time when the external temperature is lowest (during the night).

By applying the tea cosy to the upper storey and roof, the insulation improved the thermal mass of the top floor, but as the external insulation also comes down to cover the lintels of the ground floor windows, the edge of the first floor ‘platform’ perimeter and the top 300mm headroom of each ground floor room also benefits. Additionally, the existing 1970s concrete lintels which act as cold bridges are insulated.

Monitoring

On completion of Phase 1, a dynamic (digital) thermal model of the house was developed to create a comparison with the adjacent, un-improved property. Temperature/humidity sensors were installed in the house and also in the house next door, which is a more or less identical version of the original 1970s house, with exactly the same orientation, overshadowing, weather conditions etc. The results were compared over a period of 5 weeks. Energy bills for the house were compared before and after the retrofit.

Based on observed performance and the dynamic digital model, additional insulation is most effective at first floor level and roofspace level, in accordance with the environmental strategy. This does not mean the thermal envelope at ground floor does not need to be improved/upgraded (done by installing new glazing and injected cavity wall insulation in the case of Barncroft Way), but that additional insulation (on top of this) is beneficial at first floor and roofspace level.



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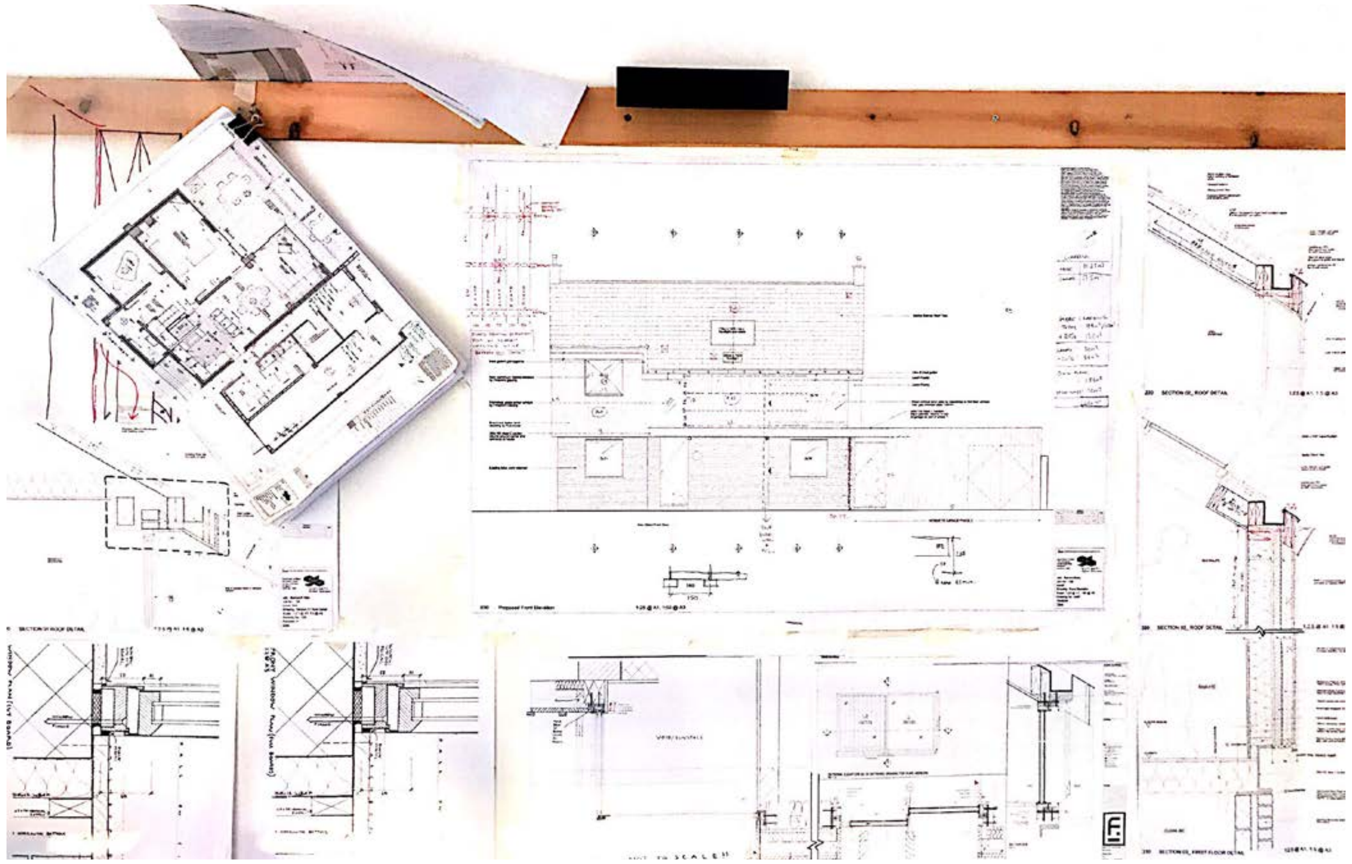

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Figs 49, 50
'Agile' administration. Architect's revision in process. Drawings were only revised 'live' by hand with the builder present and revisions recorded on smart phone

Contract Management

In a parallel research strand, the project also deliberately set out to test a contractual approach that eliminated the issue of drawing revisions. This was based on Batty's experience of contractual problems elsewhere and which are widespread in the industry.

From the outset, a contractual route was devised to allow incremental small decisions to be made without generating misunderstandings through multiple drawing issues.

The architect (as contract administrator) met with the builder each morning for approximately 20-30 minutes. The single set of contract drawings were then revised on site as required and hung in the area of the house where they were required that day. This base, contract set of drawings were signed with the contract. Subsequent revisions to the drawings were made in the presence of both CA and builder and a photographic record taken on phones. 1:1 details were drawn whenever possible with product samples hung as part of the 'information wall'. The whole house became a single, central, dynamic, agile information model – a kind of 'analogue BIM' – so that everyone knew where the latest information was. This optimised communication and understanding. No formal architect's instructions/drawing revisions or drawing issue registers were used.

Fig. 51
St Albans house exterior:
The house is warmer and lighter than previously. The larch overcladding refers back to the site's rural history
Photo: Matt Chisnall

Fig. 52
View from the glass corner to the rear garden, showing exposed original roof joists and refurbished parquet floor. An example of limiting new materials and visually exposing the fabric/ history of the house
Photo: Matt Chisnall

OUTPUTS AND FINDINGS

Main House

In summary, a cold, dark house was opened up and warmed up creating contemporary and flexible living spaces while preserving the essence of the base house period design. Areas of the house can be closed off – for instance, using the sitting room sliding partitions – to retain heat in areas occupied in the evening rather than seeking uniform heat levels across the entire interior. Environmental performance has improved with space heating demand considerably lower and a one third reduction in fuel bills.

The thermal cladding was also used as an opportunity to both reinforce the period qualities of the house, while updating the aesthetics and responding to the semi-rural qualities of its setting.

Client satisfaction has been high and costs were kept substantially projects. While peer appreciation has been high, anecdotally, neighbours find the refurbished style challenging, despite the suburban context and sensitive approach.

Environmental Performance

Two years' worth of data has been collected following the retrofit of Barncroft Way in 2018. It shows how the way the house is lived in and inhabited has developed into a particular pattern. In the colder evenings, after dinner, the large open plan space is closed off (sliding door and normal door) and not used. This effectively reduces the ground floor area of the house by approximately half. The family close off and withdraw to the living room, with the benefit of the new stove if required. Individual radiators are adjusted to suit this pattern, heating only the spaces being used (four persons in a relatively small space produce heat by themselves). The amount of glazing in relation to the external wall in the living room, compared to the adjacent open plan space, is smaller. Finally the family retire upstairs for undressing and sleeping. The main bedroom benefits from being directly over the living room and is pre-warmed by rising heat from this space.

The digital monitoring determined that the retrofitted house would save an estimated 60 per cent of energy consumption for space heating (gas as source, in this instance). An estimated two thirds of this reduction can be attributed to the new external insulation at first floor (plus cavity insulation at ground floor and a doubling of insulation in the roof space to 400mm).[9] A further third is attributed to the new windows. This flows from a combination of the specification of the glazing/window type, and also some increased areas of glazing that may contribute through solar gain.

Energy bills have decreased by 45 per cent but this also includes energy for hot water and cooking. The percentage saving on heating alone is probably greater. By estimating an amount of gas used for non-space heating (from gas bills in the summer when space heating is not on) then it could be inferred that there is a 60% reduction in the amount of gas used for space heating. This is quite a 'blunt' calculation and assumes gas used for non space-heating is the same before and after retrofit. It does not account form some other factors such as a new boiler.


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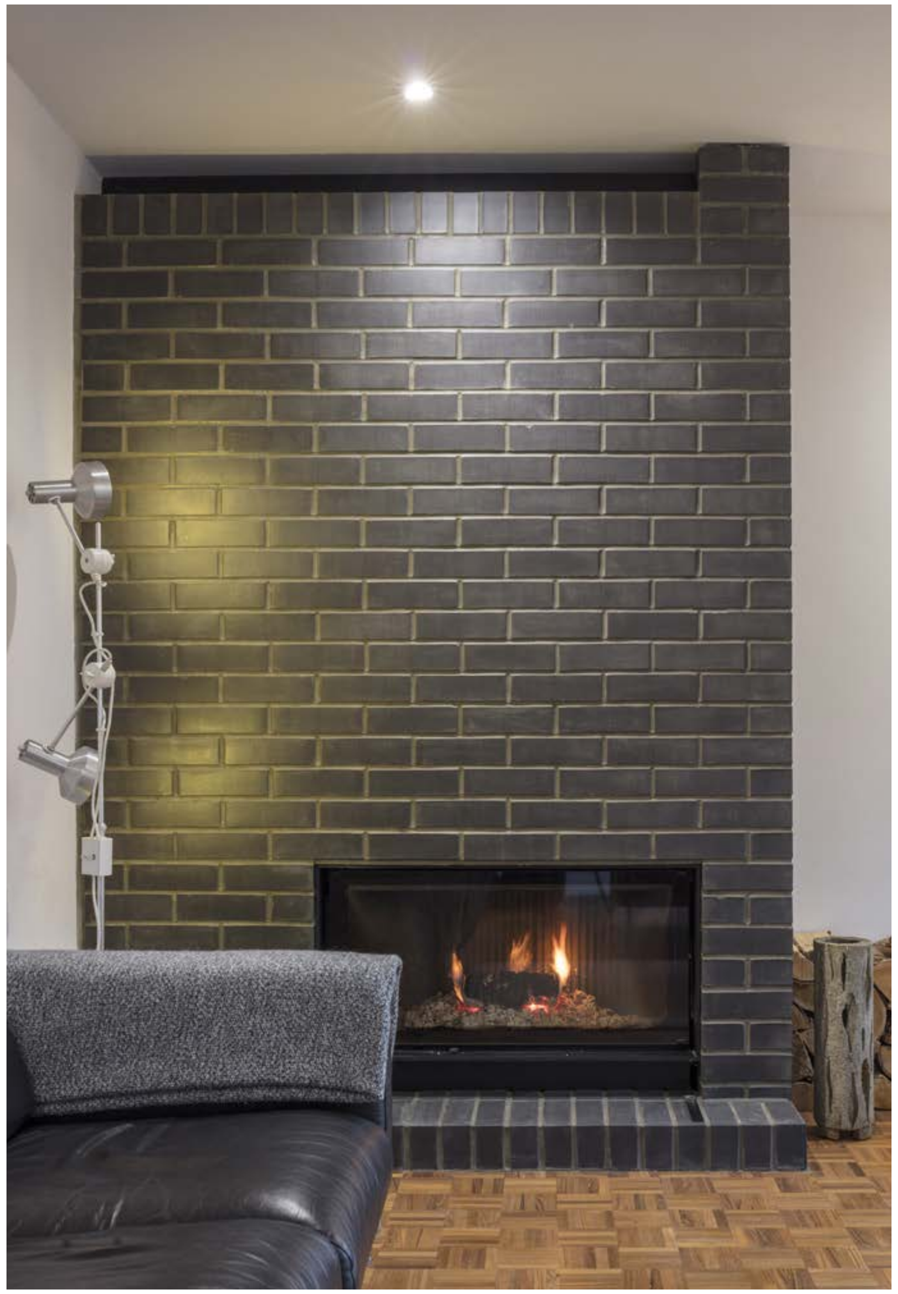
Fig. 53
Detail of the glass corner to the first floor extension over the main entrance showing internal sun space/solar chimney. The original roofline continues over this, the new first floor extension, as a 'catslide' roof
Photo: Matt Chisnall

Fig. 54
Solar chimney with ventilating window. A significant energy benefit was derived through the opening and closing of this window
Photo: Matt Chisnall


55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Figs 55, 56
The new black brick fireplace reinstates the location of an original fireplace and connects to the original flue
Fig. 55: *Photo: Matt Chisnall*

Fig. 57
View from south on completion of Phase 1. The detail of the differentiated first floor is clearly visible over the existing brickwork of the ground floor. A black steel C section is used to create a strong horizontal line expression
Photo: Matt Chisnall


57

Figs 58, 59
Internal view of kitchen and opened up living/ dining area. The original parquet floor has been retained and refurbished. The back-to-back sliding doors on the ground floor allow flexibility of layout and different configurations of the ground floor spaces. The sitting room is beyond the sliding partitions
Photos: Matt Chisnall


58


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Fig. 60
View from rear (north west)
Photo: Matt Chisnall

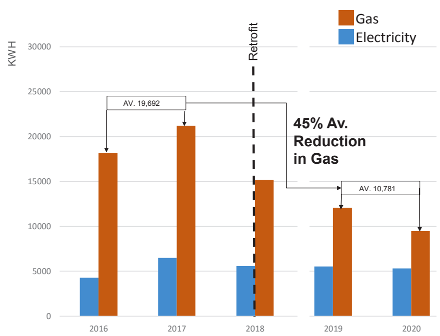

Fig. 61
Graph showing reduction in energy consumption following retrofit

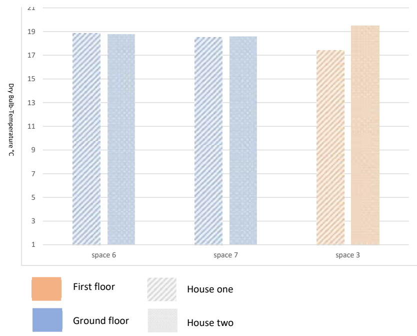

Fig. 62
Graph showing the DBT Temperature comparison between the upgraded house and the identical neighbouring house

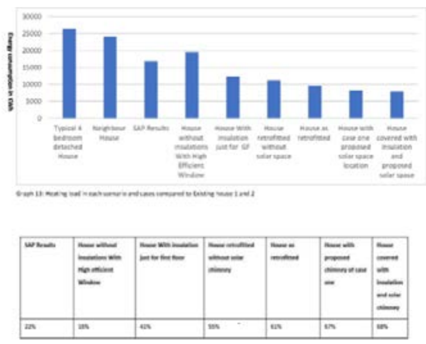

Fig. 63
Data from Collaborative MSc Architecture & Environmental Design Dissertation Project, University of Westminster

Importantly, learning from the dynamic thermal simulations, it was apparent that extending the insulated external cladding to cover the ground floor would have resulted in a negligible further reduction in energy consumption and may even result in some overheating.

According to the model, the benefit of the glazed-in void over the front door as a solar space made only a negligible contribution to the reduction in energy consumption. However, anecdotally, the homeowners believe the hot air produced passively from this space is beneficial in that it washes back through into the first floor. The window into the space (the original bathroom window of the house) is opened by the owners each morning and closed each evening. Compared with the house next door, the retrofitted house is noticeably warmer, particularly the first floor rooms.[10]

The internal 'sun space' here was tested to see if it worked as a solar chimney as part of the environmental strategy for the house. The thermo-syphoning was evaluated in the dynamic thermal model, and found to make a less significant contribution. This is likely to be, in part, because the opening at the top of the chimney, back into the main house, was too small. This is the existing window opening to the bathroom (now enclosed by the solar chimney). The bathroom was in use throughout the work, so enlarging this opening would have been difficult. The obscured glass reduces efficiency and the outlet window into the main house (the existing bathroom window opening) was also too small.

However, the space does work as a draught lobby and as a buffer space, and warms the ground floor WC below. In occupancy, the feeling of 'heat' created by this space has been noted.[11]

Capital Savings

Capital cost savings from this approach were considerable with final construction costs at approximately 40 per cent of demolition and rebuild, with approximately a further 10 per cent saved on alternative accommodation during work by using the 'tea cosy' external cladding.

Remaining in residence during works avoided a substantial hidden cost for clients (including for example alternative housing, relocation and council tax during construction, estimated conservatively at £25,000) was also a key benefit. However, the day-to-day logistics of the family being in residence while building work was taking place meant that certain decisions were made to limit that day's work, to create a clear separation between where the family/builders could go. This required planning and, on occasion, meant that tasks took longer than they would have with a fully vacant work site.

Material waste was substantially reduced. Only four skips of material were generated and a large component of this waste was the former windows. Concrete tiles were recycled and used as hardcore by the builders on another job.

Fig. 64
View along Barncroft Way showing the retrofitted house compared with its original neighbour
Photo: Matt Chisnall

Tea Cosy Benefits

The tea cosy strategy was an effective model for clarifying and reducing costs without inconveniencing the clients, and could be developed further as a systematic package approach. There would be some performance gap between theory and practice when disseminating the model since the model is based on exactly sized radiators, whereas the actual size in any house may not be perfectly sized for the situation. Nor does the model account for heat lost through pipe work, air in radiators etc. This means there is a difference between the model which is based on exact energy demand, while the energy bills reflect actual gas usage.

As figures for bills are entirely under the control of energy suppliers, Batty argues that RIBA should be lobbying energy companies to provide more detailed breakdowns of usage in order to allow architects to devise and test the efficiency of different means of energy saving. Currently, energy suppliers often use a mix of meter readings and estimates within their bills which tend to keep energy usage in their favour (selling you more, rather than less).

Developing a user manual for clients is also important as seemingly small occupancy habits can make important differences – for example, closing the blind on the large Velux window above the staircase at night was a surprisingly important factor in heat conservation. Manuals for occupancy might usefully be provided for clients' use and to feed back into future research.

Contract Administration

Agile contract administration was markedly successful for builder and architect. Drawing with the builder present optimised communication and understanding. No formal architects instructions/drawing revisions or drawing issue registers were used. Drawings were only revised 'live' by hand with the builders present and recorded on a smart phone. All the contractual milestones were met and, on a local project, time was saved in comparison to a regime of weekly site visits and digitally issued instructions, revisions and drawing issue registers.[12]

About half of architectural practices in the UK have between one and five persons. The mainstay of these practices is the private residential project, most often carried out with a traditional form of contract, with the architect acting as the contract administrator.

The project needs to be close to a practice's base to ensure that travel time to daily meetings does not become a significant factor and that it remain truly agile, however this approach had many positives that could be tested more widely. It also reduced the overall architects' fee – perhaps more a benefit for a client than the practice – but this was achieved at the same time as a higher quality outcome creating greater project satisfaction.

CRITICAL SELF-APPRAISAL

One of the main findings was the effectiveness of cladding only the upper-storey for environmental effectiveness. Yet the decisions which led to this were not entirely environmentally driven, but part of a broader and more instinctive design driven strategy. They included: ensuring the house retains visible brickwork at ground level to relate visually to the neighbouring properties, and to the original 1970s design; construction/material costs; the pragmatics of construction which meant a section of the envelope would be new build at upper level, suggesting a logical differentiation between upper and lower; as well as to improve the thermal insulation of the upper floors in relation to general theories of heat loss.

A key concern has been how best to share the important knowledge generated by a small project to the diverse groups who would learn from it; architecture often keeps such important knowledge tacit or implied.[13] In this case, such interest groups include architects, builders, local authorities, self-builders, clients and architectural students. Potentially a package (or guide) can be developed out of this one-off project that could offer a systemic approach to refurbishing volume-builder housing of the 1960s and 1970s.

The dynamic monitoring of energy was of limited value because the environmental model was constructed retrospectively, rather than being actively part of the design process. It has shown how complex it is to compare a house being lived in by a family of four with the same physical house that is being lived in by a single person. A future research project should undertake before and after monitoring of the same house with the same occupation levels to study in detail why, for example, cladding of ground floor in addition to the first floor would not result in a pro-rata reduction in heat loss.

There is a benefit for the architect to be in complete control of the environmental model, during design and afterwards, to be able to accurately switch off/on different elements etc. This suggests the idea of a single model being used for everything (drawings, costs, enviro modelling) for instance through BIM. In practice it is still uncommon for individual houses to have their own Dynamic Thermal Simulation model. Especially in refurbishments, architect’s fees certainly do not cover such extended responsibilities. If we are going to make inroads into carbon savings, this has to change.

Phase 2, which began in November 2020, remodels the quadruple garage, reconnecting it to the main house, creating more habitable space and less internal parking. Further dissemination is planned at this point, along with submission for professional awards. Dissemination in Phase 1 is considered as work in progress. Batty has also received interest through the project's dissemination from potential future clients for a similar design and agile contract administration.

DISSEMINATION, ACHIEVEMENTS, PEER REVIEW

Articles

Architects Projects (2019). 'Stainless steel surfaces central to reconfigured 70s house', *Architects Projects*, 26 June 2019. (Available: https://architectprojects.co.uk/stainless-steel-surfaces-central-to-reconfigured-70s-house/) [Accessed: 26 July 2020]

Howdle, J. (2019). 'Amazing space: The 1970s St Albans home transformed beyond recognition'. *Hertfordshire Advertiser (Property)*, 3 June 2019, p.1. (Available: https://www.hertsad.co.uk/property/amazing-space-the-1970s-st-albans-home-transformed-beyond-recognition-1-6084978) [Accessed: 26 July 2020]

Howdle, J. (2019). 'Comment: Working Wonders with 1970's homes'. *Hertfordshire Advertiser (Property),* 5 June 2019. (Available: https://www.hertsad.co.uk/property/comment-working-wonders-with-1970s-homes-1-6085683) [Accessed: 26 July 2020].

Sustainability Trust (2019). 'How smart architecture can improve your home's energy efficiency'. *Sustainability Trust (NZ)*. Online. (Available: https://sustaintrust.org.nz/blog/retrofit-home) [Accessed: 26 July 2020]

Self Build Magazine (2020). 'Exciting eco renovation', *Build It!*, April 2020, p. 9.

RIBA (2020). 'Getting hands-on with a daily builder's briefing', *RIBA Bulletin*, 5 March 2020.

Russwood (2020). 'Retro Refit', *Profile*, issue 26, November 2020, p.7. (Available: https://www.russwood.co.uk/wp-content/uploads/2020/11/Profile-26_web_pdf_.pdf) [Accessed: 20 November 2020].

Lectures

Batty, S. (2018). '1970's House Retrofit', presented at *Human Comfort Symposium*, University of Westminster, 19 November 2018.

Batty, S. (2020). 'Invited Lecture: Agile Contract Administration', Oxford Brookes University, 26 June 2020.

FOOTNOTES

1 Digital model of the house created using EDSL TAS software.

2 NHBC Foundation. (2015). *Homes through the Decades, the Making of Modern Housing*. (Milton Keynes: NHBC Foundation).

3 Department for Communities and Local Government. (2015). English Housing Survey, Headline Report (2013-2014). (London: Department for Communities and Local Government), (Fig. 2.1).

4 Green Age. (2015). 'How much energy does my home use?' *The Green Age*, 9 November 2015. (Available: https://www.thegreenage.co.uk/how-much-energy-does-my-home-use/) [Accessed: 22 March 2020]

5 Evans, S. (2014). 'A detailed look at why UK homes are using less energy.' *Carbon Brief*, 16 June 2014. (Available: https://www.carbonbrief.org/a-detailed-look-at-why-uk-homes-are-using-less-energy) [Accessed: 22 March 2020]

6 Latham, M. (1994). *Constructing the Team*. (London: HMSO). See also: https://www.designingbuildings.co.uk/wiki/Adversarial. – Latham concentrates on larger projects. Generally, there is a shortage of information/guidelines regarding the contract admin role of smaller scale projects. Ostime, N. (2014). *Small Projects Handbook*. (London: RIBA Publishing) started to address this.

7 RIBA (2016). *What Clients think of Architects, Feedback from the 'Working with Architects' Client Survey 2016*. (London: RIBA Publishing).

8 Sinclair, D. (2013). *RIBA Plan of Work 2013 Overview.* (London: RIBA Publishing)

9 The original 1970s house may have had a thin layer of fibreglass quilt in the roof space, perhaps 100mm at ceiling level- This was added to over time by other owners. Before Phase 1 works there was approximately 200mm Mineral wool insulation.

As part of phase 1 works this was doubled to 400mm in the eaves, with an additional new 50mm rigid insulation carried over a central storage area, a new type of roof construction so that the loft storage area is partially insulated.

10 During the monitoring period 12 April 2019 to 15 May 2019 there was no heating on at all in Retrofit house, whereas in the comparison house heating was turned on periodically by the elderly lady resident, making a true like-for-like comparison difficult. What can be inferred from the results is that the internal temperatures in the unheated Retrofit house were the same or slightly higher than the comparison house with the heating periodically on during the monitoring period, when the outside temperature fluctuated between 5 °C at night and 18 °C during the day.

11 Source: Collaborative MSc Dissertation Project (MSc Architecture & Environmental Design University of Westminster)

12 Batty kept a resource and timesheet for ten years at his previous practice, HUT. Acknowledging all jobs are different, in comparison to similar sized and types of jobs, Batty considers the agile contract admin system to have saved approximately 50% of the resources that would have been expended during the site work stage, compared with 'traditional' contract admin. He estimates that the fee he would charge for his time for agile contract admin on this project (stages 1+2), reflecting time as carried out, would be approximately £15,000 [1 man day per week, over 30 weeks [stages 1+2)= 30 man days during site work: 30@£500/day].

This compares with a fee calculated according to the old RIBA fee scales – 13% fee of £240,000 project total = £31,200 (overall fee). Site work stage @ 25% of this [£7,800] – half of what it needs to be for agile contract administration, but this is still a severe underestimate for anyone working as a sole practitioner and does not guarantee quality of output.

13 Blythe, R. and van Schaik, L. (2013). 'What if Design Practice Matters?', in Fraser, M. (ed). *Design Research in Architecture: an overview*, (Farnham: Ashgate), pp. 53-70

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