AGAR GROVE PHASE 1A

MAX FORDHAM

Location: Agar Grove Phase 1A, Wrotham Road, London NW1

Construction: reinforced in-situ concrete frame on internal rotary piles, with Brick and reconstituted stone façade

Construction completion: April 2018

Occupied since: April 2018

Certification Date: April 2018

Gross External Area: 4,875m^2

Treated Floor Area: 3,265m^2

Form Factor Ratio: 1.6

Construction cost: £2,044/m^2 GEA

Heat Source(s): Gas

Primary Energy (PE): 118(kWh/m^2/a)

Heating Demand: 13 (kWh/m^2/a)

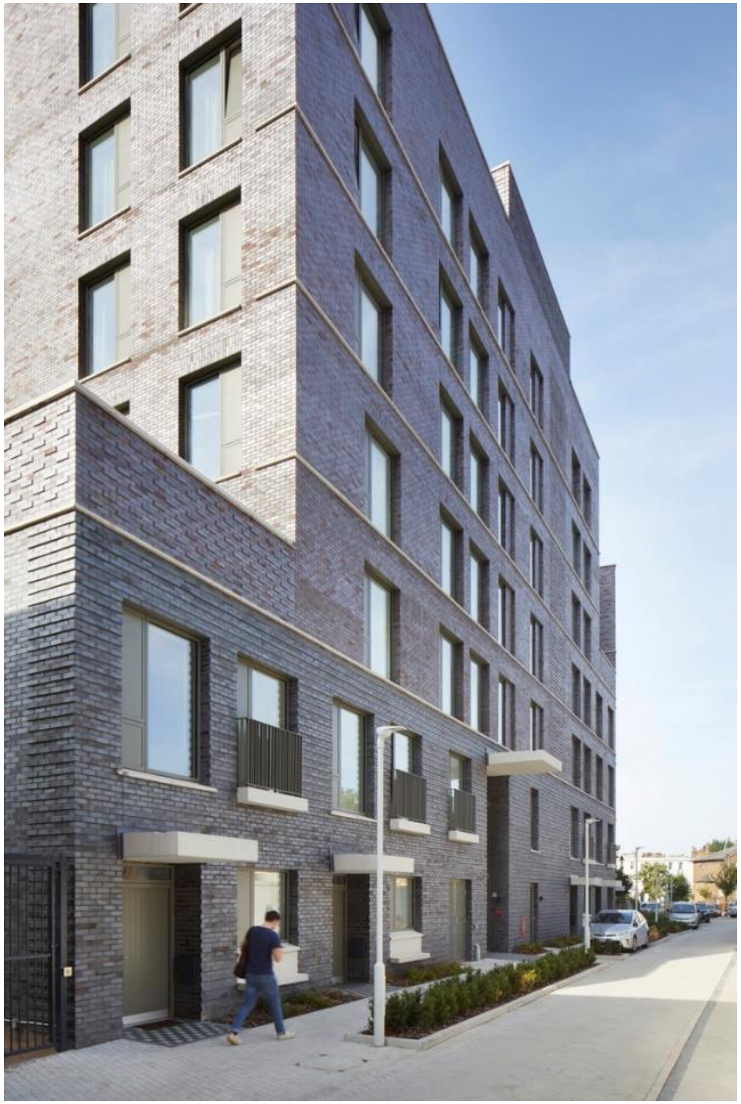
Air Changes/Hr: 0.6 (@50pascals)

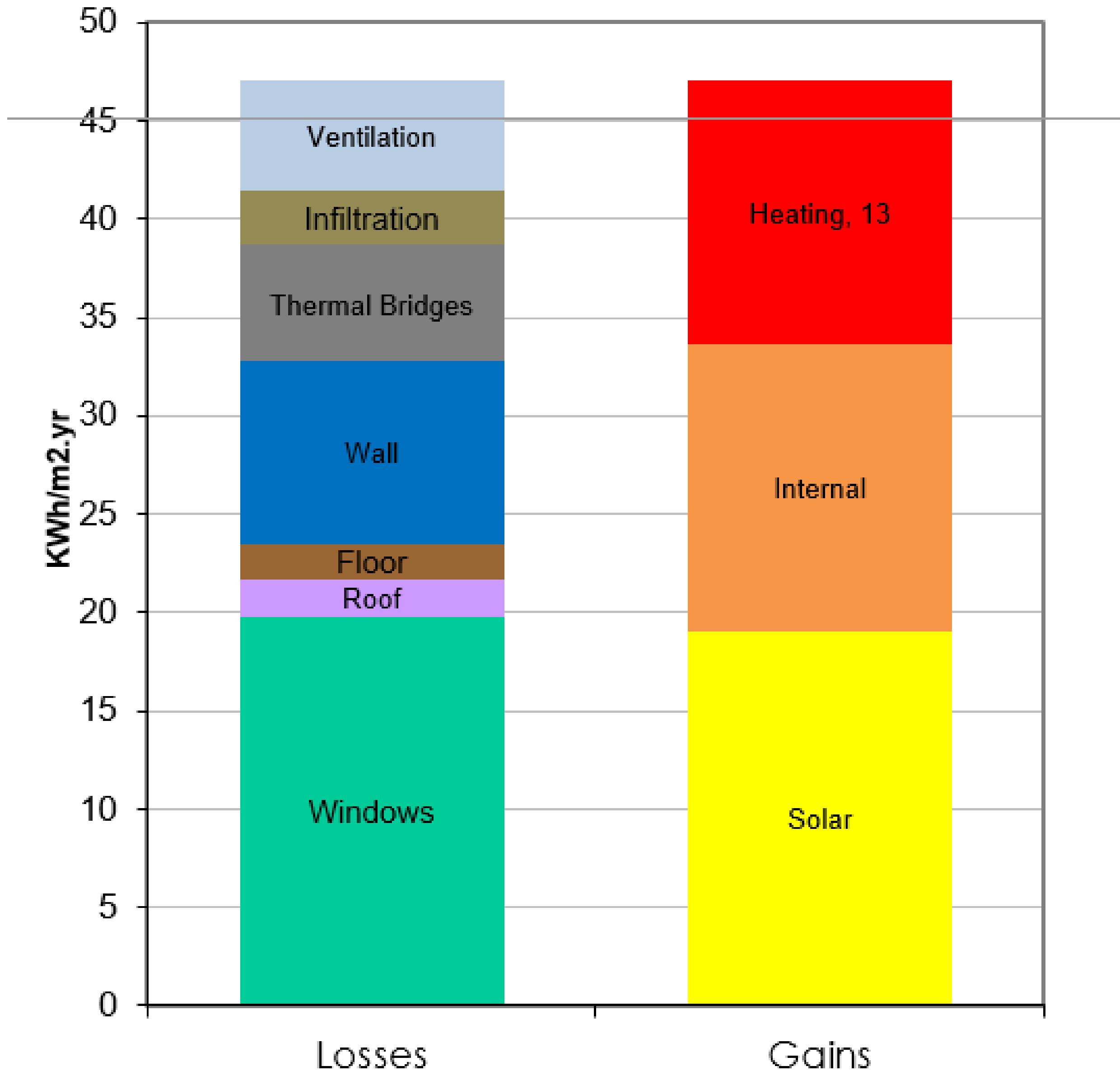
Heating Load: 9 (W/m^2)

TEAM CREDITS:

- Client/ Developer: Camden Council
- Architect: Hawkins\Brown Architects & Architype
- PH Consultant: Max Fordham LLP & Architype
- Contractor: Hill Partnership
- Certifier: WARM
- Project Manager and Quantity Surveyor: Arcadis
- Structural Engineer: Peter Brett Associates
- MEP Consultant: Max Fordham LLP & Mark Robinson Associates

PROJECT OVERVIEW





PASSIVHAUS CERTIFICATE

Key concepts and design intent

Agar Grove Phase 1a delivers 38 social rented homes for the London Borough of Camden, part of a masterplan of 493 homes for new and existing tenants. The project will be cross subsidised by future private sale phases with the budget for the first phase at £9m. Planning for the whole estate was granted in Spring 2014 with the project starting on site in Spring 2016 and completion in April 2018. All homes are built to the Passivhaus standard, promoting a ‘fabric-first’ approach and with an estimated 90% energy bill reduction helping to tackle fuel poverty.

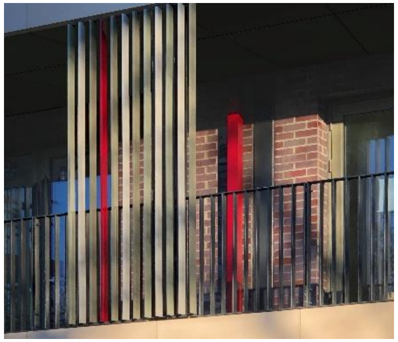
Agar Grove is already a pleasant place to live, but the existing layout of the estate does not compare well to today’s principles of good design. It is inefficient, out-dated and disconnected from the wider city. All existing tenants are being offered a home in the new development.

The predominantly brick and reconstituted stone façade materials used throughout the redevelopment are complementary to the surrounding context. Textured brickwork is used to express a plinth as well as tops and edges. Decorative metalwork is used to give expression to doors and, balustrades alongside shading and colour to the balconies.

Stone banding gives depth and detail to the street elevation and a quality finish to the full width balconies.

A two-storey plinth expresses the band of maisonettes and double height communal entrances lining the street. This ensures no bedrooms are on the ground floor and gives passive surveillance from waist height kitchen windows. A large majority of the apartments are dual aspect, with living spaces benefitting from the South-facing aspect, a balcony running the full width of the façade and panoramic views of central London from the middle levels and above.

Natural light and open spaces make the homes feel welcoming and spacious. Double height communal entrances offer a direct view through the building to the residents’ garden on entering. Stairwells and corridors are naturally lit and ventilated, with a touch of colour and pattern.



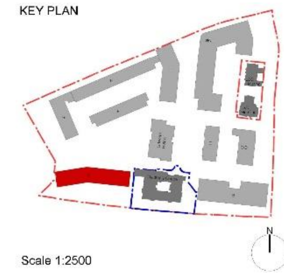
DESIGN PHILOSOPHY & SITE PLAN

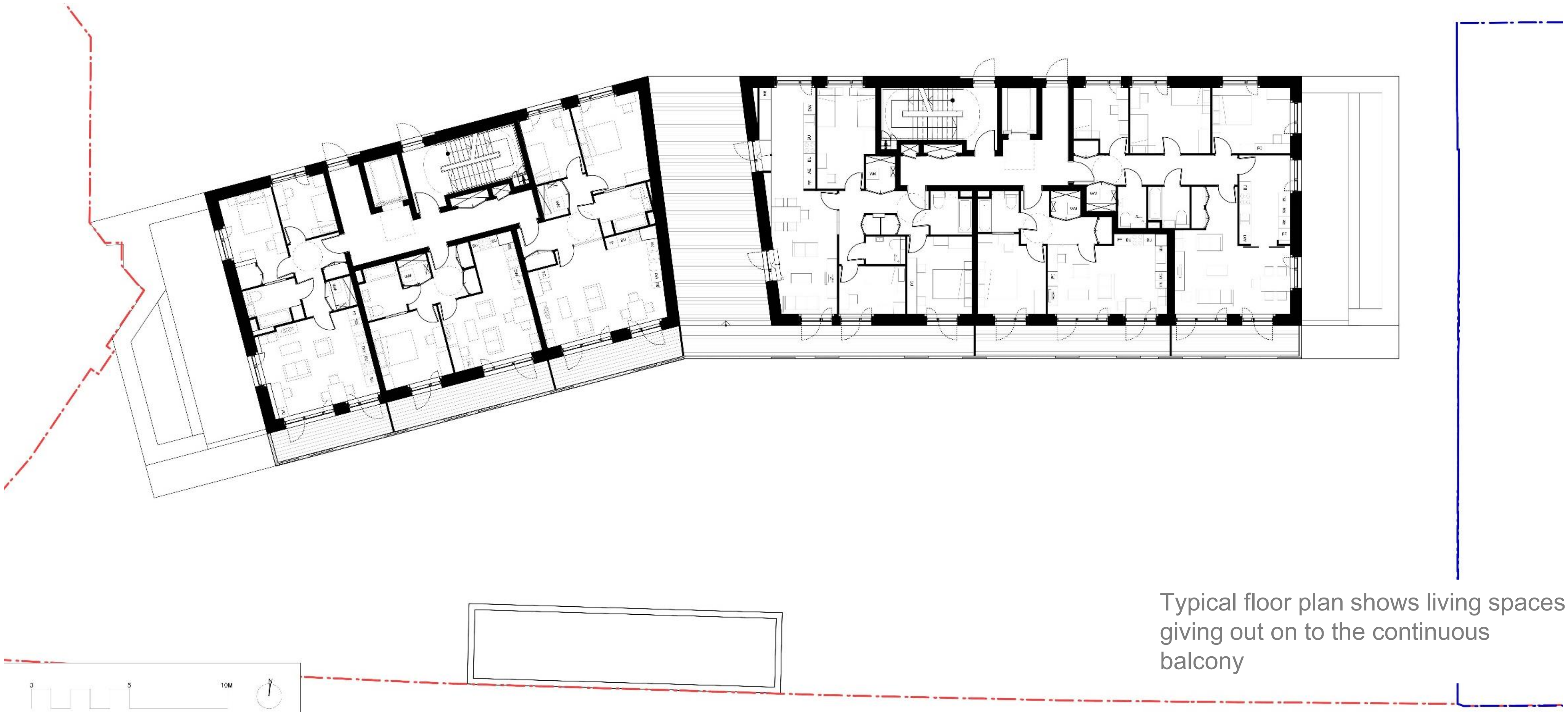
Site Plan

Site plan in context shows the building making a street between the existing terrace and nursery. A secure residents garden is the buffer between the building and an elevated railway line

DESIGN PHILOSOPHY & SITE PLAN

Plans



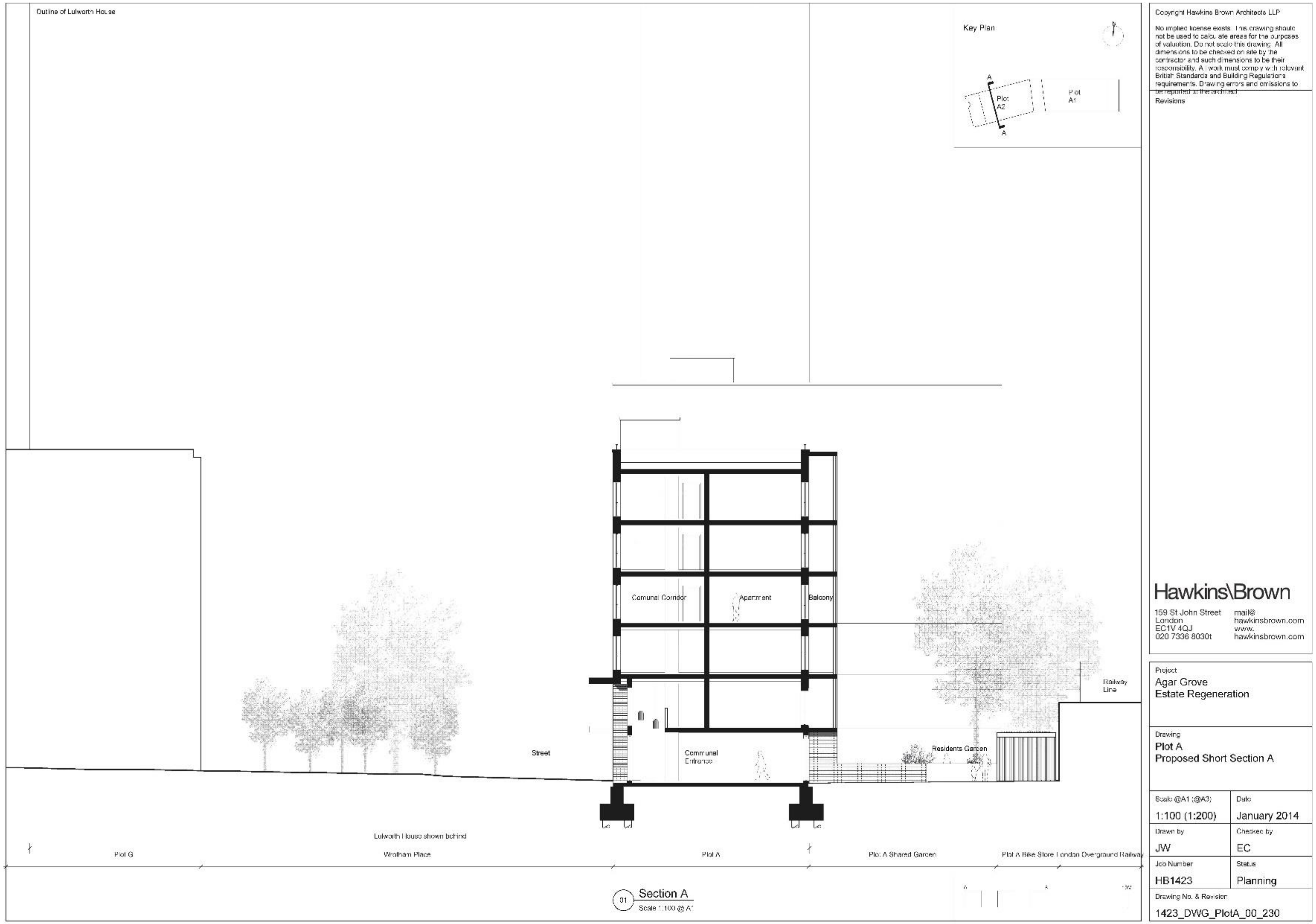


Typical floor plan shows living spaces giving out on to the continuous balcony

Plans

The maisonettes give activity to the street with all bedrooms elevated

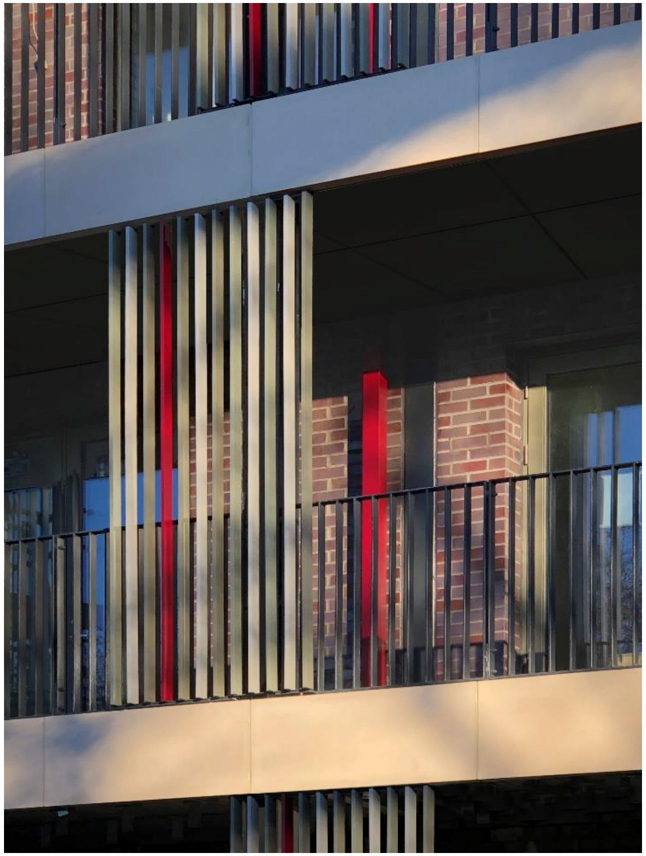
Key sections & elevations



Short section shows the simple thermal line and narrow building gauge to minimise East/West elevations

Internal & external images

The Southern façade gives shade in summer



Low winter sun penetrates beyond the balconies, deep into the floor plan

Internal & external images

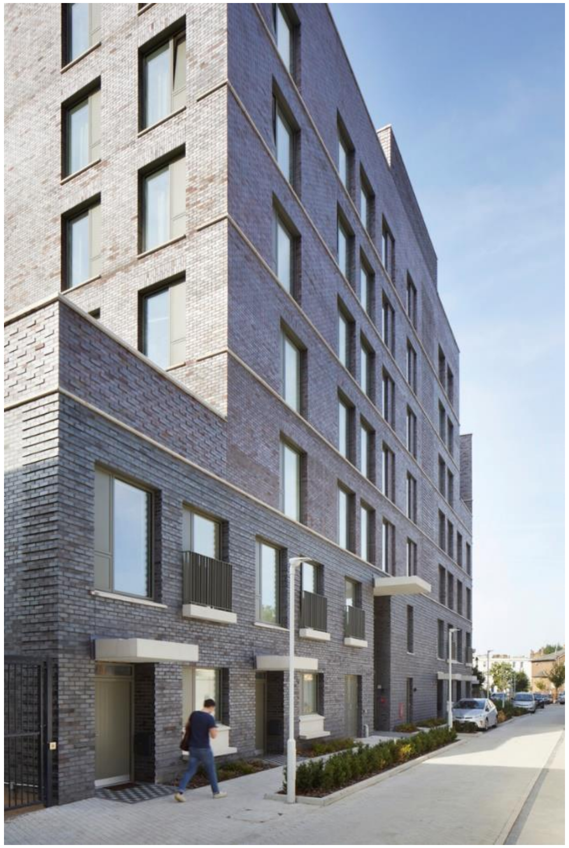
The Northern façade has less glazing than conventional multi-residential projects, with insulated side panels making the openings appear more generous

Internal & external images

The scale of the building steps down at both edges to address the surrounding context

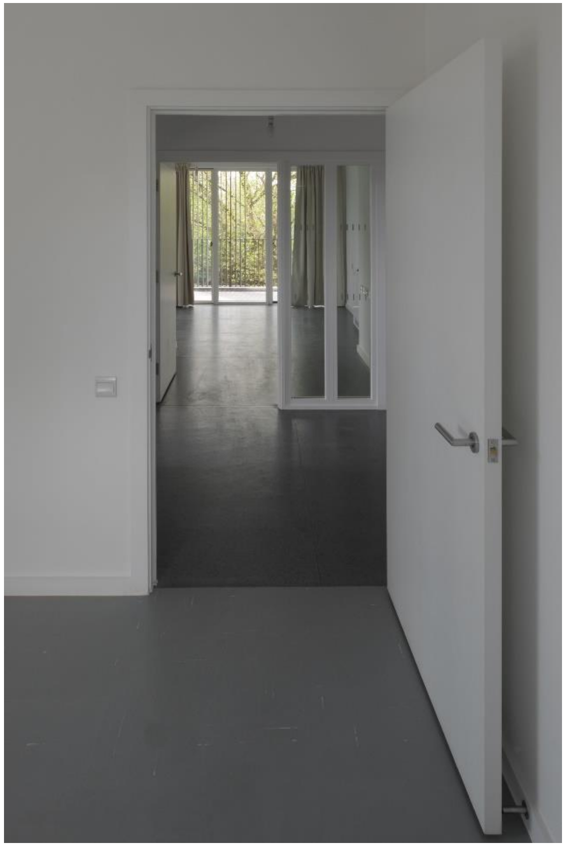
The shared entrances have a view through the building into the garden at the rear

Internal & external images



Buffer planting, high windows and kitchen units enable residents to leave ground floor windows open

All living spaces face out on to a generous balcony



The narrow gauge of the block and gazed screens afford views and ventilation through the whole building

Internal & external images

The core arrangement allows natural lighting and ventilation of the shared corridors

Balconies have panoramic views across London and many residents have planted these extensively

Top: Residents of the first phase meeting the Mayor and local government politicians in their home

Bottom: Homes are serviced by two communal MVHR units at roof level allowing for simple changing of filters

Summer comfort strategy:

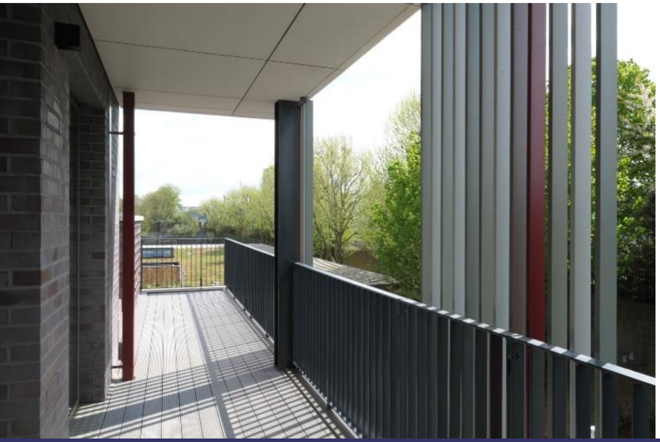
There was no specific guidance on how to analyse overheating in housing at the time of this project's design development, so Max Fordham created a strategy to appraise the risk and ensure the design could adapt.

The energy strategy aims to minimise internal heat gains, both by lean pipework design, careful installation to make sure the system is well insulated, and low running temperatures.

No. Occupants: 105

Overheating/year: 6%

Glazing as % of TFA: 30%



Modelling was carried out using the Islington 2030 DSY from the PROMETHEUS probabilistic weather data website[1]. The results were compared against CIBSE TM52's adaptive overheating criteria[2].This modelling determined that living rooms would not overheat if ventilation openings could be opened during occupied hours. On noisier facades this could lead to a compromise between acoustic and thermal comfort as temperatures rise.

To address this, large openings were provided to purge heat from the spaces quickly, preventing the need for windows to be open for long periods of time. This position was reached through collaborative design of the building form, orientation, and ventilation openings. There was a drive to provide dual-aspect apartments wherever possible to optimise passive ventilation. This was coupled with strategic glazing sizes for each orientation, shading by southern balconies, solar glazing and ventilation openings sized in line with the modelling recommendations.

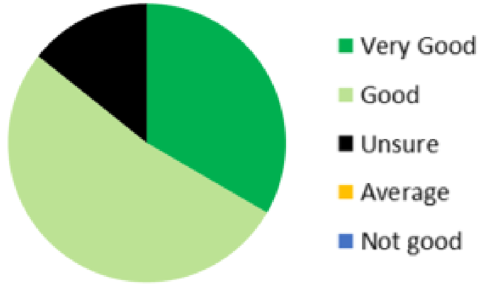
[1] https://emps.exeter.ac.uk/engineering/research/cee/research/prometheus/
[2] https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q20000008I7f5AAC

SUMMER COMFORT & VENTILATION

Monitored data graphs/ charts

- Temperature, RH and CO_2 were monitored in 3 example flats. The data showed that internal temperatures rarely dropped below 21°C in winter, and only rose above 26 °C in peak summer months, with major temperature peaks being rare.
- The team worked together, led by Camden, to produce and carry out tailored occupant feedback questionnaires for summer and winter. All respondents felt the air quality was good. The feedback on summer temperatures was more mixed, and has prompted Camden to educate residents on how to best keep their flats cool, for example not all were aware that closing blinds could reduce solar gains.

Resident feedback: Air quality compared to previous home

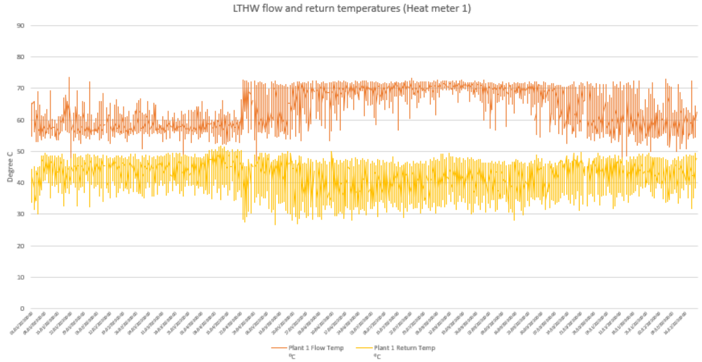


Residents were asked what they like about the building:

“Clean, outdoor space, more light. Will never feel cold in this flat, temperature doesn’t drop.”

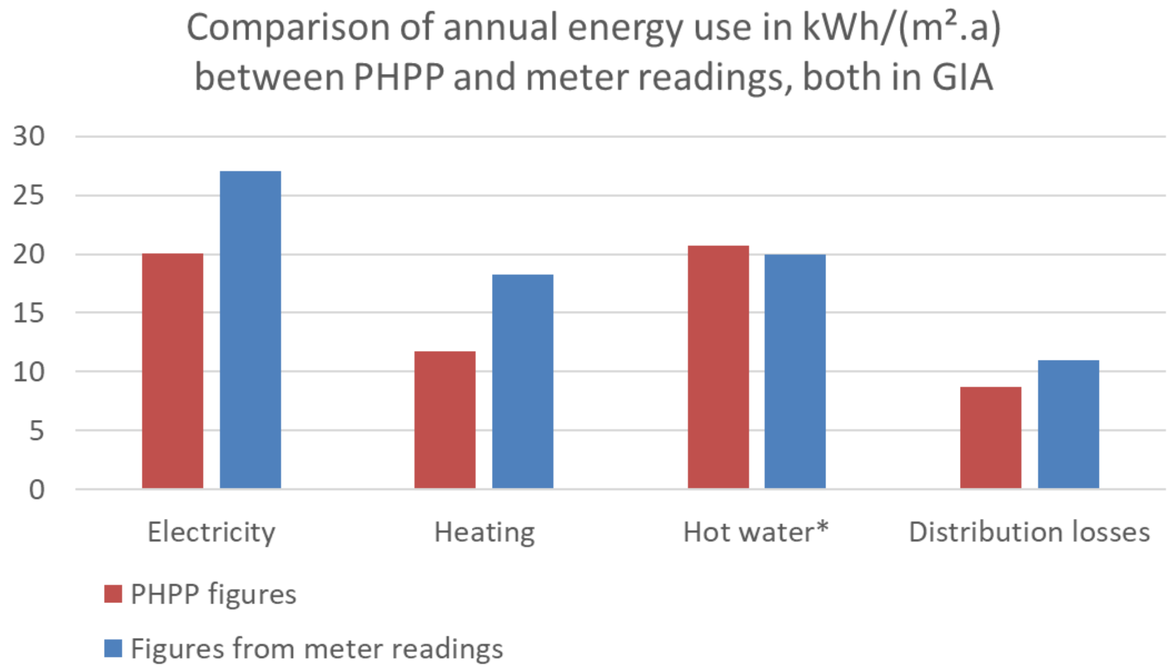
“Everything, quietness, light, plenty of space, marvellous building.”

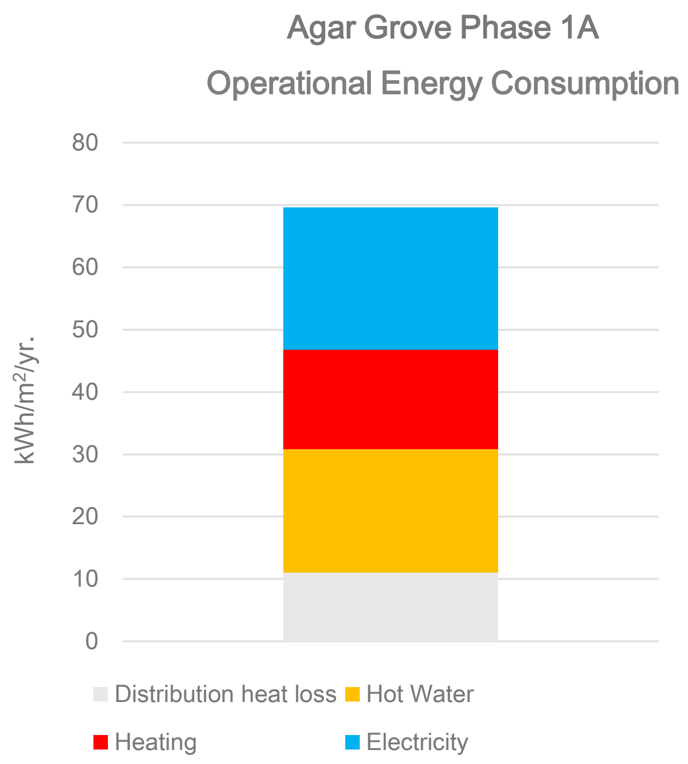
Plant room flow and return temperatures: average 64 / 42°C



Monitored data graphs/ charts

- PHPP by default uses a standard occupancy and internal heat gain figure for multi-residential buildings. The confirmed occupancy for the monitoring period was higher (105 in reality, compared to 81 from PHPP). We've run a scenario in PHPP with this higher occupancy, including the increased operational energy use including domestic hot water, and higher internal heat gains leading to lower heating demand. The figure on the right summarises the measured operational energy consumption. The figures below show the predictions from the PHPP model compared with measurements. The following pages have more details, including some things which aren't available in the metered data.





Monitored data graphs/ charts

Electricity (23kWh/m^2/yr metered, 27 kWh/(m².a) including unmetered communal spaces.)

•Data is taken from utility meter readings for a year period 2018/19 and from the communal MVHR system during 2020.

•MVHR accounts for 3kWh/m^2/yr.

•Data from 2020 utility meter readings is not currently available, it is expected that this would not vary significantly year on year and so 2018/19 data has been used.

•Does not include any contribution from the communal PV panels.

•The metering does not cover electrical consumption of plant room and communal areas, which we have estimated at 4 kWh/(m².a) based on the PHPP.

Heating (16kWh/m^2/yr space heating demand, ≈ 18 kWh/(m².a) including boiler efficiency)

•Data taken from the year 2020 from the plant room heat meter which measures the amount of heat produced by the gas fired boilers (this heat is used for heating and hot water via a communal heating system and heat interface units in each dwelling).

•The load is estimated based on taking the total heat consumption and subtracting an estimate of the hot water consumption and distribution losses which are assumed to remain fairly constant over the year.

•The base data does not account for the efficiency of the gas boilers, which we've estimated at 88%

Hot Water (20kWh/m^2/yr.)

•Data taken from the year 2020 from the boiler plant room heat meter.

•The value for hot water was estimated based on a review of the summer consumption data (June, July, Aug), where it's been assumed that the load remains relatively constant throughout the year as the occupants hot water consumption will be relatively consistent. The distribution losses were then subtracted from this load. This is taken from the plant room heat meter.

Distribution heat losses (11kWh/m^2/yr.)

•Provides an estimate for the amount of heat lost within the building's communal heat distribution system (includes plant room and distribution pipework).

•Data taken from the year 2020.

•The value was worked out by taking the total heat consumption from the plantroom heat meter and subtracting the heat meter data for all 38 dwellings (via each dwelling's individual heat meter used for billing).

•Data is expressed per m^2 using Gross Internal Area (GIA). The average GIA of a dwelling is 109m^2.

•It is understood that all dwellings were occupied during the analysis periods.

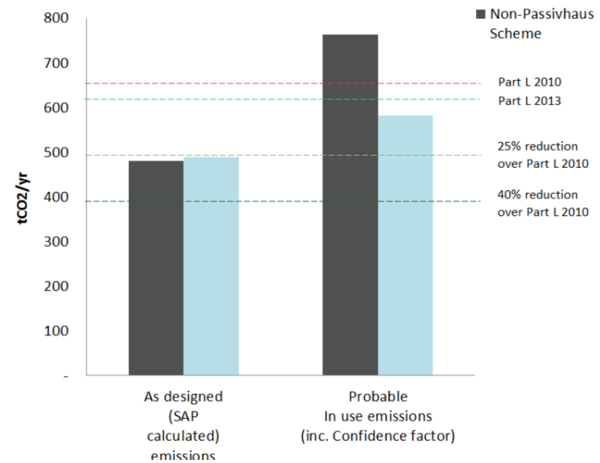
Key Construction Innovations

- The form of the building is efficient, allowing insulation thicknesses below those conventionally associated with Passivhaus. The building generally uses standard construction products, so is replicable.
- The building features a low-temperature and lean heat network, with performance data meaningfully measured at commissioning.
- The roof level communal MVHR system is unusual for multi-residential developments, and allows easy access for maintenance, filter changes etc.

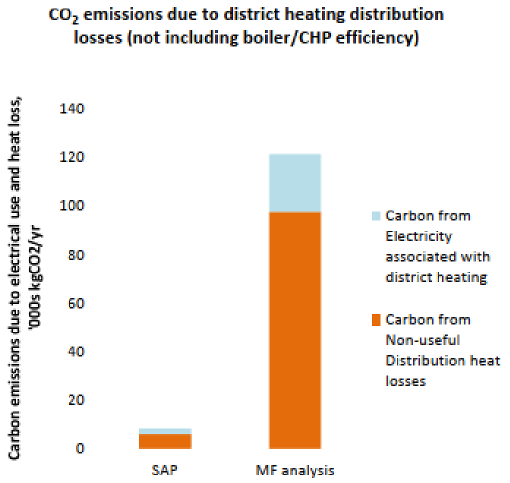
What is special about the building?

- Agar Grove was the first large-scale inner city residential Passivhaus development in the UK, and its success has paved the way for more Passivhaus housing developments. It has shown:
  - PH can be a key driver for addressing fuel poverty
  - PH housing can be delivered affordably
- The team successfully pitched Passivhaus and communal boilers by making a compelling case against the then-held view that all developments should connect to district heat networks (DHN). The work drew attention to DHN heat losses which were underrepresented in modelling at the time
- The scheme incorporates communal MVHR, which is an unusual solution. This removes the maintenance burden from tenants, and ensures a continuous supply of fresh filtered air
- The thickness of insulation has been optimised, which helped with detailing, and allowed the use of more standard components and processes

Carbon emissions of PH vs non PH: modelled and in-use



DHN Heat losses: modelled vs predicted



LESSONS LEARNED

What would we do differently & Lessons Learned?

- Running communal LTHW heating systems at low temperatures pushed the available technology to its limits because it was created for higher temperatures. On future developments we are proposing low carbon heat sources using ambient loop distribution: this technology is optimised to operate at low temperatures and is being used on Phase 1C
- We would model the whole life carbon and design to current targets
- Insulated side panels to Northern façade don't perform as well as a 'full' wall build up.
- Fully glazed, mainly landscape orientation of windows to Phase 1c should enable greater amount of free area.
- Thicker framed windows tend to perform better, these can be cloaked to maintain sight lines.
- A full brick return is not ideal from PH perspective, as it leads to increased thermal bridging, consider lining with a thin piece of masonry or metal.
- There is value to having continuity in design input, and completing the design for the contractor on a D&B basis.