AECB Kent Group

The AECB (Association for Environment Conscious Building) was founded in 1989 and by 2000 had reached a membership of over 1000. In 2006 it became a not-for-profit limited company, AECB Ltd. Since then, it has continued to thrive providing news, support, building standards on green building to a membership that continues to grow. In 2012 the AECB set up the Passivhaus Trust, and in 2013 set up the Carbonlite Retrofit Programme, to complement the Green Deal. They have presented evidence to government panels on Energy.

The Kent Group is run by Paul Mallion FRICS of Conker Conservation Ltd.

Stonebridge Road Development adjacent to Kingsmead Playing Field

Introduction

The AECB group was kindly invited to the site by Nicholas Thurston, Principal Policy Officer (Climate & Environment), and shown around by the site manager from Jenners. Information on the construction was gathered from the site manager or by inspection of exposed elements. The visit took place during the week of the Canterbury Climate Action Festival 2022 in the spirit of collective knowledge-sharing and common endeavour to act on the causes and effects of climate change. Nicholas set out the context for the project and how five of the homes on the site allocated for affordable rent had heating system design changed from gas central heating to air source heat pump heating during the project to reduce carbon emissions. Nicholas requested collective feedback from the group on aspects of the development that might be improved for future similar projects in order to improve their energy efficiency, carbon emissions and other sustainability aspects.

The following feedback is a compilation of the observations from the AECB group of building design and building construction professionals.

Orientation

It is a restricted site with limited options, however, it appears that solar orientation played no part in the design; only 6 out of 16 houses has an elevation facing within 30 degrees of south.
Only 7 out of 16 have a south facing living space.
Orientating buildings to within 30 degrees of south can reduce energy consumption by 15% free of charge, as windows can be enlarged to benefit from solar gain.

Design

Georgian architectural proportions limit the size and spacing of windows, limiting the amount of free solar gain available, and greatly restricting the type of window that can be used, eg sliding sash windows have to be used.
Parapet walls add cost and complexity, and create thermal bridges and air leakage paths described below. They also add maintenance risks as parapet gutters are prone to blockage.
Simpler and more contemporary designs offer far more scope for admitting free solar gain, reducing maintenance, and improving daylighting.

Thermal Insulation

Wall insulation is reliant on a single board of phenolic foam in the cavity, 75mm wide, secured with stainless steel ties. Holes formed through the wall for vents were inspected showing poorly fitting boards, gaps between boards, and an airgap behind the boards; all fairly typical cavity wall problems.

Our assessment of the U value corrected for wall ties and gaps is 0.325W/m^{2}K, this is below the limiting fabric parameter accepted by building regulations Part L1A 2016.

It is preferable not to rely on a single layer for the insulation, good practice is to use at least two layers of material, so that risk of gaps between boards is reduced; and to use a full fill cavity insulation to reduce risk of boards not fitting and debris entering the cavity void.

Photo 1- View through wall showing missing cavity insulation, poorly fitting

insulation boards, gap between boards and inner leaf.

Loft insulation is 400mm of quilt, this is a good standard.

Floor insulation is 150mm of Kingspan PIR board. U value 0.146 is good.

Airtightness

Air permeability (the level of draughts) recorded as 4.65m^3/m^2h for the show house. Each house is to be individually tested. This result is average for developer housing, but woefully short of good energy standards. Energy efficient houses use the metric of air leakage rate measured in air changes per hour (ach), slightly different to air permeability. A value of 1.0ach is a good value, meaning that these houses are nearly 5 times more draughty than a good design.

Houses are finished internally with 'dot and dab' drylined plasterboard walls, well known for many years as the worst method for achieving good results for air leakage. Concrete blocks are porous, therefore need a coating to prevent air leakage before plasterboarding.
There was no evidence of a structural airtightness strategy, therefore the buildings rely on mastic to keep draughts at bay, this is a short term strategy and will result in the air leakage worsening over time.

Glazing

Basic uPVC double glazing which is inefficient by current standards. Georgian bars require numerous small panes of glazing or large panes sub-divided with internal spacers, this greatly reduces the thermal efficiency of the glass. Typical values for the glazing (centre-pane), corrected for the thermal bridges through glazing bars is 1.3 to 1.4W/m^{2}K. Triple glazing achieves 0.5W/m^{2}K, 260% better.

Photo 2- Basic double glazing with Georgian glazing bars, each spacer is a thermal bridge and reduces the performance of the pane, sash windows have poor long term airtightness

Sliding window units are difficult to make airtight due to the nature of the construction, brush seals have a limited lifespan and will increase draughts over time.

Solar Shading

No solar shading is provided to any windows, the west facing windows to 10 no. dwellings could cause overheating in warm conditions.

No solar shading to south facing windows on 6no. south facing units. No solar shading to the 11 no. west facing windows, which are the most likely to suffer from overheating.

Summary of U values and air leakage compared to Building Regulations and good practice			
Element	Actual U value	Minimum Building Regulations value (limiting fabric parameters)	Recommended U value
Wall	0.325	0.3	0.15
Roof	0.1	0.2	0.15
Floor	0.146	0.25	0.15
Glazing centre pane	1.3-1.4	n/a	0.50
Whole window	1.6-1.8	2.0	0.85
Air permeability m^3/m^2h	4.65	10	0.6-1.0

Table for U values and air leakage, red signifies very poor performance, green is good. Note that new dwellings are designed using Target Emissions Rate and Target Energy Efficiency Rate rather than elemental values, but this table demonstrates that the development does not achieve high standards compared to the bare minimum values allowed. Values calculated using Ubakus.de

Ventilation

No ventilation systems have been installed. The properties rely on trickle vents in windows and extract fans to bathrooms.

Bathroom fans have been used in the kitchen, contrary to Building Regulations, neither is there any grease filtering, the external grilles have insect screens, this results in blockages and diminished performance. See extract from building regulations below.

Photo 3- External louvres to kitchens should not have insect mesh.

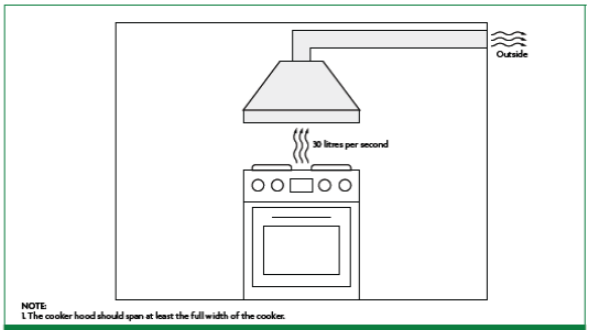

Diagram 1.1 Minimum kitchen extract ventilation rate in cases where a cooker hood extracts to the outside[1]

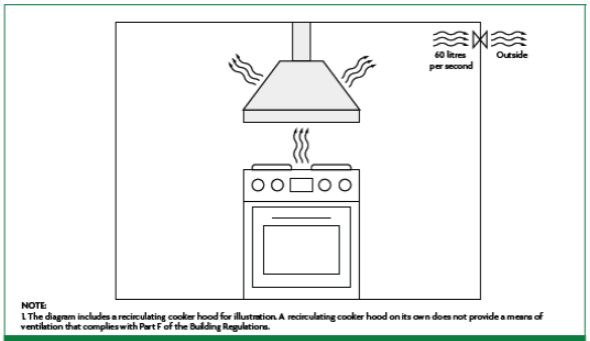

Diagram 1.2 Minimum ventilation rate for kitchen extract where a cooker hood does not extract to the outside[1]

At the top floor on the 3 storey units, the curved windows are not fitted with trickle vents, therefore 2 no. holes have been drilled through the wall for passive vents, this is over-ventilation and will result in serious draughts.

Whole house mechanical ventilation system with heat recovery should have been considered, in conjunction with greatly improved draught proofing (an ach value of less than 3.0 is recommended).

Renewables

No renewables have been included. Sub-optimal orientation limits the scope, but several of the dwellings have potential for solar thermal or solar PV.

Heating and hot water system

Air sourced heat pumps provide heating, this appears to be the sole concession to the environment at the development. The system is thought to be adequate but basic, clearly designed down to the lowest installation cost rather than lowest running cost. There is no thermal store or buffer vessel, only a small expansion vessel.

When installing a heat pump with no thermal store, it is best that the system is designed to ensure minimum system volume and load. This stops cycling, which along with emitter sizing, is a large part of reduced heat pump performance. We then recommend that all radiators are fitted with auto-balancing valves (these can be manually balanced but this is time consuming and hard to manage depending on installer experience) and living spaces would not have the TRV head installed so are always open. This allows bedrooms to be controlled to a lower room temperature to the rest of the dwelling based on homeowner comfort levels. With the valves fitted and set up correctly, the system will be hydraulically balanced, ensuring the correct amount of heat goes to each radiator, thus reducing overheating/underheating in rooms and maximising system efficiency.

Hot water pipes not lagged, hopefully to be picked up during snagging.

Heat emitters

Enlarged to allow for the lower temperature provided by ASHP. Very poor design, triple panel radiators used when taller slimmer double panels could have worked and taken up less floor space in the small rooms.

Photo 4- radiators did not need to be triples, it would be have been better to make them taller to avoid taking up floor space.

Materials

No consideration appears to have been given to sustainable materials- wall and floor insulations are foamed petro-chemical boards, not recyclable or sustainable. Mineral wool products used in the roof have lower environmental impact.

uPVC used in rainwater goods and windows is a petro-chemical product which has a high carbon footprint and very limited recyclability in practice. They are difficult to repair, not maintainable and have a short lifespan.

Valley and parapet gutters have been made watertight using a liquid system, these systems create tons of hazardous waste known to be a pollution risk to water courses.

Maintenance

Valley gutters and parapet gutters are well known to be maintenance problems. Parapet walls are also prone to deterioration from frost, weathering faster than masonry which is protected by a roof overhang. Brick external finish has a high carbon impact, but has a very long low maintenance life. If lime-based mortar was used, it would allow for reuse in the future, cement mortars prevent bricks being salvaged.

Quality control

Air leakage is a major indicator of quality, poor air leakage results indicates low quality control with regard to the thermal envelope. Internal and external finishes are well finished, but these have no impact on the environmental quality of the development.

Public space

The road is shown as ‘homezone’ on the planning application which is a good idea, but is being constructed as a regular road with kerbs and finished with tarmac.

Electro Magnetic Radiation

Unit 8 is within 6m of a substation, increasing risk of noise complaints from low frequency humming, and known links to health conditions.

Energy Costs

As there are no improvements in insulation or airtightness or renewables over the original designed as gas-boiler heated homes, there is a risk that the fuel bills are the same or higher through the move to air source heat pumps. The system commissioning, operating instructions for tenants and monitoring of performance will be important to ensure that bills are kept low and the risk of high fuel bills is avoided

Fact check on Council publicity quote

Whilst it is important to highlight advantages of projects, the AECB group felt that the Council's press release overstated the sustainability benefits of this project:

"The five homes for social rent are packed full of green technology to make them consume much less energy with air source heat pumps removing the need for gas plus very high levels of insulation and high-quality window and doors making the properties cool in the height of summer and warm and cosy in the winter.	Only one additional technology used- heat pump Houses will consume the same or more energy than normal houses Standard levels of insulation and standard DG windows No indication these buildings will be cool in the summer as there is no solar shading strategy
"All of the homes have been built to incredibly high standards, and we hope that by building these houses ourselves we have set an example for other developers in our district of the very high quality we expect for our residents.	Built to regular developer standards, only just compliant with building regulations No exemplar has been set.
"The projected carbon emissions from heating these council homes and providing hot water will be reduced by 65% and the overall running cost is lower than conventional gas boilers.	Varies in reality based on where the property is located and the amount of renewable energy going into the local grid, the south east is one of the lowest producers of renewables to the grid according to carbonintensity.org

Conclusion

It is laudable that Canterbury City Council should create affordable homes and have a goal of creating more energy efficient housing. Regrettably this development is no better in terms of building standards than the average developer project. The estate has a single feature for the reduction of carbon emissions, air sourced heat pumps. It is highly likely that these homes will cost more to run than the equivalent heated by gas condensing boilers, as heat pumps only come into their own on very efficient buildings.

High efficiency is created by a combination of higher thermal insulation levels, lower air leakage rates, larger areas of south facing glazing, better quality glazing, and higher standards of workmanship, none of which were demonstrated here.

We also have to challenge the energy standards used in conventional energy assessments, as relying on SAP and EPCs to compare buildings is inadequate and leads to the well known 'performance gap'. We need to use much tougher assessment calculations such as the Passivhaus Planning Package and ensure that clients, designers, contractors and trades are better trained and more aware of the problems of current housing. A good project starts with a sound brief from the client.

Paul Mallion

AECB Kent Group was represented by members and associates of members:

Paul Mallion	Conker Conservation	Chartered surveyor and passivhaus designer, CCAP member
Gavril Postnikov	Conker Conservation	Graduate surveyor
Tess O Sullivan	Rural Housing	Housing needs specialist
Tim Wren	Solaris Energy	Renewable heating specialist
Daniel Large	Solaris Energy	Renewable heating specialist
David Browne	Convert Energy	Renewable energy specialist
Ben Glancy	Convert Energy	Renewable energy specialist
Alastair Russell	Ian Sayer	Chartered quantity surveyor, CCAP member
Richard Porteous	Built Environment Technology	Mechanical ventilation specialist
Jonathan Deacon	Draughting Solutions	Geomatic surveyor
Ross Evans	Human Habitat	Passivhaus tradesperson
Richard Barwick	R J Barwick	Engineer and retrofit contractor
Chris Lowe	Pioneering low energy home owner	Retired hospital facilities engineer