High Level Carbon Assessment

Introduction

This section has been written to supplement the Outline Business Case / options appraisal being carried out by AtkinsRéalis, on behalf of Aberdeen City Council (ACC), to determine the most appropriate course of action to remediate the Reinforced Autoclaved Aerated Concrete (RAAC) issue which has been identified in 504 domestic units in the Balnagask area.

This section will focus on the likely carbon impact associated for each of the proposed options. The main decision factor for the option will be embodied carbon, however some consideration has also been given for the potential to carry out retrofit interventions to the properties. This is to comply with ACC's statutory obligation to meet the Energy Efficiency Standard for Social Housing 2 (EESSH2), which requires all social housing stock to have an Energy Performance Certificate (EPC) rating of B or above (a SAP score of 81). This is also an opportunity to improve thermal performance and tenant comfort, address any associated issues such as damp and mould, and ultimately reduce energy usage and bills for tenants which in turn can help to alleviate fuel poverty.

As this project is currently in the early design stages, it should be noted that these recommendations are high level, and further detailed design work will be required once a preferred RAAC remediation option is progressed.

Whole Life Carbon

Whole Life Carbon Assessment is defined as '' the carbon impacts over the entire life cycle of a built asset, from its construction through to its end of life. A whole life carbon assessment (WLCA) is the calculation and reporting of the quantity of carbon impacts expected throughout all life cycle stages of a project, but also includes an assessment of the potential benefits and loads occurring beyond the system boundary'' (RICS Whole Life Carbon Assessment for the Built Environment, 2nd Edition, July 2024).

Given the early, feasibility stage of the project, it should be noted that this is currently a high-level exercise based on several assumptions. It is recommended that a more

detailed Whole Life Carbon Assessment is carried out in RIBA Stage 2 once a preferred option is identified.

Embodied Carbon

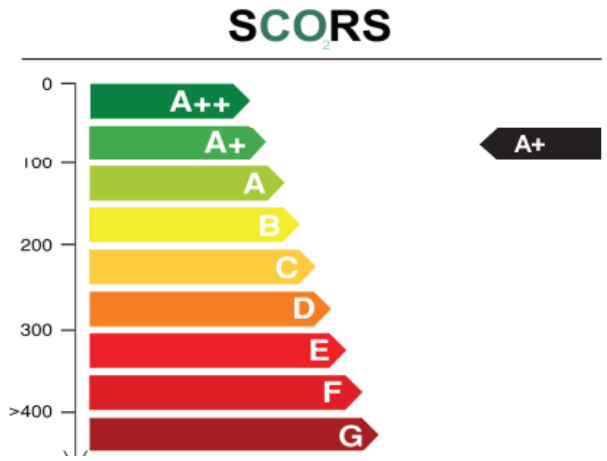
Fairhurst, working in conjunction with AtkinsRéalis and ACC, have identified several options to deal with the RAAC issue. These are:

- Option 1 – Bearing Enhancement
- Option 2 – RAAC Panel Timber Support Frame
- Option 3 – Roof Replacement
- Option 4A – Demolish Only
- Option 4B – Demolish and Rebuild

The associated embodied carbon emissions (Stages A1-A5 of the project life cycle) for each of the proposed remediation options has been highlighted (see pages 29 – 32). These have been highlighted and ranked in the table below.

Option	Description	Embodied Carbon by Type	Score Rating	Ranking
1	Bearing Enhancement	75 $kgCO_2e/m^2$	A+	1
2	Timber Panel Support	80 $kgCO_2e/m^2$	A+	2
3	Roof Replacement	141 $kgCO_2e/m^2$	A	3
4A	Demo Only	283 $kgCO_2e/m^2$	D	4
4B	Demo & rebuild	545 $kgCO_2e/m^2$	G	5

The SCORS assessment undertaken shows that Options 1 & 2 have a similar level of embodied carbon associated, with Option 1 being 5 $kgCO_2e/m^2$ less. Both achieve an A+ rating against the SCORS.



Option 3 has nearly twice the embodied carbon of options 1 & 2, but still achieves an A rating, although this does not meet the SCORS target of 137 kgCO_2e/m^2. One benefit of introducing a new roof is the opportunity to incorporate better insulation as part of the RAAC remedial work, which will result in a betterment of operational energy use and associated carbon emissions.

Options for demolition (option 4A) and demolition & rebuild (option 4B) are, as expected, significantly more carbon intensive, with 4A having three and half times more embodied carbon than options 1 & 2, and twice as much as option 3. Options 4B has seven times more embodied carbon than options 1 & 2, and nearly four times as much in comparison to Option 3. Whilst there is significantly more embodied carbon, it would be expected that any new build property would be built in line with ACC's Housing Programme Employer's Requirements and hence have a higher standard of energy performance which would reduce operational carbon emissions in the long term.

It should also be noted that when compared against other carbon assessment methodologies, particularly RICS and LETI guidance, Options 1, 2 & 3 all meet the required performance targets (3 does not comply with SCORS as noted above), whereas Option 4 does not meet this. The table below compares this for all options.

Options	Meets SCORS Target (137 kgCO_2e/m^2)	Meets RICS Target (144 kgCO_2e/m^2)	Meets LETI Target (201 kgCO_2e/m^2)
1	Yes	Yes	Yes
2	Yes	Yes	Yes
3	No	Yes	Yes
4A	No	No	No
4B	No	No	No

Operational Energy & Associated Carbon Emissions

In addition to the embodied carbon associated with each of the options, it is important to also consider the carbon emissions from the ongoing habitation / operation of the buildings. Given the level of intervention works that need to happen to remediate the RAAC options, ACC may view this as a suitable opportunity to carry out a wider programme of retrofit improvement measures to meet statutory obligations such as EESSH2 and improved comfort for tenants.

Current Performance

Allied Surveyors (AS) have carried out EPC Certificates for a sample of properties that represent the key types across the estate. The majority of properties are currently and EPC rating of C, with a minority being B or D. During this initial assessment, AS noted the potential for improvement by carrying our basic interventions, but in most cases the properties remained as an EPC C, with a small number achieving B. The below table summarises the findings of this initial assessment.

Initial Assessment

Address	Type	Current Energy Usage (kWh/m2/yr)	GIFA	Current EPC & CO2	Potential EPC & CO2
28 Farquhar	Mid-Terrace	232	87	B/C (71 / 68)	B (84 / 82)
196 Farquhar	Top Floor flat	215	48	C (74 / 76)	C (74 / 74)
198 Farquhar	Ground Floor Flat	243	48	C (72 / 73)	C (76 / 78)
469 Balnagask	Top Floor Flat	223	48	C (74 / 75)	C (74 / 75)
471 Balnagask	Ground Floor Flat	270	48	C (70 / 70)	C (75 / 77)
481 Balnagask	Top Floor Flat	228	48	C (73 / 74)	C (73 / 74)
5 Burnbank	Mid-Terrace	259	98	D (68 / 63)	B/C (81 / 77)
6 Pentland	Top Floor Flat	199	48	C (76 / 78)	C (76 / 78)
8 Pentland	Ground Floor Flat	223	48	C (74 / 75)	C (77 / 79)

AtkinsRéalis then suggested a suite of improvement measures and asked AS to re-run the RdSAP calculation. This was on the basis of the following measures being implemented:

- Enhanced external wall insulation.
- Enhanced floor slab insulation.
- Enhanced roof insulation (already being achieved in Option 3)
- Upgraded windows and doors.
- Upgrade of MEP systems such as the boiler OR tie into a District Heat Network (DHN)

In all cases an EPC B was achievable, however for both the Ground and Top floor flat it was only just achieving the 81-point threshold for a B. It should be noted that the RdSAP modelling is based on high level assumptions, and hence detailed design and modelling will be required to refine the specification and installation once a preferred option has been identified, to ensure that EESSH2 is actually achievable.

Re-run assessment of 3 typologies

Address	Type	Current Energy Usage (kWh/m2/yr)	GIFA	Current EPC & CO2	Potential EPC & CO2
196 Farquhar	Top Floor flat	215	48	C (74 / 76)	B (81 / 85)
471 Balnagask	Ground Floor Flat	270	48	C (70 / 70)	B (81 / 85)
5 Burnbank	Mid-Terrace	259	98	D (68 / 63)	B (86 / 85)

Wider Considerations

We understand that ACC are considering tying into the existing heat network to act as the primary heat source for these units, which is linked to the recently built Energy from Waste (EfW) plant. This would help to provide a decarbonised heat solution, give ACC control over pricing, and act as a potential revenue stream.

Further studies will be required to ascertain the infrastructure required for any district scheme to be linked to the existing properties, any alterations required to the existing heating system to facilitate this connection, and further modelling to ascertain the impact on EPC rating, energy usage and carbon emissions. Initial review by AS has shown the properties achieving a high band C when connected to a communal network, however this needs to be caveated by the fact that the modelling was based on limited information and that there is currently no specific instruction for

modelling EfW in SAP. This rating is likely due to perceived distribution loss from a community scheme. We would note that we have undertaken a review of guidance (see BRE_Technical_Note-Energy_from_Waste_Facilities_(ERF)_1.0) issued by the Building Research Establishment (BRE) which suggests that energy / heat from a EfW powered DHN should provide a significant benefit when compared to gas boilers.

Another consideration that should be made is whether EESSH2 is the correct criteria to link any retrofit upgrades to. The new 'Social Housing Net Zero Standard' (SHNZS) is currently under consultation, and it is expected that this will replace EESSH2. This will mean that EPC certificates are no longer the metric by which improvements are measures, and instead improvement in Energy Use Intensity (EUI) will be the likely metric. This would require a more detailed analysis using a Dynamic Simulation Model (DSM) to quantify improvements, which can then be assessed post implementation.

Indicative Costs

The AtkinsRéalis Cost Management team have produced indicative costs for implementing the suite of measures described in the previous section. This is on the basis of a DHN being the primary heat source. The costs are similar for Options 1, 2 & 3, with a slight uplift for Option 3 due to inflation (longer implementation programme). The table below notes these costs. For further detail and breakdown of these costs, please refer to 'RAAC Options Appraisal – Feasibility Estimate' report prepared by AR Cost Management.

Option	Additional Cost for EESSH2 Compliance
1 & 2	£40,964,200
3	£41,456,700
4B	N/A (New build)

Recommended Next Steps

This Report is intended to help shortlist a preferred option/s to progress further detailed work. It is our recommendation to consider the following actions is next steps to progress:

- Confirm preferred option design option or further shortlisting of the current five options.
- Progress more detailed design work based on the preferred / shortlisted options.
- Appoint a Whole Life Carbon Assessor who will be able to undertake an assessment at RIBA stage 2 based on more detailed design information.

- Further RdSAP modelling for a wider sample of properties to understand if EPC B can definitely be achieved. It may also be prudent, given the limitation of RdSAP, to undertake data gathering and Dynamic Simulation Modelling of a sample group of properties to allow a more detailed understanding of actual energy usage and carbon emissions. This would then allow alignment with any changes to legislations i.e. the change from EESSH2 to SHNZS.
- Further work to understand the viability of connecting into the existing heat network including an understanding of capacity of the network, project heat demand, infrastructure required for connection, conversion work required in properties and more detailed capital and revenue cost assessments.
- Update the cost model based on the chosen options/s and the associated additional design work and modelling to allow a more accurate cost to be determined.
- Carry out a pilot study on a small sample of properties to test the preferred solution/s to allow real feedback that is based on pre and post implementation evaluation.
- Consider this study against the wider ongoing works for the ACC estate, particularly EESSH2 compliance works, planned new builds, planned maintenance spend, decant strategy, and ultimately addressing the other sustainability factors of social and economic.