Glebe Farm Barn, Glebe Farm, Northcroft, Weedon, Buckinghamshire, HP22 4NR

Carbon Analysis Report

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Report produced by -

Ian Bacon
Director
Blewburton Limited
23 St Martin's Street
Wallingford
Oxon
OX10 0EL

Tel: 01491 825337

E-mail: info@blewburton.com

Web: www.blewburton.com

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Introduction

Blewburton Ltd (BBL) has been commissioned to prepare an analysis of the lifetime carbon emissions of the proposed redevelopment of the Glebe Farm Barn at Glebe Farm, Northcroft, Weedon, Buckinghamshire, HP22 4NR and to compare it with the lifetime emissions of the existing barn, if converted to residential accommodation, rather than demolished and replaced with a new build construction.

A proposal was submitted to Buckingham County Council – Aylesbury area for the conversion of the existing building and this was approved at appeal in 2022. Notwithstanding this approval, it is now felt that a better long term approach would be to demolish the building and construct a new, energy efficient property for environmental and running cost reasons.

Methodology

The carbon emissions associated with the conversion of the existing building will first be calculated, based on size and structure and available plans.

The carbon emissions of the proposed new building will then be calculated according to the available plans and the outline specification provided by the applicant following consultation with BBL. These will then be compared.

In all cases the carbon calculations are undertaken using the approved methodology for demonstrating compliance with Part L of the Building Regulations. Elmhurst Design SAP 2012 v.4.14 software is used for preparing the SAP calculations. As such, the calculations refer only to regulated emissions comprising heating, ventilation, cooling and lighting. Non-regulated emissions for items such as white goods, audio-visual equipment, chargers etc., can be assumed to be the same for both scenarios.

The conversion option falls under Part L1B of the building Regulations, whereas the new build option is covered by Part L1A of the Building Regulations. The approach to modelling is the same for both options, but the requirements are different and this is reflected in the subsequent calculations for this exercise and more detail is supplied later in the report.

Summary of the Development Proposal

The proposal is to demolish the existing barn, pictures below, and to replace it with a single, four-bedroom, detached bungalow. Site location, floor plans and elevations also shown below.

Figures 1 & 2: Existing barn images

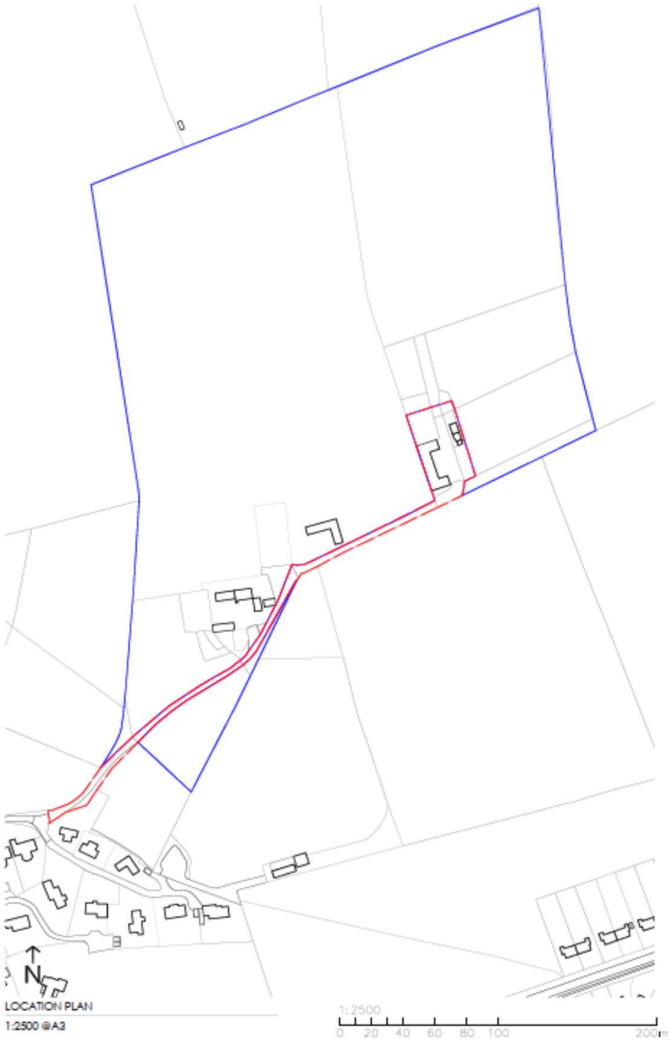

Figure 3: Site location plan

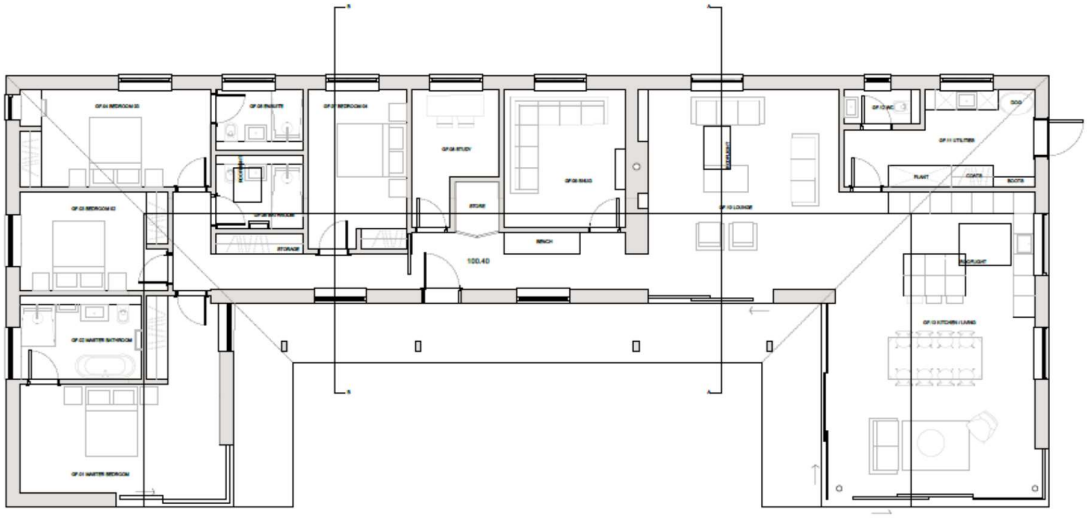

Figure 4: Proposed new build G/F plan

Figure 5: Proposed new build east & west elevations

The Conversion Option

The existing barn has permission for conversion to a 4-bedroom dwelling and as previously stated this would need to comply with Part L1B of the Building Regulations which governs carbon emissions associated with fixed energy uses within the dwelling.

The key factors for the assessment of carbon emissions are the thermal properties of the major building elements and the performance of the heating system.

The developer recognises the need to improve overall efficiency of the building fabric and supplied services as the first steps in achieving a sustainable energy solution for the converted dwelling and modelling has therefore been undertaken with the specification outlined in Table 1, below.

This reflects a significant uplift over Part L1B minimum requirements.

Element	Specification	Minimum Part L1B Compliance
Upgraded external walls	0.22W/m²K – timber clad on retained/new medium blockwork, 100mm Knauf DriTherm 32 insulation, 100mm lightweight block, plasterboard on dabs	0.55W/m²K
Ground floor	0.15W/m²K – Beam and block floor with 100mm Celotex insulation and 65mm screed	0.70W/m²K if no improvement work is proposed and could be retained at the current unimproved level of 0.43W/m²K
Roof - pitched	0.16W/m²K – 100mm Celotex insulation between the rafters and Celotex PL4040 insulated plasterboard below	0.16W/m²K
Windows/glazed doors/roof lights	Double glazed with U-values of 1.50 W/m²K, 1.60 W/m²K & 1.30 W/m²K (g-value of 0.72) respectively	1.60W/m²K for all
Solid entrance doors	1.00 W/m²K	1.40W/m²K
Lights	75% low energy light fittings	75% to be low energy
Ventilation	Intermittent fans in all kitchens/wet rooms	n/a

Heating	Mitsubishi Ecodan 8.5kW PUZ-WM85YAA Air Source Heat Pump (ASHP) *	Minimum efficiencies apply
Distribution	Underfloor heating	n/a
Controls	Time & temperature zone controls*	Requirements dependent on floor area
Cooling	None	n/a
Secondary heating	None	Minimum efficiencies apply
Hot water	From ASHP system to 210l capacity Ecodan hot water tank, with thermostat and separate time controls*	Minimum efficiencies apply
Showers	Non-electric	n/a

*** Note: We are not heating engineers, boiler and controls are purely indicative for calculation purposes at this stage**

Table 1: Barn conversion modelled specification

The New Build Option

The new build dwelling will be required to meet the requirements of Part L1A of the Building Regulations and these are more onerous than the requirements under Part L1B. Much of the same approach is modelled, but also included are the extent to which the construction embraces modern build practices to ensure minimisation of thermal bridging and air permeability.

Modelling has therefore been undertaken with the specification outlined in Table 2, below, and this, again, reflects a significant uplift over Part L1A minimum requirements.

Element	Specification	Minimum Part L1B Compliance
New external walls	0.17 (0.18)W/m²K – timber clad on retained/new medium blockwork (or 100mm artificial stone with no cladding), 150mm Knauf DriTherm 32 insulation, 100mm lightweight block, plasterboard on dabs	0.26W/m²K
Ground floor	0.11W/m²K – Beam and block floor with 150mm Celotex insulation and 65mm screed	0.18W/m²K

Roof - pitched	0.14W/m²K – 100mm Celotex insulation between the rafters and Celotex PL4060 insulated plasterboard below	0.16W/m²K
Windows/glazed doors/roof lights	Tripe glazed with U-values of 1.20 W/m²K, 1.20 W/m²K & 1.20 W/m²K (g-value of 0.64) respectively	1.60W/m²K for all
Solid entrance doors	1.00 W/m²K	1.40W/m²K
Air Pressure test	5.00m³/h.m² @50Pa	8.00 m³/h.m²@50Pa
Thermal mass	Medium	n/a
Thermal bridging	LABC Construction Details and hi-therm lintels	n/a
Lights	100% low energy light fittings	75% to be low energy
Ventilation	Intermittent fans in all kitchens/wet rooms	n/a
Heating	Mitsubishi Ecodan 8.5kW PUZ-WM85YAA Air Source Heat Pump (ASHP) *	Minimum efficiencies apply
Distribution	Underfloor heating	n/a
Controls	Time & temperature zone controls*	Requirements dependent on floor area
Cooling	None	n/a
Secondary heating	None	Minimum efficiencies apply
Hot water	From ASHP system to 210l capacity Ecodan hot water tank, with thermostat and separate time controls*	Minimum efficiencies apply
Showers	Non-electric	n/a

*** Note: We are not heating engineers, boiler and controls are purely indicative for calculation purposes at this stage**

Table 2: New build dwelling modelled specification

Results and Conclusions

Table 3, below, summarises the results from the two models undertaken using the assumptions detailed above. It shows the annual projected carbon emissions arising from energy use associated with heating, hot water provision, fans and lighting. It then shows a projected 60-year carbon emissions figure, which is a time frame frequently used in the UK when assessing long term impacts associated with buildings.

	Conversion option	**New Build Option**	**Percentage difference (%)**
Total CO_2 emissions $KgCO_2/yr.$	3560	2120	40.45
Total CO2 emissions KgCO2/60yrs	213,600	127,200	40.45

Table 3: Conversion and new build modelling results

This shows that the proposed change to a new build solution on this site, as opposed to a conversion would have strong savings in terms of carbon emissions from day one and when viewed longer term, this statement becomes even more true. This, in turn would also provide occupants with lower fuel bills.

It is worth noting that the specification used for the conversion does not feature assumptions for issues such as thermal bridging and air pressure testing and the reason for this is two-fold. One, they are not required under Part L1B of the Building Regulations and this is linked to the second reason, which is that they are difficult to deliver when existing structures form part of the build process. Hence one of the large advantages of going for a new build approach.

It should also be stressed that the specification used for the conversion assessment could easily have been stripped back to be even more in favour of making the argument for the new build approach, but we felt it was important to reflect a strong approach here, as this is likely what could be built. Notwithstanding this, the new build option still performs significantly better.

Once/if planning permission is granted for the new build approach and more detailed SAP calculations are undertaken for the dwelling, it is expected that it will be possible to further improve the performance of the new build dwelling, however, at a 40.45% improvement over the conversion option, from a carbon saving perspective, it clearly makes sense to change this project to a new build situation.