

ELDER

GREYFRIARS HOUSE

20 - 30 GREYFRIARS ROAD , READING

BREEAM MATERIALS 01

GREENGAGE





Brighter strategies
for greener projects



Client: Elder Developments (Greyfriars) Ltd
Project: 20-30 Greyfriars Road, Reading
Report: BREEAM Materials 01

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1.0 INTRODUCTION

On behalf of Elder Developments (Greyfriars) Ltd ('Elder'), Greengage have undertaken a Stage 2 life cycle assessment (LCA) of the proposed co-living scheme at 20-30 Greyfriars Road, located in Reading. This exercise contributes towards an environmentally considerate design process by considering the embodied carbon of the proposal, whilst also meeting the requirements set out within the BREEAM V6.1 Mat 01 criteria.

This report is prepared ahead of an application for full planning permission to redevelop the site to provide 266 co-living residential units along with associated shared community facilities. The official planning description of the proposed development is as follows:

'Demolition of the existing building and the erection of a part-7, part-13 storey building comprising 266 co-living units (Sui Generis) and associated communal amenity facilities, refuse storage, cycle parking and plant equipment.'

A single BREEAM assessment is being undertaken as part of the planning application. This has been registered as a 'fully fitted' residential institution development under the New Construction V6.1 scheme. The results from the LCA will therefore be exported into a BREEAM-V6.1 EN15804 format, to calculate the number of BRE EN EcoPoints and therein, the number of Mat 01 credits that have been obtained.

In line with the BREEAM Mat 01 Stage 2 criteria, the options appraisal undertaken accounts only for the various forms of design for the superstructure, substructure, hard landscaping and building services of the building.

2.0 PROCESS

As part of a workshop, Greengage consulted with the design team to determine the most relevant options to be assessed within the LCA. This included a baseline analysis of the proposed design as well as alternative options to the proposed design to be considered within the analysis.

The scope of the assessment has been undertaken in accordance with the BREEAM New Construction V6.1 criteria. Figure 2.1 below sets out the scope set out within the BREEAM manual that has been applied.

Figure 2.1 BREEAM NC V6.1 LCA Scope

Level 1 Group element	Level 2 Element	Level 3 Sub-element
2. Superstructure	1. Frame	1. Steel frames 2. Space decks 3. Concrete casings to steel frames 4. Concrete frames 5. Timber frames 6. Other frame systems
	2. Upper floors	1. Floors
	3. Roof	1. Roof structure 2. Roof coverings 3. Specialist roof systems 5. Rooflights, skylights and openings
	4. Stairs and ramps	1. Stair or ramp structures
	5. External walls	1. External enclosing walls above ground floor level 2. External enclosing walls below ground level 3. Solar or rain screening
	6. Windows and external doors	1. External windows
	7. Internal Walls and Partitions	1. Walls and partitions (Education only)
Level 1 Group element	Level 2 Element	Level 3 Sub-element
1. Substructure	1. Substructure	1. Standard foundations 2. Specialist foundation systems 3. Lowest floor construction 4. Basement excavation 5. Basement retaining walls
8. External works*	2. Roads, paths and pavings	1. Roads, paths and pavings 2. Special surfacings and pavings
*Include hard landscaping that is installed as part of the project under assessment and: – Is within a defined curtilage of the building – Or is clearly more associated with it (for example, an access road or car park that is intended to serve only the building under assessment or the building and, to a lesser extent, other buildings). Hard landscaping with no such distinction shall be excluded.		

Level 1 Group element	Level 2 Element	Level 3 Sub-element
5. Services	5. Heat source	1. Heat source
	6. Space heating and Air-conditioning	1. Central heating 2. Local heating 3. Central cooling 4. Local cooling 5. Central heating and cooling 6. Local heating and cooling 7. Central air-conditioning 8. Local air-conditioning
	7. Ventilation	1. Central ventilation 2. Local ventilation 3. Smoke extract or control
	9. Fuel installations and systems	1. Fuel storage 2. Fuel distribution systems

Material quantities were obtained from the Circle cost plan issued for Design Freeze 1 (3rd October 2024). Material quantities for the various options were provided by the Architect, Darling Associates; Structural Engineer, Form Structures; MEP Engineer, Meinhardt; and Landscape Architect, Henshall Green Ltd.

These figures were then input into LCA modelling software, OneClick LCA, to produce the results shown below in section 3.0.

For the options appraisals, the BREEAM-LCA database within OneClick LCA was used as this provided a significantly greater number of datapoints and therefore enables a more accurate result to be calculated.

As One Click LCA is BREEAM accredited software, the results will have accounted for the total equivalent kilograms of carbon dioxide per square metre ($\text{kgCO}_2\text{eq/m}^2$) for each of the options appraised. In accordance with standard methodology, the total GWP has been split out into each of the lifecycle stages as specified within the EN 15978 boundary and converted into BRE EN EcoPoints.

These include the following stages:

- A1–A3 = Product Stage;
- A4 = Product Transportation Stage;
- A5 = Construction & Installation Stage;
- B1–B7 = In Use Stage; and
- C1–C4 = End of Life Stage.

2.1 SUPERSTRUCTURE OPTIONS

The superstructure is formed of an RC frame over 13no. floors with a concrete core, concrete floors and brick and rendered walling. Following consultation with both the architect and structural engineer, the following alternative design options were analysed:

- Option 1 – 100% render external walls;

- Option 2 – 100% rainscreen external walls;
- Option 3 – 100% brickwork external walls; and
- Baseline Model and Option 4 – 70% brick and 30% render external walls.

The results of the superstructure options analysis can be found in section 3.0 below.

2.2 SUBSTRUCTURE OPTIONS

The substructure is formed of contiguous piles, a retaining wall and a reinforced concrete slab. Following consultation with the structural engineer, the following alternative foundations options were analysed:

- Option 1 – Settlement raft foundation;
- Baseline Model and Substructure Option 2 – RC pile foundations;
- Option 3 – Settlement raft foundations with 50% GGBS SCMs; and
- Option 4 – RC pile foundations with 50% GGBS SCMs.

The results of the substructure options analysis can be found in section 3.0 below.

2.3 HARD LANDSCAPING OPTIONS

The hard landscaping is primarily concrete aggregate paving. Following consultation with the landscape architect and structural engineer, the following options were analysed:

- Option 1 – Granite pavements; and
- Baseline Model and Hard Landscaping Option 2 – 100% concrete aggregate paving.

The results of the hard landscaping options analysis can be found in section 3.0 below.

2.4 BUILDING SERVICES OPTIONS

The building services strategy includes an all-electric strategy with water heating sourced by an ASHP, with MVHR provided. Following consultation with the landscape architect and structural engineer, the following options were analysed:

- Baseline Model and Building Services Option 1 – Centralised heat pumps for domestic hot water and local direct electric space heating;
- Option 2 – Centralised heat pumps for space heating and domestic hot water; and
- Option 3 – Localised direct electric hot water cylinder and direct electric space heating.

The results of the building services options analysis can be found in section 3.0 below.

3.0 RESULTS

3.1 SUPERSTRUCTURE

Table 3.1 shows the breakdown of kg of carbon dioxide equivalent per square metre net internal area by building element for each of the superstructure options. Within the EN 15978 scope, this covers the A1-A3 lifecycle stages.

Table 3.1 Embodied carbon in superstructure material options

Ref	Option 1 kgCO ₂ e/m ²	Option 2 kgCO ₂ e/m ²	Option 3 kgCO ₂ e/m ²	Option 4 kgCO ₂ e/m ²
2.1 Frame	47.47	47.47	47.47	47.47
2.2 Upper floors	126.26	126.26	126.26	126.26
2.3 Roof	14.60	14.60	14.60	14.60
2.4 Stairs and ramps	0.00	0.00	0.00	0.00
2.5 External walls	49.41	76.39	46.92	44.71
271.342.6 Windows & External Doors	6.60	6.60	6.60	6.60
TOTAL	244.36	271.34	241.86	239.66

Four façade options were considered for the superstructure to evaluate their environmental impacts and suitability for the project:

1. 100% render – This option uses a full render façade. While it is a cost-effective and lightweight choice, it may not provide the desired aesthetic appeal or durability for the project.
2. 100% rainscreen – A rainscreen façade was assessed, which offers high durability and is often used for enhanced weather resistance. However, it has a higher carbon impact due to the materials involved, making it less favourable in a sustainability-focused design.

- 100% brick – This option uses a full brick façade, known for its durability and traditional appearance. Brick provides good thermal mass but increases material usage and embodied carbon.
- 70% brick and 30% render – The selected option allocates 70% of the external wall area to brick and 30% to render. This combination leverages the durability, thermal mass, and traditional aesthetic appeal of brick for most of the façade while incorporating render to reduce overall material use and embodied carbon. The render portion provides a cost-effective alternative, reducing the façade’s carbon impact without compromising on design quality.

3.2 SUBSTRUCTURE

Table 3.2 shows the breakdown of kg of carbon dioxide equivalent per square metre net internal area for each of the substructure options. Within the EN 15978 scope, this covers the A1-A3 lifecycle stages.

Table 3.2 Embodied carbon in substructure material options

Ref	Option 1 kgCO ₂ e/m ²	Option 2 kgCO ₂ e/m ²	Option 3 kgCO ₂ e/m ²	Option 4 kgCO ₂ e/m ²
1.0 Substructure	88.69	65.76	57.72	79.80

Four substructure options were considered to determine the most suitable foundation approach for the project:

- Settlement raft – High concrete and rebar use, leading to a higher embodied carbon footprint.
- RC pile caps and piles, suspended base slab – Chosen option, providing structural stability with optimised concrete use.
- Pile and pile caps with 50% GGBS – Reduces carbon through GGBS but may not meet load-bearing needs and affects curing time.
- Raft with 50% GGBS – Lowers embodied carbon but may not meet load-bearing needs and affects curing time.

3.3 HARD LANDSCAPING

Table 3.3 shows the breakdown of kg of carbon dioxide equivalent per square metre net internal area for the two hard landscaping options. Within the EN 15978 scope, this covers the A1-A3 lifecycle stages.

Table 3.3 Embodied carbon in hard landscaping material options

Ref	Option 1 kgCO ₂ e/m ²	Option 2 kgCO ₂ e/m ²
8.2 Roads, paths & paving	67.33	65.76

Two hard landscaping options were considered to determine the most suitable approach for the project:

1. Granite – Not chosen due to the focus on continuity with the Station Hill scheme, which required a uniform streetscape material.
2. 100% Concrete aggregate paving – Chosen option, locally sourced to align with the materiality of Station Hill, supporting a cohesive streetscape aesthetic.

3.4 BUILDING SERVICES

Table 3.4 shows the breakdown of kg of carbon dioxide equivalent per square metre net internal area for each of the building services options. Within the EN 15978 scope, this covers the A1-A3 lifecycle stages.

Table 3.4 Embodied carbon in building services options

Ref	Option 1 kgCO ₂ e/m ²	Option 2 kgCO ₂ e/m ²	Option 3 kgCO ₂ e/m ²
5.0 Building Services	26.39	73.45	24.98

Three building services options were considered to determine the most suitable approach for the development:

1. Centralised heat pumps for DHW, local direct electric space heating – Chosen option for its balance of efficiency and decentralised control, with centralised heat pumps providing efficient domestic hot water and local electric heating minimising infrastructure requirements.
2. Centralised heat pumps for space heating and DHW – Not chosen due to the additional heating distribution pipework required, which increases complexity and costs.
3. Localised direct electric hot water cylinder and space heating – Offers simplicity but results in higher lifecycle costs due to the lower efficiency of individual hot water cylinders compared to central heat pumps.

4.0 BREEAM CREDIT ACHIEVEMENT

Under BREEAM New Construction V6.1, there are a total of 7no. credits available for undertaking an LCA: 6no. for analysing the superstructure at Stages 2 & 4 and 1no. for analysing the Substructure and Hard Landscaping at Stage 2.

Offices, industrial and retail buildings can achieve credits by comparison against the BREEAM benchmark. The GWP of the following elements of the substructure, hard landscaping and superstructure is converted into BRE EN EcoPoints through use of IMPACT-compliant software to deduce the number of credits that have been achieved:

- 1.0 = Substructure;
- 2.1 = Frame;
- 2.2 = Upper Floors;
- 2.3 = Roofs;
- 2.4 = Stairs and Ramps;
- 2.5 = External Walls;
- 2.6 = Windows and External Doors; and
- 8.2 = Roads, Paths and Pavings.

The options appraisal undertaken at the concept design stage of both the superstructure (4 options), the substructure & hard landscaping (6 options) and the building services (3 options) has achieved 5no. credits under Mat 01 plus a further exemplary credit, in line with the credits targeted at this stage.

Updating the LCA model with greater detail at the Technical Design Stage, will enable more detailed options to be analysed, will maximise the potential for the remaining Mat 01 credits available to be targeted.

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