Frenchay Primary School design stage 3 and 4
SCF Materials baseline carbon assessment report (A1-A3)

Frenchay Primary School, Bristol
is a Passivhaus new build school for South Gloucestershire Council (SGC) procured under Southern Construction Framework (SCF). Awarded to BAM Construction with a Stage 3 design, with no embodied carbon requirement.

This report has been produced by BAM to share with SCF at Gateway 3 and the client SGC, to show this projects materials embodied carbon, assessed at Gateway 2 with RIBA Stage 3 design and reductions at Gateway 3 with a BAM developed RIBA stage 4 design.

A1-A3 Building materials included in this assessment.
SCF minimum materials to be included in this assessment:

- Substructure; GL slab, concrete, rebar and insulation encasing materials
- Superstructure: timber frame includes insulation, walls, floor, roof and Internal timber stairs. External walls blockwork, timber cladding, render. External doors and windows.

BAM has included additional materials:

- Roof covering, internal timber partitions with insulation and plasterboard, ceiling finishes, internal doors and external canopy.

Assessing Embodied Carbon
BAM has chosen this project to trial the new SCF Materials Baseline Carbon Assessment for products/materials (A1-A3), with the aim to measure and minimise impacts.

Assessment tool
This assessment was completed by BAM carried out to EN 15978 and RICS professional statement, using OneClick LCA software.

The assessment includes materials that have Environmental Production Declarations (EPD) and where none exists, the closest match LCA data points have been used.

The Building Design
New Frenchay primary school is designed with a ground floor raft slab (forming the foundations) wrapped in insulation. Larsen truss **timber frame:** mix of timber cassettes with blown insulation and timber panels. Internal timber stud partitions with insulation, lined with plasterboard, with a mix of plasterboard and suspended ceilings.

External façade: rendered blockwork ground to first floor, timber cladding to first floor with composite triple glazed windows. Roofing is an integrated bituminous roof system incorporating membrane and insulation.

Gateway 2 Stage 3 Design Assessment
BAM completed an embodied carbon assessment on the materials (A1-A3) on the awarded design stage 3 scheme in May 2021.

We evaluated the base design and identified the top five material opportunities to be reviewed with design development to reduce the carbon impact. Specific design requirements for Passivhaus e.g. triple glazed windows, were not considered materials to change as part of this assessment given their critical role in achieving energy efficiency standards. Key considerations include:

- **Ground floor concrete slab and rebar -** Concrete equated to 122 tCO_2e and rebar to 87 tCO_2e. Review specification to increase cement replacement (e.g. 60% GGBS) for concrete and increased recycled content for rebar (e.g. 98% recycled content UK made).
- **Structural Steel -** Equated to 64 tCO_2e. Review any replacement with timber, or review specification for a low carbon steel with an Environmental Product Declaration (EPD) with higher recycled content.
- **Roof bitumen material -** Equated 34.2 tCO_2e of the assessment, review specification and design.
- **Concrete Blocks -** Equated to 6.4 tCO_2e. Review specification e.g. Aggregate Industries Enviroblock Dense which has an EPD.
- **Plasterboard -** British Gypsum 15mm Gyproc Duraline specified for internal partitions and 972m^2 of ceilings, equated to 29.8 tCO_2e carbon of the assessment. It has an EPD. Review if lower carbon material can be sourced, or quantity reduced?

Stage 4 Design
BAM engaged our supplychain, working with the design team and SGC developing the detailed design. We reviewed materials with lower carbon impact while taking into account the project budget and the current pressures faced in 2021 for material product availability. For example, Enviroblocks were considered, but suppliers advised there are issues with limited stock. To mitigate this, standard medium density blockwork was specified.

Gateway 3 Stage 4 Design Assessment
Completed in November 2021 using the same scope of materials updated with stage 4 changes and quantities. Page 2 of this report details results of both assessments.

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Gateway 2 and 3 results

Summary of the BAM led stage 4 design changes from the gateway 2 design stage 3

Substructure (lowest ground floor construction)

- Ground floor concrete raft slab encased with Insulation for Passivhaus. Insulation material changed to Kingspan Greenguard and detailed design rebar quantities reduced by 8%, using both loose and mesh reinforcements.
- **Overall, the ground floor slab/lowest floor construction materials carbon impact has reduced by 23%, removing 63 tCO_2e**
- Concrete specified had no specific percentage of cement replacement for risk of material availability and cost. Specification for rebar with 98% recycled content (UK made) would incur 30% cost uplift, advised by our supplychain so was not specified. During stage 5 we will work with supplychain for material availability with increased recycled content that is cost neutral, these will be included in stage 5 assessment

Structural Steel

- Maximised the timber structural elements that **reduced steel tonnage, removing 6 tCO_2e**
- During stage 5 we will work with the supplychain to confirm the steel material and its recycled content, to be include in stage 5 assessment

Plasterboard

- Material changed to Siniat GTEC, a lower carbon plasterboard with an EPD. Detailed design identified the requirement for specific internal partitions to be double boarded for fire protection, that increased the overall material quantity, but **changing the material has reduced the overall carbon impact, removing 10.7 tCO_2e**

Superstructure

- **Timber Frame** design efficiency, refining materials and quantities through detailed design. Changes included the external sheathing board upgraded for fire protection, amended insulation strategy to the roof and the insulation type changed in the external wall cassettes to achieve a higher fire rating and better moisture control, required for Passivhaus.
- **Bitumen roof** client SGC chose to retain existing bitumen design, detailed design material specified Bauder total roof system
- **Overall, the superstructure materials including timber frame, steel and roof has reduced the carbon impact by 14%**

BAM has reduced the carbon impact of the materials at design stage 4 by 17% by removing 102 tCO_2e

Gross Internal Floor Areas

- Gateway 2 design stage 3 GIFA 2,438m^2
- Gateway 3 design stage 4 GIFA 2,383m^2. Reduction is the result of the increased thickness of the timber frame.