BREEAM Mat01
Life Cycle Assessment
RIBA Stage 2

Paragon Asra (PA) Housing

Strathmore Centre Nursery
Strathmore Road
Teddington
TW11 8UH

Version	Revision	Date	Author	Reviewer	Project Manager
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1.0 Assessment Overview

1.1 Introduction

SRE exists to ensure that the built environment enhances life without costing the earth. This BREEAM Mat01 – Life Cycle Assessment Report has been written by SRE on behalf of Paragon Asra (PA) Housing (the Client) to assess the environmental impacts from construction products through a building lifecycle assessment (building LCA) of the new Strathmore Centre Nursery, Teddington (the Proposed Development).

The Proposed Development consists of a single storey building with nursery space and associated facilities, including external soft and hard landscaping, car parking, cycle and waste storage.

To address the Planning Policy of London Borough of Richmond Upon Thames' Council, the Proposed Development is undertaking the BREEAM assessments for the site: *Education – Fully fitted,* using the BREEAM NC 2018 methodology.

1.2 Assessment software

The building LCA software used is OneClick LCA which is a compliant LCA tool for BREEAM UK, RICS and, LCA for BREEAM UK IMPACT. These allow all the building LCA assessments to be undertaken and comply with the requirements of BREEAM NC 2018, Materials 01 criteria.

1.3 Assessment Criteria

The results of the building LCA are input into the BREEAM 2018 Mat01/02 submission tool to confirm the credits achieved at each stage.

The Options Appraisal and chosen options have been based on assumptions, since there is no structural engineer involved in the scheme at this stage.

	Assessment Procedure	Available Credits	Applicability
RIBA Stage 2	Comparison with the BREEAM LCA Benchmark AND Option appraisal	Up to 6	Benchmark comparison not required due to building type.
	Substructure and hard landscaping options appraisal	1	Targeted
	Core building services options appraisal	1	Targeted
	LCA and LCC alignment	1	Not targeted
	Third party verification	1	Not targeted
RIBA Stage 4	Comparison with the BREEAM LCA Benchmark AND Option appraisal	Up to 2	Benchmark comparison not required due to building type.

Table 1 - Summary of the assessment procedure at RIBA Stages 2 and 4

2.0 Results

2.1 Superstructure – Benchmarking (RIBA Stage 2)

The comparison with the BREEAM LCA benchmark is not applicable to this type of scheme.

2.2 Superstructure – Option appraisal (RIBA Stage 2)

2.2.1 Overview of Options

4 credits have been awarded based on the building LCA appraisal of 4 no. significantly different superstructure design options. These have been undertaken during RIBA Stage 2 and prior to the submission of the planning application. This section provides the details of the options appraised and scheme recommendations.

Design option		Option data file link	Number of children/students	Kg CO2e/Number of children/students (60 year study period)								Description of changes sheet link	Option chosen, and summary reasons for not choosing the other options (Further details provided in description of change sheets)	The following is completed for this option:- - The option data file - The Description of changes sheet
ID	Name			2.1 Frame	2.2 Upper floors	2.3 Roof	2.4 Stairs and ramps	2.5 External walls	2.6 Windows and external	2.7 Internal walls and	Total			
1	Mat01_CD_SuperS_Opt1	Link	30	468.05	1536.63	545.47	0.00	889.39	168.33	58.73	3666.61	N/A - 1st option	CHOSEN OPTION	Yes
2	Mat01_CD_SuperS_Opt2	Link	30	3097.28	1536.63	545.47	0.00	5867.57	168.33	58.73	11274.01	Link	Life cycle costs too high	Yes
3	Mat01_CD_SuperS_Opt3	Link	30	1929.19	1536.63	545.47	0.00	551.82	168.33	58.73	4790.17	Link	Aesthetic preference for other option	Yes
4	Mat01_CD_SuperS_Opt4	Link	30	1614.96	1536.63	545.47	0.00	1405.91	168.33	58.73	5330.03	Link	Other	Yes

Table 2 - Superstructure appraisal summary table (BREEAM Mat01/02 Submission tool)

Option	ID	Option type (Main difference)	Additional Details/Changes
Option 1	1	Brick and Block (masonry) construction	Brick outer leaf, insulation, block inner leaf with plasterboard. Block is precast concrete.
Option 2	2	Brick and block (masonry) construction - block is aerated concrete blocks instead of precast	Brick outer leaf, insulation, block inner leaf with plasterboard. Block is aerated concrete.
Option 3	3	Concrete frame with steel reinforcement	Kept brick outer leaf, insulation and plasterboard. Concrete frame replacing block work.

Option 4	4	Steel frame with brick outer leaf	Kept brick outer leaf, insulation and plasterboard. Replaced blockwork with steel frame. Included Metsec (metal framing components) and fibre cement boards.

Table 3 - Superstructure appraisal options summary

2.2.2 The Chosen Option

	Option 1
Mat01 design option	Mat01_CD_SuperS_Opt1
Construction type	Masonry Construction (Brick and Block)
BRE EN 15804 ecopoints (60-year study period)	N/A
Embodied Carbon ($kgCO_2eq$/bedroom)	3666.61

Option 1, the chosen option, had the lowest life cycle carbon emissions out of the 4 options appraised, and it is thought to be the most likely and applicable build-up for the type of scheme. As a result, the following specification is recommended to be incorporated into the design of the building:

- Brick and Block (precast concrete) for load-bearing structure
- External wall masonry construction, using brick and blockwork, insulation, plasterboard
- Internal partitions to be timber studs with plasterboard either side
- Ready mix concrete floor slab for ground floor
- Hollow core concrete flat roof construction
- Double glazed windows

2.3 Substructure and hard landscaping options appraisal (RIBA Stage 2)

2.3.1 Summary

1 credit has been awarded based on the building LCA appraisal of 3 different substructure and 3 different hard landscaping options. These have been undertaken during RIBA Stage 2 and prior to the submission of the planning application. This section provides the details of the options appraised and scheme recommendations.

Design option		Option data file link	Number of children/students	Kg CO2e/Number of children/students (60 year study period)								Description of changes sheet link	Option chosen, and summary reasons for not choosing the other options (Further details provided in description of change sheets)	The following is completed for this option:- - The option data file - The Description of changes sheet
ID	Name			1.0 Substructure	8.2 Roads, paths and pavings	n/a	n/a	n/a	n/a	n/a	Total			
5	Mat01_CD_SubS_HL_Opt1	Link	30	17.41	167.87						185.28	N/A - Substructure 1st option	CHOSEN OPTION	Yes - Substructure
6	Mat01_CD_SubS_HL_Opt2	Link	30	17.41	152.09						169.50	N/A - Hard landscaping 1st option	CHOSEN OPTION	Yes - Hard landscaping
7	Mat01_CD_SubS_HL_Opt3	Link	30	17.41	243258.13						243275.54	Link	Life cycle costs too high	Yes - Hard landscaping
8	Mat01_CD_SubS_HL_Opt4	Link	30	17.41	5675.07						5692.49	Link	Aesthetic preference for other option	Yes - Hard landscaping
9	Mat01_CD_SubS_HL_Opt5	Link	30	140.35	152.09						292.44	Link	Capital cost >10% and =<25% more than more than lowest option	Yes - Substructure
10	Mat01_CD_SubS_HL_Opt6	Link	30	1025.29	152.09						1177.38	Link	Life cycle costs too high	Yes - Substructure

Table 4 – Substructure and hard landscaping appraisal summary table (BREEAM Mat01/02 Submission tool)

Option	ID	Option type	Main Difference
Option1	5	Chosen Substructure + Hard Landscaping	Rammed concrete piling foundations with asphalt for all hard landscaping areas.
Option 2	6	Chosen Hard Landscaping + Chosen Substructure	Asphalt for paving and carpark, decorative paving for cycle and back garden area. Rammed concrete piling foundations.
Option 3	7	Chosen Substructure + Hard Landscaping Option	Precast concrete paving products for all external areas. Rammed concrete piling foundations.
Option 4	8	Chosen Substructure + Hard Landscaping Option	Recycled stone aggregates for cycle storage and back garden, and recycled asphalt (RAP) for carparking and pavement. Rammed concrete piling foundations.

Option 5	9	Chosen Hard Landscaping + Substructure Option	Changed to ready mix concrete for foundations and asphalt for paving and carpark, decorative paving for cycle and back garden area.
Option 6	10	Chosen Hard Landscaping + Substructure Option	Concrete slab foundations and asphalt for paving and carpark, decorative paving for cycle and back garden area.

Table 5 - Substructure and hard landscaping appraisal options summary

2.3.2 The Chosen Option

Option 1 is the chosen substructure option, while Option 2 is the chosen hard landscaping option. The chosen option for substructure has the lowest life cycle carbon emissions of the options appraised. The chosen hard landscaping option also has the lowest life cycle carbon emissions of the options appraised and is thought to be the most realistic and economically viable option at this stage. As a result, the following specifications are recommended to be incorporated into the design of the building.

Substructure	Option 1
Mat01 design option	Mat01_CD_SubS_HL_Opt1
Construction type	Rammed concrete piling foundation
BRE EN 15804 ecopoints (60-year study period)	N/A
Embodied Carbon ($kgCO_2eq$/bedroom)	185.28

Hard Landscaping	Option 2
Mat01 design option	Mat01_CD_SubS_HL_Opt2
Construction type	Asphalt and decorative paving hard landscaping
BRE EN 15804 ecopoints (60-year study period)	N/A
Embodied Carbon ($kgCO_2eq$/bedroom)	169.50

- Asphalt for paving and carpark
- Decorative paving for cycle and back garden area

2.4 Core building services options appraisal (RIBA Stage 2)

2.4.1 Overview of Options

1 credit has been awarded based on the building LCA appraisal of 3 different core building services options. These have been undertaken during RIBA Stage 2 and prior to the submission of the planning application. This section provides the details of the options appraised and scheme recommendations.

Design option		Option data file link	Number of children/students	Kg CO2e/Number of children/students (60 year study period)								Description of changes sheet link	Option chosen, and summary reasons for not choosing the other options (Further details provided in description of change sheets)	The following is completed for this option:- - The option data file - The Description of changes sheet
ID	Name			5.5.1 Heat source	5.6 Space Heating and Air Conditioning	5.7 Ventilation	5.9 Fuel Installations / Systems	n/a	n/a	n/a	Total			
11	Mat01_CD_BdServ_Opt1	Link	30	45.15	207.68	326.65	7.80				587.27	N/A - 1st option	CHOSEN OPTION	Yes
12	Mat01_CD_BdServ_Opt2	Link	30	95.69	0.00	326.65	676.27				1098.61	Link	Aesthetic preference for other option	Yes
13	Mat01_CD_BdServ_Opt3	Link	30	0.00	0.00	326.65	806.91				1133.55	Link	Prevented another sustainability factor being achieved	Yes

Table 6 – Core building services appraisal summary table (BREEAM Mat01/02 Submission tool)

Option	ID	Option type (Main difference)	Additional Details/Changes
Option1	11	ASHP	ASHP (1 no. 10 kW) for heating and hot water, underfloor heating, standard extract ventilation in wet rooms, 300L hot water cylinder.
Option 2	12	Electric Boiler	Electric boiler (1 no. 35kW) and radiators (10kW), heat distribution system for floor area, standard extract ventilation in wet rooms, 300L hot water cylinder.
Option 3	13	Gas Boiler	Gas boiler (1 no. condensing, 20-120kW) and radiators (10kW), heat distribution system for floor area, standard extract ventilation in wet rooms, 300L hot water cylinder.

Table 7 – Core building services appraisal options summary

2.4.2 The chosen option

Option 1, the chosen option, has the lowest life cycle carbon emissions out of the options appraised. Furthermore, it has been chosen over the gas/electric boiler options, as it is most suitable to allow the Proposed Development to meet the planning conditions of London Borough of Richmond Upon Thames and the London Plan. As a result, the following specifications are recommended to be incorporated into the design of the building.

	Option 1
Mat01 design option	Mat01_CD_BdServ_Opt1
Services type	ASHP
BRE EN 15804 ecopoints (60-year study period)	N/A
Embodied Carbon ($kgCO_2eq$/bedroom)	587.27

- ASHP for heating and hot water
- Wet distribution system
- Underfloor Heating
- Mechanical extracts from wet rooms

2.5 Superstructure – Benchmarking (RIBA Stage 4)

The comparison with the BREEAM LCA benchmark is not applicable to this type of scheme.

2.6 Superstructure – Option appraisal (RIBA Stage 4)

The superstructure option appraisal will be undertaken again at RIBA Stage 4, as the detailed design of the Proposed Development progresses.

The design team has committed to undertaking this, therefore the 2 credits applicable to this are likely to be awarded at the BREEAM design stage.

3.0 Conclusions

A Building LCA has been undertaken in-line with the requirements of BREEAM NC 2018, Materials 01 criteria. To-date, the assessments have been undertaken during RIBA Stage 2 and prior to the submission of the planning application for the Proposed Development.

The BREEAM Mat01/02 Results Submission Tool has confirmed that 5 credits + 1 exemplary can be awarded at this stage.

A commitment from the design team to undertake the Building LCA again during RIBA Stage 4 will likely allow 2 further credits to be awarded during the design stage.

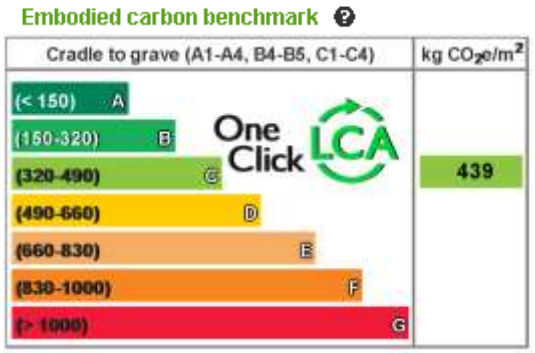
The credits awarded are summarised within Table 8.

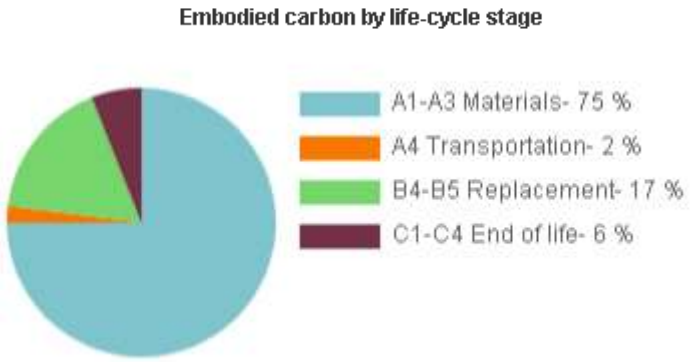
	Assessment Procedure	Available Credits	Applicability	Credits Awarded
RIBA Stage 2	Comparison with the BREEAM LCA Benchmark AND Option appraisal	Up to 6	Benchmark comparison not required due to building type.	4
	Substructure and hard landscaping options appraisal	1	Targeted	1
	Core building services options appraisal	1	Targeted	1 Exemplary
	LCA and LCC alignment	1	Not targeted	-
	Third party verification	1	Not targeted	-
RIBA Stage 4	Comparison with the BREEAM LCA Benchmark AND Option appraisal	Up to 2	Benchmark comparison not required due to building type.	TBC at RIBA Stage 4

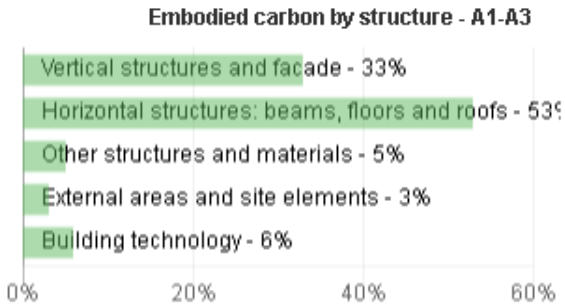
Table 8 - Summary of the credits awarded within the Materials 01 issue

Appendices

Appendix A – One Click LCA Outputs SuperS_Opt1, SubS_HL_Opt1, BdServ_Opt1



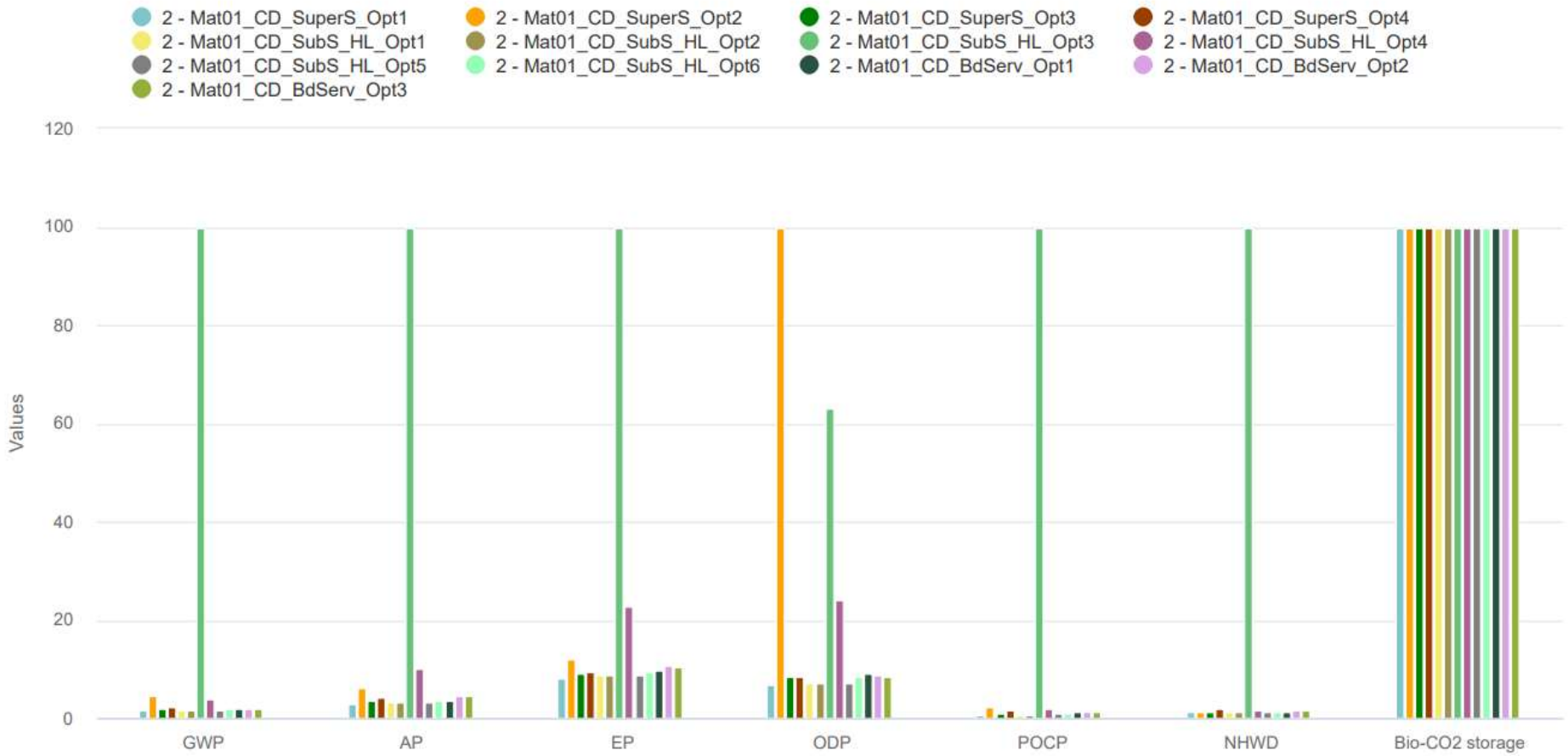




Life-cycle assessment results for BREEAM UK according to EN 15978

	Result category	Global warming kg CO2e	Acidification kg SO2e	Eutrophication kg PO4e	Ozone depletion potential kg CFC11e	Formation of ozone of lower atmosphere kg Ethenee	Non hazardous waste disposed kg	Biogenic carbon storage kg CO2e bio
A1-A3	Construction Materials	1E5	4,11E2	8,66E1	9,4E−3	3,27E1	3,04E3	1,32E4
A4	Transportation to site	2,17E3	7,22E0	1,55E0	4,03E−4	2,07E−1	8,83E0	
A5	Construction/installation process							
B1	Use Phase							
B4-B5	Material replacement and refurbishment	2,24E4	1,15E2	7,2E1	1,86E−3	1,77E1	7,45E2	
B6	Energy use							
B7	Water use							
C1-C4	Deconstruction	7,83E3	1,8E1	4,92E0	3,42E−4	1,31E0	2,53E4	
D	External impacts (not included in totals)	−1,82E4	−3,26E1	−9,8E0	−2,93E−4	−2,31E0	−8,2E2	
	Total	**1,33E5**	**5,51E2**	**1,65E2**	**1,2E−2**	**5,19E1**	**2,9E4**	**1,32E4**
	Results per denominator							
	Gross Internal Floor Area (IPMS/RICS) 293.7 m2	4,52E2	1,88E0	5,62E−1	4,09E−5	1,77E−1	9,89E1	4,49E1

Appendix B – Overview of all One Click CLA Options



Global warming

Acidification

Eutrophication

Ozone depletion potential

Formation of ozone of lower atmosphere

Non hazardous waste disposed

Biogenic carbon storage

Appendix C – One Click CLA Chosen Option Input data

1. Foundations and substructure 1 Tons CO_2e

Materials in the foundations will never be replaced, no matter assessment period length. For BREEAM UK Mat 1 IMPACT equivalent provide the data for site excavation fuel use here, c

Foundation, sub-surface, basement and retaining walls Compare answers

Search by name, manufacturer, EPD n

Resource	Quantity	CO_2e	Comment	RICS category
Basic foundation up to 5m of sand/ silt/	0 m2		quantity zero.	1.1.1.Standard
Basic foundation up to 5m of sand/ silt/	0 m2		quantity zero	1.1.2.Specialist
Basic foundation up to 5m of sand/ silt/	0 m2		quantity zero	1.1.3.Lowest floor
Basic foundation up to 5m of sand/ silt/	0 m2		quantity zero	1.1.4.Basement
Basic foundation up to 5m of sand/ silt/	0 m2		quantity zero	1.1.5.Basement retaining
Rammed concrete piling foundation for ha	73.8 m2	0,52t - 0,5%	conc foundation	1.1.1.Standard

Columns and load-bearing vertical structures Compare answers

Search by name, manufacturer, EPD ni

Resource	Quantity				CO_2e	Comment	RICS category	Tr
Ready-mix concrete, normal-strength, gen	0	m3				conc frame - zero quantity	2.1.4.Concrete frames	6(
Structural steel profiles, generic, 0% r	0	kg				steel frame - zero quantity	2.1.1.Steel frames	11
Structural steel profiles, generic, 0% r	0	kg				steel frame, conc castings -	2.1.3.Concrete casings	11
Structural steel profiles, generic, 0% r	0	kg				space decks - zero quantity	2.1.2.Space decks	11
Structural sawn timber, kiln dried, plan	0	m2	x	20	mm	timber frame - zero quantity	2.1.5.Timber frames	1:
Precast concrete blocks (CMU), 105.7 uni	197	m2	x	250	mm	5,3t - 5% block supporting wall	2.1.6.Other frame systems	6(

Internal walls and non-bearing structures Compare answers

Search by name, manufacturer, EPD ni

Resource	Quantity				CO_2e	Comment	RICS category
Gypsum plasterboard, standard, 12.5 mm,	197	m2	x	12,5 mm	0,47t - 0,4%	2013 Internal Partition	2.7.1.Internal Walls and
Gypsum plaster board, regular, generic,	197	m2	x	12,5 mm	0,72t - 0,6%	2013 Internal Partition	2.7.1.Internal Walls and
Wooden stud framing system, 145 mm, 12.7	99	m2			0,57t - 0,5%	studded wall (wooden) as p	2.7.1.Internal Walls and

2. Vertical structures and facade ⓘ 34 Tons CO_2e - 29 %

External walls and facade Compare answers

Search by name, manufacturer, EPD ni

Resource	Quantity				CO_2e	Comment	RICS category ⓘ
Gypsum plasterboard, 12.5 mm, 8.985 kg/m	373	m2	x 12,5	mm	0,59t - 0,5%	2013 External Wall	2.5.1.External enclosing
Red brick, average production, UK (The B	373	m2	x 100	mm	9,4t - 8%	2013 External Wall	2.5.1.External enclosing
Red brick, average production, UK (The B	0	m2	x 100	mm		zero quantity	2.5.2.External enclosing
PIR insulation boards, aluminium foil fa	373	m2	x 103,	mm	6,5t - 6%	2013 External Wall	2.5.1.External enclosing
Aluminium linear profiles for ceiling de	0	kg				zero quantity.	2.5.3.Solar / Rain
Precast concrete blocks (CMU), 105.7 uni	373	m2	x 250	mm	10t - 9%	block work for walls	2.5.1.External enclosing

3. Horizontal structures: beams, floors and roofs ⓘ 71 Tons CO_2e - 62 %

Floor slabs, ceilings, roofing decks, beams and roof Compare answers

Search by name, manufacturer, EPD ni

Resource	Quantity				CO_2e	Comment	RICS category ⓘ
Plywood, generic, 4-50 mm (0.16-1.97 in)	293.67	m2	x 20	mm	2,3t - 2%	2013 Exposed Floor	2.2.1.Upper Floors -
Ready-mix concrete, high-strength, gener	293.67	m2	x 150	mm	21t - 19%	2013 Exposed Floor	2.2.1.Upper Floors -
Insulation panel, PUR, 103 mm, Thane ET	293.67	m2	x 120	mm	22t - 20%	2013 Exposed Floor	2.2.1.Upper Floors -
Leveling screed, cement mortar, 1500 kg/	293.67	m2	x 50	mm	3,3t - 3%	2013 Exposed Floor	3.Internal finishes
Moisture resistant particleboard, P5 / P	293.67	m2	x 20	mm	5,4t - 5%	2013 Exposed Floor	3.Internal finishes
Gypsum plasterboard, 12.5 mm, 8.985 kg/m	293.67	m2	x 12,5	mm	0,46t - 0,4%	2013 Roof	2.3.Roofs, coverings and
Hollow core concrete slabs, generic, C30	293.67	m2	x 100	mm	6t - 5%	2013 Roof	2.3.Roofs, coverings and
Waterproofing membrane, single component	293.67	m2	x 0.1	mm	0,62t - 0,5%	2013 Roof	2.3.Roofs, coverings and
Rock wool insulation panels, unfaced, ge	293.67	m2	x 154,	mm	9,3t - 8%	2013 Roof	2.3.Roofs, coverings and

4. Other structures and materials 5 Tons CO_2e - 4 %

Other structures and materials Compare answers

Search by name, manufacturer, EPD ni

Resource	Quantity		CO_2e	Comment	RICS category	Transpor
Concrete staircase, U-shaped, with no fl	0	m		zero quantity	2.4.1.Stairs and ramps	60

Windows and doors Compare answers

Search by name, manufacturer, EPD ni

Resource	Quantity				CO_2e	Comment	RICS category
Float glass, single pane, generic, 3-12	65.4	m2	x 6	mm	1,3t - 1%	External Window	2.6.1.External Windows
Float glass, single pane, generic, 3-12	65.4	m2	x 6	mm	1,3t - 1%	External Window	2.6.1.External Windows
Glass, body-tinted, green, 6 mm, LT 72.8	48.21	m2			1t - 0,9%	Glazed Door	2.6.1.External Windows
Glass, body-tinted, green, 6 mm, LT 72.8	48.21	m2			1t - 0,9%	Glazed Door	2.6.1.External Windows
Float glass, single pane, generic, 3-12	7.65	m2	x 6	mm	0,15t - 0,1%	Rooflight	2.6.1.External Windows
Float glass, single pane, generic, 3-12	7.65	m2	x 6	mm	0,15t - 0,1%	Rooflight	2.6.1.External Windows
Window, aluminium profile frame, 1.3 W/m	7.27	m2			0,03t - ~0%	External Window default frai	2.6.1.External Windows
Window, aluminium profile frame, 1.3 W/m	5.36	m2			0,02t - ~0%	Glazed Door default frame t	2.6.1.External Windows
Window, aluminium profile frame, 1.3 W/m	1.35	m2			~0t - ~0%	Rooflight default frame thick	2.3.5.Rooflights

5. External areas and site elements

5 Tons CO_2e - 4 %

Materials and constructions for external areas Compare answers

Search by name, manufacturer, EPD ni

Resource	Quantity				CO_2e	Comment	RICS category
Asphalt for paving roads, AG 16, ECO-Asf	254.42	m2	x 50	mm	2,8t - 2%	Car parking area, pavemen	8.2.2.Special surfacings
Resin bound aggregate decorative paving	202.17	m2	x 6	mm	1,8t - 2%	cycle storage + back garder	8.2.1.Roads, paths and

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