WHOLE LIFE CARBON SUMMARY REPORT

Cividate al Piano, Fulfillment Centre

Net Zero Assessment and certification

LCD Consulting

Net Zero | LCA | LCC
Embodied Carbon
Circular Economy

Consultants in life cycle design of the built environment

DEVELOPER:	Logistics Capital Partners
PROJECT:	Cividate al Piano, Fulfillment Centre
PROJECT DESCRIPTION:	The construction of a new build,industrial warehouse. Construction Carbon has undertaken an 'as designed' Life Cycle Assessment based on information provided by Gianluca Fantoni, Logistics Capital Partners SRL, Milan. This Life Cycle Assessment for the project has been undertaken in accordance with the RICS Professional Statement Whole Life Carbon Assessment for the Built Environment (1st edition, November 2017).
DATE OF ASSESSMENT:	01/11/2021
VERIFIED BY:	Construction Carbon and LCD Consulting
PROJECT TYPE:	New build
ASSESSMENT OBJECTIVE:	To assess the whole life carbon performance of the proposed works from cradle to grave, understand hotspots and consider how the performance may be improved for future similar developments.
PROPERTY TYPE:	Industrial Warehouse
BUILDING DESCRIPTION:	Concrete and steel frame building with metal cladding and sandwhich panel facade. External works includes roads, pavements, soft landscaping and some small ancilliary buildings.
SIZE:	59,450 m2
PROJECT DESIGN LIFE:	60 Years
ASSESSMENT SCOPE:	Building parts and life stages/modules included
ASSESSMENT STAGE:	RIBA Stage 5+
DATA SOURCES:	A range of data sources for generic data such as ICE and One Click datasets as well as product specific EPDs where they were most representative.

BUILDING COVERAGE ELEMENTS

#	BUILDING PARTS/ELEMENT GROUPS	BUILDING ELEMENTS
0	FACILITATING WORKS	0.1 Temporary/Enabling works/Preliminaries
		0.2 Specialist groundworks
1	SUBSTRUCTURE	1.1 Substructure
2	SUBSTRUCTURE	2.1 Frame
		2.2 Upper floors inc. balconies
		2.3 Roof
		2.4 Stairs and ramps
	SUPERSTRUCTURE	2.5 External walls
		2.6 Windows and external doors
	SUPERSTRUCTURE	2.7 Internal walls and partitions
		2.8 Internal doors
3	FINISHES	3.1 Wall finishes
		3.2 Floor finishes
		3.3 Ceiling finishes
4	FITTINGS, FURNISHNIGS AND EQUIPMENT (FF&E)	Building related Non-building related
5	BUILDING SERVICES / MEP	5.1-5.14 Building-related services
		Non-building related
6	PREFABRICATED BUILDINGS AND BUILDING UNITS	6.1 Prefabricated Buildings and Building Units
7	WORK TO EXISTING BUILDING	7.1 Minor Demolition and Alteration Works
8	EXTERNAL WORKS	8.1 Site preparation works
		8.2 Roads, Paths, Pavings and Surfacings
		8.3 Soft landscaping, Planting and Irrigation Systen
		8.4 Fencing, Railings and Walls
		8.5 External fixtures
		8.6 External drainage
		8.7 External surfaces
		8.8 Minor Building Works and Ancillary Buildings

BACKGROUND

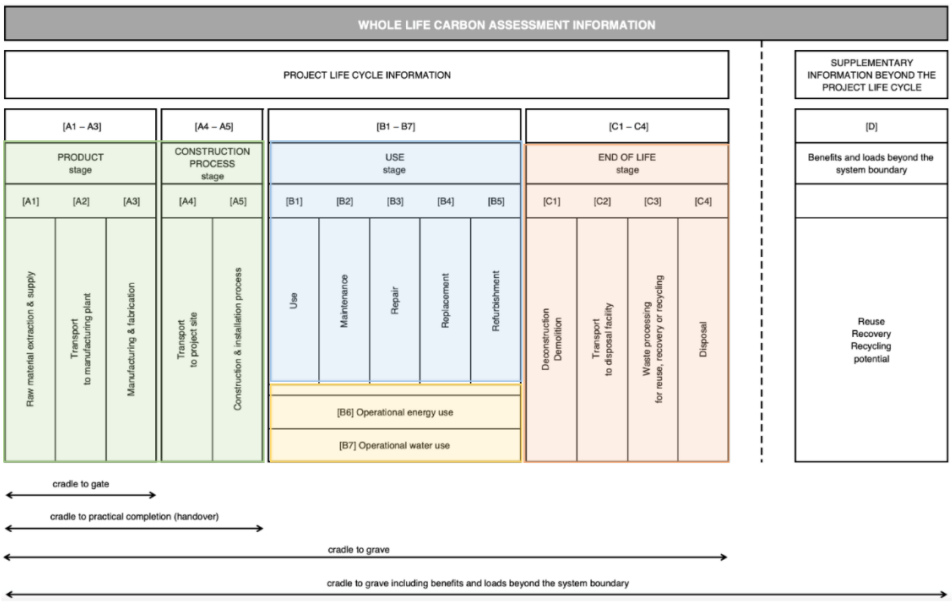
Globally, the built environment accounts for 39% of total carbon emissions. This figure includes 'embodied carbon' and 'operational carbon' emissions.

Embodied Carbon (approximately 11% of global emissions) includes:

the 'upfront' carbon emissions from the construction process (A1 - A5),
as well as maintenance and repair throughout the life cycle of the building (B1 - B5) .
and demolition at end of life (C1 - C4)

Operational emissions:

(approximately 28% of global emissions) are those associated with the energy and water used through the use of a building.



SUMMARY

EMBODIED CARBON:

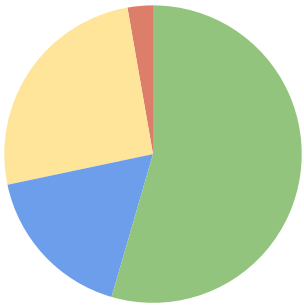
'Upfront' / 'Cradle to Practical Completion' Emissions (A1 – A5): **41,600 tonnes CO2e**

Anticipated Life Cycle 'in use' Embodied Carbon Emissions (B1 – B5): **13,128 tonnes CO2e**

Anticipated 'End of Life' Emissions (C1-C4): **2,098 tonnes CO2e**

OPERATIONAL CARBON:

Anticipated Life Cycle Operational Energy and Water Emissions (B6-B7): **19,511 tonnes CO2e**



CARBON NEUTRAL UPFRONT CARBON*

In order to achieve this the following needs to be offset: **41,600 tonnes CO2e**

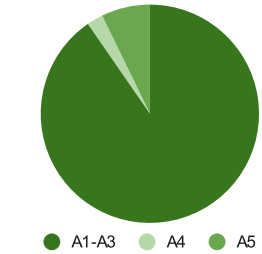
** as defined by Whole Life Carbon Network, LETI and RIBA in "Carbon Definitions for the Built Environment, Buildings and Infrastructure" (May 2021)*

Construction Carbon Ltd, Registered in England and Wales: 12688567
Registered Office: 228 Acre Road, Kingston Upon Thames, London, England KT2 6EY
VAT Registration Number: 381 4665 78

RESULTS

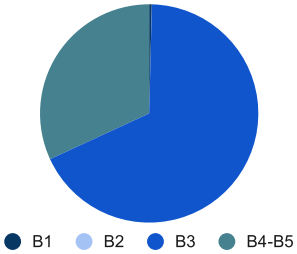
'Upfront' Embodied Carbon Emissions

A1-A3	Construction Materials	37,597	tCO2e
A4	Transportation to Site	999	tCO2e
A5	Construction and Installation	3,004	tCO2e
	Total A1-A5	**41,600**	**tCO2e**
	Total A1-A5	**0.700**	**tCO2e/m2 GFA**



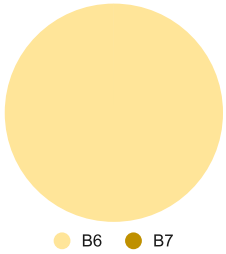
'In Use' Embodied Carbon Emissions

B1	Use emissions from materials	50.7	tCO2e
B2	Maintenance	2.28	tCO2e
B3	Repair	8890	tCO2e
B4-B5	Replacement & Refurbishment	4185	tCO2e
	Total B1-B5	**13,128**	**tCO2e**
	Total B1-B5	**0.221**	**tCO2e/m2 GFA**



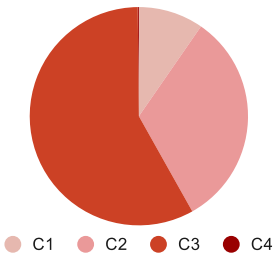
Operational Emissions

B6	Energy Usage	19,510	tCO2e
B7	Water Usage	1.71	tCO2e
	Total B1-B7	**19,511**	**tCO2e**
	Total B1-B8	**0.328**	**tCO2e/m2 GFA**



'End of Life' Embodied Carbon Emissions

C1	Demolition	202	tCO2e
C2	Waste Transport	676	tCO2e
C3	Waste Processing	1,216	tCO2e
C4	Disposal	3.6	tCO2e
	Total C1-C4	**2,098**	**tCO2e**
	Total C1-C4	**0.04**	**tCO2e/m2 GFA**



Life Cycle Total	76,338	tCO2e
	1.284	tCO2e/m2 GFA
Embodied Total	54,930	tCO2e
	0.956	tCO2e/m2 GFA
Operational Total	19,511	tCO2e
	0.328	tCO2e/m2 GFA
Biogenic Carbon	-79	tCO2e

Whole life carbon assessment, RICS - TOTAL kg CO2e - Per Element

RESULTS

	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B6+	B7	C1	C2	C3	C4	TOTAL
1 Substructure	8,265,560	437,063	380,440			0							270,449	73,888		**9,409,340**
2.1 Frame	2,987,245	21,257	204			0							26,950	3,159	155	**3,038,971**
2.2 Upper Floors	21,835,020	513,770	528,077			0	299,108	0					336,197	591,347	48	**24,080,671**
2.3 Roof	306,894	2,348	49,401			0	291,000	0					2,530	210,990	859	**864,022**
2.4 Stairs & Ramps	549,288	608	34,103			0							6,099	394		**590,493**
2.5 Ext. Walls	0	0	0			0							0	0	0	**0**
2.6 Windows & Ext. Doors	454,998	912	224			0	175,773	0					6,642	31,956	83	**638,972**
2.7. Int. Walls & Partitions	1,012,201	4,240	98,832			8,890,117	780,052	0					11,317	22,751	2,260	**10,816,505**
2.8 Int. Doors																
3 Finishes	494	1	83			0	1,481	0					1	332		**2,391**
4 Fittings, furnishings & equip																
5 Services (MEP)	1,237,219	4,463	4,456			0	2,304,459	0					7,042	611	211	**3,558,460**
6 Prefabricated																
7 Existing bldg																
8 Ext. works	947,751	13,879	54,856			0	333,453	0					8,890	281,007	0	**1,638,291**
Unclassified / Other			1,853,699	50,743	2,281				19,509,683		1,710	202,130				**21,620,246**
TOTAL kg CO2e	**37,596,668**	**998,540**	**3,004,375**	**50,743**	**2,281**	**8,890,117**	**4,185,325**	**0**	**19,509,683**		**1,710**	**202,130**	**676,117**	**1,216,436**	**3,615**	**76,258,362**

Top Material Impacts

Precast concrete ground beam, 2400 kg/m3 (British Precast)	14.45%
Precast concrete prefabricated slabs, for balcony, 200 mm, 505 kg/m2, DONNEE PAR DEFAUT (DED)	8.93%
Ready-mix concrete, normal-strength, generic, C30/37 (4400/5400 PSI), 0% recycled binders in cement (300 kg/m3 / 18.72 lbs/ft3)	8.16%
Ready-mix concrete, C30/37, 2360.0 kg/m3	7.12%
Ready-mix concrete, normal strength, generic, C25/30 (3600/4400 PSI) with CEM II/A-S, 10% GGBS content (280 kg/m3; 17.5 lbs/ft3 total cement)	4.61%
Ready-mix concrete, normal strength, generic, C32/40 (4600/5800 PSI) with CEM II/B-V, 30% fly ash content (320 kg/m3; 20 lbs/ft3 total cement)	4.17%
Precast column, C35/45 (B35 M45) (Egersund Betongteknikk)	4.07%
PIR rigid insulation boards, for exterior and facade applications, L= 0.022 W/mK, R= 3.85 m2k/W, 82 mm, 2.79 kg/m2, 34.02 kg/m3, Lambda=0.022 W/(m.K), Th	3.79%
Average site impacts based on project value per £1 million (RICS 2020)	3.63%
Reinforcement steel (rebar), generic, 80% recycled content, A615	3.42%
Pre-finished steel coils, hot and cold rolled, triple-layered, with UV protection, Colorcoat Prisma (Tata Steel)	3.13%

Top 10 Materials make up **65.49%** **of total material Impacts**

DISCLAIMER

The assessment was undertaken using One Click LCA by LCD Consulting.

The LCA predictions of embodied and operational impacts conducted in One Click LCA software, by their very nature, cannot be exact. It is not feasible to track all the impacts associated with a product or service back through history to 100% accuracy. The software has been built and tested to enable informed decisions when comparing design options. Generic and product specific environmental impact coefficients and EPDs do not necessarily correspond to those of final individual brands due to differences within industries in the way these products and services are delivered.

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LOW CARBON DESIGN PRINCIPLES / CONSIDERATIONS FOR FUTURE DEVELOPMENTS

Reduce need for materials
- Thinner floor slab
- Reduce glazing area
- Open exposed ceilings (office)
- Polished concrete floor in place of carpets

Improve functionality fewer common areas/lobbys etc
- Re-use materials directly
- Onsite aggregates from demolition

Replace with low/zero carbon alternatives
- Timber alternatives - structure, roof, cladding, Timber frame plus brick slip?
- Plastic, fibre cement or GRP over metals
- Fly-ash or GGBS in cement mix

Look for materials with Environmental Product Declarations (EPDs).