

Statement of Verification

BREG EN EPD No.: 000398

Issue 01

This is to verify that the
Environmental Product Declaration
provided by:
DB Group (Holdings) Ltd



is in accordance with the requirements of:
EN 15804:2012+A1:2013
and
BRE Global Scheme Document SD207

This declaration is for:
Cemfree Binder

Company Address

DB Group
Wellington Way
Bourn
CB23 2TQ



Signed for BRE Global Ltd

Emma Baker
Operator

25 July 2022
Date of this Issue

25 July 2022
Date of First Issue

24 July 2027
Expiry Date



This Statement of Verification is issued subject to terms and conditions (for details visit www.greenbooklive.com/terms.
To check the validity of this statement of verification please, visit www.greenbooklive.com/check or contact us.
BRE Global Ltd., Garston, Watford WD25 9XX.
T: +44 (0)333 321 8811 F: +44 (0)1923 664603 E: Enquiries@breglobal.com





Environmental Product Declaration

EPD Number: 000398

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013
Commissioner of LCA study	LCA consultant/Tool
DB Group Wellington Way Bourn CB23 2TQ	Flavie Lowres BRE Bucknalls Lane Watford Via LINA
Declared/Functional Unit	Applicability/Coverage
1 tonne of CEMFREE	Product Average.
EPD Type	Background database
Cradle to Gate	Ecoinvent 3.2
Demonstration of Verification	
CEN standard EN 15804 serves as the core PCR ^a	
Independent verification of the declaration and data according to EN ISO 14025:2010 <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External	
(Where appropriate ^b) Third party verifier: Pat Hermon	
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)	
Comparability	
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A1:2013. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A1:2013 for further guidance	

Information modules covered

Product			Construction		Use stage							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	Related to the building fabric				Related to the building			C1	C2	C3	C4	D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, Recovery and/or Recycling potential
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: Ticks indicate the Information Modules declared.

Manufacturing site(s)

Pennine Aggregates
 Pennine Aggregates
 Waterswallows Ln
 Buxton
 SK17 7JD

Construction Product:

Product Description

Cemfree binder is a proprietary Alkali-Activated Cementitious Material (AACM) that uses a source of alkali to activate pozzolanic materials such as Ground Granulated Blast-furnace Slag (GGBS) which can replace a variety of cement types to create Cemfree Concrete. The reaction between the alkali and GGBS in Cemfree binder forms a solid material comparable to Portland Cement (PC) and can be used in conventional ready mix and pre-cast concrete in applications such as: retaining walls, capping beams, piling, strip foundations, reinforced foundations, piles, raft slabs, walls, mass concrete fill, over-site applications, floors, pre-cast elements.

Technical Information

Cemfree is a binder that is used predominantly as an PC replacement in concrete. The concretes produced with Cemfree have enhanced durability characteristics compared to PC concretes, as outlined below:

Property	Relevant Standard	Results/comment
Fire	BRE Test Methodology	The Cemfree and the control concretes exhibited broadly similar behaviour in a hydrocarbon fire test, both in terms of strength loss and mass loss.
Alkali Silica Reaction	RILEM test method AAR-3	The amount of expansion measured during the test was small and much less than the pass/fail criteria in RILEM AAR-3 (not exceeding 0.05% at 52 weeks). There were no visual features of note and the necessary criteria for weight changes during the test were met. There was no evidence of cracking and/or gel within thin cut sections.

Property	Relevant Standard	Results/comment
Chloride ingress	DD CEN/TS 12390-11:2010	Equivalent to or exceed the performance of PC control concretes.
Carbonation	DD CEN/TS 12390-10:2007	Cemfree has exhibited higher depths of carbonation, compared to control PC concretes. Further research is required but we have not witnessed corrosion in our field trial specimens. The initial results from the PAS 8820:2016 compliance testing are promising, however, and if concretes were to be compared on an equal strength basis it is likely that carbonation resistance could be similar to the control concretes.
Freeze – Thaw	DD CEN/TS 12390-9:2006	The accelerated frost scaling test indicate “good” performance.
Water penetration	BS EN 12390-8	All of the Cemfree mixes tested are deemed acceptable based on the PAS 8820:2016 criteria and exceeded the performance of PC control concretes.
Sulphate resistance	ASTM C1012, BS EN 12390-8	Cemfree mixes tested complied with the high resistance classification and exceeded the performance of the PC control concretes.

Carbonation

During and after the lifetime of concrete structures, hydrated binders like Cemfree, contained within the concrete reacts with CO₂ in the atmosphere, removing it. The quantity of CO₂ taken up will depend on the type of application and its treatment after its lifetime. This reaction takes place mainly on the surface of concrete. Structural concrete applications are designed according to strict codes which ensure that carbonation at the concrete surface does not lead to corrosion of reinforcement. Carbonation can nevertheless be particularly relevant after demolition when the surface in contact with air increases very significantly. Carbonation contributes to a reduced GWP impact of concrete products over their whole life.

Main Product Contents

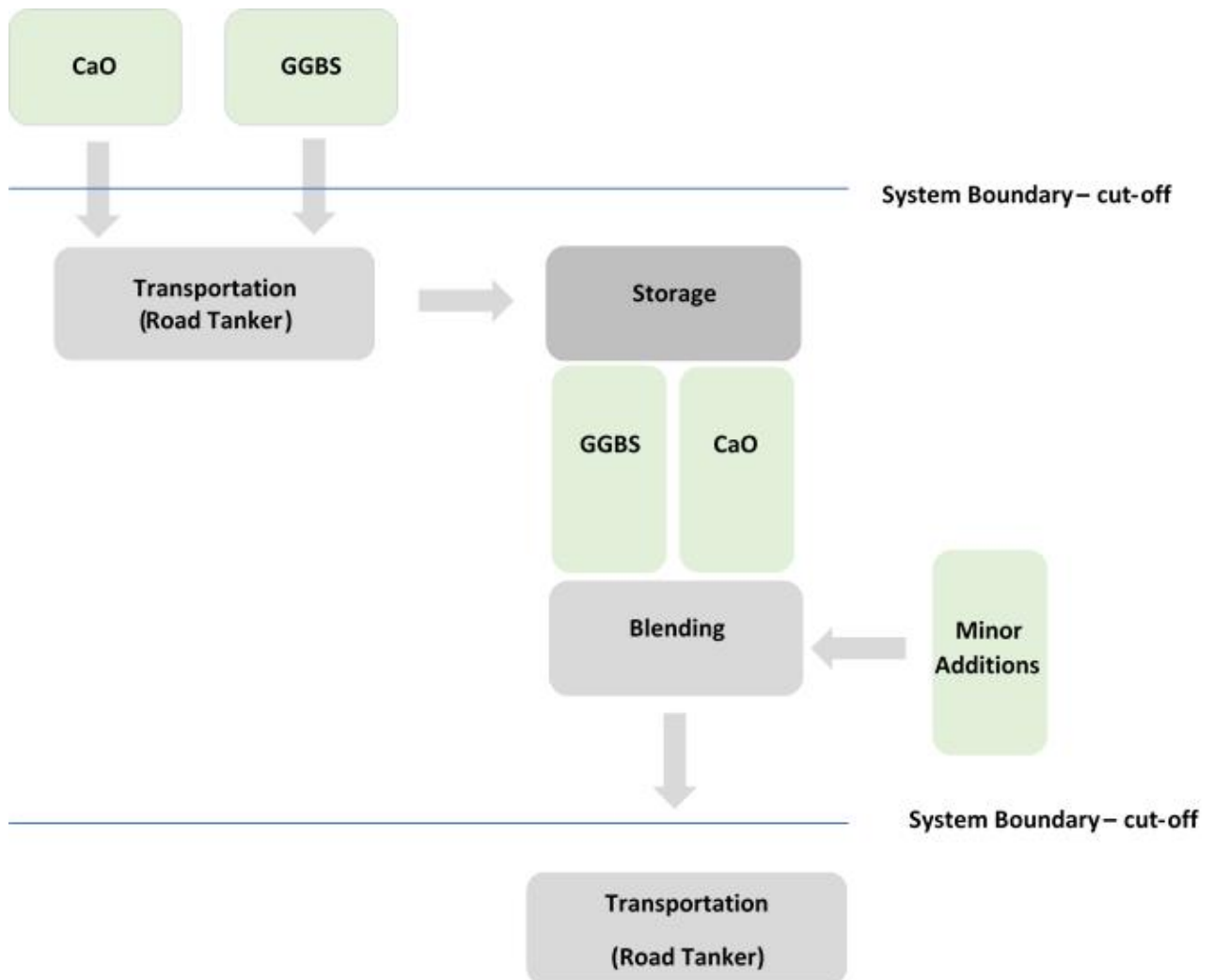
Composition of Cemfree can be seen in the table below.

Material/Chemical Input	%
GGBS	95
CaO	5

Manufacturing Process

Cemfree is a blend of GGBS and activator which are brought to site by tanker as dry powders. The powders are stored in silos, weighed to the required proportions, blended and delivered to the client on demand in tankers.

Process flow diagram



Life Cycle Assessment Calculation Rules

Declared / Functional unit description

The declared unit is 1 tonne of Cemfree

System boundary

This EPD is a cradle to gate assessment and will cover modules A1 to A3 in accordance with the modular approach of EN15804+A1.

Data sources, quality and allocation

This EPD is for the 1 tonne of Cemfree product at 2.85-3.02 g/cm³ manufactured at Pennine Aggregates site in Buxton. Pennine Aggregates also manufactures other products at the same facility. This EPD is not representative of those products. Manufacturer-specific data from Pennine Aggregates covering a production period from 1st June 2020 to 1st June 2021 from the Buxton site has been used for this EPD.

The Cemfree product output forms 1.1% of Pennine Aggregates' total production by mass. All inputs (energy, packaging, raw materials), energy, water, waste water have been allocated at this percentage. All raw

materials are delivered to site by tanker, little waste is therefore generated. The manufacturer has assumed that no material is wasted as the dust that is generated during blending is reintroduced into the feedstock.

The quantities of input materials were calculated based on a mix design. Each input is brought to site from a single supplier.

Secondary data have been drawn from the BRE LINA database v2.0.83 and the background LCI datasets are based on ecoinvent v3.2 (2015). The quality level of geographical and technical representativeness is Very Good. The quality level of time representativeness is Fair as the background LCI datasets are based on ecoinvent v3.2 which was compiled in 2015 and so there is less than 10 years between the reference year according to the documentation, and the time period for which data are representative

Two tables of results are presented in this EPD:

- “LCA results 1 – 2.3% economic allocation” which shows the results for Cemfree with a 2.3% economic allocation done to the GGBS – based on recommendations from “Embodied carbon of concrete in buildings, Part 1: analysis of published EPD” written by Jane Anderson and Alice Moncaster and following EN15804 recommendation.
- “LCA results 2 – no economic allocation” which shows the results with no economic allocation done to the GGBS – see Further information table.

Secondary data have been drawn from the BRE LINA database v2.0.83 and the background LCI datasets are based on ecoinvent v3.2 (2015). The quality level of geographical and technical representativeness is Very Good. The quality level of time representativeness is Fair as the background LCI datasets are based on ecoinvent v3.2 which was compiled in 2015 and so there is less than 10 years between the reference year according to the documentation, and the time period for which data are representative

Cut-off criteria

Data collected at the Pennine manufacturing site was used. The inventory process in this LCA includes all data related to raw material and their associated transport to the manufacturing site (there is one supplier for each raw material). There is no packaging included as none is used to package the finished product which is transported in tankers. Process energy, water for general consumption at the plant and wastes related to the manufacturing process of Cemfree are included.

LCA Results 1 – 2.3% economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

			Parameters describing environmental impacts						
			GWP-total	ODP	AP	EP-freshwater	POCP	ADPE	ADPF
			kg CO ₂ eq	kg CFC11 eq	mol H ⁺ eq	kg (PO ₄) ³⁻ eq	kg C ₂ H ₄ equiv.	kg Sb equiv.	MJ, net calorific value.
Product stage	Raw material supply	A1	2.67E+02	1.34E-05	1.11E+00	4.09E-01	3.14E-01	2.46E-02	2.88E+03
	Transport	A2	1.21E+01	2.23E-06	4.05E-02	1.07E-02	7.06E-03	3.19E-05	1.83E+02
	Manufacturing	A3	8.00E+00	5.16E-07	4.32E-02	9.98E-03	2.46E-03	9.64E-06	1.23E+02
	Total (of product stage)	A1-3	2.87E+02	1.61E-05	1.19E+00	4.29E-01	3.24E-01	2.47E-02	3.19E+03

GWP = Global Warming Potential;
 ODP = Ozone Depletion Potential;
 AP = Acidification Potential for Soil and Water;
 EP = Eutrophication Potential;

POCP = Formation potential of tropospheric Ozone;
 ADPE = Abiotic Depletion Potential – Elements;
 ADPF = Abiotic Depletion Potential – Fossil Fuels;

LCA Results 1 (continued) – 2.3% economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

			Parameters describing resource use, primary energy					
			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	1.64E+02	2.09E-03	1.64E+02	3.04E+03	0.00E+00	3.04E+03
	Transport	A2	2.43E+00	9.03E-06	2.43E+00	1.81E+02	0.00E+00	1.81E+02
	Manufacturing	A3	1.06E+01	1.92E-05	1.06E+01	1.63E+02	0.00E+00	1.63E+02
	Total (of product stage)	A1-3	1.76E+02	2.12E-03	1.76E+02	3.38E+03	0.00E+00	3.38E+03

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
 PERM = Use of renewable primary energy resources used as raw materials;
 PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
 PENRM = Use of non-renewable primary energy resources used as raw materials;
 PENRT = Total use of non-renewable primary energy resource

LCA Results 1 (continued) – 2.3% economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m ³
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	1.58E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	3.96E-02
	Manufacturing	A3	0.00E+00	0.00E+00	0.00E+00	3.32E-02
	Total (of product stage)	A1-3	0.00E+00	0.00E+00	0.00E+00	1.66E+00

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results 1 (continued) – 2.3% economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories						
			HWD	NHWD	RWD	
			kg	kg	kg	
Product stage	Raw material supply	A1	5.67E+00	7.64E+00	5.03E-03	
	Transport	A2	7.66E-02	8.52E+00	1.26E-03	
	Manufacturing	A3	2.02E-02	2.08E-01	9.00E-04	
	Total (of product stage)	A1-3	5.76E+00	1.64E+01	7.19E-03	

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results 1 (continued) – 2.3% economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

			CRU	MFR	MER	EE
			kg	kg	kg	MJ per energy carrier
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	1.51E-02	0.00E+00	0.00E+00
	Total (of product stage)	A1-3	0.00E+00	1.51E-02	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Additional information

LCA Results 2 – no economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts			GWP-total	ODP	AP	EP-freshwater	POCP	ADPE	ADPF
			kg CO ₂ eq	kg CFC11 eq	mol H ⁺ eq	kg (PO ₄) ³⁻ eq	kg C ₂ H ₄ equiv.	kg Sb equiv.	MJ, net calorific value.
Product stage	Raw material supply	A1	1.13e+2	6.91e-6	4.68e-1	2.08e-1	8.48e-2	2.46e-2	9.72e+2
	Transport	A2	1.21e+1	2.23e-6	4.05e-2	1.07e-2	7.06e-3	3.19e-5	1.83e+2
	Manufacturing	A3	8.00e+0	5.16e-7	4.32e-2	9.98e-3	2.46e-3	9.64e-6	1.23e+2
	Total (of product stage)	A1-3	1.33e+2	9.65e-6	5.52e-1	2.28e-1	9.43e-2	2.47e-2	1.28e+3

GWP = Global Warming Potential;
 ODP = Ozone Depletion Potential;
 AP = Acidification Potential for Soil and Water;
 EP = Eutrophication Potential;

POCP = Formation potential of tropospheric Ozone;
 ADPE = Abiotic Depletion Potential – Elements;
 ADPF = Abiotic Depletion Potential – Fossil Fuels;

LCA Results 2 – no economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	1.34e+2	2.02e-3	1.34e+2	1.03e+3	0.00+0	1.03e+3
	Transport	A2	2.43e+0	9.03e-6	2.43e+0	1.81e+2	0.00+0	1.81e+2
	Manufacturing	A3	1.06e+1	1.92e-5	1.06e+1	1.63e+2	0.00+0	1.63e+2
	Total (of product stage)	A1-3	1.47e+2	2.05e-3	1.47e+2	1.37e+3	0.00e+0	1.38e+3

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
 PERM = Use of renewable primary energy resources used as raw materials;
 PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
 PENRM = Use of non-renewable primary energy resources used as raw materials;
 PENRT = Total use of non-renewable primary energy resource

LCA Results 2 (continued) – no economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m ³
Product stage	Raw material supply	A1	0.00e+0	0.00e+0	0.00e+0	1.31e+0
	Transport	A2	0.00e+0	0.00e+0	0.00e+0	3.96e-2
	Manufacturing	A3	0.00e+0	0.00e+0	0.00e+0	3.32e-2
	Total (of product stage)	A1-3	0.00e+0	0.00e+0	0.00e+0	1.38e+0

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;

NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results 2 (continued) – no economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories						
			HWD	NHWD	RWD	
			kg	kg	kg	
Product stage	Raw material supply	A1	4.12e+0	2.96e+0	3.19e-3	
	Transport	A2	7.66e-2	8.52e+0	1.26e-3	
	Manufacturing	A3	2.02e-2	2.08e-1	9.00e-4	
	Total (of product stage)	A1-3	4.21e+0	1.17e+1	5.35e-3	

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results 2 (continued) – no economic allocation

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life			CRU	MFR	MER	EE
			kg	kg	kg	MJ per energy carrier
Product stage	Raw material supply	A1	0.00e+0	0.00e+0	0.00e+0	0.00e+0
	Transport	A2	0.00e+0	0.00e+0	0.00e+0	0.00e+0
	Manufacturing	A3	0.00e+0	1.51e-2	0.00e+0	0.00e+0
	Total (of product stage)	A1-3	0.00e+0	1.51e-2	0.00e+0	0.00e+0

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

References

BSI. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A1:2013. London, BSI, 2013.

BSI. Environmental labels and declarations – Type III Environmental declarations – Principles and procedures. BS EN ISO 14025:2010 (exactly identical to ISO 14025:2006). London, BSI, 2010.

BSI. Environmental management – Life cycle assessment – Principles and framework. BS EN ISO 14040:2006. London, BSI, 2006.

BSI. Environmental management – Life cycle assessment – requirements and guidelines. BS EN ISO 14044:2006. London, BSI, 2006.