ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	British Precast Concrete Federation
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BPC-20170093-CCD1-EN
Issue date	26/07/2017
Valid to	25/07/2022

UK Manufactured Precast Aerated Concrete Blocks as produced by members of the

Aircrete Products Association (APA) a product group of British Precast

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AIRCRETE PRODUCTS ASSOCIATION

General Information

British Precast Concrete Federation

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-BPC-20170093-CCD1-EN

This Declaration is based on the Product Category Rules:
Aerated concrete, 07.2014
(PCR tested and approved by the SVR)

Issue date
26/07/2017

Valid to
25/07/2022

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dr. Burkhart Lehmann
(Managing Director IBU)

Precast Aircrete Concrete Blocks

Owner of the Declaration
British Precast Ltd
The Old Rectory
8 Main Street, Glenfield
Leicester, LE38DG

Declared product / Declared unit
1 m^3 of generic precast aerated concrete blocks with an average gross density of 600kg m^3 .

Scope:
This is an association declaration which uses average data from member companies of the Aircrete Product Associations (APA) to form an average 1m^3 precast aerated concrete blocks. The data covers a period of 12 months (From January to December 2014). All data were collected from UK factories.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

The CEN Norm /EN 15804/ serves as the core PCR
Independent verification of the declaration according to /ISO 14025/
☐ internally ☒ externally

Mr Carl-Otto Neven
(Independent verifier appointed by SVR)

Product

Product description / Product definition
The product covered in this EPD is a generic 1m^3 of precast aerated concrete blocks. Aerated concrete blocks, commonly referred to as Aircrete, are lightweight, autoclaved, thermal insulation blocks normally used as internal masonry blocks. As a result of the raw materials and manufacturing process, the cellular (small bubbles) internal structure of the blocks gives a low density but good compressive strength. Unlike most other concrete products, the Aircrete manufacturing process uses a combination of natural hydration reactions and accelerated curing processes. The concrete mix is essentially a very fine grained mixture of cement, lime, pulverised fly ash (PFA) and sand with water. Variations to this mix design exist with some ground sand blocks not containing PFA. To this, finely powdered aluminium is added. The reaction between the constituent materials releases hydrogen gas which gives the product its aerated structure.
The aeration process takes place in moulds and, once an initial set has occurred, the blocks are loaded into autoclaves where they are steam cured.
Primary data for the production of aerated concrete blocks were collected from members of the Aircrete Products Association (APA), a product group of British Precast. This data were used to generate a mass weighted average of production for the EPD.

For the placing on the market of the product in the EU/EFTA (with the exception of Switzerland) Regulation (EU) No. 305/2011 /CPR / applies. The product needs a Declaration of Performance taking into consideration /EN 771-4:2011+A1: 2015, Specification for masonry units. Autoclaved aerated concrete masonry units and the CE-marking. For the application and use the respective national provisions apply.

Application
Aircrete is a lightweight thermal insulation block normally used as internal masonry but is also used in external, cavity, foundation and separating party walls in houses and other buildings

Technical Data
Aerated concrete products are manufactured to /BS EN 771-4:2011+A1:2015/ Specification for masonry units. Autoclaved aerated concrete masonry units.

Constructional data

Name	Value	Unit
Compressive strength	2.9 - 8.7	N/mm^2
Gross density	460 - 760	kg/m^3
Thermal conductivity	0.09 - 0.19	W/(mK)
Water vapour diffusion resistance factor acc. to /EN1745/	5/10	-
Shrinkage - Nominal Drying Shrinkage Value /BS EN 680/ Conventional Reference Value)	0.4	mm/m
Reaction to fire	A1	Euro class
Equilibrium moisture content	6	%
Vapour resistivity	60	MNs/g
Specific heat capacity	1.05	kJ/kgK

The information contained within the Constructional Data table is based on APA Technical Committee agreed Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to EN 771-4:2011+A1:2015/ Specification for masonry units. Autoclaved aerated concrete masonry units.

Base materials / Ancillary materials

The concrete mix proportions for this EPD are as follows:
PFA 61% other aggregates 14% cement 14% Quicklime 8%; water 3%.
Note - these are averaged figures and not all blocks covered by this EPD will follow this mix.
No /REACH/ substances of very high concern are included.

Reference service life

Autoclaved aerated concrete (Aircrete) is a durable material. Walls constructed from the products will have durability equivalent to walls of traditional masonry and will fulfil their intended function for the life of the building in which they have been installed. This statement of durability is the opinion of the British Board of Agrément (BBA). With reference to masonry products declared under the same IBU scheme the reference service life (RSL) is 150 years.

LCA: Calculation rules

Declared Unit

The declared unit is 1 m^3 of generic precast aerated concrete blocks (460-760 kg/m^3). Concrete blocks are manufactured to a range of dimensions, 440 x 215 x 100 mm taken as the dimensions for this EPD, although this EPD can apply to other block formats which commonly exist. Information on density and other physical characteristics are shown in the table below.

Declared unit

Name	Value	Unit
Declared unit	1	m^3
Gross density	600	kg/m^3
Declared unit	0.6	t
Grammage	60	Kg/m2

System boundary

Type of EPD: Cradle to Gate with all options declared. The modules considered in the Life Cycle Assessment are modules A1-C4 inclusive.

Packaging

The amount and type of packaging used on autoclaved aerated concrete blocks will vary dependent on specific requirements. In a proportion of cases product will need no packaging other than banding and pallets for transportation. In other circumstances, the product will be stacked, banded, shrink-wrapped and placed on pallets for transportation.

Cut-off criteria

/EN 15804/ requires that where there are data gaps or insufficient input data for a unit process the cut-off criteria shall be 1% of renewable and non-renewable primary energy usage and 1% of the total mass of this unit process. The total neglected flows from a product stage must be no more than 5% of product inputs by mass or 5% of primary energy contribution.

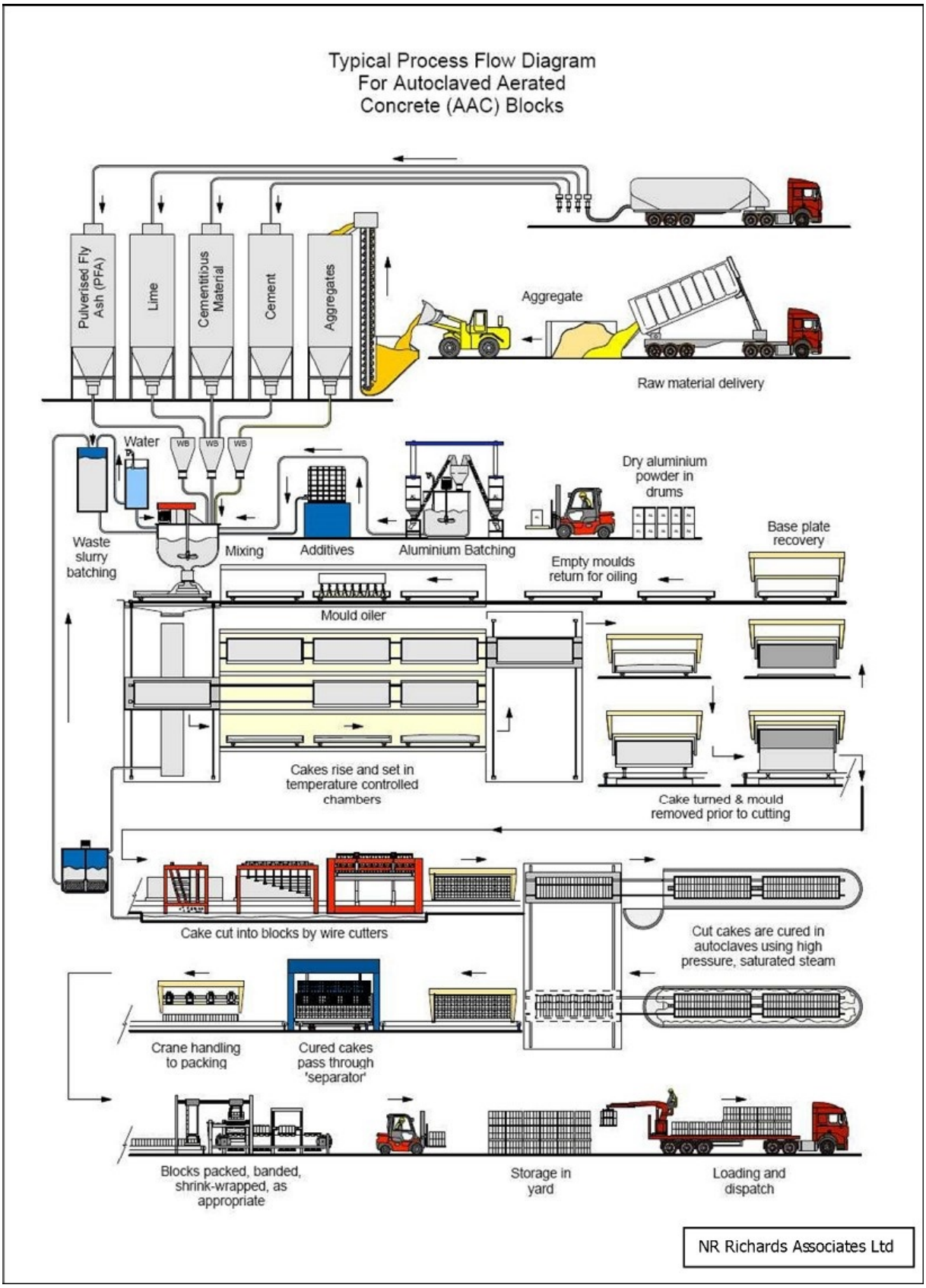
In this assessment, all information gathered from data collection for the production of precast concrete has been modelled, i.e. all raw materials used, the electrical energy and other fuels used, use of ancillary materials and all direct production waste. Transport data on input and output flows are also considered. Scenarios have been developed to account for downstream processes such as fabrication, installation, demolition and waste treatment. No cut-offs have been made. Hence this study complies with the cut-off criteria defined in the PCR.

Background data

Background data is based primarily on a generic dataset /GaBi ts 2014 software database/ integrated into the IBU verified bespoke British Precast Envision EPD tool. The background data also includes UK specific cement data supplied by members of the Mineral Products Association (MPA). (Tool Verified 07/03/17).

Allocation

All allocation is performed according to the /PCR/. As no co-products are produced, the flow of materials and energy and also the associated release of substances and energy into the environment are related exclusively to the concrete produced.


Typical Process Flow Diagram
For Autoclaved Aerated
Concrete (AAC) Blocks
Pulverised Fly Ash (PFA)
Lime
Cementitious Material
Cement
Aggregates
Aggregate
Raw material delivery
Water
WB
WB
WB
Dry aluminium powder in drums
Waste slurry batching
Mixing
Additives
Aluminium Batching
Empty moulds return for oiling
Base plate recovery
Mould oiler
Cakes rise and set in temperature controlled chambers
Cake turned & mould removed prior to cutting
Cake cut into blocks by wire cutters
Cut cakes are cured in autoclaves using high pressure, saturated steam
Crane handling to packing
Cured cakes pass through 'separator'
Blocks packed, banded, shrink-wrapped, as appropriate
Storage in yard
Loading and dispatch
NR Richards Associates Ltd

Comparability
Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.
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LCA: Scenarios and additional technical information

The following information supports the declaration of modules A1-C3 inclusive.

Transport to the building site (A4)

Name	Value	Unit
Transport distance	86	km
Capacity utilisation (including empty runs)	50	%

Installation into the building (A5)

Name	Value	Unit
Material loss	3	%

Use or application of the installed product (B1)
In practice, given the nature of the product and its application in the structure of the building, no impacts are associated with the use stage of concrete over the lifetime of the building. However, carbonation of concrete will occur during the lifetime of the building and is included in module B1. Carbonation is calculated using the approach recommended by the Mineral Products Association and BPCF and follows the methodology developed by Pommer et al. /Pommer 2005/, with reference to the work of Engelsen and Justnes /Engelsen 2014/, who have made further refinements related to the amount of CaO that can carbonate and the carbonation of slag.

For precast concrete carbonation factors based on BPCF research and expert judgement have been used. The surface area is assumed to be 20m² based on two exposed faces of each concrete block in a single leaf structure.
The study period is assumed to be 150 years (the RSL).

Modules B2 - B7 (Maintenance, Repair, Replacement, Refurbishment, Operational Energy Use, Operational Water Use)
It is assumed that the autoclaved aerated concrete blocks covered by this EPD do not require maintenance, repair, replacement or refurbishment during their lifetime. Consequently, the impacts associated with these lifecycle stages are zero. There is no operational energy or operational water requirement associated with the product, however, it is acknowledged that any building material choice will have an impact on the operational energy and, in some cases, the operational water demand of the final building.

Reference service life

Name	Value	Unit
Reference service life	150	a

End of life (C1-C4)

Name	Value	Unit
Recycling	90	%
Landfilling	10	%

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LCA: Results

In Table 1 "Description of the system boundary", all declared modules are indicated with an "X"; Module D which is not declared is indicated with "MND". Indicator values are declared to three valid digits.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1m3 Generic Precast Aerated Concrete Block

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
GWP	[kg CO_2-Eq.]	168.00	3.62	1.10	-57.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.08	1.43	0.97
ODP	[kg CFC11-Eq.]	7.10E-7	2.45E-12	5.80E-12	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.41E-12	1.48E-11	1.07E-11
AP	[kg SO_2-Eq.]	2.08E-1	1.51E-2	6.84E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.67E-3	9.81E-3	5.78E-3
EP	[kg $(PO_4)^{3-}$-Eq.]	1.99E-2	3.70E-3	1.09E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.12E-3	2.37E-3	7.86E-4
POCP	[kg ethene-Eq.]	6.00E-2	-5.66E-3	6.68E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-3.25E-3	1.43E-3	5.55E-4
ADPE	[kg Sb-Eq.]	2.87E-4	6.80E-8	1.58E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.90E-8	2.53E-6	3.32E-7
ADPF	[MJ]	1.20E+3	4.98E+1	1.81E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.86E+1	2.69E+1	1.25E+1

Caption	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources

RESULTS OF THE LCA - RESOURCE USE: 1m3 Generic Precast Aerated Concrete Block

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
PERE	[MJ]	192.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	[MJ]	192.00	1.01	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	2.07	1.47
PENRE	[MJ]	1.29E+3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRM	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRT	[MJ]	1.29E+3	4.99E+1	2.02E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.86E+1	2.76E+1	1.30E+1
SM	[kg]	395.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	[m^3]	5.28E-1	3.24E-3	3.00E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.86E-3	7.76E-3	2.65E-3

Caption	PERE = Use of renewable primary energy excluding renewable primary energy resources 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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1m3 Generic Precast Aerated Concrete Block

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD	[kg]	1.10E-2	2.32E-7	8.10E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.33E-7	1.97E-6	2.96E-7
NHWD	[kg]	8.02E+0	8.73E-4	9.59E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.01E-4	1.31E-2	6.01E+1
RWD	[kg]	3.51E-2	5.36E-5	8.26E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.07E-5	2.68E-4	1.81E-4
CRU	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	[kg]	0.00	0.00	22.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	524.00	0.00
MER	[kg]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	[MJ]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EEE = Exported thermal energy

Interpretation

Interpretation of the results has been carried out considering the methodology, data-related assumptions and any limitations declared in the EPD.
Interrogation of the LCA results show that the cradle-to-grave **GWP** (Global Warming Potential) impact of 1m3 of autoclaved aerated concrete is 119.5 kgCO2e (Modules A1-C4).

For **GWP**, A1-A3 accounts for 137% of the lifecycle impact with carbonation in the use phase and post-demolition, reducing the overall impact of aircrete products. Carbonation in the use phase alone reduces the **GWP** impact by 45%.

The LCA results show that the cradle-to-grave primary energy demand of the declared unit is 1608 MJ (Modules A1-C4).

Analysis of the **PERT/ PENRT** (use of renewable primary energy resources/ Total use of non-renewable primary energy resources) figures shows the largest contributors are cement 22(%), aggregates and powders 18(%) and utilities used in production 39(%).
For primary energy demand, A1-A3 accounts for 92% of the lifecycle impact.

The cradle to grave Net use of fresh water (**FW**) is 0.55m3 (Modules A1-C4) with the product stage (A1-A3) accounting for 97% of this.

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EN ISO 14044
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thinkstep
GaBi ts 2014 software database

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