

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-20180013-CCD1-EN
Issue date	26/03/2018
Valid to	25/03/2023

UK manufactured single leaf concrete cladding panel
Produced by members of British Precast
Architectural and Structural
a product group of the British Precast Concrete
Federation

www.ibu-epd.com / <https://epd-online.com>



General Information

<p>British Precast Concrete Federation</p> <hr/> <p>Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany</p> <hr/> <p>Declaration number EPD-BPC-20180013-CCD1-EN</p> <hr/> <p>This Declaration is based on the Product Category Rules: Pre-cast concrete components, 07.2014 (PCR tested and approved by the SVR)</p> <hr/> <p>Issue date 26/03/2018</p> <hr/> <p>Valid to 25/03/2023</p> <hr/>  <hr/> <p>Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)</p> <hr/>  <hr/> <p>Dr. Burkhard Lehmann (Managing Director IBU)</p>	<p>Precast concrete cladding</p> <hr/> <p>Owner of the Declaration British Precast Ltd The Old Rectory 8 Main Street, Glenfield Leicester, LE3 8DG</p> <hr/> <p>Declared product / Declared unit 1m² of concrete cladding panel, single leaf 150mm with acid etched face. Includes insulation and plasterboard.</p> <hr/> <p>Scope: This is an association declaration which uses manufacturing data from member companies of British Precast Architectural & Structural (BPAS) and a defined mix design to form an average 1m² of precast concrete cladding panel wall unit. It is based on data covering 55,884 tonnes of precast concrete production over a period of 12 months (From January to December 2015). This covers the majority of cladding of the type described in the functional unit manufactured by the membership of British Precast Architectural and Structural.</p> <p>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.</p> <hr/> <p>Verification</p> <table border="1"> <tr> <td colspan="2">The CEN Norm /EN 15804/ serves as the core PCR</td> </tr> <tr> <td colspan="2">Independent verification of the declaration according to /ISO 14025/</td> </tr> <tr> <td><input type="checkbox"/> internally</td> <td><input checked="" type="checkbox"/> externally</td> </tr> </table> <hr/>  <hr/> <p>Mr Carl-Otto Neven (Independent verifier appointed by SVR)</p>	The CEN Norm /EN 15804/ serves as the core PCR		Independent verification of the declaration according to /ISO 14025/		<input type="checkbox"/> internally	<input checked="" type="checkbox"/> externally
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Product

Product description / Product definition

The declared product is a 1m² of concrete cladding panel single leaf 150mm with acid etched face. Including rebar consisting of 2 layers of B503 mesh. Stainless steel fixings consisting of 2 restraints and 2 dowels per panel. The declared unit includes insulation and plasterboard. Precast concrete is made of cement, aggregates, water, and (if needed) admixtures. Primary data for the production of the precast panels was collected from members of British Precast Architectural and Structural (BPAS).

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 /EN14992:2007+A1:2012/ Precast concrete products - Wall elements and the CE marking.

For the application and use the respective national provisions apply.

Application

Precast concrete cladding can be used as a structural element but is more usually used as a non-structural decorative façade to a building. Precast concrete cladding can be used in precast frame constructions. The majority is used with in-situ concrete or steel frames, and for refurbishments.

Technical Data

Concrete is specified in accordance with /BS 8500/ and /BS EN 206/.

Precast concrete cladding panels are manufactured to /EN 14992:2007 +A1:2012/ Precast Concrete Products: Wall Elements

Constructional data

Name	Value	Unit
Gross density (Concrete only)	2380	kg/m ³
Compressive strength (Concrete only)	40	N/mm ²
Ultimate tensile strength (Steel)	650	N/mm ²
Tensile yield strength (Steel)	500	N/mm ²

Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to /EN 14992:2007 +A1:2012/ Precast Concrete Products: Wall Elements

The information contained within the Constructional Data table is based on BPAS Technical Committee agreed performance data.

Base materials / Ancillary materials

The element design used to generate this EPD is as follows:

White CEM - 63kg
 Primary Aggregate - 270kg
 Insulation - 9kg
 Plasterboard - 8.35kg
 Steel Reinforcement - 12kg
 Steel fixings - 1.7kg
 Etching Acid - 0.2kg
 Water - 21kg

The concrete mix agreed by the BPAS technical committee is designed to be representative of average UK products. For further information on the mix design and coverage of this EPD contact the British Precast technical team +44 (0)116 232 5170. The concrete mix and product build will vary between manufacturers. For details of a products mix contact the individual BPAS member.

No /REACH/ substances of very high concern are included.

Reference service life

/BS 8500/, the UK's concrete specification standard complementary to /EN206/, sets durability requirements for precast concrete elements. The reference service life (RSL) for the declared unit is 100 years.

LCA: Calculation rules

Declared Unit

The declared unit is 1m² of concrete cladding panel single leaf 150mm with acid etched face. Including rebar consisting of 2 layers of B503 mesh. Stainless steel fixings consisting of 2 restraints and 2 dowels per panel. 100mm insulation and plasterboard. Information on density and other physical characteristics are shown in the table below.

Declared unit

Name	Value	Unit
Density Concrete only	2380	kg/m ³
Declared unit	1	m ²
Grammage	385	kg/m ²

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.

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.

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.

LCA: Scenarios and additional technical information

The following information supports the declaration of modules A1-C4 inclusive.

Transport to the building site (A4)

Name	Value	Unit
Transport distance	279	km
Capacity utilisation (including empty runs)	50	%

End of life (C1-C4)

Name	Value	Unit
Recycling	90	%
Landfilling	10	%

Installation into the building (A5)

Name	Value	Unit
Material loss	0.009	%

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 1m² based on one exposed surface for an average external wall. Carbonation of the panels other surface will depend on cavity conditions and so was not modelled in this EPD.

The study period is assumed to be 100 years (the RSL).

Modules B2 - B7 (Maintenance, Repair, Replacement, Refurbishment, Operational Energy Use, Operational Water Use)

It is assumed that the precast concrete cladding covered by this EPD does not require maintenance, repair, replacement or refurbishment during its 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

/BS 8500/, the UK's concrete specification standard complementary to /EN206/, sets durability requirements for precast concrete elements. The reference service life (RSL) for the declared unit is 100 years.

Name	Value	Unit
Reference service life	100	a

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: 1m2 Generic Precast Concrete Cladding Wall Unit

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
GWP	[kg CO ₂ -Eq.]	107.00	7.34	0.07	-3.76	0.00	0.00	0.00	0.00	0.00	0.00	-0.21	1.34	-5.22	0.16
ODP	[kg CFC11-Eq.]	1.44E-6	8.64E-13	1.50E-14	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.57E-13	9.73E-13	6.31E-13
AP	[kg SO ₂ -Eq.]	1.99E-1	3.06E-2	1.90E-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	5.58E-3	6.30E-3	3.68E-3
EP	[kg (PO ₄) ³ -Eq.]	6.03E-2	7.36E-3	1.63E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.34E-3	1.49E-3	5.01E-4
POCP	[kg ethene-Eq.]	8.79E-2	-1.17E-2	8.33E-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	-2.13E-3	6.73E-4	2.89E-4
ADPE	[kg Sb-Eq.]	1.60E-4	1.19E-7	5.02E-9	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.17E-8	1.63E-6	2.23E-7
ADPF	[MJ]	635.00	101.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.40	17.30	8.03

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: 1m2 Generic Precast Concrete Cladding Wall Unit

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
PERE	[MJ]	97.40	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]	9.74E+1	2.47E+0	6.32E-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	4.50E-1	1.37E+0	9.70E-1
PENRE	[MJ]	710.00	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
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]	7.10E+2	1.01E+2	4.10E-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	1.84E+1	1.77E+1	8.32E+0
SM	[kg]	14.80	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]	2.63E-1	8.65E-4	1.75E-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	1.57E-4	4.76E-3	1.58E-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:

1m2 Generic Precast Concrete Cladding Wall Unit

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD	[kg]	3.19E-4	4.14E-7	3.36E-10	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.55E-8	6.24E-7	1.32E-7
NHWD	[kg]	1.90E+1	1.11E-3	6.42E-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	2.01E-4	8.17E-3	3.86E+1
RWD	[kg]	3.06E-2	1.11E-4	2.31E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.02E-5	1.66E-4	1.14E-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	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	336.00	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 1m² of precast concrete cladding is 105.7 kgCO_{2e} (Modules A1-C4).

For **GWP**, A1-A3 accounts for 101% of the lifecycle impact with carbonation in the use phase and post-demolition, reducing the overall impact of the cladding panel. Carbonation in the post crushing phase of the end of life reduces the **GWP** cradle to grave impact by 5.9%.

The LCA results show that the cradle-to-grave primary energy demand of the declared unit is 958.1 MJ (Modules A1-C4).

Analysis of the **PERT/ PENRT** (Total use of renewable primary energy resources/ Total use of non-renewable primary energy resources) figures shows the largest contributors are cement 23(%), utilities 23(%) and transport 15(%).

For primary energy demand, A1-A3 accounts for 84% of the lifecycle impact.

The cradle-to-grave Net use of fresh water (**FW**) is 0.271m³ (Modules A1-C4) with the production stage (A1-A3) accounting for 97% of this.

References

Institut Bauen und Umwelt

Institut Bauen und Umwelt e.V., Berlin(pub.):
Generation of Environmental Product Declarations
(EPDs);
www.ibu-epd.de

ISO 14025

DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804

EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

PCR Part A

Institut Bauen und Umwelt e.V., Königswinter (pub.):
Product Category Rules for Construction Products from the range of Environmental Product Declarations of Institut Bauen und Umwelt (IBU), Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report. April 2013

PCR Part B

Part B: Requirements on the EPD for Pre-cast concrete components, Version 1.6, Institut Bauen und Umwelt e.V., www.bau-umwelt.com, 2014

EN ISO 14040

EN ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework

EN ISO 14044

EN ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines.

EN 206

BS EN 206:2013: Concrete. Specification, performance, production and conformity

EN 14992:2007+A1: 2012: Precast Concrete Products – Wall Elements.

EU No 305/2011

Regulation (EU) No 305/2011 - construction products regulation

BS 8500

BS 8500-1:2015: Concrete. Complementary British Standard to BS EN 206. Method of specifying and guidance for the specifier.

Engelsen 2014

Engelsen, C. and Justnes, H. (2014) CO₂ binding by concrete - Summary of the state of the art and an assessment of the total binding of CO₂ by carbonation in the Norwegian concrete stock. SINTEF Building and Infrastructure, Oslo, Norway.

Pommer 2005

Pommer, K. and Pade, C (2005) Guidelines - Uptake of carbon dioxide in the life cycle inventory of concrete. Danish Technological Institute, Copenhagen, Denmark

thinkstep

GaBi ts 2014 software database

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