

# 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-20170148-CCD1-EN
Issue date	11/12/2017
Valid to	10/12/2022

UK manufactured Precast Concrete Ground Beam  
Produced by members of the British Precast  
Architectural and Structural (BPAS)  
a product group of the British Precast Concrete  
Federation

[www.ibu-epd.com](http://www.ibu-epd.com) / <https://epd-online.com>



## General Information

<p><b>British Precast Concrete Federation</b></p> <hr/> <p><b>Programme holder</b>          IBU - Institut Bauen und Umwelt e.V.          Panoramastr. 1          10178 Berlin          Germany</p> <hr/> <p><b>Declaration number</b>          EPD-BPC-20170148-CCD1-EN</p> <hr/> <p><b>This Declaration is based on the Product Category Rules:</b>          Pre-cast concrete components, 07.2014          (PCR tested and approved by the SVR)</p> <hr/> <p><b>Issue date</b>          11/12/2017</p> <hr/> <p><b>Valid to</b>          10/12/2022</p> <hr/> <p></p> <hr/> <p>Prof. Dr.-Ing. Horst J. Bossenmayer          (President of Institut Bauen und Umwelt e.V.)</p> <hr/> <p></p> <hr/> <p>Dr. Burkhard Lehmann          (Managing Director IBU)</p>	<p><b>Precast Concrete Ground Beams</b></p> <hr/> <p><b>Owner of the Declaration</b>          British Precast          The Old Rectory          8 Main Street, Glenfield          Leicester, LE38DG</p> <hr/> <p><b>Declared product / Declared unit</b>          1m<sup>3</sup> generic precast concrete ground beam.</p> <hr/> <p><b>Scope:</b>          This is an association declaration which uses manufacturing data from member companies of the British Precast Architectural and Structural and a defined mix design to form an average 1m<sup>3</sup> of precast concrete ground beam. This EPD is based on production data which represents 90.4% of BPAS's total recorded precast concrete production volume. It is based on data covering a period of 12 months (From January to December 2014). All data was collected from UK factories.</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><b>Verification</b></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/> <p></p> <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 product covered in this EPD is a generic 1m<sup>3</sup> of precast concrete ground beam. Concrete beams are made of cement, aggregates, water and (if needed) admixtures. In most cases the beam will be reinforced with steel bars.

The beams covered by this EPD have been manufactured through casting into preformed moulds. The dry components (a mixture of coarse and fine aggregates and cement) are thoroughly mixed before a measured amount of water is added and the mix is poured into the mould. Once demoulded, the beams are cured outside.

Primary data for the production of precast concrete beams was collected from members of the 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 /EN 13225:2013/ Precast concrete products - Linear structural elements and the CE-

marking. For the application and use the respective national provisions apply.

### Application

Precast ground beams can be used in a variety of applications as part of the formwork for a building and provide an alternative to traditional foundations, they are typically designed to span between pad foundations or bases. An example of an application would be low-rise housing. Some precast ground beam systems incorporate connections to secondary beams, which can be used to form a beam and block ground floor for the building.

### Technical Data

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

Precast concrete ground beams are manufactured to /EN 13225: 2013/ Precast Concrete Products – Linear Structural Elements.

For geometrical data, detailing, mechanical strength, fire resistance, acoustic insulation parameters and durability see the design specifications.

### Constructional data

Name	Value	Unit
Gross density	2400	kg/m <sup>3</sup>
Compressive strength	40	N/mm <sup>2</sup>
Reinforcing steel	-	
Ultimate tensile strength	650	N/mm <sup>2</sup>
Tensile yield strength	500	N/mm <sup>2</sup>

Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to /EN 13225:2013 Precast Concrete Products - Linear Structural Elements/

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

### Base materials / Ancillary materials

The concrete mix design used to generate this EPD is as follows:

CEMI - 350kg  
 Primary Aggregate - 800kg  
 Limestone - 975kg  
 Steel Reinforcement - 100kg  
 Super Plasticiser - 7.96kg  
 Water - 175kg

The mix agreed by the BPAS technical committee is designed to be representative of average UK products. The mix will vary between manufacturers. For details of a products mix contact the 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 reinforced concrete elements. The reference service life (RSL) for the declared unit is 100 years.

## LCA: Calculation rules

### Declared Unit

The declared unit is 1m<sup>3</sup> of generic precast concrete ground beam including steel reinforcement. Concrete beams are manufactured to a range of dimensions, the cross section dimensions 600 x 300 mm are taken as the dimensions for this EPD. Information on density and other physical characteristics are shown in the table below.

### Declared unit

Name	Value	Unit
Density	2400	kg/m <sup>3</sup>
Declared unit	1	m <sup>3</sup>
Declared unit	2.4	t

### 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	182	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 British Precast Concrete Federation (BPCF) research and expert judgement have been used. In this case use phase carbonation has not been modelled due to the assumption that a ground beam will not be exposed to the air on any surface.

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 beams 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

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

Name	Value	Unit
Reference service life	100	a

## LCA: Results

### 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 Concrete Ground Beam

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
GWP	[kg CO <sub>2</sub> -Eq.]	447.00	29.70	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.38	8.30	-34.30	0.71
ODP	[kg CFC11-Eq.]	2.86E-6	2.01E-11	3.25E-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	5.63E-12	5.91E-11	4.27E-11
AP	[kg SO <sub>2</sub> -Eq.]	7.88E-1	1.24E-1	1.78E-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	3.47E-2	3.93E-2	2.31E-2
EP	[kg (PO <sub>4</sub> ) <sup>3-</sup> -Eq.]	7.84E-2	3.03E-2	1.64E-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	8.49E-3	9.48E-3	3.14E-3
POCP	[kg ethene-Eq.]	2.38E-1	-4.64E-2	1.19E-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	-1.30E-2	5.73E-3	2.22E-3
ADPE	[kg Sb-Eq.]	7.59E-4	5.58E-7	1.06E-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	1.56E-7	1.01E-5	1.33E-6
ADPF	[MJ]	3.04E+3	4.08E+2	8.16E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.14E+2	1.08E+2	5.01E+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 Concrete Ground Beam

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
PERE	[MJ]	470.00	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]	4.70E+2	8.32E+0	8.85E-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	2.33E+0	8.29E+0	5.89E+0
PENRE	[MJ]	3.45E+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]	3450.00	410.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	115.00	110.00	51.90
SM	[kg]	132.00	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 <sup>3</sup> ]	8.37E-1	2.66E-2	4.60E-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	7.44E-3	3.10E-3	6.43E-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 Concrete Ground Beam

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD	[kg]	7.12E-2	1.91E-6	1.76E-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	5.33E-7	7.88E-6	1.19E-6
NHWD	[kg]	3.96E+1	7.16E-3	6.46E-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	2.00E-3	5.23E-2	2.40E+2
RWD	[kg]	1.62E-1	4.39E-4	7.76E-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	1.23E-4	1.07E-4	7.25E-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]	0.00E+0	0.00E+0	6.02E+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	0.00E+0	2.10E+3	0.00E+0
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 1m<sup>3</sup> of precast concrete ground beam is 450.1 kgCO<sub>2</sub>e (Modules A1-C4).

For **GWP**, A1-A3 accounts for 99% of the lifecycle impact with carbonation in the use phase and post-demolition, reducing the overall impact of the beam. Carbonation in the post crushing phase of the end of life reduces the **GWP** cradle to grave impact by 7.6%.

The LCA results show that the cradle-to-grave primary energy demand of the declared unit is 4633 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 30(%), steel 23(%) and transport 14(%).

For primary energy demand, A1-A3 accounts for 85% of the lifecycle impact.

The cradle-to-grave Net use of fresh water (**FW**) is 0.913m<sup>3</sup> (Modules A1-C4) with the production stage (A1-A3) accounting for 92% of this.

## References

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### 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.):  
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### EN ISO 14040

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

### EU No 305/2011

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### BS EN 206

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### BS 8500

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### Engelsen 2014

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### thinkstep

GaBi ts 2014 software database

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