

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-20160005-CCD1-EN
Issue date	08/03/2017
Valid to	07/03/2022

UK produced Precast Hollowcore Flooring
Precast Flooring Federation (PFF)
part of British Precast

www.bau-umwelt.com / <https://epd-online.com>



General Information

British Precast Concrete Federation

Programme holder

IBU - Institut Bauen und Umwelt e.V.
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Germany

Declaration number

EPD-BPC-20160005-CCD1-EN

This Declaration is based on the Product Category Rules:

Pre-cast concrete components, 07.2014
(PCR tested and approved by the SVR)

Issue date

08/03/2017

Valid to

07/03/2022



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



Dr. Burkhard Lehmann
(Managing Director IBU)

Precast Hollowcore flooring

Owner of the Declaration

British Precast
The Old Rectory
Main Street, Glenfield, LE3 8DG
Leicester, United Kingdom

Declared product / Declared unit

1 m² of 150 mm precast concrete prestressed hollow core flooring slab

Scope:

This is an association declaration which uses average data from 10 member companies of the Precast Flooring Federation (PFF) to form an average 150 mm hollow core flooring slab unit. It is based on data collected from the flooring factories of Acheson & Glover, Bison Manufacturing, Cemex UK, Charcon Construction Solutions, Creagh Concrete, F P McCann, Forterra Building Products, Litecast, Longley Concrete Floors and TT Concrete Products, covering 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

The declared product is a 150 mm deep precast concrete prestressed hollow core flooring slab. Hollow core slabs are designed for a typical span of 6 metres. The declared unit can be used with or without a structural concrete topping. Thermal insulation (made of expanded polystyrene (EPS), extruded polystyrene (XPS), polyisocyanurate (PIR) or polyurethane (PUR)) may also be used. Concrete topping and thermal insulation are not included in this EPD. Precast concrete is made of cement, aggregates, water, prestressed steel reinforcement and (if needed) admixtures. Primary data for the production of precast concrete prestressed hollow core flooring slabs was collected from 10 members of the Precast Concrete Federation. This data was used to generate a mass weighted average of production for the EPD.

Application

One hundred and fifty (150) mm deep hollow core slabs are used in a wide range of applications, most often as suspended or upper floors in typical housing

and multi-storey residential/ office buildings. Hollow core slabs may also be used for buildings roofs.

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 /BS EN 1168:2005+A3:2011 Precast concrete products. Hollow core slabs/ and the CE-marking.

For the application and use the respective national provisions apply.

Technical Data

- Concrete is specified in accordance with /BS 8500/ and /BS EN 206/.
- Precast pre-stressed hollow core slabs are manufactured to /BS EN 1168/.

Constructional data

Data in accordance with the Declaration of Performance and the following data:

Name	Value	Unit
Thermal conductivity	2	W/(mK)
Water vapour diffusion resistance factor	150	-
Sound absorption coefficient (at 125 Hz)	0.01	%
Gross density	2000	kg/m ³
Compressive strength	60	N/mm ²
Tensile strength	4.1	N/mm ²
Flexural strength (based on 15% of the compressive strength taken as 50 N/mm ²)	15	N/mm ²
Modulus of elasticity	33500	N/mm ²
Equilibrium moisture content (at 75% RH)	0.3	%
Prestressing steel stress	1770	N/mm ²

Base materials / Ancillary materials

The concrete mix proportions are as follows: aggregates 76% cement 17%; reinforcement 1%; water 6%.

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

Reference service life

/BS 8500/, the UK's concrete specification standard complementary to /BS EN 206/, sets durability requirements for reinforced/ prestressed elements. The reference service life (RSL) for the declared unit is 100 years.

LCA: Calculation rules

Declared Unit

The declared unit is 1 m² of 150 mm deep precast concrete prestressed hollow core slab design for a typical span of 6 metres. Information on density and other physical characteristics are shown in the table below.

Declared unit

Name	Value	Unit
Density (mean value)	2000	kg/m ³
Conversion factor to 1 kg	0.00333	-
Grammage	300	kg/m ²
Declared unit	1	m ²

Note: Density includes reinforcement. Amount of

reinforcement per declared unit is on average 2.772 kg.

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.

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

Transport to the building site (A4)

Name	Value	Unit
Litres of fuel	0.576	l/100km
Transport distance	188	km
Capacity utilisation (including empty runs)	50	%
Gross density of products transported	2000	kg/m ³

Installation into the building (A5)

Name	Value	Unit
Material loss	0.027	kg

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 judgment have been used. The depth of carbonation on each surface has been modelled as 1.59 mm based on average conditions for a precast element of this type. The surface area is assumed to be 1 m² based on one exposed surface of the floor, with the other surface covered by screed or other covering.

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

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

The precast concrete prestressed hollow core flooring slab 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

Name	Value	Unit
Reference service life	100	a

End of life (C1-C4)

Name	Value	Unit
Recycling	270	kg
Landfilling	30	kg

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 significant 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 of 150mm deep prestressed hollow core slabs

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
GWP	[kg CO ₂ -Eq.]	50.20	3.85	0.01	-1.81	0.00	0.00	0.00	0.00	0.00	0.00	-0.15	1.04	-3.50	0.17
ODP	[kg CFC11-Eq.]	3.84E-7	2.61E-12	4.15E-13	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.03E-13	7.38E-12	5.34E-12
AP	[kg SO ₂ -Eq.]	8.30E-2	1.61E-2	2.25E-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	4.33E-3	4.91E-3	2.89E-3
EP	[kg (PO ₄) ³ -Eq.]	7.39E-3	3.94E-3	2.08E-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	1.06E-3	1.19E-3	3.93E-4
POCP	[kg ethene-Eq.]	2.99E-2	-6.02E-3	1.51E-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	-1.62E-3	7.17E-4	2.78E-4
ADPE	[kg Sb-Eq.]	9.97E-5	7.23E-8	1.11E-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	1.95E-8	1.26E-6	1.66E-7
ADPF	[MJ]	276.00	53.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.30	13.50	6.26

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 of 150mm deep prestressed hollow core slabs

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
PERE	[MJ]	39.70	1.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	1.04	0.74
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]	39.70	1.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29	1.04	0.74
PENRE	[MJ]	302.00	53.10	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.30	13.80	6.49
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]	302.00	53.10	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.30	13.80	6.49
SM	[kg]	13.00	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]	7.16E-2	3.45E-3	5.06E-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	9.30E-4	3.88E-3	1.32E-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 of 150mm deep prestressed hollow core slabs

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD	[kg]	5.98E-3	2.47E-7	2.30E-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	6.66E-8	9.84E-7	1.48E-7
NHWD	[kg]	9.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	30.10
RWD	[kg]	1.07E-2	5.70E-5	1.01E-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	1.54E-5	1.34E-4	9.06E-5
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	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	262.00	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

References

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

General principles

for the EPD range of Institut Bauen und Umwelt e.V.
 (IBU), 2013/04
www.bau-umwelt.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., Berlin (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 1168

BS EN 1168:2005+A3:2011: Precast concrete products. Hollow core slabs.

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

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