

ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	British Ready-Mixed Concrete Association
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-RMC-20180095-CBG1-EN
Issue date	24/08/2018
Valid to	23/08/2023

UK manufactured generic ready-mixed concrete
Produced by members of the British Ready-
Mixed Concrete Association (BRMCA)
part of the Mineral Products Association (MPA)

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



General Information

British Ready-mixed Concrete Association

Programme holder

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

Declaration number

EPD-RMC-20180095-CBG1-EN

This Declaration is based on the Product Category Rules:

Concrete components made of in-situ or ready-mixed concrete, 07.2014
(PCR tested and approved by the SVR)

Issue date

24/08/2018

Valid to

23/08/2023



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



Dipl. Ing. Hans Peters
(Managing Director IBU)

Generic Ready-Mixed Concrete

Owner of the Declaration

BRMCA
Gillingham House,
38-44 Gillingham Street,
London, SW1V 1HU

Declared product / Declared unit

1m³ of generic ready-mixed concrete.

Scope:

This is an association declaration which uses manufacturing data covering 93% of production from member companies of the British Ready-Mixed Concrete Association and a defined mix design to form an average 1m³ of generic ready-mixed concrete. It is based on data covering a period of 12 months (From January to December 2015). All data was 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 is a generic 1 m³ of ready-mixed concrete, where the constituent proportions are 310 kg of cementitious material, 1915 kg of natural aggregate, 137 litres of mains water, 2 litres of recycled water and 1.6 litres of a chemical admixture. The fresh wet density is a representative 2380 kg/m³. With many sources of cementitious materials and natural aggregates this generic concrete can be assumed to be at a consistence class not less than S3 and strength class not less than C30/37. Due to the wide variation of cements and natural aggregates available throughout the UK confirmation of consistence and strength class for any concrete should be confirmed by the producer before supply.

Ready-mixed concrete is made by mixing coarse and fine aggregates, cement and water in controlled proportions. Chemical admixtures are used to reduce water content and improve fresh and hardened concrete properties. Delivered to site on a just-in-time basis, ready-mixed concrete may be cast into any conceivable shape with almost no limit on volume. When hardened, concrete can carry substantial compressive loads by itself, but is more frequently

reinforced to substantially increase its tensile and flexural strength.

Concrete to /EN 206/ and /BS 8500/ is not covered by the EU Construction Products Regulation. For the use and application of the concrete in the UK refer to /BS 8500/ *Concrete – Complementary British Standard to /BS EN 206/*

Application

Nearly all foundations, floors and the majority of building structures are made of concrete. Concrete is also often key to the architecture of our buildings, contributing greatly to their energy efficiency and visual appeal.

Technical Data

Concrete is specified and supplied in accordance with /BS 8500-2/ and /BS EN 206/.

Constructional data

Name	Value	Unit
Thermal conductivity	1.6	W/(mK)
Gross density	2380	kg/m ³
Characteristic compressive strength, cube/cylinder	30/37	MPa
Characteristic tensile strength	2.9	MPa
Modulus of elasticity	33	GPa

Concrete to /EN 206/ and /BS 8500/ is not covered by the EU Construction Products Regulation. Concrete is supplied in accordance with the project specification and the appropriate requirements of /EN 206/ and /BS 8500/. Third party product conformity certification is recommended but any requirement is at the discretion of the specifier. Concrete to /EN 206/ and /BS 8500/ is not subject to CE Marking.

Base materials / Ancillary materials

The concrete constituent proportions used to generate this EPD are:

CEM I - 200kg

GGBS - 95kg

Fly Ash - 15kg

Natural aggregate - 1915kg

Water – 139 litres

Chemical admixture - 1.55kg

These values represent a generic factory produced ready mixed concrete. The composition of products complying with the EPD will vary depending on client specification and application. More detailed information is available in the respective manufacturer's documentation (e.g. product data sheets).

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

Reference service life

For most common applications and with suitable design and execution the service life of concrete is normally assumed to be not less than fifty years but may be 100 years or more. Requirements for durability in the UK, for either not less than 50 or not less than 100 years, are set out in /BS 8500-1/ Annex A.

The reference service life is declared as 100 years.

Packaging

Ready-mixed concrete is supplied without packaging.

LCA: Calculation rules

Declared Unit

The product is a generic 1 m³ of ready-mixed concrete, comprising 310 kg of cementitious material, 1915 kg of natural aggregate, 137 litres of mains water, 2 litres of recycled water and 1.6 litres (1.55 kg) of chemical admixture. The fresh wet density is a representative 2380 kg/m³.

Declared unit

Name	Value	Unit
Density (mean value)	2380	kg/m ³
Declared unit	1	m ³
Declared unit	2.38	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.

Environment and health during manufacturing

Members of the BRMCA have formal Environmental Management Systems to put in place environmental protection measures which extend beyond national guidelines.

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 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-B1 and C1-C4 inclusive.

Transport to the building site (A4)

Name	Value	Unit
Transport distance	12	km
Capacity utilisation (including empty runs)	50	%

Installation into the building (A5)

Name	Value	Unit
Material loss	3	%

This EPD contains an allowance of 3% to represent the average difference between ready-mixed concrete delivered and that accounted for in the permanent works. This difference may be due to the reliability of measurement, the use of surplus concrete as extra blinding or fill, or comprise inert material recovered from chute washing and invariably incorporated somewhere into the works. This material is not waste but it may be colloquially identified as wastage by the contractor.

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 concrete carbonation factors based on MPA research and expert judgement have been used. The depth of carbonation on each surface has been modelled as 1.59mm based on average conditions for a concrete element. The surface area is assumed to be 2 m².

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 concrete 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.

In case a **reference service life** according to applicable ISO standards is declared then the assumptions and in-use conditions underlying the determined RSL shall be declared. The same holds for a service life declared by the manufacturer.

Reference service life

Name	Value	Unit
Reference service life	100	a

End of life (C1-C4)

Name	Value	Unit
Recycling	90	%
Landfilling	10	%

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	X	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1m3 Generic Ready-mixed Concrete

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	
GWP	[kg CO ₂ -Eq.]	246.00	2.01	0.19	-19.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.84	8.27	-18.90	1.98
ODP	[kg CFC11-Eq.]	1.69E-6	2.37E-13	2.00E-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	9.73E-13	6.01E-12	3.90E-12	
AP	[kg SO ₂ -Eq.]	3.98E-1	8.39E-3	1.28E-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	3.45E-2	3.85E-2	2.27E-2	
EP	[kg (PO ₄) ³ -Eq.]	4.90E-2	2.02E-3	3.07E-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	8.29E-3	9.21E-3	3.09E-3	
POCP	[kg ethene-Eq.]	1.18E-1	-3.20E-3	1.39E-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	-1.32E-2	4.16E-3	1.79E-3	
ADPE	[kg Sb-Eq.]	4.54E-4	3.26E-8	3.36E-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	0.00E+0	1.01E-5	1.38E-6	
ADPF	[MJ]	1.52E+3	2.76E+1	3.57E+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	1.14E+2	1.07E+2	4.97E+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 Ready-mixed Concrete

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
PERE	[MJ]	76.90	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]	76.90	0.68	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.78	8.49	6.00
PENRE	[MJ]	1.65E+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]	1.65E+3	2.77E+1	3.65E+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	1.14E+2	1.10E+2	5.14E+1
SM	[kg]	30.70	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]	41.10	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]	258.00	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]	3.85E-1	2.37E-4	9.81E-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	9.73E-4	2.94E-2	9.79E-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 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 Ready-mixed Concrete

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
HWD	[kg]	6.98E-2	1.13E-7	1.29E-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	4.66E-7	3.86E-6	8.13E-7
NHWD	[kg]	8.62E+1	3.03E-4	1.68E-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	1.24E-3	5.05E-2	2.38E+2
RWD	[kg]	5.22E-2	3.03E-5	3.42E-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	1.25E-4	1.02E-3	7.03E-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	7.14E+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	0.00E+0	2.08E+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

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PCR Part A

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GaBi 2014 ts software database

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