

ENVIRONMENTAL PRODUCT DECLARATION

IN ACCORDANCE WITH EN 15804+A1 & ISO 14025 / ISO 21930

for Ready-Mix Concrete

WAIBEL BETON DARMSTADT GMBH & CO. KG

C25/30, Nb. 15344440

GENERAL INFORMATION

MANUFACTURER INFORMATION

Manufacturer	Waibel Beton Darmstadt GmbH & Co. KG
Address	Pfungstädter Straße 172 64297 Darmstadt
Contact details	06151/54088
Website	www.waibel-gruppe.de

PRODUCT IDENTIFICATION

Product name	15344440
Additional label(s)	C25/30; F3; XC4, XF1 or XC4, XF1, XA1
Product number / reference	15344440
Place(s) of production	Darmstadt, Germany

EPD INFORMATION

EPDs of construction products may not be comparable if they do not comply with EN 15804 and if they are not compared in a building context.

EPD program operator	OneClick LCA
EPD standards	This EPD is in accordance with EN 15804+A1 and ISO 14025 standards.
Product category rules	The CEN standard EN 15804 serves as the core PCR. In addition, the PCR is used.
EPD preparer	Annika Bantle Master Builders Solutions Deutschland GmbH
EPD verification	Independent verification of this EPD and data, according to ISO 14025: <input type="checkbox"/> External verification <input checked="" type="checkbox"/> Internal certification
Verification date	14 th July 2021
EPD verifier	
EPD number	
ECO Platform nr.	
Publishing date	
EPD valid until	

PRODUCT INFORMATION

PRODUCT SCOPE

This declaration and its LCA study are relevant to concrete and concrete products manufactured by Waibel Beton in Darmstadt, Germany. As the owner of the declaration, Waibel Beton may be liable for the underlying information and evidence; the program operator shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

PRODUCT DESCRIPTION

The product 15344440 covered by this Environmental Product Declaration (EPD) is for a specific concrete mixture for commercial construction developed and produced by Waibel Beton for markets in the Hesse region. The design compressive strength is 25 MPa (3,626 psi) at 28 days.

Concrete is batched and delivered in accordance with local standards. The producer provides product that meets or exceeds the standards based on standard operating procedures.

Warranties and additional information are determined by the producer's terms and conditions.

During normal use, hardened concrete is stable and inert and does not pose a significant health or environmental hazard.

Fresh, plastic concrete must be managed in accordance with local regulations. Hardened concrete is an inert product and can be recycled subject to local regulations.

This EPD reports the impacts for the concrete components made of in-situ or ready-mixed concrete. The life cycle phases covered are A1 (Raw Material Supply: Upstream Processes), A2 (Transportation from Supplier to Gate of Producer) and A3 (Concrete Production – Core Process). This EPD is based on a cradle-to-gate system boundary deemed appropriate as concrete mixtures are supplied to a variety of products and the function of the final product is not specifically determined. Reference service life is not relevant due to the cradle-to-gate boundary conditions.

Life cycle stages that are not included in this EPD are A4 (Transportation to the Construction Site), A5 (Construction and Installation Process), B1-7 (Use Phase) and C1-4 (End of Life Stage).

PHYSICAL PROPERTIES OF THE PRODUCT

Name	Value	Unit
Density	2,000 – 2,500	kg/m ³
Thermal conductivity	*	W/(mK)
Water vapor diffusion resistance	*	-
Sound absorption coefficient	*	%
Compressive strength	25 - 40	N/mm ²
Tensile strength	*	N/mm ²
Flexural strength	*	N/mm ²
Modulus of elasticity	*	N/mm ²

(* These characteristics are not relevant for ready-mix concrete)

PRODUCT RAW MATERIAL COMPOSITION

The ready-mix concrete and its upstream materials covered by this Environmental Product Declaration conform to the appropriate ASTM standards as described in NSF International PCR for Concrete, UNSPSC code 30111500, CSI Specification Section 03 30 00 or the requirements of European standard EN 206:2013, BS 8500-1:2015 and BS 8500-2:2015 based on the IBU PCR. Ready-mix concrete is generally batched at a plant, centrally mixed and then discharged into a truck mixer for delivery (central mixed) or dry-batched into the truck for mixing in the production yard, in transit or at the job site (truck mixed). Ready-mix concrete does not require packaging.

The base material ranges for the defined ready-mix concrete are:

Material	Amount %
Binders	10-20 %
Sands	30-40 %
Aggregates	40-50 %
Admixtures	< 1 %
Water	3-10 %

MANUFACTURING PROCESS

Health and safety measures with potential impact to human health during manufacturing are to be consistently adhered to per regional regulatory requirements. Initiatives must be undertaken to minimize or eliminate potential impacts to the environment based on the use of best practices including engineered controls. Fresh, plastic concrete must be managed in accordance with local regulations. Hardened concrete is an

inert product and can be recycled subject to local regulations. If disposed under the European waste catalogue, the waste code 17-01-01 for non-hazardous concrete and 17-01-06 for concrete containing hazardous substances is applicable. Any substances with hazardous and toxic properties that may be of concern to human health and/or the environment are provided in corresponding SDS documents based on regulatory requirements.

LIFE-CYCLE ASSESSMENT

LIFE-CYCLE ASSESSMENT INFORMATION

The LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

A summary of the life cycle stages included in the EPD is as follows:

- I. Raw Material Supply (upstream processes): Extraction, handling and processing of the raw materials used in production of concrete: cement, supplementary cementitious materials, aggregate (coarse and fine), water, admixtures and other materials or chemicals used in concrete mixtures.
- II. Transportation: Transportation of these materials from supplier to the 'gate' of the concrete producer.
- III. Manufacturing (core processes): The core processes result from the energy used to store, batch, mix and distribute the concrete and operate the facility (concrete plant).
- IV. Water use in mixing and distributing concrete.

The processes excluded from the EPD are as follows:

- I. Production, manufacture and construction of buildings, capital goods and infrastructure with an expected lifespan of over 5 years.
- II. Production and manufacture of concrete production equipment, concrete delivery vehicles, earth-moving equipment and laboratory equipment with an expected lifespan of over 5 years.
- III. Personnel-related activities (travel, furniture, office supplies) as well as energy and water use related to company management and sales activities.

A summary of the limitations of this EPD include:

This EPD does not report all the environmental impacts due to manufacturing of the product, but rather reports the environmental impacts for those categories with established life cycle assessment-based methods to track and report. Unreported environmental impacts include (but are not limited to) factors attributable to human health, land use change and habitat destruction.

This EPD was calculated using industry average cement data. Cement LCA impacts can vary depending upon manufacturing processes, efficiency and fuel sources by as much as 50% for some environmental impact categories. Cement accounts for as much as 90% of the impacts of the concrete mix(es) included in this EPD and thus manufacturer specific cement impacts could result in variation of as much as 45%.

This EPD reports the results of an LCA for 'cradle to gate' analysis and is intended for business-to-business communications. Thus, declarations themselves are not comparative assertions, defined as an environmental claim regarding the superiority or equivalence of one product versus a competing product that performs the same function. An EPD does not make any statements that the product covered by the EPD is better or worse than any other product.

To assess the local impacts of product manufacturing, additional analysis is required. Life cycle impact assessment results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Comparability:

EPD of concrete mixtures may not be comparable if they do not comply with this standard and data from this EPD. While an EPD can be used to compare concrete mixtures, the data cannot be used to compare between construction products or concrete mixtures used in different concrete products unless the data is integrated into a comprehensive LCA. For example, precast concrete, concrete masonry units and site cast concrete

all have different manufacturing processes whose impacts are attributed to different LCA stages. This precludes direct comparison between mixtures used in these different products unless all life cycle phases are included, and a functional unit is used.

Allocation:

During the production of ready-mix concrete, co-products are not introduced into the mixture designs. The product category rules for this EPD recognize fly ash, silica fume and slag as recovered materials and thus the environmental impacts allocated to these materials are limited to the treatment and transportation required to use as a concrete material input.

DECLARED AND FUNCTIONAL UNIT

Declared unit	1m ³
Mass per declared unit	2,300 kg
Functional unit	

SYSTEM BOUNDARY

This EPD covers cradle to gate with options scope with following modules; A1 (Raw material supply), A2 (Transport) and A3 (Manufacturing), A4 (Transport), A5 (Assembly) as well as C1 (Deconstruction), C2 (Transport at end-of-life), C3 (Waste processing) and C4 (Disposal). In addition, module D - benefits and loads beyond the system boundary is included.

Product stage			Assembly stage		Use stage							End of life stage				Beyond the system boundaries		
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	D	D
x	x	x	x	x	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x	x	x
Raw materials	Transport	Manufacturing	Transport	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstr./demol.	Transport	Waste processing	Disposal	Reuse	Recovery	Recycling

Modules not declared = MND. Modules not relevant = MNR.

CUT-OFF CRITERIA

All material and energy flows known or suspected to release substances into the air, water or soil in quantities that contribute significantly to any of the indicators in ISO 21930 are included. In cases where there is insufficient input data for a unit process or data gaps, the cut-off criteria used is 1% of renewable primary resources (energy), 1% of non-renewable primary resource (energy) usage, 1% of the total mass input of that unit process and 1% of environmental impacts. The total of neglected input flows per module does not exceed 5%.

DATA QUALITY AND VARIABILITY

The requirements for data quality and background data correspond with the requirements of NSF International PCR for concrete. The calculated data in this report is based on actual ready-mix concrete compositions. Manufacturer specific data is based on average data from the past 12 months.

The period over which inputs to and outputs from the system are accounted for is 100 year from the year for which the data is deemed representative.

The technology coverage reflects the physical reality for the declared ready-mix concrete product.

Used datasets are complete according to the system boundary within the limits set by the criteria for the exclusion of inputs and outputs.

To calculate the life cycle of the declared ready-mix concrete products, the software solution GaBi ts 8.5.0.79 from thinkstep AG and One Click LCA from Bionova were used. Background datasets were extracted from the GaBi and Ecoinvent databases. The last revision of the GaBi data is less than 3 years ago according to thinkstep AG. The One Click LCA data utilizes Ecoinvent version 3.6. Altogether, the data quality is considered high.

This EPD was created using the default data noted in appendix A of the NSF International PCR for concrete. The following table summarizes the overall quality assessments for the main inputs for ready-mix concrete.

Ratings: good, fair, poor

Inputs	Data Quality					
	Technology	Time	Geography	Complete	Reliability	Source
Binders						
Cement (CEM I)	good	2018	Europe	good	good	Gabi 8.5
Cement, blast furnace slag 21-35%	good	2019	Global	good	good	Ecoinvent 3.6
Hard coal fly ash	good	2017	Germany	good	good	EPD Baumineral
Blast furnace slag	good	2018	Germany	fair	good	Gabi 8.5/ASTM
Limestone	good	2017	Europe	good	good	Gabi 8.5
Silica fume	good	2017	US	fair	good	Gabi 8.5

Sands						
Market for sand	good	2019	Global	good	good	Ecoinvent 3.6
Natural sand, washed	good	2016	Europe	good	good	Gabi 8.5
Limestone powder	good	2017	Europe	good	good	Gabi 8.5
River dredge sand	fair	2016	Global	fair	good	Gabi 8.5
Aggregates						
Market for gravel, round	good	2019	Global	good	good	Ecoinvent 3.6
Recycled aggregate	good	2016	US	good	good	Gabi 8.5
Recycled glass	fair	2016	Europe	fair	good	Gabi 8.5
Lightweight aggregate/expanded	good	2016	Europe	good	good	Gabi 8.5/Ecoinvent
Recycled concrete	good	2016	US	good	good	Gabi 8.5
Admixtures						
Market for plasticizer	good	2019	Global	good	good	Ecoinvent 3.6
All other	good	2018	US/Europe	good	good	Gabi 8.5
Water						
Market for tap water	good	2019	EU	good	good	Ecoinvent 3.6
Desalinated water	fair	2018	Middle East	fair	good	Gabi 8.5
Energy						
US Electricity grid mix	good	2016	US	good	good	Gabi 8.5/US LCI
US Natural gas	good	2016	US	good	good	Gabi 8.5/US LCI
Transport						
Freight, lorry >32 tonne, euro 5	good	2019	EU	good	good	Ecoinvent 3.6
Freight train	good	2019	EU	good	good	Ecoinvent 3.6
Freight, inland waterways, barge	good	2019	EU	good	good	Ecoinvent 3.6
Freight, sea, container ship	good	2019	EU	good	good	Ecoinvent 3.6

ENVIRONMENTAL IMPACT DATA

ENVIRONMENTAL IMPACTS - EN 15804+A1, CML / ISO 21930

Impact category	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Global warming potential	kg CO2e	1,86E2	2,24E1	3,09E0	2,12E2	0E0	MND	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Depletion of stratospheric ozone	kg CFC11e	9,62E-6	3,34E-6	1,25E-7	1,31E-5	0E0	MND	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Acidification	kg SO2e	5,91E-1	1,53E-1	6,53E-3	7,51E-1	0E0	MND	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Eutrophication	kg PO4 3e	1,49E-1	4E-2	1,47E-2	2,04E-1	0E0	MND	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Photochemical ozone formation	kg C2H4e	2,2E-2	2,99E-3	2,56E-4	2,53E-2	0E0	MND	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Abiotic depletion of non-fossil	kg Sbe	1,84E-3	2,04E-4	8,8E-6	2,05E-3	0E0	MND	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0
Abiotic depletion of fossil	MJ	1,27E3	2,94E2	4,17E1	1,61E3	0E0	MND	MND	MND	MND	MND	MND	MND	MND	0E0	0E0	0E0	0E0	0E0

BIBLIOGRAPHY

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ISO 14040:2006 Environmental management. Life cycle assessment. Principles and frameworks.

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

Ecoinvent database v3.6 and One Click LCA database.

EN 15804:2012+A2:2019 Sustainability in construction works – Environmental product declarations – Core rules for the product category of construction products.

RTS PCR EN 15804:2019 RTS PCR in line with EN 15804+A2. Published by the Building Information Foundation RTS 1.6.2020.

GaBi ts 8.5: Software and GaBi database, LBP, University of Stuttgart and thinkstep AG, 2018

ASTM C94, C94 M Standard Specification for Ready-mixed Concrete

CSI Specification Section 03 30 00 Cast-in-Place Concrete

EN 206:2013, Beton - Festlegung, Eigenschaften, Herstellung und Konformität

ABOUT THE MANUFACTURER

Concrete is a versatile building material where opportunities for use are unlimited. At Waibel, we supply various concrete solutions through our 10 ready-mix concrete plants in Germany and abroad. Our factory group covers the entire depth of production for ready-mix concrete with our gravel pits relying on the sustainable extraction of raw materials. Whether a large-scale construction site or an addition to a private house, we can respond to your needs.

EPD AUTHOR AND CONTRIBUTORS

Manufacturer	Waibel Beton Darmstadt GmbH & Co. KG
EPD preparer	Annika Bantle Master Builders Solutions Deutschland GmbH annika.bantle@mbcc-group.com
EPD verifier	
EPD program operator	
Background data	This EPD is based on Ecoinvent 3.6 (cut-off) and One Click LCA databases.
LCA software	The LCA and EPD have been created using One Click LCA Pre-Verified EPD Generator for Cementious Products

