ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804+A2

Beyer Baustoffhandelsgesellsch. mbH – WU-Beton C30/37 XC4, XD1, XF1, XM1, XA1; Dmax=32mm

Owner of the declaration
Beyer Baustoffhandelsgesellsch. mbH
Robert-Koch-Str. 32
55129 Mainz - Hechtsheim
Germany

Product
WU-Beton C30/37 XC4, XD1, XF1, XM1, XA1; Dmax=32mm

Declared product / Declared unit
1 m³ of WU-Beton C30/37 XC4, XD1, XF1, XM1, XA1; Dmax=32mm

This declaration is based on Product Category Rules
EN 15804:2012 + A2:2019,
NPCR 020 PART B for concrete and concrete elements (v3.0)

Program operator:
EPD-Norge
Majorstuen P.O. Box 5250
N-0303 Oslo
Norway

Declaration number:
NEPD-7701-7040-2

Registration number:
NEPD-7701-7040-2

Issue date
02.10.2024

Valid to
02.10.2029

EPD Software
Emidat EPD Tool v1.0.0

General Information

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Program Operator
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EN 15804:2012 + A2:2019,
NPCR 020 PART B for concrete and concrete elements (v3.0)

Statements
The owner of the declaration shall be liable for the underlying information and evidence. EPD Norway shall not be liable with respect to manufacturer, life cycle assessment data and evidences.

Declared unit
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General information on verification of EPD from EPD tools
Independent verification of data, other environmental information and the declaration according to ISO 14025:2010, § 8.1.3 and § 8.1.4.
Verification of each EPD is made according to EPD-Norway's guidelines for verification and approval requiring that tools are i) integrated into the company's environmental management system, ii) the procedures for use of the EPD tool are approved by EPD-Norway, and iii) the process is reviewed annually by an independent third party verifier. See Appendix G of EPD-Norway's General Programme Instructions for further information on EPD tools.

Verification of EPD tool
Charlotte Merlin, FORCE Technology
(no signature required)

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Place of production
Mainz, Germany

Management system
-

Organisation no
HRB 2891

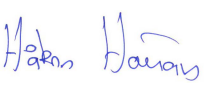
Issue date
02.10.2024

Valid to
02.10.2029

Year of study
2023

Comparability
EPDs of construction products may not be comparable if they do not comply with EN 15804 and are not seen in a building context. EPD data may not be comparable if the datasets used are not developed in accordance with EN 15804 and if the background systems are not based on the same database (including primary and secondary data).

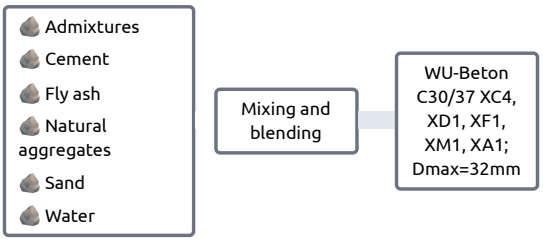
Development and verification of EPD
The declaration was created using the Emidat EPD tool v1.0, developed by Emidat GmbH. The EPD tool is integrated in the company's management system, and has been approved by EPD Norway.
Developer of EPD: Oliver Juli
Reviewer of company-specific input data and EPD: Jeanette Müller

Approved

Håkon Hauan, CEO EPD-Norge

Product

Product description

Concrete is a building material made up of several components, including cement, water, sand, gravel, and air. Ready-mix concrete is manufactured in a batch plant in a controlled environment, using precise mix designs (with the addition of other cementitious materials or chemical admixtures that improve the properties of the concrete), ensuring consistency in quality, strength, and composition. This consistency leads to predictable performance in construction projects. Ready-mix concrete is then delivered to the construction site in an unhardened state, ready to use, eliminating the need for on-site mixing. This saves time in labor, equipment setup, and material handling, speeding up the construction process. The product is produced according to DIN EN 206. Testing was conducted according to EN 12350 and EN 12390. Performance data of the product with respect to its characteristics in accordance with the relevant technical provision (no CE-marking).



The most common man-made substance in the world is concrete. Regardless of the magnitude of the construction, it is a necessary component of roads, buildings, bridges, dams, pavements, pipelines, sewers, and other structures. It is made up of naturally occurring aggregates with varying granulometries (sand, fine gravel, and gravel) joined by hydrated cement paste. To improve particular qualities of the fresh or hardened concrete, such as workability, durability, or early and final strength, chemical admixtures can also be used. After manufacture, concrete is workable enough to be transported, poured, pumped, put in place, and compacted at the project site, where it gradually solidifies and gains strength.

Product specification

Name of ingredient	Share of total weight	Country of origin
Admixtures	0 - 2 %	Germany
Cement	10 - 25 %	Germany
Fly ash	2 - 10 %	Germany
Natural aggregates	50 - 80 %	Germany
Sand	10 - 25 %	Germany
Water	2 - 10 %	Germany

Technical data

	Unit	Value
Compressive Strength (Cylinder)	N / mm²	35.0
Gross Density	kg / m³	2315.0

Market

Germany

Reference service life

50 years

LCA: Calculation rules

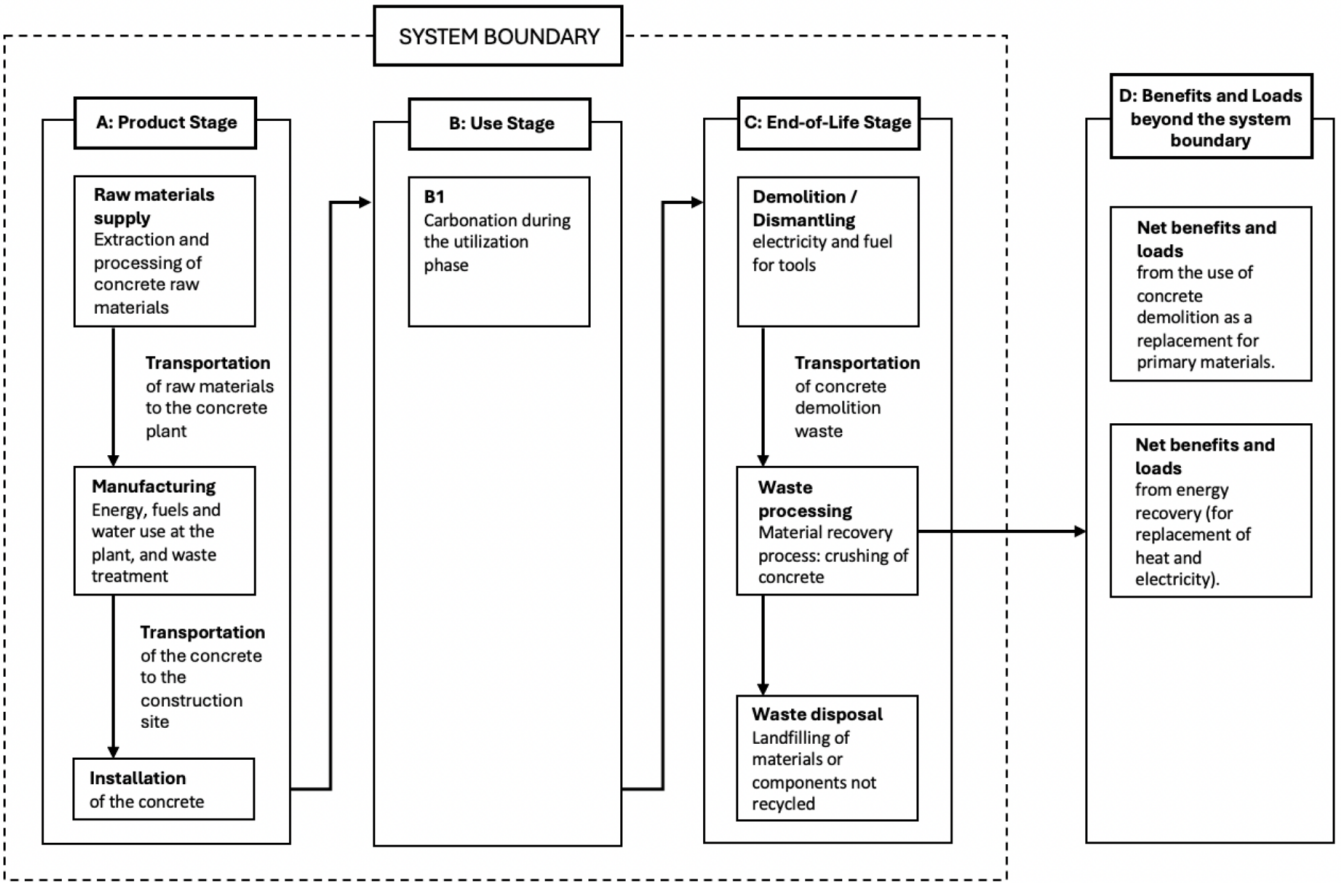
Declared unit

1 m³ of WU-Beton C30/37 XC4, XD1, XF1, XM1, XA1; Dmax=32mm

Reference service life

50 years

System boundary



Data quality

The Emidat EPD Tool v1.0.0 was used for LCA modeling and calculation. Background data was used from ecoinvent database v3.10.

System boundaries (X=included, MND=module not declared)

	Production			Installation		Use stage							End-of-Life				Next product system
	Raw material supply	Transport	Manufacturing	Transport	Installation Process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Demolition	Transport	Waste Processing	Disposal	Benefits and loads beyond the system boundary
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	x	x	x	x	x	x	MND	MND	MND	MND	MND	MND	x	x	x	x	x
Geography			DE	DE	DE	DE	MND	MND	MND	MND	MND	MND	DE	DE	DE	DE	DE

For the geographies modeled in A1 and A2, refer to *Product specification*.

Type of EPD: cradle to gate with options, modules C1-C4 and module D (A1-A3, C, D, additional modules A4, A5, and B1)

Stage of Material Production and Construction

Module A1: Extraction and processing of raw materials

Module A2: Transportation of raw materials to the plant

Module A3: Concrete production at the plant and waste treatment

Module A4: Transportation to the construction site

Module A5: Includes processes associated with concrete installation (e.g., pumping on the construction site), as well as the production, transportation, and treatment of unused concrete

Use Stage

Module B1: Carbonation during the utilization phase

Disposal Stage

Module C1: Demolition/Dismantling

Module C2: Transportation of concrete demolition waste for processing

Module C3: Sorting of waste components and recycling of concrete

Module C4: Disposal of concrete

Credits and burdens outside the system boundaries

Module D: Credits and burdens from the use of demolished concrete as a replacement for primary materials

Cut-off criteria

Environmental impacts of the following processes are considered to be negligible: Production and use of formwork and falsework for the installation of concrete, Materials used for the curing of concrete (e.g. plastics, aluminum).

Allocation

The allocation is made in accordance with the provisions of EN 15804. Production-process-level elementary flows (energy and fuels, ancillary materials, and waste) are allocated to the declared unit, using the total production of the production process for the reference year.

LCA: Scenarios and additional technical information

The following information describe the scenarios in the different modules of the EPD.

Transport to the building site (A4)	Value	Unit
Transported mass	2315.00	kg
Fuel consumption	5.17	L / 100km
Average distance from manufacturer to construction site	13.80	km
Transport mode	truck	
Gross density of products transported	2315.00	kg / m³

Formwork and Falsework each contribute less than 1% of the total product CO2 emissions, and are therefore neglected under cut-off rules. (Kaethner, Burridge, 2012). Other sources: Concrete waste: Adams & Hobbs (2023). Electricity, Diesel: Ecoinvent benchmark average.

Installation into the building (A5)	Value	Unit
Formwork	-	kg
Falsework	-	kg
Concrete waste (installation losses, typical wastage rate on site)	1.50	%
Distance to waste landfill facility (for installation losses)	50	km
Amount of electricity to pour 1 m3 of concrete	3	kWh
Amount of diesel to pour 1 m3 of concrete	60	MJ
Water	0.29	m³
Wastewater treatment	0.29	m³

Calculation of carbonization according to EN 16757. k-factor results from the concrete's compressive strength and its application. The cement absorption factor (maximum theoretical CO2 uptake) depends on the average clinker content in cement. The correction factor results from cement substitutes in the recipe.

Use of the installed product (B1)	Value	Unit
Reference use period	50	years
Application	Building, outside, exposed to rain	
Degree of carbonation (Dc)	0.85	-
Cement absorption factor	0.18	kg CO_2 / kg Cement
k-factor	1.60	mm / year^0.5
Correction factor	1.05	-
Surface area of concrete	5	m²

Specific diesel consumption for a building demolition according to 'Model for Life Cycle Assessment of buildings' (Gervasio, H. and Dimova, S.). Carbonation during waste processing is not considered. Recycling rate for concrete of 93% reflects the

modeled country. Source: Mineralische Bauabfälle Monitoring 2018 Bericht zum Aufkommen und zum Verbleib mineralischer Bauabfälle im Jahr 2018 (https://kreislaufwirtschaft-bau.de/).

End of life (C1-C4)	Value	Unit
Material for recycling (total)	2152.95	kg
Distance to waste recycling facility	50	km
Material for landfill (total)	162.05	kg
Distance to waste landfill facility	50	km
Concrete to recycling	2152.95	kg
Diesel required to demolish 1 kg of concrete	0.07	MJ / kg

Calculation of benefits and loads per EN 15804+A2.

Reuse, recovery and/or recycling potentials (D)	Value	Unit
Amount of recycled material that system takes in	0	kg
Avoided gravel production	2152.95	kg

LCA: Results

Core environmental impact indicators

Indicator	Unit	A1-3	A4	A5	B1	C1	C2	C3	C4	D
GWP-total	kg CO_2-eq.	184.53	3.31	10.76	-2.73	16.24	12.00	13.20	1.01	-21.61
GWP-fossil	kg CO_2-eq.	184.29	3.31	10.61	-2.73	16.24	11.99	13.20	1.01	-21.56
GWP-biogenic	kg CO_2-eq.	0.21	1.7e-03	0.15	0	1.6e-03	6.0e-03	1.3e-03	1.0e-04	-0.02
GWP-luluc	kg CO_2-eq.	0.03	1.2e-03	4.0e-03	0	1.4e-03	4.3e-03	1.1e-03	5.3e-04	-0.02
ODP	kg CFC-11-Eq	3.6e-06	6.9e-08	1.7e-07	0	2.5e-07	2.5e-07	2.0e-07	2.9e-08	-1.7e-07
AP	mol H+-Eq	0.45	7.8e-03	0.07	0	0.15	0.03	0.12	7.2e-03	-0.13
EP-freshwater	kg P-Eq	0.04	2.3e-04	2.6e-03	0	4.7e-04	8.4e-04	3.8e-04	8.4e-05	-6.6e-03
EP-marine	kg N-Eq	0.04	2.0e-03	0.03	0	0.07	7.4e-03	0.06	2.7e-03	-0.03
EP-terrestrial	mol N-Eq	1.25	0.02	0.31	0	0.74	0.08	0.60	0.03	-0.38
POCP	kg NMVOC-Eq	0.36	0.01	0.09	0	0.22	0.05	0.18	0.01	-0.10
ADPE	kg Sb-Eq	1.6e-04	9.5e-06	8.9e-06	0	5.8e-06	3.4e-05	4.7e-06	1.6e-06	-1.2e-04
ADPF	MJ, net calorific value	850.03	49.66	122.05	0	212.36	179.94	172.66	24.85	-258.73
WDP	m^3 world Eq deprived	66.84	0.25	1.55	0	0.52	0.90	0.42	0.07	-32.26

GWP-total: Global Warming Potential - total **GWP-fossil**: Global warming potential - fossil **GWP-biogenic**: Global Warming Potential - biogenic **GWP-luluc**: Global Warming Potential - luluc **ODP**: Depletion potential of the stratospheric ozone layer **AP**: Acidification potential, Accumulated Exceedance **EP-freshwater**: Eutrophication potential - freshwater **EP-marine**: Eutrophication potential - marine **EP-terrestrial**: Eutrophication potential - terrestrial **POCP**: Photochemical Ozone Creation Potential **ADPE**: Abiotic depletion potential - non-fossil resources **ADPF**: Abiotic depletion potential - fossil resources **WDP**: Water (user) deprivation potential

The indicated Global Warming Potential (GWP) values are considered gross values. They include impacts from the combustion of waste-derived fuels and biomass. LCIA data read from ILCD+EPD files are interpreted as gross values.
Net values exclude impacts from the combustion of waste-derived fuels and biomass. For A1-3, net GWP-fossil is 147.39 kg CO_2-eq. , and net GWP-biogenic is 0.21 kg CO_2-eq. .

Additional indicators

Indicator	Unit	A1-3	A4	A5	B1	C1	C2	C3	C4	D
PM	disease incidence	4.1e-06	3.2e-07	1.7e-06	0	4.2e-06	1.2e-06	1.9e-05	1.6e-07	-2.0e-06
IRP	kBq U235-Eq	538.22	0.06	8.46	0	0.10	0.22	0.08	0.02	-1.82
ETP-fw	CTUe	102.33	11.77	20.19	0	30.09	42.64	24.47	3.40	-117.96
HTP-c	CTUh	1.8e-05	2.1e-08	3.0e-07	0	6.3e-08	7.7e-08	5.2e-08	4.6e-09	-2.0e-07
HTP-nc	CTUh	1.2e-05	3.3e-08	2.1e-07	0	2.9e-08	1.2e-07	2.3e-08	4.5e-09	-1.8e-07
SQP	dimensionless	1050.96	49.95	39.21	0	14.88	180.96	12.10	48.89	-242.19

PM: Potential incidence of disease due to PM emissions **IRP**: Potential Human exposure efficiency relative to U235 **ETP-fw**: Potential Comparative Toxic Unit for ecosystems **HTP-c**: Potential Comparative Toxic Unit for humans - cancer effects **HTP-nc**: Potential Comparative Toxic Unit for humans - non-cancer effects **SQP**: Potential Soil quality index

IRP: This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.
ETP-fw, **HTP-c**, **HTP-nc** and **SQP**: The results of these environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with these indicators.

Use of resources

Indicator	Unit	A1-3	A4	A5	B1	C1	C2	C3	C4	D
PERE	MJ	151.67	0.79	8.08	0	1.30	2.85	1.06	0.23	-23.45
PERM	MJ	0	0	0	0	0	0	0	0	0
PERT	MJ	151.67	0.79	8.08	0	1.30	2.85	1.06	0.23	-23.45
PENRE	MJ	840.96	49.67	121.92	0	212.36	179.95	172.67	24.85	-258.74
PENRM	MJ	9.08	0	0.14	0	0	0	-8.44	0	0
PENRT	MJ	850.04	49.67	122.05	0	212.36	179.95	164.22	24.85	-258.74
SM	kg	50.00	0	0.75	0	0	0	0	0	2152.95
RSF	MJ	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0
FW	m³	4.18	7.2e-03	0.08	0	0.01	0.03	0.01	0.03	-0.77

PERE: Primary energy resources - renewable: use as energy carrier **PERM**: Primary energy resources - renewable: used as raw materials **PERT**: Primary energy resources - renewable: total **PENRE**: Primary energy resources - non-renewable: use as energy carrier **PENRM**: Primary energy resources - non-renewable: used as raw materials **PENRT**: Primary energy resources - non-renewable: total **SM**: Use of secondary material **RSF**: Renewable secondary fuels **NRSF**: Non-renewable secondary fuels **FW**: Net use of fresh water

Waste flows

Indicator	Unit	A1-3	A4	A5	B1	C1	C2	C3	C4	D
HWD	kg	0.94	0.07	0.18	0	0.24	0.26	0.19	0.03	-2.02
NHWD	kg	30.15	1.45	330.51	0	3.24	5.24	2.64	162.68	-36.07
RWD	kg	ND	1.5e-05	ND	0	2.3e-05	5.4e-05	1.9e-05	3.9e-06	-4.4e-04

HWD: Hazardous waste disposed **NHWD**: Non harzardous waste disposed **RWD**: Radioactive waste disposed

Output flows

Indicator	Unit	A1-3	A4	A5	B1	C1	C2	C3	C4	D
CRU	kg	0	0	0	0	0	0	0	0	0
MFR	kg	18.73	0	0.28	0	0	0	2152.95	0	0
MER	kg	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	0	0	0	0	0	0	0
EET	MJ	0	0	0	0	0	0	0	0	0

CRU: Components for re-use **MFR**: Materials for recycling **MER**: Materials for energy recovery **EEE**: Exported electrical energy **EET**: Exported thermal energy

Name	Value	Unit
Biogenic carbon content in product	0	kg C
Biogenic carbon content in accompanying packaging	0	kg C

Additional requirements

Greenhouse gas emissions from the use of electricity in the manufacturing phase

GoOs were not used and double quantification is not included.

Electricity	Unit	Value
Electricity from grid	kg CO_2-eq. / kWh	0.47

Additional environmental information

Additional environmental impact indicators required in NPCR Part A for construction products

Indicator	Unit	A1-3	A4	A5	B1	C1	C2	C3	C4	D
GWP-IOBC	kg CO_2-eq.	ND	3.31	ND	-2.73	16.24	11.99	13.20	1.01	-21.60

GWP-IOBC: Global Warming Potential - Instantaneous oxidation of biogenic carbon

Bibliography

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EN 15804:2012+A2:2019	Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
DIN CENTR 15941:2010-11	Sustainability of construction works - Environmental product declarations - Methodology for selection and use of generic data
DIN EN 15942:2022-04	Sustainability of construction works - Environmental product declarations - Communication format business-to-business
ISO 21930:2017-07	Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services
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PCR	NPCR 020 PART B for concrete and concrete elements (v3.0)
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