Environmental Product Declaration

In accordance with ISO 14025 and EN 15804 for:

Solid precast concrete, pre-stressed, slab elements

from

Bohus Betong

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Programme information

Programme:	The International EPD® System
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CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2012:01, Construction products and construction services, (EN 15804:A1) v.2.33.
PCR review was conducted by: The Technical Committee of the International EPD® System. The review panel may be contacted via info@environdec.com.
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
External independent verifier: Håkan Stripple at *IVL Swedish Environmental Research Institute* E-mail: hakan.stripple@ivl.se *In case of recognised individual verifiers:* Approved by: The International EPD® System
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EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Bohus Betong AB
Svarteborg 27
455 97 Dingle
The EPD owner has the sole ownership

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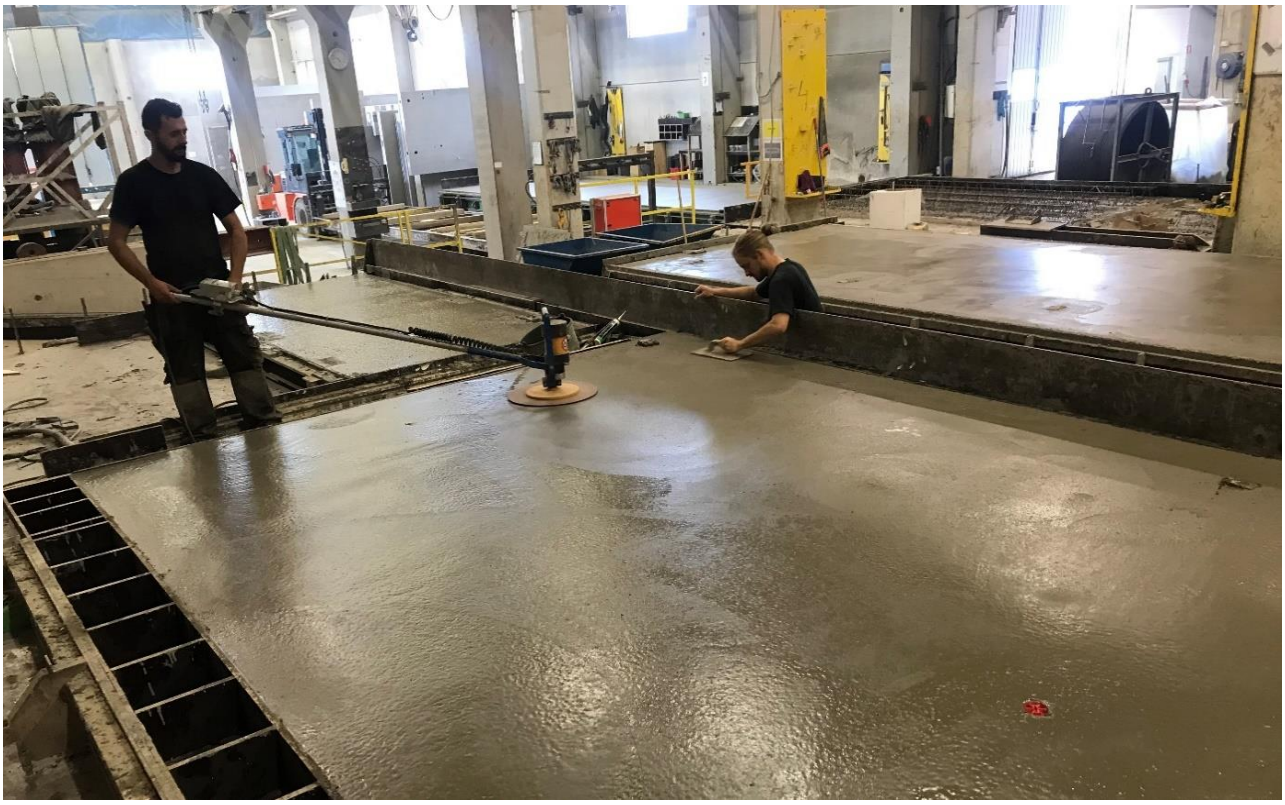
Description of the organisation: Bohus Betong AB is an independent privately-owned company established in 1925. With the business idea to “design, manufacture, deliver and assemble complete concrete structures for housing, agricultural buildings, and offices”, the company offers a wide range of precast concrete products. The products are currently used in various buildings on the Swedish market. Bohus Betong has about 60 employees who are motivated to make high quality products to their customers every day.

Product-related or management system-related certifications: Products from Bohus Betong AB are certified by Nordcert according to EN 305 and other standards. The certification secures that all products fulfil their technical requirements and that they are manufactured according to current building norms.

Name and location of production sites: Bohus Betong AB has two production sites, one located in Dingle and one in Jönköping, Sweden.



Product information

Product name: Solid precast concrete, pre-stressed, slab elements.

Product description: Solid slab elements are used in different varieties and reinforced with steel bars and prestressed steel wires. The elements are customised for individual projects and are produced after requirements specified by the customer. This can include specifications for recesses and other details for electrical wires, drains and ventilation pipes. In the first part of the process, the product is optimized in terms of the lifecycle for the building.

All raw materials are transported to the factory. Cement is the ingredient in concrete that affects the environment the most and therefore, Bohus Betong tries to minimize the cement content in the concrete without reducing the quality of the products. When cement is produced at the cement factory, a calcination process is taking place. During this process, carbon dioxide is released from the limestone. Concrete recaptures a part of this carbon dioxide in its use phase and in its end-of-life stage. The recapturing of carbon dioxide in the use phase is included in this EPD. Reinforcing steel also has a significant environmental impact and optimizing the content of reinforcement is therefore prioritized. The reinforcement is usually cut and bended in Bohus Betong's factories.

Concrete is produced by putting aggregate, cement, water, and admixtures in a concrete mixer. After mixing, the liquid concrete is poured into a mould and the surface is prepared. Moulds for the elements and recesses are normally made of wood. Sometimes, when there is a large number of similar moulds, they are produced in steel. After a night in the moulds, the concrete has hardened and the mould is removed. After this, the element is inspected. Finally, the slab element is stored until delivery.

The solid slab elements are registered and assessed in Byggvarubedömningen, and in SundaHus.

More information can be found at the website www.bohusbetong.se.

Geografical scope: (Sweden) Solid precast concrete, pre-stressed, slab elements are manufactured at the production site in Jönköping and in Dingle, Sweden.

UN CPC code: 375

LCA information

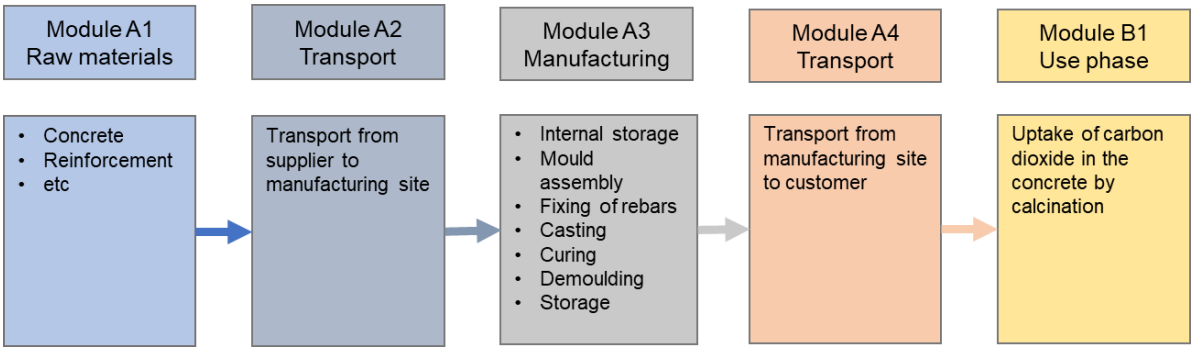
Declared unit: 1 metric tonne of solid precast concrete, pre-stressed, slab elements.

Reference service life: The expected service life of the product is 50 years.[1]

Time representativeness: Data is representative for production year 2020. For energy and transports, generic industry data from Ecoinvent and Agri-footprint has been used. Specific EPD data has been used for concrete and reinforcement.

Database(s) and LCA software used: Ecoinvent 3.6, Agri-footprint and SimaPro 9.1.1.1.

Description of system boundaries: This is a cradle to gate EPD with options, A4 and B1 is added.



A1: Extraction and processing of raw materials, generation of electricity and generation of waste in the production.
A2: Transports from suppliers to Bohus Betong production site.
A3: Manufacturing of the product at Bohus Betong production site.
A4: Transport from Bohus Betong production site to the customer.
B1: Carbonation of the solid precast concrete, pre-stressed, slab element during its use phase.

The use phase of the products, B1, is included in the study to cover the uptake of carbon dioxide in concrete by carbonation. It is the net emissions from the cradle-to-gate activities that has a real impact on climate change. From a national perspective, the concrete stock takes up CO_2 at almost the same rate as the emission occurs from the calcination. By including the uptake of carbon dioxide in the use phase, this “cradle-to-gate with options study” provides a more coherent picture of the real climate impact from the product.

Estimates and assumptions: Heat, electricity and other energy use, as well as waste in the production are calculated as a weighted average per produced tonne of all products using yearly production data and rate for 2020. No assumptions made.

There are variations in the mix of materials (concrete and reinforcement) in the concrete product. Material percentages in the content information are averages.

Around 86 % of the product precast concrete, pre-stressed, slab elements are produced in Jönköping and the remaining 14 % at Dingle production site. In the calculations for this EPD, 100 % of the production is assumed to have been carried out in Jönköping.

[1] https://www.svenskbetong.se/bygga-med-betong/bygga-med-prefab/miljo-och-hallbarhet/livslangd-for-byggnader

The variation in material composition for different mixes and the related environmental impact is within +/- 10 % compared to the given average in this EPD.

The distance to customers used in A4 is an average for Bohus Betongs customers, it is estimated to be 102 km by truck.

Cut off criteria: All major materials, production energy use and waste are included. Materials less than 1 % weight in the concrete product are not taken into account.

Data quality: The data quality can be described as fair for waste estimations and transports and good for other data. The primary data collection has been done thoroughly and all relevant flows are considered.

Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation:

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	x	x	x	x	ND*	x	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	EU	EU	SE	SE	-	SE	-	-	-	-	-	-	-	-	-	-	-
Specific data used	About 40 %					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	within +/- 10 % compared to the given average in this EPD					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	<10 %					-	-	-	-	-	-	-	-	-	-		-

*Not declared.

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Renewable material, weight-%
Reinforcement	6	4	0
Concrete	994	0	0
TOTAL	1 000	0	0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	
TOTAL*	0	0	

*No packaging materials.

Dangerous substances from the candidate list of SVHC for Authorisation	EC No.	CAS No.	Weight-% per functional or declared unit
TOTAL*	-	-	0

*No dangerous substances from the candidate list of SVHC for Authorisation.

Environmental Information

Potential environmental impact – mandatory indicators according to EN 15804

Results per tonne solid precast concrete, pre-stressed, slab elements							
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot.A1-A3**	**A4**	**B1**
Global warming potential (GWP)	kg CO_2 eq.	1.35E+02	6.98E-01	0.00E+00	1.36E+02	1.03E-02	-2.93E+00*
Depletion potential of the stratospheric ozone layer, (ODP)	kg CFC-11 eq.	3.47E-06	9.80E-08	0.00E+00	3.57E-06	2.10E-11	0.00E+00
Acidification potential (AP)	kg SO_2 eq.	1.54E-01	2.54E-03	0.00E+00	1.56E-01	4.33E-05	0.00E+00
Eutrophication potential (EP)	kg PO_4^{3-} eq.	5.91E-02	5.98E-04	0.00E+00	5.97E-02	9.90E-06	0.00E+00
Formation potential of tropospheric ozone (POCP)	kg C_2H_4 eq.	1.79E-02	9.19E-05	0.00E+00	1.80E-02	2.12E-06	0.00E+00
Abiotic depletion potential – Elements	kg Sb eq.	1.24E-04	9.40E-06	0.00E+00	1.33E-04	4.14E-10	0.00E+00
Abiotic depletion potential – Fossil resources	MJ, net calorific value	4.11E+02	1.04E+01	0.00E+00	4.21E+02	1.46E-01	0.00E+00

** Only the carbonation of the product is considered in the use phase as it is strongly related to the calcination in A1 (net CO_2 emission) and the CO_2 uptake is calculated for 50 years.*

Use of resources

Results per tonne solid precast concrete, pre-stressed, slab elements								
Indicator		**Unit**	**A1**	**A2**	**A3**	**Tot.A1-A3**	**A4**	**B1**
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	2.30E+02	2.86E-01	0.00E+00	2.30E+02	1.96E-04	0.00E+00
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	2.30E+02	2.01E+01	0.00E+00	2.50E+02	1.96E-04	0.00E+00
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	5.97E+02	1.07E+01	0.00E+00	6.07E+02	1.56E-01	0.00E+00
	Used as raw materials	MJ, net calorific value	1.54E+01	0.00E+00	0.00E+00	1.54E+01	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	6.12E+02	1.07E+01	0.00E+00	6.23E+02	1.56E-01	0.00E+00
Secondary material		kg	1.39E+01	0.00E+00	0.00E+00	1.39E+01	0.00E+00	0.00E+00
Renewable secondary fuels		MJ, net calorific value	8.09E+01	0.00E+00	0.00E+00	8.09E+01	0.00E+00	0.00E+00
Non-renewable secondary fuels		MJ, net calorific value	1.17E+02	0.00E+00	0.00E+00	1.17E+02	0.00E+00	0.00E+00
Net use of fresh water		m^3	3.45E+00	1.45E-02	0.00E+00	3.46E+00	3.99E-05	0.00E+00

Waste production and output flows

Waste production

Results per tonne solid precast concrete, pre-stressed, slab elements							
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot.A1-A3**	**A4**	**B1**
Hazardous waste disposed	kg	3.69E-03	8.52E-06	0.00E+00	3.70E-03	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	1.00E+00	2.94E-02	0.00E+00	1.03E+00	1.29E-08	0.00E+00
Radioactive waste disposed	kg	3.31E-03	1.44E-05	0.00E+00	3.32E-03	0.00E+00	0.00E+00

Output flows

Results per tonne solid precast concrete, pre-stressed, slab elements							
Indicator	**Unit**	**A1**	**A2**	**A3**	**Tot.A1-A3**	**A4**	**B1**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	1.31E-04	0.00E+00	2.46E-01	2.46E-01	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	4.59E+00	4.59E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, thermal	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Interpretation of LCA results

Environmental impact for 1 tonne of precast product is mainly caused by module A1, see Figure 1**.** Module A2 contributes marginally to the parameters, and the contribution from A3 and A4 is almost insignificant. B1 has a marginal positive impact on the global warming potential, which is shown as a negative bar in the figure.

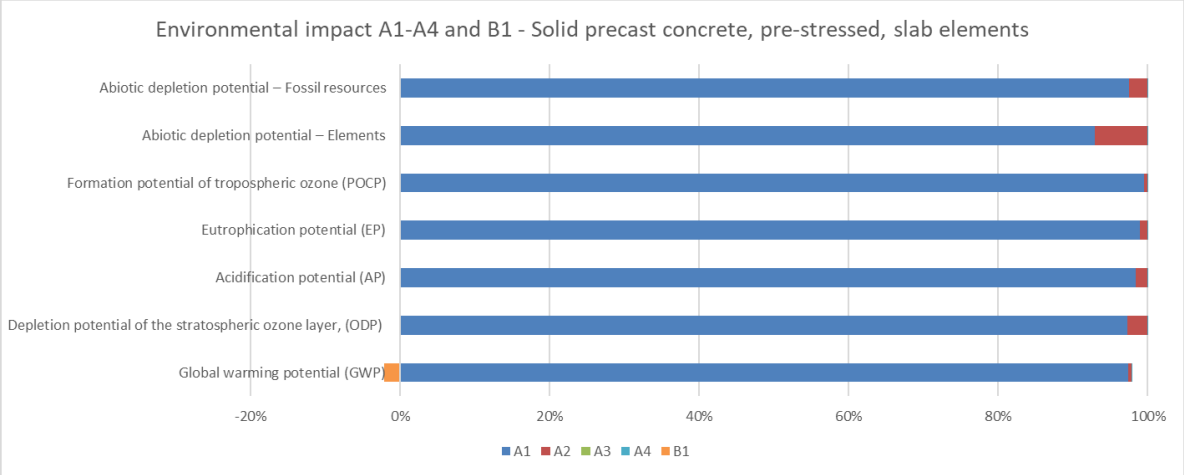


Figure 1. Figure of the contributions from the environmental impacts in A1-A4 and B1 for solid precast concrete, pre-stressed, slab elements.

Module A1 consumes the majority of resources and produces the majority of the waste compared to Module A2-A4.

Within module A1, the extraction and processing of concrete used in the product is the main contributor to the environmental impact, see Figure 2. Impact in A1 is further increases by produced waste mainly in the form of reinforcement and wood. Impact from other waste in the process is insignificant. The water used in the production of the products is drawn from the groundwater. In the area where the manufacturing takes place, the water supply is deemed as good and water scarcity is not an issue.

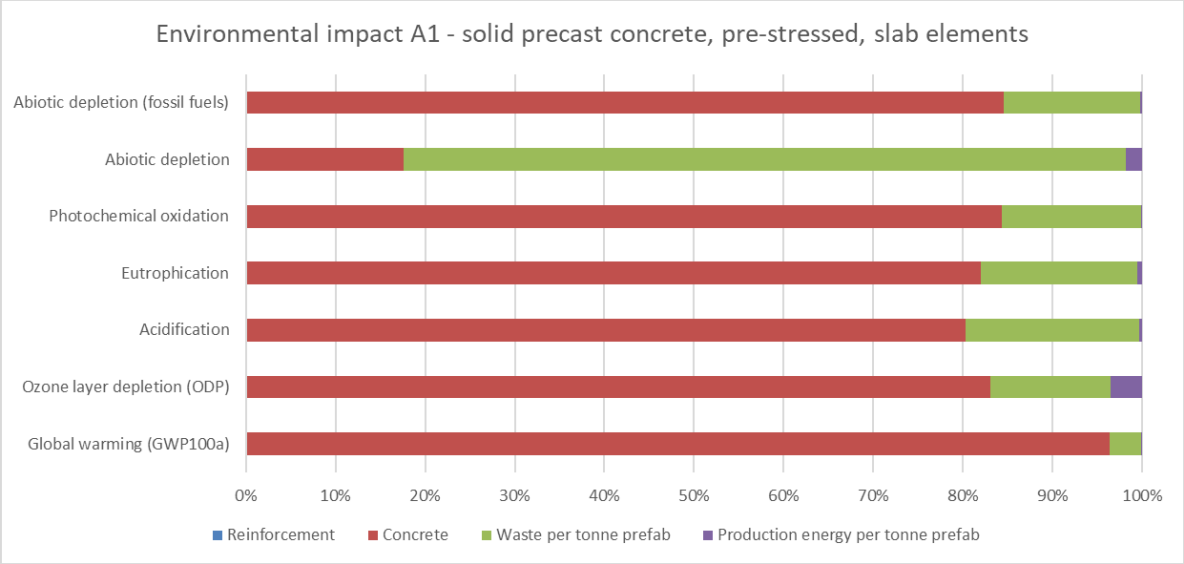


Figure 2. Figure of the contributions from the environmental impacts in A1 for solid precast concrete, pre-stressed, slab elements.

Additional information

The calculations of B1 have been done according to the standard SS-EN 16757:2017 – Sustainability of construction works – Environmental product declarations – Product Category Rules for concrete and concrete elements.

References

General Programme Instructions of the International EPD® System. Version 3.01.

SS-EN 15804:2012 Sustainability of construction works – Environmental product declarations – Product Category Rules for concrete and concrete elements

PCR 2012:01. Construction products and construction services. V2.3
PCR 2012:01-Sub-PCR-G

SS-EN 16757:2017 Sustainability of construction works – Environmental product declarations – product Category Rules for concrete and concrete elements

Ecoinvent 3.6 database, http://www.ecoinvent.org/
Agri-footprint database, https://www.agri-footprint.com/

LCA software SimaPro Analyst 9.1.1.1

Material Safety Data sheets for:

- Superplasticizer masterglenium Ace 435
- Air-entraining admixtures Masterair 100
- Dynamon SX-A170

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