Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Solid concrete wall

from

Gunnar Prefab AB

Programme:	The International EPD® System, www.environdec.com
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com

General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): *PCR 2019:14 VERSION 1.2.4 (2022-09-07), C-PCR-003 (2019-12-20) UN CPC code 37550*
PCR review was conducted by: *The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact.*
Life Cycle Assessment (LCA)
LCA accountability: Nadia Al-Ayish, IVL Swedish Environmental Research Institute
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☒ EPD verification by individual verifier Third-party verifier: Vito D'Incognito, Take Care International,    Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation

factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025

Company information

Owner of the EPD:
Gunnar Prefab AB

Contact:
Daniel Kivistö

Description of the organisation:
Gunnar Prefab AB is a family business founded in 1995, by Gunnar Englund, as a subsidiary of Gunnar Englund Byggare AB, which then owned the concrete station in Rättvik.
Gunnar Prefab develop, manufacture, and deliver prefabricated concrete products throughout Sweden.
The company started in 1995 by manufacturing the concrete horse and concrete piles.
In 1999, Gunnar prefab started manufacturing and supplying their own product GPLINK a, a concrete barrier so-called tongue closure that can be used as both temporary and permanent protection after roads and at workplaces.
They work with continuous development of their products and can manufacture most of what is requested.

Product-related or management system-related certifications:
Certified by Nordcert

Name and location of production site(s):
Rättvik, Sweden

Product information

Product name:
Solid concrete wall

Product identification:
EN206, SS-EN 13369, EN 14992

Product description:
Solid walls are used as load-bearing interior walls in buildings. The concrete wall can be ordered in different lengths, heights and thicknesses. It can be can serially manufactured and also form-casted in single editions as well as supplied with electrical installations included and cutouts for doors and windows. An indoor concrete construction is not subjected to any natural degradation mechanisms and have therefore a long service life. It also has a low repair, replacement and maintenance requirements during use stage. With prefabricated concrete elements, a modern building's requirements for sound insulation, fire protection and moisture safety are met. Concrete is recyclable and may be used to produce new concrete as aggregates or as a filling material for roads etc.

The concrete is bought from a ready-mix factory and cast in forms at Gunnar Prefabs factory.

Technical information:

Specification	Solid concrete wall
Strength class for concrete	C35/45
Exposure class	XC0, XC1
w/c-ratio	0.40
Technical standard followed	EN206, SS-EN 13369, EN 14992
Element thickness	200 mm
Weight	~500 kg/m^2

UN CPC code:
37550 – Prefabricated structural components for building or civil engineering, of cement, concrete or artificial stone.

Geographical scope:
Sweden (All declared modules)

LCA information

Functional unit / declared unit:
1 tonne of precast concrete wall

Reference service life:
The product is designed for a service life of 50 years. However, indoor concrete in dry environment, e.g., exposure class X0, XC1, is not subjected to corrosion or frost attack. The required service life is met by applying the design criteria in Eurocode.

Time representativeness:
2021

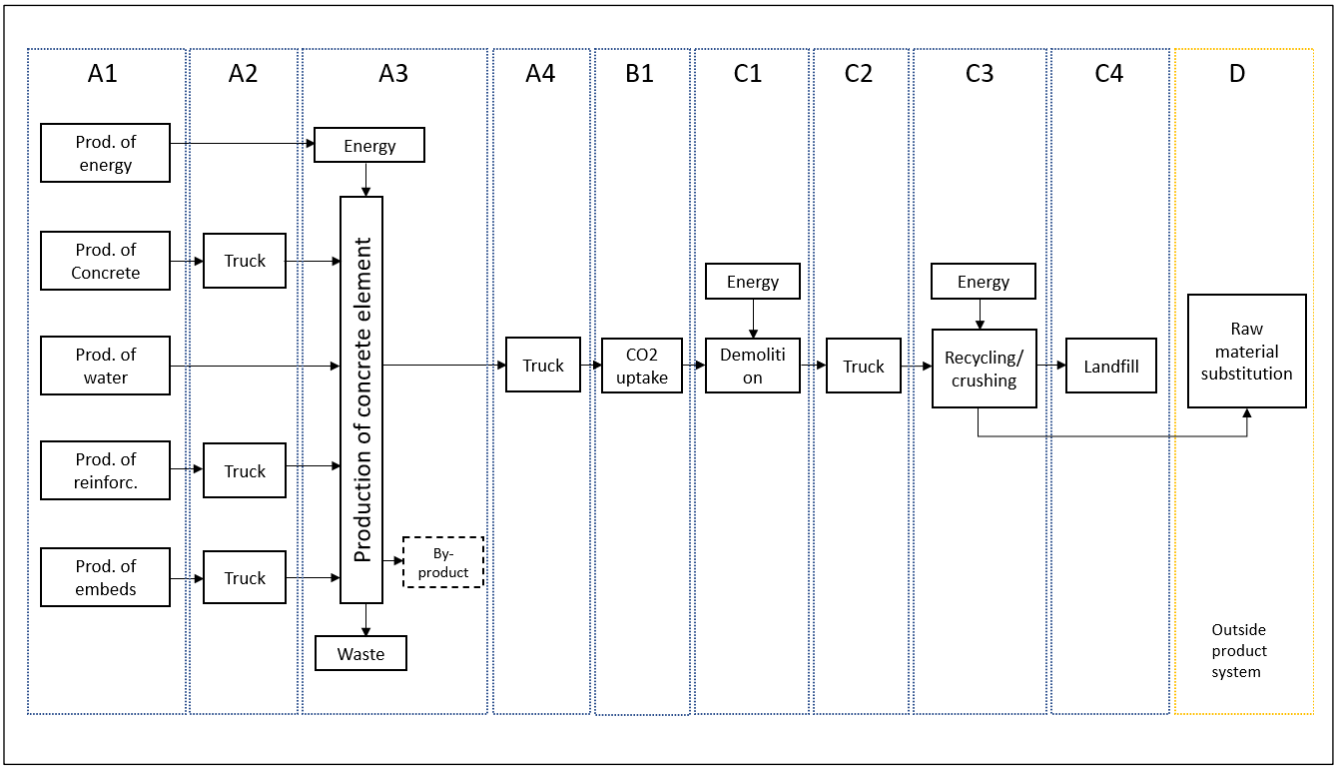
Database(s) and LCA software used:
Sphera database from 2021. IVL's EPD Generator for Gunnar prefab.

Description of system boundaries:
The EPD is a so-called Cradle to gate with options, modules C1–C4, module D and with optional modules (A1–A3 + C + D and additional modules). The additional modules are A4 and B1. Excluded life-cycle stages are A5, B2-B7.

The polluter pays principle is applied according to PCR. For waste management, this means that emissions that occur at material recycling facilities must be allocated to the next life cycle, if the next life cycle pays for the residual material. However, transport to the recycling facility is included. The life cycle begins with the extraction of raw materials used for the products, which defines the boundary with nature.

Carbon dioxide uptake through carbonation in the use stage is taken into account in the calculations. Carbonation is a natural chemical process where part of the carbon dioxide released during the calcination process during cement production is reabsorbed to the concrete when exposed to air. This usually occurs during the concrete product's use and final stage.

System diagram:



- Module A1: Production of raw materials.
- Module A2: Transportation of raw materials to Gunnar Prefab's factory.
- Module A3: Manufacturing.
- Module A4: Transport of element to construction site.
- Module B1: Carbonation of the precast concrete element during its use phase
- Module C1: Demolition.
- Module C2: Transport to waste processing.
- Module C3: Waste processing
- Module C4: Disposal
- Module D: Benefits and loads beyond the system boundary

Allocation:

Incoming energy, water and waste production in-house is allocated equally among all joint co-products through mass allocation.
By-products in this study generate a very low contribution to the overall revenue are therefore neglected.

Transportation:

The transport included in this study is the transport of raw materials, products to customers and waste from the production site. The transport is mostly carried out through heavy trucks and concrete truck.

Energy utilities:
Both electricity and heat are used at the factory.
Electricity is based on hydro power and wind power. The heat applied is average Swedish district heating.

Secondary energy:
No other secondary energy has been used apart from what is included in district heating

Direct emissions from production:
Direct emissions occur from the burning of fuels in the factory.

Waste:
Waste is generated from wastage in production as well as packaging from various products. Steel products go to recycling, wood products such as EU pallets and other wooden materials go to energy recovery and the concrete is cast into low-revenue by-products.

Scenario for module A4:
The concrete elements are in average transported 200 km to customer by a 35 tonne Euro VI truck.

Scenario for module B1:
The wall is assumed to be coated and exposed to a dry indoor environment. The service life is 50 years.

Scenario for module C1:
Demolition of a concrete frame is based on Erlandsson and Pettersson (2015). Energy consumption is 36 MJ/ton, diesel.

Scenario for module C2:
The assumed scenario based on industry consensus. Transport to waste management or landfill is carried out through a 40-ton Euro V truck for 35 km. It is applied to both concrete and steel.

Scenario for module C3:
It is assumed that 100% of the concrete and steel is recycled.

Scenario for module C4:
No disposal is assumed.

Scenario for module D:
Concrete: As applied in C3. All concrete replaces the production of crushed aggregate.

Steel: As applied in C3. The steel in the product replaces the production of new steel. However, only the primary share of the steel can be credited.

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

	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	-	X	-	-	-	-	-	-	X	X	X	X	X
Geography	SE	SE	SE	SE	-	SE	-	-	-	-	-	-	SE	SE	SE	SE	SE
Specific data used	>90%					-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	-					-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	-					-	-	-	-	-	-	-	-	-	-	-	-

Content information

Product components	Weight, kg	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Concrete C35/45 std	97,5	0	0
Reinforcement, Celsa	2,3	73	0
Embeds, steel	0,18	0	0
Embeds PP plastic	0,2	0	0
Embeds, HDPE plastic	0,08	0	0
TOTAL	100	73	0
Packaging materials	**Weight, kg**	**Weight-% (versus the product)**	**Weight biogenic carbon, kg C/kg**
No packaging materials are used			
TOTAL			

Dangerous substances from the candidate list of SVHC for Authorisation	EC No.	CAS No.	Weight-% per functional or declared unit
None			

Environmental Information

Results of the LCA – Potential environmental impact for 1 ton (1000 kg) of solid wall before hardening

Potential environmental impact – mandatory indicators according to EN 15804

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3***	**A4**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	1.62E+02	1.06E+01	-6.50E+00	3.02E+00	2.10E+00	6.05E-01	0.00E+00	-1.40E+00
GWP-fossil	kg CO_2 eq.	1.59E+02	1.05E+01	-6.50E+00	3.00E+00	2.08E+00	6.00E-01	0.00E+00	-1.39E+00
GWP-biogenic	kg CO_2 eq.	3.37E+00	3.27E-02	0.00E+00	-3.89E-03	6.48E-03	-7.78E-04	0.00E+00	-1.30E-04
GWP-LULUC	kg CO_2 eq.	1.04E-01	5.87E-02	0.00E+00	2.49E-02	1.16E-02	4.97E-03	0.00E+00	-1.04E-02
ODP	kg CFC 11 eq.	4.09E-05	2.37E-07	0.00E+00	3.88E-16	4.70E-08	7.76E-17	0.00E+00	-4.23E-15
AP	mol H^+ eq.	3.30E-01	1.18E-01	0.00E+00	1.75E-02	2.34E-02	3.50E-03	0.00E+00	-7.66E-03
EP-freshwater	kg P eq.	8.68E-03	5.43E-04	0.00E+00	9.01E-06	1.08E-04	1.80E-06	0.00E+00	-1.04E-05
EP-marine	kg N eq.	6.21E-02	6.36E-02	0.00E+00	8.56E-03	1.26E-02	1.71E-03	0.00E+00	-3.65E-03
EP-terrestial	mol N eq.	1.32E+00	6.05E-01	0.00E+00	9.48E-02	1.20E-01	1.90E-02	0.00E+00	-3.94E-02
POCP	kg NMVOC eq.	3.11E-01	8.26E-02	0.00E+00	1.65E-02	1.64E-02	3.30E-03	0.00E+00	-7.11E-03
ADP-M&M	kg Sb eq.	8.30E+00	5.66E-06	0.00E+00	2.31E-07	1.12E-06	4.62E-08	0.00E+00	-2.48E-07
ADP-fossil**	MJ	7.04E+02	1.60E+02	0.00E+00	4.04E+01	3.17E+01	8.08E+00	0.00E+00	-3.28E+01
WDP	m^3	9.54E+01	1.88E+02	0.00E+00	2.64E-02	3.74E+01	5.27E-03	0.00E+00	-1.30E+01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption								

*For environmental impact of hardened product, the values in A1-A3 are multiplied with 1,03.

** Disclaimer: The results of this environmental impact indicator should be used with caution as the uncertainty in these results is large or because there is limited experience with the indicator.

"E" means exponent (10^x). For example, 3.5 E-02 means 3.5*10-2 and can be read as 0.035.

Potential environmental impact – additional mandatory and voluntary indicators

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3**	**A4**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
PM	Disease incidence	3.50E-01	6.34E-07	0.00E+00	6.10E-08	1.26E-07	1.22E-08	0.00E+00	-3.21E-08
IRP	kBq U235 e	7.85E+03	3.60E-01	0.00E+00	7.01E-03	7.14E-02	1.40E-03	0.00E+00	-7.15E-01
ETP-fw	CTUe	1.80E+02	2.80E+02	0.00E+00	2.92E+01	5.55E+01	5.84E+00	0.00E+00	-2.03E+01
HTP-c	CTUh	1.31E-03	5.59E-09	0.00E+00	5.90E-10	1.11E-09	1.18E-10	0.00E+00	-6.04E-10
HTP-nc	CTUh	1.59E-02	3.41E-07	0.00E+00	3.27E-08	6.77E-08	6.55E-09	0.00E+00	-2.21E-08
SQP	Dimensionless	4.73E+02	2.05E+02	0.00E+00	1.39E+01	4.06E+01	2.78E+00	0.00E+00	-8.88E+01

Use of resources

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3**	**A4**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
RPEE	MJ	3.37E+02	5.49E+01	0.00E+00	2.25E+00	1.09E+01	4.51E-01	0.00E+00	-1.76E+01
RPEM	MJ	5.13E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TPE	MJ	3.38E+02	5.49E+01	0.00E+00	2.25E+00	1.09E+01	4.51E-01	0.00E+00	-1.76E+01
NRPE	MJ	7.08E+02	1.60E+02	0.00E+00	4.05E+01	3.18E+01	8.09E+00	0.00E+00	-3.29E+01
NRPM	MJ	8.24E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TRPE	MJ	7.16E+02	1.60E+02	0.00E+00	4.05E+01	3.18E+01	8.09E+00	0.00E+00	-3.29E+01
SM	kg	4.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	1.33E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	2.29E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W	m^3	4.10E+00	4.39E+00	0.00E+00	2.58E-03	8.71E-01	5.16E-04	0.00E+00	-3.26E-01
Acronyms	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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water								

Waste production and output flows

Waste production

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3**	**A4**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	4.76E-02	6.74E-10	0.00E+00	2.04E-09	1.34E-10	4.08E-10	0.00E+00	-8.82E-09
Non-hazardous waste disposed	kg	9.12E+01	2.02E-02	0.00E+00	6.01E-03	4.01E-03	1.20E-03	0.00E+00	-1.37E-02
Radioactive waste disposed	kg	1.96E-02	1.73E-04	0.00E+00	4.89E-05	3.44E-05	9.79E-06	0.00E+00	-6.16E-03

Output flows

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3**	**A4**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	1.50E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+03	0.00E+00	0.00E+00
Materials for energy recovery	kg	1.12E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+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	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	0.00E+00	0.00E+00

Other environmental performance indicators

Results per functional or declared unit									
Indicator	**Unit**	**A1-A3**	**A4**	**B1**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-IOBC/GHG	kg CO2 eq.	1.60E+02	1.06E+01	-6.50E+00	2.97E+00	2.10E+00	5.94E-01	0.00E+00	-1.37E+00

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