Environmental Product Declaration for Barro Group Pre-mix Concrete E40SPLS

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

Programme Information

EPDs within the same product category but registered in different EPD programmes may not be comparable. For two EPDs to be comparable, they shall be based on the same PCR (including the same version number up to the first two digits) 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.

Barro Group, as the EPD owner, has the sole ownership, liability, and responsibility for the EPD.

Declaration Owner		
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Product category rules (PCR)	PCR 2019:14 Construction Products, Version 1.3.4 2024-04-30 (valid until 2025-06-20) c-PCR-003: Product Category Rules (PCR) for Concrete and concrete elements (EN 16757) Version 2024-04-30	
PCR review conducted by	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña Contact: info@environdec.com	
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification		
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No		

About Barro Group

BARRO GROUP is the leading independent supplier and distributor of high-quality construction materials.
Since commencing business in 1946, the family-owned Barro Group, operated by an experienced management team and skilled workforce, has established and secured an interest in a range of associated operations.
Barro Group is an integrated resources, manufacturing and distribution group, well-equipped to provide continued supplies of quality construction materials, genuine customer service and reliable delivery to any project - residential, commercial, civil, industrial.
Barro Group produces and delivers concrete in accordance with "Australian Standard 1379 – Specification and supply of concrete". The Barro Group Pty Ltd operates a Quality Management System which complies with the requirements of AS/NZS ISO 9001:2015 for the manufacture, sale and distribution of premixed concrete (Client Number 1035).

Barro Group products

PREMIXED CONCRETE
standard mixes, and decorative and high-performance concrete mixes

QUARRY MATERIALS
aggregates, crushed rock, sands, gravels

BUILDERS' SUPPLIES
steel reinforcing and accessories, bagged cement products, building materials, oxides, tools of trade, landscape supplies

CONCRETE PRECAST PANELS
concrete precast panels

To support its core activities, Barro operates:

- well maintained delivery **fleet**;
- quality control **laboratories** for product testing and product development;
- fully equipped **workshops** for the servicing of plant and equipment;
- and supplies and services **tyres** for trucks and earthmoving equipment.

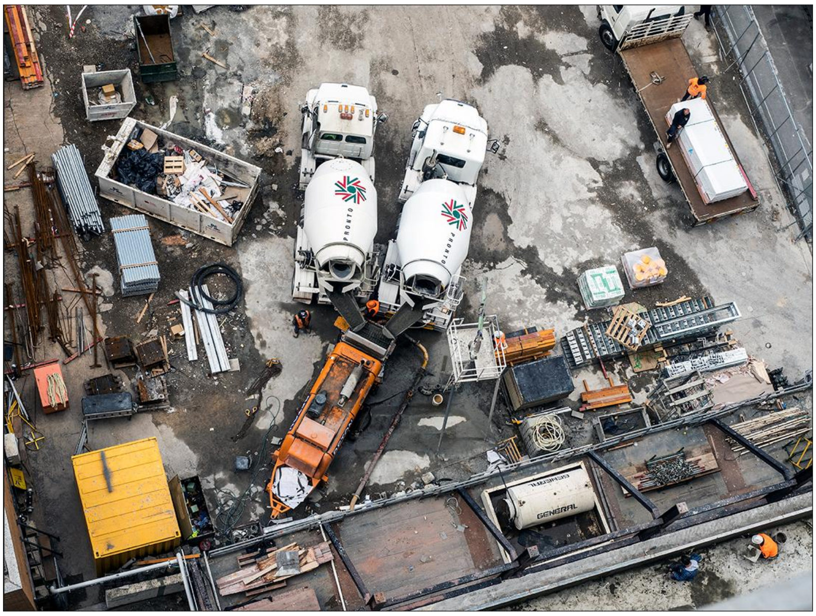
Barro Group is committed to continually improving performance to maintain high standards in occupational health and safety and environmental management, including its recycling and energy-saving strategies.
By maintaining high standards and competitive prices, Barro Group has been the selected supplier of construction materials to many landmark construction projects, and has a proven record of excellence in the supply of premixed concrete, quarry products and other construction materials.
The depth and experience and competence of the management of Barro Group are evidenced by its growth and diversification over the years.
The Group is clearly well suited both technically and through its production facilities to successfully meet the needs of major construction projects.

Product information

Concrete is a composite material that is made up of cement, water, and aggregates such as sand, gravel, or crushed rock. Other materials, such as fly ash or slag, may also be added to the mixture to enhance its properties and reduce cement use. When the cement and water are mixed, a chemical reaction occurs, creating a paste that binds the aggregates together. Once the mixture has hardened, it forms a strong and durable material that can be used in a variety of construction applications, including foundations, pavements, buildings, and decorative features. Concrete is prized for its strength, durability, and versatility, and it has become an essential material in modern construction.

Concrete is a versatile construction material that is used in a wide range of applications due to its strength, durability, and cost value. The technical purpose of concrete is to provide a strong and stable foundation or structure for buildings, roads, bridges, dams, and other projects.

Concrete is intended to be used as a construction material for a wide range of structures and infrastructure projects, including:
Commercial, residential and industrial buildings: Concrete is a popular choice for commercial, residential and industrial buildings due to its fire resistance, sound insulation, and ability to withstand harsh weather conditions.



Building foundations: Concrete is commonly used to create solid foundations for buildings, as it provides a strong and stable base that can support the weight of the structure.
Roads and bridges: Concrete is often used in the construction of roads and bridges due to its durability and ability to withstand heavy traffic loads.
Dams and water reservoirs: Concrete is a preferred material for building dams and water reservoirs, as it can withstand the weight of large bodies of water and resist erosion and other forms of damage.
Sidewalks and curbs: Concrete is commonly used to create sidewalks and curbs in urban areas, as it is durable, slip-resistant, and requires minimal maintenance.
Retaining walls: Concrete is often used to build retaining walls to hold back soil and prevent erosion, especially on steep slopes or hillsides.
Overall, concrete's intended use is to provide a strong, durable, and long-lasting construction material that can be used in a variety of applications.

Industry classification

UN CPC 375 - Articles of concrete, cement and plaster

Mix information

Classification code	Strength (MPa)	Product name/description
E40SPLS	40	S40MPa, low shrink, 600ms nominal

Production sites

This EPD covers concrete from 18 of Barro Group's batching plants in Victoria, Australia:

- Mount Evelyn
- Ringwood
- Springvale
- Dandenong
- Port Melbourne
- Sunshine
- Sunbury
- Bacchus Marsh
- Coburg
- Donnybrook
- Werribee
- Laverton
- Point Wilson
- Moolap
- Grovedale
- Bannockburn
- Lincoln Causeway
- Wodonga

Figure 1 Victorian Barro Group batching plant locations

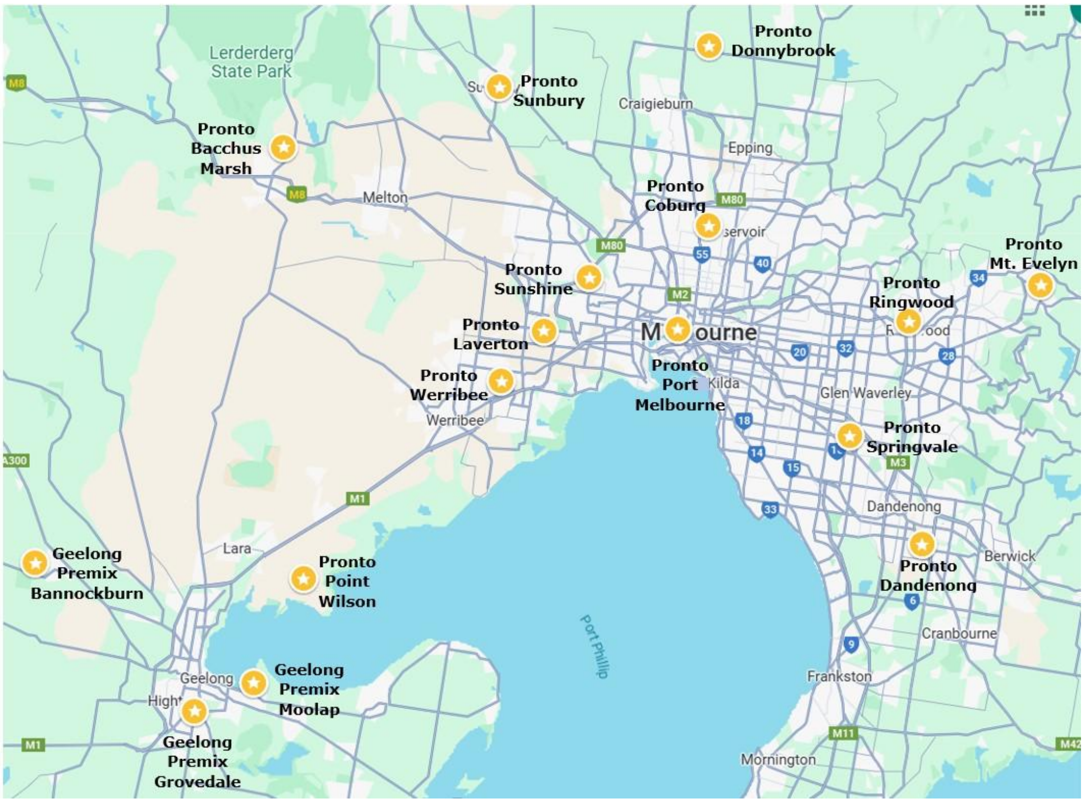


Figure 2 Melbourne and Geelong Barro Group batching plant locations

LCA information

This EPD is for concrete mix E40SPLS produced at any of the Victorian batching plants. The mix results are declared as a production weighted average of all sites.

Declared unit

One cubic metre (1 m^3) of Barro Group mix E40SPLS concrete.

1m^3 of concrete is approximately 2 384 kg.

Background data

Primary data for the LCA was collected and provided by Barro Group for the year 1 January 2023 – 31 December 2023.
SimaPro® LCA software v10.0.1.2 was used for the LCA modelling. All global background data are taken from Ecoinvent v3.10 allocation recycling cut-off model (Weidema, Bauer et al. 2023). Background data for Australian material inputs, energy use, waste treatment and trucks are all sourced from the AusLCI EN15804 database v2.44 (Lifecycles 2024) which are then updated to Ecoinvent 3.10 for consistency with other data. Background data is less than 10 years old or have been updated within this timeframe.

Cut-off criteria

The cut-off threshold for the LCA study was flows contributing less than 1% for any impact category included in the LCA. No flows were deliberately excluded due to this threshold, however particularly minor inputs expected to be well below this threshold were not considered. Packaging for chemical admixtures is expected to be well below this threshold and therefore not included in the study. Infrastructure, production equipment, and personnel related activities are non-attributable and excluded from the system boundary.

Allocation

Fly ash – an input of some of the concrete mixes – is considered a by-product from coal-powered electricity generation, hence only the impacts from the transport of fly ash from the supplier to the batching plant were considered.

Content declaration

The approximate mass composition of the concrete mixes produced at the batching plants are summarised in Table 1. The weight of one m^3 of the product varies depending on the mix.

Table 1 Declared Barro Group concrete mix composition by mass

Component	Quantity	Post-consumer recycled material (%)	Biogenic material (%)	Biogenic material (kg C/m^3 of product)
Coarse Aggregate	32 - 49%	0	0	0
Sand	25 - 44%	0	0	0
Manufactured Sand	0 - 13%	0	0	0
Cement	6 - 27%	0	0	0
Fly Ash	0 - 6%	0	0	0
Ground Granulated Blast Furnace Slag (GGBFS)	0 – 17%	0	0	0
Chemical Admixtures	<0.5%	0	0	0
Activator	0 - 0.5%	0	0	0

As Barro Group premixed concrete is delivered in bulk there is no packaging for the products included in this EPD. There is no biogenic carbon or recycled material in the declared concrete mixes.

The mix included in this EPD does not contain substances in the Candidate List of Substances of Very High Concern in the European Chemicals Agency in concentrations >0.1% of the weight of the product. For further information, the safety data sheet for Barro Group concrete can be found here.

Mix information

Classification code	Strength (MPa)	Product name/description
E40SPLS	40	S40MPa, low shrink, 600ms nominal

System boundary

The system boundary describes the process steps included in the LCA. This LCA will cover the cradle-to-gate with options plus end-of-life life cycle stages (modules A1-A4, C1-C4, and D). Due to the multifunctional use of concrete, modules A5-B7 are not declared as these modules are best modelled at the construction/building project level. Please note that although informative, the use of the results of modules A1-A3 without considering the results of the entire module C are discouraged.

Table 2 System boundary table according to EN 15804+A2 life cycle stages

	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	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	AU, JP	AU	AU	AU	-	-	-	-	-	-	-	-	AU	AU	AU	AU	AU
Specific data used	>85%[1]			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

X = module declared in this study. ND = module not declared in this study.

[1]Cement is a large majority of the impact (more than 80% for the GP cement mixes). The cement impact comes from the specific cement supplier EPD. Other major inputs including GGBFS and quarry materials are similarly sourced from the specific supplier EPD and data from self-owned quarries respectively.

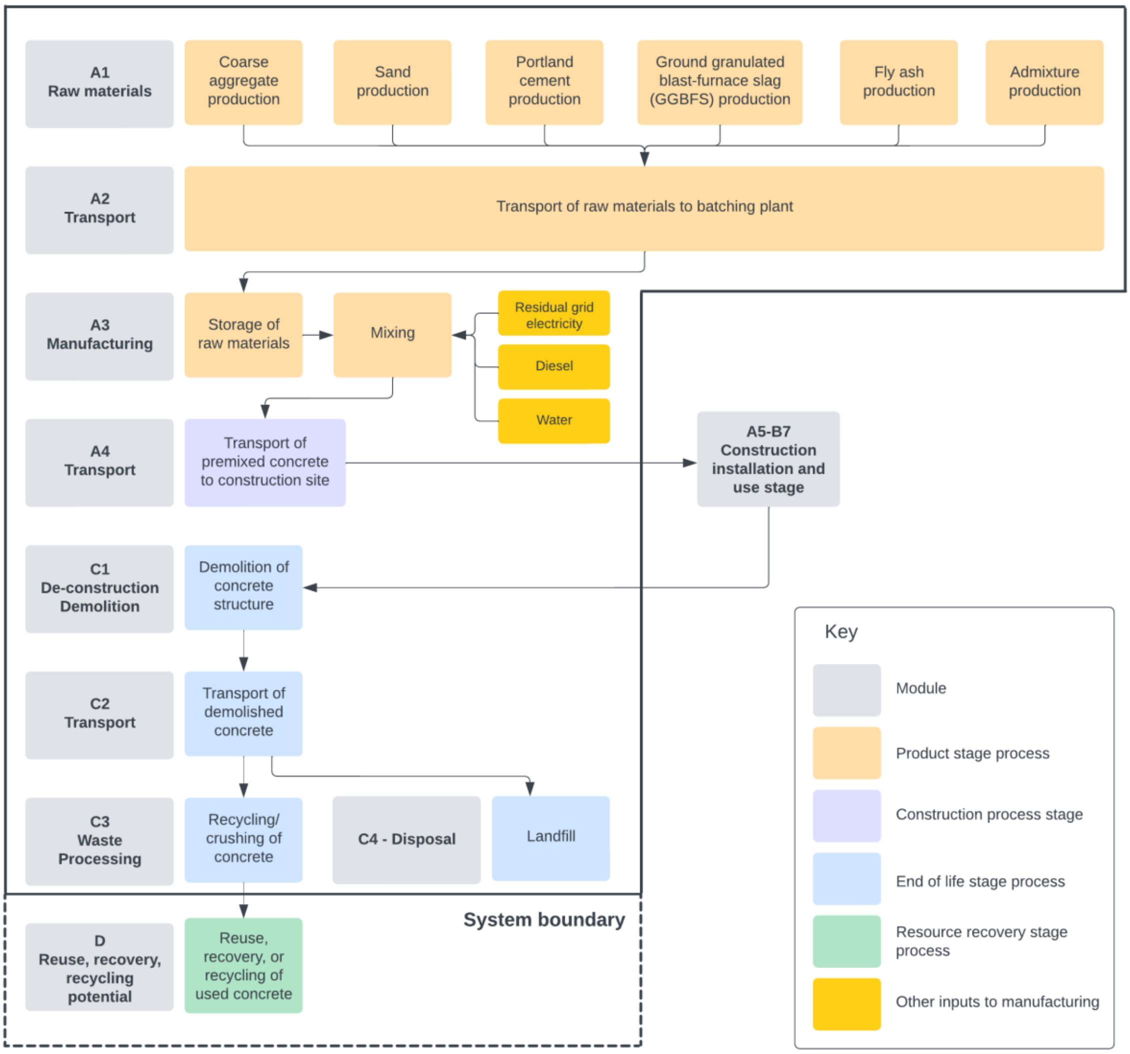


Figure 3 System boundary diagram for Barro Group concrete mixes

Product stage (A1-A3)

Barro Group concrete mixes involve coarse aggregates and sand from various self-owned quarries. Other raw materials are supplied from third parties. All raw materials are typically transported to the batching plant by truck. The electricity grid mix used in A1 and A3 is the residual market grid mix for Victoria, using the AusLCI residual market mix which is based on data published by the Australian Government, Department of Climate Change (2024) - GWP-GHG = 1.044 kg CO_2 eq./kWh.

Transport to construction site (A4)

The concrete agitator truck was modelled using the customisable 28t truck from the AusLCI EN15804 database (Lifecycles 2024). A large concrete mixer truck was assumed, with capacity 7.4m^3 and loaded weight 28t. The average fuel use and load assumptions were obtained from the Survey of Motor Vehicle Use, Australia 2020 (Australian Bureau of Statistics 2020) using data from the articulated truck. The average cartage distance for Barro Group premix concrete from the batching plants to the construction site is 10km.

End-of-Life (C1-C4, D)

For the calculation of end-of-life modules, it is assumed the mixes have been used to produce an unreinforced ground-bearing traditional concrete slab, with thickness 0.1m, for a residential family home. At the end-of-life of the concrete structure, the structure is demolished and either sent to recycling or landfill. Therefore, the downstream scenarios assume that there will be crushing and recycling of the concrete for the proportion that is not landfilled. Module D is based on the scenario "crushed concrete substitutes primary material without further processing" (e.g. in road construction). The R2 value used is 0.8, as per the masonry recycling rate from Pickin, Wardle et al. (2023). This is a scenario currently in use and representative of one of the most likely scenario alternatives for concrete products. Due to lack of data and for a more conservative assumption, there is assumed to be no carbonation (CO_2 absorption) of concrete material in any of these modules.

Table 3 End-of-Life scenario parameters for modules C1-C4, D

Processes	Quantity per m^3 of concrete	Unit	Notes
Collection	2 384	kg	Based on 25MPa with 30% GGBFS concrete from AusLCI database (ALCAS 2023).
Deconstruction demolition diesel usage	145	MJ	Assumption for a generic scenario.
Transport distance to recycling	25	km	Distance from Melbourne CBD to concrete aggregate recycling centre.
Transport distance to landfill	55	km	Distance from Melbourne CBD to landfill for concrete waste.
Concrete recovered for recycling	80	% by mass	Based on masonry recycling rate from (Pickin, Wardle et al. 2023).
Concrete disposed to landfill	20	% by mass	Concrete not recycled is sent to landfill. Based on masonry recycling rate from (Pickin, Wardle et al. 2023).

Environmental impact indicators

The environmental indicators for the impact categories described in this EPD are summarised in the tables below. Environmental Footprint 3.1 (EF 3.1) was used. Abbreviations of each indicator will be used in the results tables for simplicity.

Table 4 Mandatory potential environmental impact indicators according to EN 15804:2012+A2:2019

Indicator	Abbreviation	Units
Global warming potential – fossil	GWPF	kg CO_2 eq.
Global warming potential – biogenic	GWPB	kg CO_2 eq.
Global warming potential - land use/land use change	GWPL	kg CO_2 eq.
Global warming potential - total	GWPT	kg CO_2 eq.
Ozone depletion potential	ODP	kg CFC 11 eq.
Acidification potential	AP	mol H+ eq.
Eutrophication potential - freshwater	EPF	kg P eq.
Eutrophication potential – marine	EPM	kg N eq.
Eutrophication potential - terrestrial	EPT	mol N eq.
Photochemical ozone creation potential	POCP	kg MNVOC eq.
Abiotic depletion potential – minerals & metals*	ADPE	kg Sb eq.
Abiotic depletion potential – fossil fuels*	ADPF	MJ
Water deprivation potential*	WDP	m^3 H2O eq.

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of the results are high and as there is limited experience with the indicator.

Table 5 Additional potential environmental impact indicators according to EN 15804:2012+A2:2019

Indicator	Abbreviation	Units
Particulate Matter emissions	PM	Disease incidence
Ionising Radiation – human health**	IRP	kBq U-235-eq.
Eco-toxicity – freshwater*	ETPF	CTUe
Human toxicity – cancer*	HTPC	CTUh
Human toxicity – non-cancer*	HTPNC	CTUh
Land use related impacts / soil quality*	SQP	Dimensionless
Global warming potential - excluding biogenic uptake, emissions, and storage	GWP-GHG	kg CO_2 eq.

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of the results are high and as there is limited experience with the indicator
** Disclaimer: 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.

Table 6 Use of resources, waste production, and output flows

<table>
<tr><th colspan="2">Indicator</th><th>Abbreviation</th><th>Units</th></tr>
<tr><td rowspan="3">Primary energy resources - Renewable</td><td>Use as energy carrier</td><td>PERE</td><td rowspan="6">MJ, net calorific value</td></tr>
<tr><td>Used as raw materials</td><td>PERM</td></tr>
<tr><td>Total</td><td>PERT</td></tr>
<tr><td rowspan="3">Primary energy resources – Non-renewable</td><td>Use as energy carrier</td><td>PENRE</td></tr>
<tr><td>Used as raw materials</td><td>PENRM</td></tr>
<tr><td>Total</td><td>PENRT</td></tr>
<tr><td colspan="2">Use of secondary materials</td><td>SM</td><td>kg</td></tr>
<tr><td colspan="2">Use of renewable secondary fuels</td><td>RSF</td><td>MJ, net calorific value</td></tr>
<tr><td colspan="2">Use of non-renewable secondary fuels</td><td>NRSF</td><td>MJ, net calorific value</td></tr>
<tr><td colspan="2">Net use of fresh water</td><td>FW</td><td>m3</td></tr>
<tr><td colspan="2">Hazardous waste disposed</td><td>HWD</td><td>kg</td></tr>
<tr><td colspan="2">Non-hazardous waste disposed</td><td>NHWD</td><td>kg</td></tr>
<tr><td colspan="2">Radioactive waste disposed</td><td>RWD</td><td>kg</td></tr>
<tr><td colspan="2">Components for reuse</td><td>CRU</td><td>kg</td></tr>
<tr><td colspan="2">Material for recycling</td><td>MFR</td><td>kg</td></tr>
<tr><td colspan="2">Materials for energy recovery</td><td>MER</td><td>kg</td></tr>
<tr><td colspan="2">Exported energy – electrical</td><td>EEE</td><td>MJ per energy carrier</td></tr>
<tr><td colspan="2">Exported energy – thermal</td><td>EET</td><td>MJ per energy carrier</td></tr>
</table>

Environmental performance indicator results

The estimated impact results are only relative statements which do not indicate the end points of the impact categories, exceeding threshold values, safety margins or risks.

Results are declared per 1m³ of concrete.

Core indicators

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWPF	kg CO_2 eq.	3.04E+02	2.68E+00	1.36E+01	5.11E+00	7.10E+00	2.46E+00	-1.70E+01
GWPB	kg CO_2 eq.	2.57E-01	7.47E-04	7.57E-03	1.24E-03	1.98E-03	2.32E-03	-1.11E-01
GWPL	kg CO_2 eq.	2.84E-01	6.78E-05	4.72E-04	2.28E-04	1.75E-04	2.32E-03	-2.71E-01
GWPT	kg CO_2 eq.	3.05E+02	2.68E+00	1.36E+01	5.11E+00	7.11E+00	2.47E+00	-1.73E+01
ODP	kg CFC11 eq.	1.90E-05	3.65E-08	2.14E-07	1.16E-06	1.60E-06	1.02E-06	-1.59E-07
AP	mol H+ eq.	2.97E+00	7.06E-03	1.27E-01	3.22E-02	7.72E-02	2.36E-02	-1.42E-01
EPF	kg P eq.	7.73E-03	1.58E-05	1.11E-04	5.21E-05	4.30E-05	2.30E-04	-5.28E-04
EPM	kg N eq.	1.09E+00	2.63E-03	5.99E-02	7.89E-03	3.47E-02	8.21E-03	-4.44E-02
EPT	mol N eq.	1.22E+01	2.88E-02	6.56E-01	8.82E-02	3.80E-01	8.99E-02	-5.00E-01
POCP	kg NMVOC eq.	3.19E+00	1.08E-02	1.95E-01	2.68E-02	1.04E-01	2.61E-02	-1.45E-01
ADPE	kg Sb eq.	5.12E-04	9.65E-08	5.70E-07	8.70E-07	3.70E-07	5.73E-06	-4.28E-06
ADPF	MJ	3.50E+03	3.60E+01	1.79E+02	7.00E+01	9.91E+01	7.01E+01	-1.47E+02
WDP	m³ depriv.	1.90E+03	1.99E-02	2.33E-01	1.05E-02	2.47E-02	3.15E+00	-1.29E+01

Additional indicators

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
GWP-GHG	kg CO_2 eq	2.97E+02	2.68E+00	1.36E+01	5.11E+00	7.10E+00	2.47E+00	-1.73E+01
PM	disease inc.	1.53E-05	4.71E-08	3.65E-06	5.06E-07	1.63E-05	4.76E-07	-3.03E-06
IRP	kBq U-235 eq.	3.81E-01	5.44E-03	3.81E-02	3.09E-01	4.37E-01	3.11E-01	-5.96E-02
ETPF	CTUe	1.98E+03	1.23E+00	6.20E+00	1.69E+01	2.30E+01	1.64E+01	-1.57E+01
HTPC	CTUh	1.05E-07	1.73E-10	9.56E-10	1.28E-10	2.90E-10	5.83E-10	-1.30E-08
HTPNC	CTUh	3.84E-06	3.37E-09	1.36E-08	6.49E-10	1.24E-09	1.01E-09	-3.82E-08
SQP	Pt	1.76E+03	5.08E-02	3.80E-01	8.83E+00	3.12E-01	1.47E+02	-2.26E+03

Resource use, waste flows, and output flows

Indicator	Unit	A1-A3	A4	C1	C2	C3	C4	D
Resource use								
PERE	MJ NCV	1.30E+02	5.65E-02	4.01E-01	2.37E-01	7.74E-01	1.21E+00	-3.00E+01
PERM	MJ NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ NCV	1.30E+02	5.65E-02	4.01E-01	2.37E-01	7.74E-01	1.21E+00	-3.00E+01
PENRE	MJ NCV	3.61E+03	3.60E+01	1.79E+02	4.68E+00	1.09E+02	7.28E+01	-1.42E+02
PENRM	MJ NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ NCV	3.61E+03	3.60E+01	1.79E+02	4.68E+00	1.09E+02	7.28E+01	-1.42E+02
SM	kg	4.30E+01	1.50E-05	3.23E-04	1.96E-03	4.47E-02	1.75E-02	-5.72E-03
RSF	MJ NCV	3.28E-03	1.88E-06	6.41E-05	2.52E-05	1.18E-04	3.76E-04	-2.70E-03
NRSF	MJ NCV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.46E-01	0.00E+00	0.00E+00	6.31E-04	5.83E-03	7.52E-02	0.00E+00
Waste flows								
HWD	kg	5.70E-01	3.07E-03	1.94E-02	3.43E-03	5.02E-02	3.49E-02	-2.89E-01
NHWD	kg	8.84E+03	9.95E-02	6.51E-01	1.10E-01	1.00E+00	1.04E+00	-4.60E+00
RWD	kg	8.31E-05	1.29E-06	9.16E-06	1.01E-06	1.18E-05	1.07E-05	-1.42E-05
Output flows								
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	2.61E-03	8.00E-07	4.58E-06	3.65E-05	3.44E-04	3.26E-04	-2.16E-03
MER	kg	1.00E-05	1.94E-08	2.54E-07	1.97E-07	1.35E-06	1.17E-06	-5.85E-06
EEE	MJ	2.45E-02	2.96E-04	3.37E-03	3.66E-04	4.58E-03	3.99E-03	-4.31E-03
EET	MJ	1.27E-02	3.81E-05	1.35E-03	4.67E-04	2.51E-03	2.49E-03	-5.12E-03

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