ENVIRONMENTAL PRODUCT DECLARATION

GS LCF40G40 40 MPa (LCF40G40)

ELVIN GROUP (ACT)

READY-MIXED CONCRETE

In accordance with ISO 14025 and EN 15804:2012+A2:2019

Programme:	The International EPD® System, www.environdec.com
Regional programme:	EPD Australasia Limited, www.epd-australasia.com
EPD type:	EPD of multiple products, based on a representative product
EPD registration number:	EPD-IES-0019657:001
Publication date:	2025-03-07
Valid until:	2030-03-07
EPD Process Certified by:	Epsten Group, Inc. 101 Marietta St. NW, Suite 2600, Atlanta, Georgia 30303, USA www.epstengroup.com

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

Table of Contents

Version number	Date	Description of changes	Approved
1.0	07/03/2025		Njoud Willans

General information

Programme and verification information

Declaration Owner:	Elvin Group (ACT) Pty Ltd 7 Cheney Place Mitchell ACT 2911, Australia W: www.elvingroup.com.au
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EPD Producer:	Elvin Group (ACT) Pty Ltd 7 Cheney Place Mitchell ACT 2911, Australia W: www.elvingroup.com.au Divercity Consulting E: terry@divercity.net.au
EPD Process Certified by:	Epsten Group 101 Marietta St NW Suite 2600, Atlanta, GA 30303, United States W: www.epstengroup.com

Version	1.0
EPD Registration Number	EPD-IES-0019657:001
Valid From	2025-03-07
Valid Until	2030-03-07
Reference year for data	2023 (Elvin Group ACT mix design and production data)
Geography	Australia
EPD Type	EPD of multiple products, based on a representative product
Product Category Rules	PCR 2019:14 Construction Products (EN 15804:A2) Version 1.3.4

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)

Product category rules (PCR):

PCR 2019:14 Construction Products Version 1.3.4 (EN 15804:A2) and complementary PCRs – PCR 2019:14-c-PCR-003 c-PCR-003 Concrete and Concrete Elements (EN 16757) (2023-01-02)

Referenced by the GCCA Industry EPD Tool for Cement and Concrete (v5.0), International Version, verified to comply with the General Programme Instructions (GPI 4.0) of the International EPD® System.

PCR review was conducted by: The Technical Committee of the International EPD System. Review chair: Claudia A. Peña. A full list of members available on www.environdec.com. 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

EPD Process Certified by:

Megan Blizzard

Epsten Group
101 Marietta St NW Suite 2600, Atlanta, GA 30303, United States
W: www.epstengroup.com Epsten Group

Accredited by: A2LA, Certificate #3142.03

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: Elvin Group (ACT)
Contact: Njoud Willans – Technical Manager

About Elvin Group (ACT):

The Elvin Group has evolved from a family owned and operated business in the early 1970s into the predominant producer of pre-mixed concrete in the Canberra region. The Group has three concrete plants and the largest fleet of trucks enabling it to provide unmatched production and delivery rates in the region.

The locally based management team has driven Elvin's growth and evolution through its focus on continuous improvement, team building and the adoption of improved practices and technologies. Minimising the Group's environmental impact has been a core value, for many years the plants have used recyclers and generated solar power.

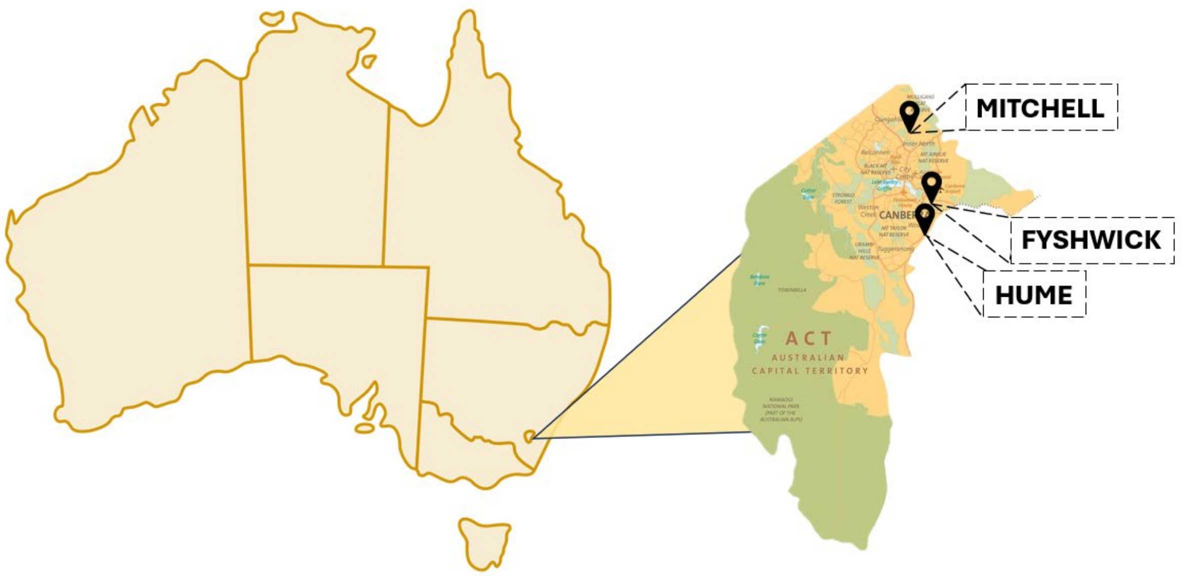
Recently, Elvins became a fully owned subsidiary of Heidelberg Construction Materials.

Product-related or management system-related certifications:

The IMS of Elvin Group (ACT) meets the requirements of:
• Statutory regulations
• Product standards
• ISO 9001:2015 Quality Management Systems
• ISO 14001:2015 Environmental Management Systems; and
• AS/NZS 4801:2001 Occupational Health & Safety Management Systems.

Name and location of production sites:

Elvin Group (ACT) operates through 3 primary locations within the Australian Capital Territory, these being Mitchell, Fyshwick and Hume.



Product information

Product identification:

Concrete is a construction material made from the combination of cement, water, fine aggregates (such as sand), and coarse aggregates (such as crushed stone). In Australia, AS1379 details the specification and supply of concrete based on compressive strength, slump, mix proportions, durability criteria and testing methods. The standards define two classes of concrete in relation to their design and application, these being normal and special.

Normal class concrete is typically used for residential applications, such as house slabs and driveways, where compressive strength is the sole specification. Special class concrete, however, is commonly used for commercial projects, such as bridges, roads, and high-rise buildings, with more detailed specifications which may require concrete of high strength, performance, slump, workability or durability.

UN CPC code: 54 [Construction services]

CPV code: 44114000-3 [Ready-mixed concrete]

ANZSIC code: 203 [Cement, Lime, Plaster and Concrete Manufacturing]
2033 [Ready-mixed Concrete Manufacturing]

Product name:

This EPD aims to assess the potential environmental impacts of **ready-mixed concrete** produced by Elvin Group (ACT). This EPD covers a variety of special class mixes produced by Elvin Group (ACT), these which are referred to as **GS** mixes.

Product description:

Elvin Group (ACT) has implemented GS mixes as a more sustainable alternative to conventional concrete. GS mixes are designed with lower embodied carbon for applications ranging from general, structural, to those requiring high performance, high early strength and durability, all with a technical service life of 50 years. The reduction in embodied carbon is primarily attributed to significant replacement of general purpose cement with supplementary cementitious materials (referred to as SCMs hereafter). The main sources of SCMs used by Elvin Group (ACT) are fly ash and slag. GS mix SCM blend makeups are detailed below:

F – Fly ash is the primary SCM, used alongside general purpose cement
S – Slag is the primary SCM, used alongside general purpose cement
T – A combination of fly ash and slag is used alongside general purpose cement as a ternary blend

For the purpose of the EPD, GS mixes have been grouped into product families based on their application, SCM blend type and proportion. Three primary applications and their corresponding sub-families are listed below:

Sub-family	Description	Application	SCM makeup (fly ash, slag or ternary)
LC	Low Carbon	General	F/S/T
SLC	Structural Low Carbon	Structural	F/S/T
LCHP	Low Carbon High Performance	High Performance	F/T

Family groupings of GS mixes covered in the EPD are provided below, alongside their descriptions and applications. It is important to note a fair comparison of environmental performance of products, 60 in total grouped into 14 families, should consider consistent applications, i.e. fit for purpose concrete products.

Family	Strength (MPa)	Product code	Description	Application
LCF30	20	LCF30G20	Special 20 MPa 30% SCM	General
	25	LCF30G25	Special 25 MPa 30% SCM	General
	32	LCF30G32	Special 32 MPa 30% SCM	General
	40	LCF30G40	Special 40 MPa 30% SCM	General
LCF40	32	LCF40G32	Special 32 MPa 40% SCM	General
	40	LCF40G40	Special 40 MPa 40% SCM	General
	50	LCF40G50	Special 50 MPa 40% SCM	General
	65	LCF40G65	Special 65 MPa 40% SCM	General
LCT40	20	LCT40G20	Special 20 MPa 40% SCM	General
	25	LCT40G25	Special 25 MPa 40% SCM	General
	32	LCT40G32	Special 32 MPa 40% SCM	General
	40	LCT40G40	Special 40 MPa 40% SCM	General
	50	LCT40G50	Special 50 MPa 40% SCM	General
	65	LCT40G65	Special 65 MPa 40% SCM	General
SLCF40	32	SLCF40S32	Special 32 MPa 40% SCM	Structural
	40	SLCF40S40	Special 40 MPa 40% SCM	Structural
	50	SLCF40S50	Special 50 MPa 40% SCM	Structural
	65	SLCF40S65	Special 65 MPa 40% SCM	Structural
	80	SLCF40S80	Special 80 MPa 40% SCM	Structural
LCT50	20	LCT50G20	Special 20 MPa 50% SCM	General
	25	LCT50G25	Special 25 MPa 50% SCM	General
	32	LCT50G32	Special 32 MPa 50% SCM	General
	40	LCT50G40	Special 40 MPa 50% SCM	General
	50	LCT50G50	Special 50 MPa 50% SCM	General
	65	LCT50G65	Special 65 MPa 50% SCM	General

SLCT50	32	SLCT50S32	Special 32 MPa 50% SCM	Structural
	40	SLCT50S40	Special 40 MPa 50% SCM	Structural
	50	SLCT50S50	Special 50 MPa 50% SCM	Structural
	65	SLCT50S65	Special 65 MPa 50% SCM	Structural
	80	SLCT50S80	Special 80 MPa 50% SCM	Structural
LCT60	25	LCT60G25	Special 25 MPa 60% SCM	General
	32	LCT60G32	Special 32 MPa 60% SCM	General
	40	LCT60G40	Special 40 MPa 60% SCM	General
	50	LCT60G50	Special 50 MPa 60% SCM	General
	65	LCT60G65	Special 65 MPa 60% SCM	General
SLCT60	32	SLCT60S32	Special 32 MPa 60% SCM	Structural
	40	SLCT60S40	Special 40 MPa 60% SCM	Structural
	50	SLCT60S50	Special 50 MPa 60% SCM	Structural
	65	SLCT60S65	Special 65 MPa 60% SCM	Structural
	80	SLCT60S80	Special 80 MPa 60% SCM	Structural
LCHP20	32	LCHP20HE32	Special 32 MPa 20% SCM	High Performance
	40	LCHP20HE40	Special 40 MPa 20% SCM	High Performance
	50	LCHP20HE50	Special 50 MPa 20% SCM	High Performance
LCHP25	32	LCHP25HE32	Special 32 MPa 25% SCM	High Performance
	40	LCHP25HE40	Special 40 MPa 25% SCM	High Performance
	50	LCHP25HE50	Special 50 MPa 25% SCM	High Performance
LCHP30	50	LCHP30HE50	Special 50 MPa 30% SCM	High Performance
	65	LCHP30HE65	Special 65 MPa 30% SCM	High Performance
LCHP40HPX	32	LCHP40HPX32	Special 32 MPa 40% SCM	High Performance
	40	LCHP40HPX40	Special 40 MPa 40% SCM	High Performance
	50	LCHP40HPX50	Special 50 MPa 40% SCM	High Performance
	65	LCHP40HPX65	Special 65 MPa 40% SCM	High Performance
LCHP50HPX	32	LCHP40HPX32	Special 32 MPa 50% SCM	High Performance
	40	LCHP40HPX40	Special 40 MPa 50% SCM	High Performance
	50	LCHP40HPX50	Special 50 MPa 50% SCM	High Performance
	65	LCHP40HPX65	Special 65 MPa 50% SCM	High Performance
LCHP60HPX	32	LCHP60HPX32	Special 32 MPa 60% SCM	High Performance
	40	LCHP60HPX40	Special 40 MPa 60% SCM	High Performance
	50	LCHP60HPX50	Special 50 MPa 60% SCM	High Performance
	65	LCHP60HPX65	Special 65 MPa 60% SCM	High Performance

Low Carbon Concrete projects:

25 Catalina Drive, Majura Avenue

Contractor:
Construction Control

Supply period:
Nov-2020 to Apr-2022

Concrete supply:
~12,000 m^3

GP replacement by SCMs:
31%

Queanbeyan Civic and Cultural Precinct

Contractor:
ADCO Constructions

Supply period:
Nov-2021 to Oct-2023

Concrete supply:
~7,000 m^3

GP replacement by SCMs:
34%

Canberra Hospital Expansion Project

Contractor:
Multiplex

Supply period:
Mar-2022 to Jul-2024

Concrete supply:
~ 23,000 m^3

GP replacement by SCMs:
33%

AWM Bean Building and Central Energy Plant

Contractor: Hindmarsh

Supply period: Oct-2022 to Jul-2024

Concrete supply: ~5,000 m3

GP replacement by SCMs: 31%

North Gungahlin High School

Contractor: Hindmarsh

Supply period:
Aug-2023 to Aug-2024

Concrete supply: ~6,000 m^3

GP replacement by SCMs: 31%

Gugan Galwan Indigenous Youth Centre

Contractor: Projex Building Group

Supply period: Mar-2024 to Jun-2024

Concrete supply: ~500 m^3

GP replacement by SCMs: 35%

ANZAC Park East

Contractor: Construction Control

Supply period: Ongoing at time of publication (supply commencing Mar-2024)

Concrete supply: ~10,000 m^3 (at time of publication)

GP replacement by SCMs: ~35% (at time of publication

LCA information

Declared unit: **1 m³** of **ready-mixed concrete**.

Reference service life:

The reference service life is not specified as it is outside the scope of the study (use stage B is excluded).

Time representativeness:

Primary input data for all company owned processes in the product stage (A1-A3) and construction stage (A4 but excluding A5) is based on Elvin's annual plant production, fleet and mix data collected in 2023 (1-year data), while the remaining stages and processes rely on secondary input data dating largely to 2018 (6-year data).

Databases and LCA software used:

GCCA's Industry EPD Tool for Cement and Concrete (International), developed by GCCA and Quantis, is a web-based calculation tool which was used to create the EPD. The tool produces two major outputs: a self-declaration summary of general information and LCA results, and a background report with the complete set of input data and LCA results, the latter containing all necessary information required to both produce an EPD and for verification purposes. The tool refers to the LCA database provided alongside, this containing background data from ecoinvent (v3.10) (2018) cut-off system model.

Allocation:

Allocation procedures were selected according to ISO 14044:2006, clause 4.3.4 and PCRs EN15804:2012+A2:2019. As such, relevant material flows were allocated on a physical (mass) basis, proportional to weighted average plant production capacities. Secondary materials considered as waste products, such as fly ash and silica fume, were allocated on a physical basis. Secondary materials with significant positive economic value were identified as co-products, hence were allocated on an economic basis, such co-products in the scope of the EPD include granulated blast furnace slag from steel production. It is also worth noting that the GGCA Tool allocates impacts from either mass or volumetric inputs (converted to a mass if applicable as part of a mass balance) to the declared unit of 1 m^3 through user-specified concrete densities relative to the product type and composition.

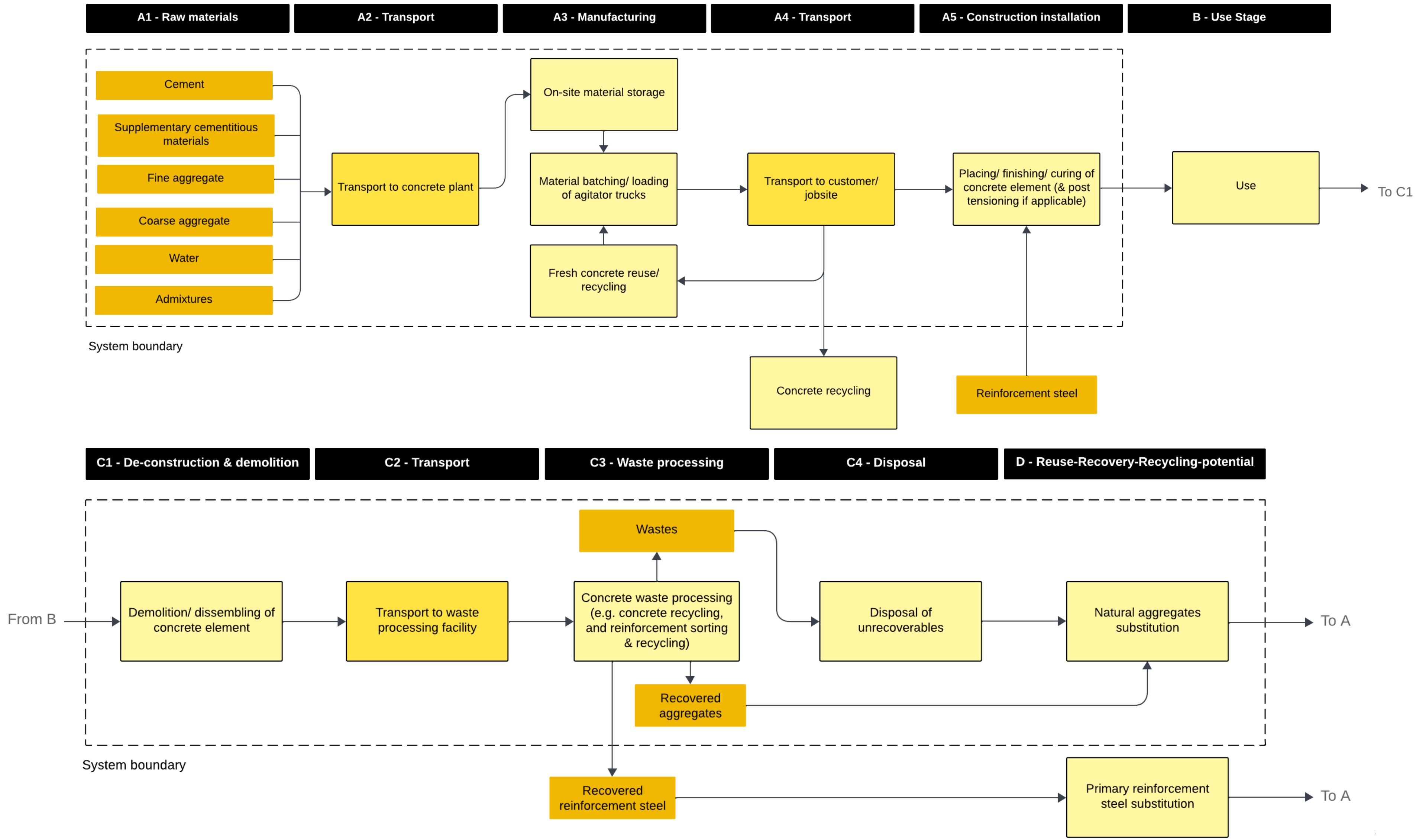
Cut-off rules:

No mass and energy flows are excluded from sub-processes using company specific primary data. The only exception to this is the omission of packaging of silica fume additives which accounts for <0.01% of mass inputs to the ready-mixed concrete manufacturing process (refer to *Packaging* for further details). In all processes which reference the ecoinvent database, default cut-off criteria of 1% of total mass input are used, as well as a maximum of 5% cut-off of total mass and energy flows in the stages from cradle to construction, adhering to EN 15804:2012+A2:2019.

Description of system boundaries:

The EPD covers the life cycle of GS ready-mixed concrete from cradle to grave (modules A1-A3, A4-A5, C1-C4 & D), excluding module B (use stage). Refer to the system diagram and modules declared below:

System diagram:



Modules declared:

	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	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	AU + GLO + RER	GLO + EURO 4 + AU	AU + RoW	AU + GLO	GLO	-	-	-	-	-	-	-	GLO	GLO + EURO 4	AU + GLO + RoW	GLO	GLO
Share of specific data	>60%*			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - products	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation - sites	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

X – Module declared
ND - Module not declared

* The percentage of specific data is assumed to be larger than 60%, but it cannot be proved since one or several EPDs that are used as data sources lack information on the percentage of specific data used.

Share of specific data (in GWP-GHG indicator) and data variation:

For the purpose of the EPD, multiple concrete mixes were combined into a single representative product group through averaging constituent materials, noting GWP-GHG variation between primary and secondary products is <10% absolute. Operational-specific data is averaged across all three plant locations based on weighted annual volume production (m^3), i.e. 49%, 38% & 13% of production in 2023 from Mitchell, Hume and Fyshwick respectively, noting again the GWP-GHG variation among sites is <10%. Both specific data, from company owned processes and available material and energy primary data, and generic data, sourced largely from GCCA, Quantis and ecoinvent v3.10, is used throughout the LCA process. A combination of specific and generic data is used within upstream stages A1-A4, while remaining downstream stages (A5, C1-C4 and D) rely on the latter.

Geographical and temporal relevance of data:

The GGCA EPD Tool uses regionalised data where applicable, utilising ASO (Asia and Oceania) in the current EPD to represent Australia-specific data in exchanges such as:

- Default electricity mix in manufacturing (overwritten in the current EPD with Australia specific)
- Default emission standards for road transport
- Default clinker (not applicable in the current EPD)
- Default cement (clinker factor and MICs) (overwritten in the current EPD with specific third-party cement EPD)

Data quality:

A table outlining the processes of the declared modules is found below, stating the relevant data use, sources and corresponding data quality adhering to the UN Environmental Global Guidance on LCA database development scheme from EN 15804-A2.

It is to be noted, the treatment of missing data is managed by the EPD owner through appropriate procedures and documentation used in third-party EPD Process verification. This includes periodic checks (on an annual basis) of all user inputs to the GCCA Tool to identify unaccounted data, assess their cruciality to the EPD process and results, and seek out estimation techniques using primary data as a priority if applicable, or through use of relevant secondary/industry data to estimate data values.

Stage	Process	Data used	Source	Geography	Year	Data Quality
A1	Raw material supply (inclusive of upstream extraction and processing of primary and secondary materials)	Specific cement defined by supplier EPD clinker factor, kiln fuels and emissions, EFs and MICs (overwriting ASO default)	Cement Australia	AU-NSW / ACT	2023	Very good
		Fly ash from hard coal and silica fume as waste products, and granulated slag from steel production as a co-product (economic allocation)	GCCA / Quantis / Elvin Group (ACT) data / AusLCI	GLO / AU-NSW / AU	2018 / 2023	Good
		Natural crushed aggregates, natural alluvial sand, and manufactured sand	ecoinvent v3.10	GLO	2018	Good
		Plasticisers and superplasticisers as admixtures	EFCA	RER	2015	Fair
		Annual plant mix design and production data (material quantities)	Elvin Group (ACT) primary data	AU-ACT	2023	Very good
A2	Transport of raw materials to plants	Product based mode of transport and regionalised emission standards	ecoinvent v3.10 / GCCA	GLO / EURO 4	2018	Good
		Truck distances between raw material manufacturers and Elvin plants	Elvin Group (ACT) primary data	AU-ACT	2023	Very good
A3	Manufacturing of concrete (including waste management)	Electricity, water, diesel and gas consumption in plant operation, alongside solar generation and reuse/ recycling logs	Elvin Group (ACT) primary data	AU-ACT	2022 / 2023	Very good
		Australia region-specific electricity mix (overwriting ASO default)	DCCEEW	AU	2023	Very good
		On-site transportation fuel emissions (diesel)	ecoinvent v3.10	RoW	2018	Good
A4	Transport of concrete to site	Product based mode of transport – customised as agitator truck with fuel allowances for mixing/ discharge/ washing	ecoinvent v3.10 / Quantis / GCCA	GLO	2018	Good
		Average truck fleet distances between plant and point of use	Elvin Group (ACT) primary data	AU-ACT / NSW	2023	Very good
A5	Construction-installation process of building	Diesel powered building machines, electricity consumption, water consumption, wastewater and waste concrete (default 3%)	ecoinvent v3.10 / Quantis	GLO	2018	Good
C1	Deconstruction – demolition of concrete structure	Diesel powered building machines and particulate emissions	ecoinvent v3.10 / Quantis	GLO	2018	Good
C2	Transport of demolished concrete to end-of-life processing	Product based mode of transport and regionalised emission standards	ecoinvent v3.10 / GCCA LCA Model report	GLO / EURO 4	2018	Good
		Transport distance from demolition to waste processing facilities is estimated from Model for LCA of buildings	JRC Technical report	EU27	2018	Good
C3	Waste processing and recovery of concrete	Waste concrete processing at dry sorting plant, using electricity and excavation by hydraulic digger, specified by recycling rate (specific Australia C&D recovery rate)	ecoinvent v3.10 / Quantis	GLO / RoW / AU	2018 / 2022	Good
C4	Disposal of unrecoverables	Inert material to landfill, including recarbonation	ecoinvent v3.10 / Quantis	GLO	2018	Good
D	Benefits and loads of recycled materials	Concrete and steel: difference between impacts of recycling 1 kg of material and impacts of 1 kg primary material avoided, multiplied by mass flow sent to recycling minus initial recycled material content, including recarbonation	ecoinvent v3.10 / GCCA LCA	GLO/ RoW	2018	Good

Company-specific Manufacturing Process (Module A3):

ISO 14044 Section 5.2 requires company-specific processes to be described in qualitative and quantitative detail. The manufacturing of concrete products at each plant location first consists of delivered raw material storage in silos (cement, fly ash and slag), bins (sand and aggregates) and tanks (admixtures and water). These raw materials serve as mass inputs to the manufacturing process, consisting of the precise weighing and batching through computer-controlled systems and plant equipment (such as conveyer belts). The operation of batching plant systems requires the consumption of electricity from the grid; however, on-site solar generation is provided to the grid as a co-product.

On-site transportation via diesel powered loaders is required to transfer sand and aggregates to the weighing and batching plant, whereas powdered and liquid material is discharged directly from storage. Additionally, for concrete mixes requiring hot water, natural gas is consumed in the heat exchanging system.

Batched materials are loaded into agitator trucks where they are thoroughly mixed to create a consistent concrete mix, ready for transport to site. Before this occurs, the trucks are washed with water to ensure no material or debris is present on the exterior, this water which is reclaimed and recycled where possible.

Lastly, output flows (apart from the concrete product) from the manufacturing process consist of components for reuse and materials or waste to recycling. Waste management systems ensure the reuse of leftover concrete where appropriate and according to AS1379, as well as the use of the on-site recycler to separate water, aggregates and sludge sheets from unused loads if viable or alternatively, the production of hardened/crushed concrete for landscaping purposes.

Quantitative manufacturing process data is addressed in the EPD Process procedures and documentation developed and maintained by Elvin Group (ACT) for third-party verification.

Key Assumptions & Limitations:

1. Plant specific data is collected over a period of 1 year (from January to December) and is thereby representative of the annual collection period.
2. Gross GWP is reported which includes the greenhouse gas emissions from the incineration of secondary fuels in clinker production.
3. Environmental exposure classes of A1 & A2 are selected based on concrete mix design and usage.
4. Transport of raw materials are representative of bulk one-way delivery. Distances are estimated from direct routes of origin to destination and weighted by 2023 annual plant production.
5. Grid purchased electricity is based on the reported 2023 Australian energy mix, overwriting the default GCCA ASO regionalised electricity mix. For this EPD, the energy mix comprises of coal (46.0%), oil (1.78%), natural gas (17.1%), wind (11.7%), solar (16.5%), biofuels and waste (1.14%) and hydro (5.85%). The grid purchased electricity climate impact (GWP-GHG) is 0.72 kg CO_2 eq./kWh.
6. Transport of concrete to site accounts for the entirety of distance travelled by truck fleet in 2023.
7. Onsite transport by loaders and forklifts accounts for the entirety of fuel consumption in 2023.
8. No hazardous or non-hazardous waste is directly produced during the manufacturing stage of the EPD as all non-product output flows are accounted for as either components for reuse or materials/waste for recycling (as determined by waste management logs).

9. Annual batching and mix production exports from plant operation software programs are used in determining the material quantities consumed and total quantities of concrete produced.
10. To account for seasonal changes, the average of summer and winter admixture dosage extremes are used in concrete mix design quantities.
11. Default approaches for recarbonation are implemented in the GCCA Tool during the Waste Processing (C3) and Disposal (C4) modules and are thus reflected in the EPD results. See *Additional information* for more detail.
12. End of life treatment of concrete is based on the scenario outlined by GCCA where at the end of its use stage (excluded from the system boundary), concrete products are demolished, crushed and followed by either landfilling or recycling for primary aggregate substitution (module D). A recycling rate of 78% is adopted from the 2022 National Waste Report which indicates the recovery of C&D waste in Australia in 2020-21. Refer to *Additional Information* for further detail on module C end of life scenarios.
13. The environmental performance of concrete products is reflective of the quality and accuracy of primary and generic data used within the LCA process.

More information:

The GCCA EPD Tool can be found online at https://concrete-epd-tool.org/
The Tool references the database: GCCA_EPD-Tool_LCA-Database-v4.0_2023-04-28.xlsx'.

Refer to the GCCA LCA Model report and User Guide for additional information on assumptions, data quality, allocation, declared stages and associated processes/ exchanges accounted for in the LCA study.

All necessary procedures and documentation have been created and managed by Elvin Group (ACT) for third-party verification. Included in this documentation is the study goal, treatment of missing data, comprehensive company-specific data and relevant assumptions and explanations used in primary data preparation.

LCA undertaken by: Elvin Group (ACT)
Address: 7 Cheney Pl, Mitchell ACT 2911, Australia
Website: https://elvingroup.com.au/
Phone: (02) 6175 9600
Contact: Tahlia Rajic – Technical Engineer

Content information

The table below provides estimated contributions of materials used in the entire range of GS ready-mixed concrete produced by Elvin Group (ACT) on a weight basis (w/w%):

Product components	Content (%)
GP cement	5 – 19
SCMs	3 – 17
Coarse aggregates	28 – 43
Fine aggregates	22 – 46
Admixtures	0.1 – 0.3
Water	7 – 8

No dangerous substances from the candidate list of SVHC are reported, or these are negligible.

Packaging

No packaging is declared as the materials used in concrete production are delivered to Elvin Group (ACT) in bulk and transported directly from plants to site via agitator truck.

It is noted that silica fume arrives at the plants pre-packaged in paper bags, however, as mentioned in *Cut-off rules* the quantities of packaging are excluded in the ready-mixed concrete manufacturing process. The quantity of packaging of silica fume used in the entire process is estimated as <0.01% by mass. Additionally, this packaging is not considered hazardous and does not introduce any significant effects or energy use in their extraction, use or disposal, and thus affirms the omission of silica fume packaging.

Co-products and recycled materials

As beforementioned in *Allocation*, the SCM of slag is considered as a co-product of relevant production processes and therefore introduces economically allocated impacts. The SCMs of fly ash and silica fume are considered as waste products, and hence only introduce impacts in their transport to plant. In addition to co-products, Elvin Group (ACT)'s GS concrete products comprise of recycled waste materials. Up to 83% of fresh water is replaced by recycled and/or reclaimed water, consisting of reclaimed water from on-site recycling facilities. Similarly, fine aggregates consist of a 50:50 blend of natural and manufactured sand, the latter collected as a waste dust from quarry operation.

Product identification

A summary of the properties of the GS ready-mixed concrete product group covered in this EPD is provided below:

Product Identification	
Product name	GS LCF40G40 40 MPa
Product code	LCF40G40
EPD registration code	EPD-IES-0019657:001
Description	Special 40 MPa 40% SCM
Application	General
Strength	40 MPa
Density	2320 kg/m^3
Functional unit	1 m^3
LCA scope	Modules A1-A5, C1-C4 & D
Geographical region	Australia
Primary data reference year	2023

Environmental information

The environmental indicators used in the EPD are listed below with their abbreviations and units:

Indicator	Abbreviation	Units
Core environmental impact indicators		
Global Warming Potential total	GWP-total	kg CO_2 eq.
Global Warming Potential fossil fuels	GWP-fossil	kg CO_2 eq.
Global Warming Potential biogenic	GWP-biogenic	kg CO_2 eq.
Global Warming Potential land use and land use change	GWP-luluc	kg CO_2 eq.
Depletion potential of the stratospheric ozone layer	ODP	kg CFC 11 eq.
Acidification potential, Accumulated Exceedance	AP	mol H^+ eq.
Eutrophication potential, fraction of nutrients reaching freshwater end compartment	EP-freshwater	kg PO_4^{3-} eq.
Eutrophication potential, fraction of nutrients reaching freshwater end compartment	EP-freshwater	kg P eq.
Eutrophication potential, fraction of nutrients reaching marine end compartment	EP-marine	kg N eq.
Eutrophication potential, Accumulated Exceedance	EP-terrestrial	mol N eq.
Formation potential of tropospheric ozone	POCP	kg NMVOC eq.
Abiotic depletion potential for non-fossil resources	ADPE**	kg Sb eq.
Abiotic depletion for fossil resources potential	ADPF**	MJ
Water (user) deprivation potential, deprivation-weighted water consumption	WDP	m^3
Additional environmental impact indicators		
Global Warming Potential greenhouse gas	GWP-GHG*	kg CO_2 eq.
Potential incidence of disease due to pm emissions	PM	Disease incidence
Potential human exposure efficiency relative to U235	IRP	kBq U235 eq.
Potential comparative toxic unit for ecosystems	ETP	CTUe
Potential comparative toxic unit for humans	HTPC	CTUh
Potential comparative toxic unit for humans	HTPNC	CTUh
Potential soil quality index	SQP	dimensionless
Parameters describing resource use		
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ
Use of renewable primary energy resources used as raw materials	PERM	MJ
Total use of renewable primary energy resources	PERT	MJ
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ
Total use of non-renewable primary energy resources	PENRT	MJ
Use of secondary material	SM	kg

Use of renewable secondary fuels	RSF	MJ
Use of non-renewable secondary fuels	NRSF	MJ
Use of net fresh water	FW	m^3
Information describing waste categories		
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg
Outputs		
Components for re-use	CFR	kg
Material for recycling	MFR	kg
Materials for energy recovery	MFEE	kg
Exported energy, electricity	EE - e	MJ
Exported energy, thermal	EE - t	MJ
Extra indicators		
Emissions from calcination and removals from carbonation	CC	kg CO_2 eq.
Emissions from combustion of waste from renewable sources	CWRS	kg CO_2 eq.
Emissions from combustion of waste from non-renewable sources	CWNRS	kg CO_2 eq.
Removals and emissions associated with biogenic carbon content of the bio-based product	GWP-prod	kg CO_2 eq.
Removals and emissions associated with biogenic carbon content of the bio-based packaging	GWP-pack	kg CO_2 eq.

Notes	The LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.
	Module C is included in the EPD; this it is discouraged to use the results of modules A1-A3 (A1-A5 for services) without considering the results of module C.

Product Environmental Performance

Potential environmental impact – mandatory indicators according to EN 15804

Indicator	Unit	LCF40G40							
		A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq.	2.53E+02	1.94E+00	1.71E+01	9.64E+00	1.01E+01	3.80E+00	-1.02E+00	-1.31E+01
GWP-fossil	kg CO_2 eq.	2.53E+02	1.94E+00	1.71E+01	9.63E+00	1.01E+01	3.79E+00	-1.03E+00	-1.30E+01
GWP-biogenic	kg CO_2 eq.	1.67E-01	7.95E-05	1.51E-02	1.05E-03	2.16E-03	6.60E-03	4.40E-04	-3.25E-02
GWP-luluc	kg CO_2 eq.	4.09E-02	7.86E-04	3.87E-03	8.36E-04	4.84E-03	6.80E-03	1.64E-03	-1.03E-02
ODP	kg CFC 11 eq.	4.82E-06	3.02E-08	3.48E-07	1.47E-07	1.46E-07	4.23E-08	9.23E-08	-1.06E-07
AP	mol H^+ eq.	1.41E+00	8.07E-03	1.25E-01	8.69E-02	5.24E-02	3.06E-02	2.26E-02	-8.24E-02
EP-freshwater	kg PO_4^{3-} eq.	1.57E-01	1.49E-04	6.13E-03	2.75E-04	1.01E-03	2.25E-03	2.59E-04	-3.53E-03
EP-freshwater	kg P eq.	5.25E-02	4.97E-05	2.04E-03	9.17E-05	3.38E-04	7.50E-04	8.65E-05	-1.18E-03
EP-marine	kg N eq.	6.75E-02	2.94E-03	3.25E-02	4.03E-02	1.96E-02	7.08E-03	8.62E-03	-1.95E-02
EP-terrestrial	mol N eq.	2.95E+00	3.20E-02	4.14E-01	4.41E-01	2.13E-01	7.35E-02	9.41E-02	-2.48E-01
POCP	kg NMVOC eq.	7.86E-01	1.17E-02	1.21E-01	1.32E-01	7.15E-02	2.20E-02	3.37E-02	-6.71E-02
ADPE*	kg Sb eq.	2.00E-04	5.45E-06	2.51E-05	3.53E-06	2.76E-05	2.91E-05	5.09E-06	-6.92E-05
ADPF*	MJ	1.83E+03	2.83E+01	1.79E+02	1.26E+02	1.42E+02	7.15E+01	7.83E+01	-1.56E+02
WDP*	m^3	4.41E+01	1.36E-01	2.07E+00	3.09E-01	8.28E-01	1.14E+00	2.19E-01	-2.62E+01

* 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.

Potential environmental impact – additional mandatory and voluntary indicators

Indicator	Unit	LCF40G40							
		A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-GHG*	kg CO_2 eq.	2.53E+02	1.94E+00	1.71E+01	9.64E+00	1.01E+01	3.80E+00	-1.02E+00	-1.31E+01
PM	Disease incidence	9.85E-06	1.98E-07	1.99E-06	2.47E-06	1.10E-06	3.55E-07	5.14E-07	-1.34E-06
IRP	kBq U235 eq.	2.41E+03	2.50E-02	7.26E+01	5.65E-02	1.83E-01	6.82E-01	4.99E-02	-1.13E+00
ETP	CTUe	1.73E+02	6.80E+00	1.72E+02	1.79E+01	4.09E+01	1.76E+01	1.07E+01	-8.36E+01
HTPC	CTUh	7.70E-07	9.68E-09	6.46E-08	3.77E-08	6.46E-08	1.37E-08	1.44E-08	-1.54E-07
HTPNC	CTUh	1.47E-05	1.87E-08	4.99E-07	1.72E-08	9.11E-08	4.99E-08	1.41E-08	-1.06E-07
SQP	dimensionless	1.19E+03	2.85E+01	6.47E+01	8.86E+00	1.32E+02	3.90E+01	1.54E+02	-1.66E+02

Use of resources

Indicator	Unit	LCF40G40							
		A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	2.99E+01	3.72E-01	6.24E+00	7.73E-01	2.77E+00	9.09E+00	7.27E-01	-1.30E+01
PERM	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
PERT	MJ	2.99E+01	3.72E-01	6.24E+00	7.73E-01	2.77E+00	9.09E+00	7.27E-01	-1.30E+01
PENRE	MJ	4.93E+02	2.83E+01	1.39E+02	1.26E+02	1.42E+02	7.15E+01	7.83E+01	-1.56E+02
PENRM	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
PENRT	MJ	4.93E+02	2.83E+01	1.39E+02	1.26E+02	1.42E+02	7.15E+01	7.83E+01	-1.56E+02
SM	kg	5.52E+02	0.00E+00	1.66E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	2.76E+01	0.00E+00	8.28E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	3.72E+01	0.00E+00	1.11E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	1.08E+00	4.17E-03	4.98E-02	8.19E-03	2.37E-02	3.25E-02	8.12E-02	-6.20E-01

* This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO_2 is set to zero.

Waste production and output flows

Indicator	Unit	LCF40G40							
		A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	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
NHWD	kg	4.64E-02	0.00E+00	1.55E+01	0.00E+00	0.00E+00	0.00E+00	5.16E+02	0.00E+00
RWD	kg	3.52E-01	6.11E-06	1.06E-02	1.38E-05	4.50E-05	1.67E-04	1.22E-05	-2.74E-04
CFR	kg	1.12E+01	0.00E+00	3.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	1.38E+02	0.00E+00	5.84E+01	0.00E+00	0.00E+00	1.81E+03	0.00E+00	0.00E+00
MFEE	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
EE - e	MJ	1.27E+00	0.00E+00	3.81E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE - t	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

Extra environmental Indicators

Indicator	Unit	LCF40G40							
		A1-A3	A4	A5	C1	C2	C3	C4	D
CC	kg CO_2 eq.	1.20E+02	0.00E+00	3.44E+00	0.00E+00	0.00E+00	-1.75E+00	-4.22E+00	0.00E+00
CWRS	kg CO_2 eq.	2.73E-02	0.00E+00	8.20E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNRS	kg CO_2 eq.	6.42E-01	0.00E+00	1.93E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP-prod	kg CO_2 eq.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
GWP-pack	kg CO_2 eq.	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Additional information

Module C - End of life scenarios

The end of life of ready-mixed concrete products is based on generic scenarios as detailed in EN 15804:2012+A2:2019 and EN 16757:2022:

- C1, de-construction, demolition
- C2, transport to waste processing
- C3, Waste processing for reuse, recycling and energy recovery
- C4, disposal and the associated processes

In particular, EN 16757:2022 outlines four specific waste processing scenarios for module C3, each introducing benefits and loads outside the system boundary except for scenario 1:

1. “Disposal of concrete at landfill site”
2. “Reuse of recovered concrete elements in new construction works”
3. “Use of concrete debris, e.g., in land restoration”
4. “Crushing/recycling of concrete”
    i. “Crushed concrete substitutes primary material without further processing”
    ii. “Substitution of natural aggregates in fresh concrete”

In the current EPD, end of life treatment of concrete is based on scenario 4ii, described by GCCA where at the end of its use stage, concrete products are demolished, crushed and followed by either landfilling or recycling through a region-specific recycling rate. The recycling of concrete in this scenario allows the substitution of natural aggregates in fresh concrete and depending on the product system boundary, also steel reinforcement in primary material inputs (steel reinforcement is excluded from the system boundary in the current EPD). The GCCA Tool also considers incineration and energy recovery as part of waste processing, however, this is not applicable to the geographical region of the EPD.

The recycled crushed concrete is considered to have reached its end of waste state once subjected to further processing to separate by size fraction and stockpiled, and with immediate market demand. The crushed recycled aggregates as an output of C3 then enters module D to replace virgin crushed aggregates, introducing benefits and loads beyond the system boundary.

Module C - Recarbonation

As stated by GCCA, carbonation of concrete is a process by which CO_2 in the ambient air penetrates the concrete, reacts with hydration products to form carbonates. Recarbonation is accounted for by GCCA at both waste processing (C3) and disposal (C4) stages, as presented in the GCCA LCA Model. The modelling for recarbonation during the life cycle of the concrete products follows the guidance provided in EN 16757 – Annex BB – CO_2 uptake by carbonation – Guidance on calculation, and EN 15804 – Annex C.

Differences versus previous versions

No previous versions of this EPD exist.

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