ENVIRONMENTAL PRODUCT DECLARATION

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HOLLOWCORE PLANKS

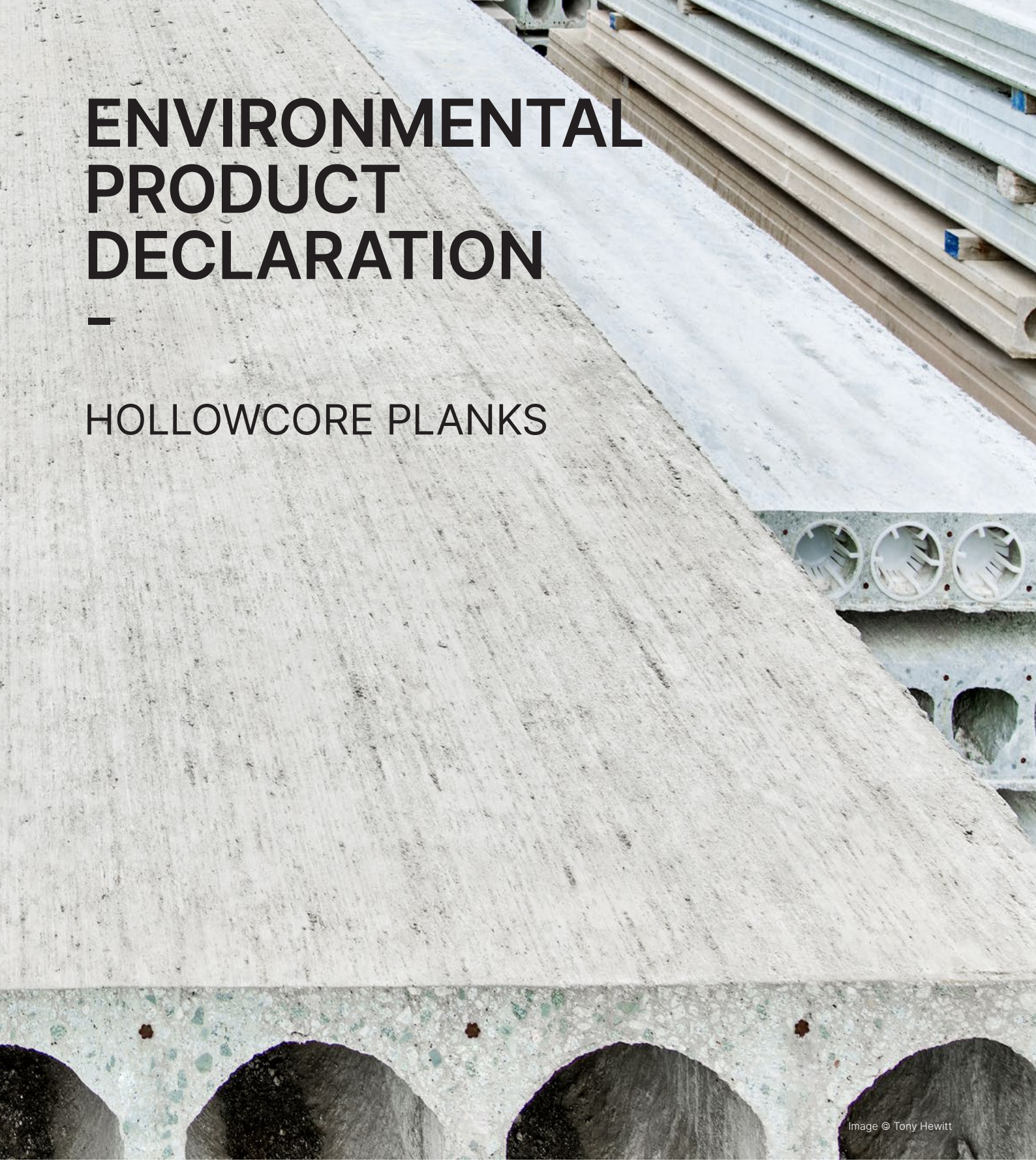

Image © Tony Hewitt

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

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Geographical Scope: Australia

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.epd-australasia.com

BGC Precast

AUSTRALASIA EPD ENVIRONMENTAL PRODUCT DECLARATION

ECO PLATFORM EPD VERIFIED

Image © Tony Hewitt

Contents

BGC Precast

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Building on 60 years of industry experience, BGC Precast, a Western Australian owned company, is a leading provider of precast concrete and hollowcore solutions throughout Australia.

At BGC Precast, our vision is to be the preferred supplier of precast concrete elements in the construction industry.

We manufacture high quality architectural and structural precast hollowcore concrete floor slabs, wall panels, columns, beams, noisewalls and stairs to our client's requirements.

All BGC Precast products are formulated and tested to meet strict Australian Standards, so customers can be assured that what we manufacture will make the grade and will be supported with unrivalled service and timely delivery.

Hollowcore Planks

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Our Location

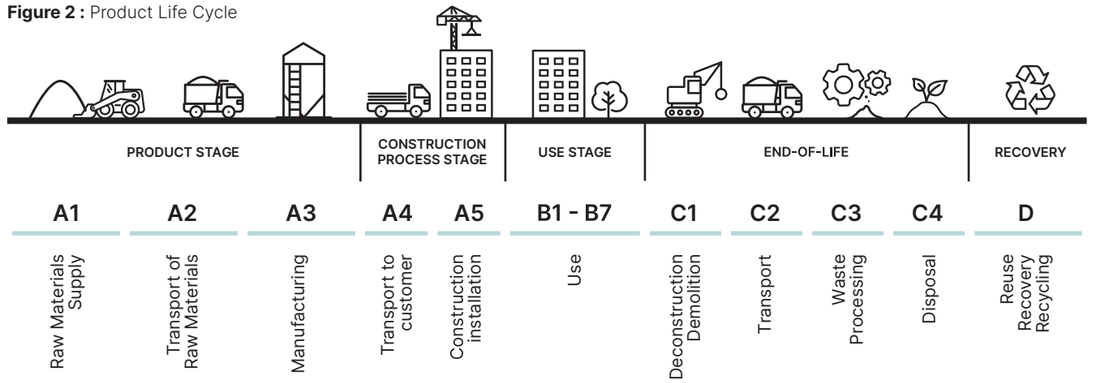
Hollowcore planks outlined in this Environmental Product Declaration are manufactured at BGC Precast's state-of-the-art manufacturing facility located at Kwinana Beach, Western Australia.

Product Life Cycle

Creating an EPD is an extensive process based on a set of Product Category Rules (PCR) and a Life Cycle Assessment (LCA). Environmental data, such as electricity and fuel consumption from the raw material process through to production of hollowcore planks is evaluated, modelled, and then reported through an independently verified EPD.

This EPD is based on a cradle-to-gate with the end-of-life modules C1-C4 and D stages included. The construction process (modules A4-A5), use stages (B1-B7) have not been modelled as these are best modelled at the building or infrastructure project level.

Figure 2 : Product Life Cycle



Hollowcore Plank Production

Hollowcore planks covered by this EPD are manufactured with a combination of cement, coarse and fine aggregates, prestressed steel strand and admixtures that are primarily sourced locally.

Concrete is manufactured on location and bonded in beds to prestressed steel strand to give the planks strength, facilitating longer spans between bearing points.

Planks are manufactured to a standard width of 1.2 m, and thereafter cut to length and widths to suit our customer's requirements. We manufacture planks in an incremental set of 7 standard thicknesses, from 160 mm up to 500 mm (½ m thick), for spans in excess of 20 m.

Our hollowcore planks are made with seven different concrete mixes (mix codes 2, 3, 7, 9, 10, 11, and 12). Although the differences between some of these mixes are minimal, we have opted to present the results for each concrete mix design separately for maximum transparency and accuracy.

Once cured, the hollowcore planks are loaded onto trucks for transport to market.

Content Declaration

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A summary of the materials used in BGC hollowcore planks is listed in Table 1.

Table 1: Product composition, per declared unit (1 tonne)

Product composition	Mass, kg	Post-consumer material, mass %	Renewable material, mass %
Hollowcore plank	1,000		
Concrete (Cement, Sand & Aggregates, Admixtures)	>95%	0%	0%
Prestressed Steel Strand	<5%	0%	0%

Industry Classification

The UN CPC and ANZSIC codes applicable to hollowcore plank products are listed below:

- UN CPC 375 - Articles of concrete, cement and plaster
- ANZSIC 20340 - Concrete Products Manufacturing

Our precast hollowcore planks can be custom made in all shapes and sizes.

Presenting the results for concrete and prestressed steel separately enables the most robust calculation of environmental impacts across numerous permutations.

Declared Unit

The declared unit is:

- 1 tonne of concrete used in reinforced concrete hollowcore planks;
- 1 tonne of steel strands used in reinforced concrete hollowcore planks.

The information contained in this EPD applies to bulk products (i.e. no packaging is used).

The EPD is product-specific; i.e. no averaging across products or sites was necessary.

Hollowcore planks do not contain any biogenic carbon.

The products included in this EPD do not contain any substances of very high concern as defined by European REACH regulation in concentrations >0.1% (m/m).

Technical Information

Technical Compliance

BGC Precast does not simply manufacture precast concrete products but develops innovative solutions based on local knowledge and experience. Our Precast team consists of highly committed customer and quality focused members experienced in all aspects of the construction industry.

Climate change has motivated BGC Precast and its customers to work towards a carbon neutral future and the publication of this EPD is an important step in this process. We support science-based research that will enable a lower environmental footprint and bring us closer to our goal of carbon neutral concrete products.

BGC Precast maintains a certified ISO 9001 Quality Management System to ensure we meet Australian Standards in the construction industry.

Our products achieve technical compliance with:

- AS 3600:2018 Concrete structures (including Amendments 1 & 2)
- AS 1379:2007 Specification and supply of concrete

System Boundary

This EPD covers the cradle-to-gate plus end-of-life life cycle stages (modules A1-A3, C1-C4, D). Construction and use stages have not been included as we cannot define a typical scenario for our range of hollowcore planks. The modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation are shown in Table 2.

Table 2: Scope of EPD

	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	Deconstruction 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	✓	✓	✓	ND	ND	ND	ND	ND	ND	ND	ND	ND	✓	✓	✓	✓	✓
Geography	AU, ID, JP, TH	AU	AU	-	-	-	-	-	-	-	-	-	AU	AU	AU	AU	AU
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

✓: Module is declared
ND: Module is not declared

Product Stage

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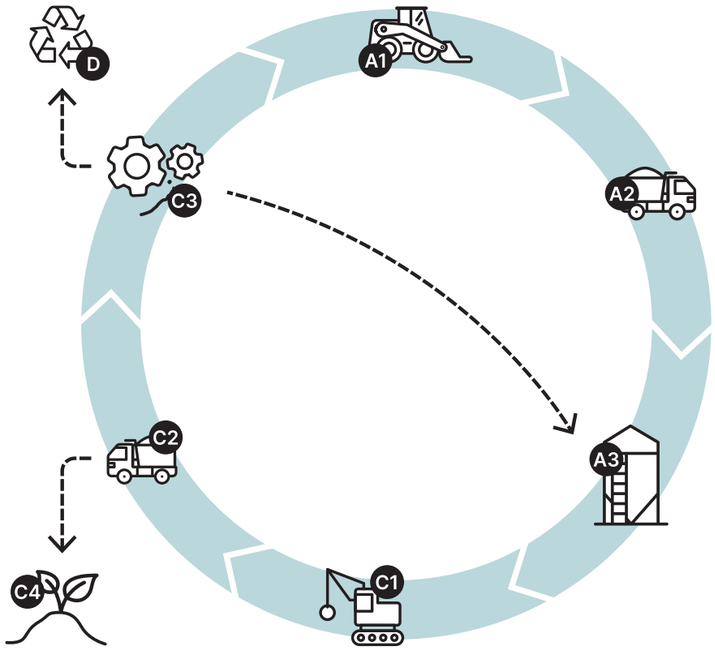
Figure 3: Product Stage and End-of-Life



A4-A5 and B1-B7 are excluded from the EPD and therefore not shown in this figure.

Table 3: End-of-life scenario parameters

Processes	Quantity per tonne of hollowcore planks	Unit
Collection process specified by type	1,000	kg collected separately
	0	kg collected with mixed construction waste
Transport from demolition site to recovery/disposal sites	50	km transport
Recovery system specified by type	0	kg for re-use
	760	kg for recycling
	0	kg for energy recovery
Disposal to landfill	240	kg product or material for final deposition
Assumptions for scenario development	61.7	MJ of diesel for the demolition process

Product Stage (A1-A3)

Investigates the environmental impacts related to the manufacturing of hollowcore planks before they leave the BGC Precast manufacturing facility.

A1 Raw Material Supply
Extraction and processing of raw materials such as cement, aggregates and steel manufacture.

A2 Transportation
Transport of raw materials to the BGC Precast manufacturing facility.

A3 Manufacturing
Manufacturing of hollowcore planks begins with the preparation of the casting bed, tensioning of steel strand, then bonding to concrete extruded from an overhead shuttle.

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

Investigates the environmental impacts related to the hollowcore planks after they have reached the end of their useful life.

C1 Demolition
Demolition of hollowcore plank structure.

C2 Transport
Transport of the concrete and steel waste.

C3 Waste Processing
Processing of concrete and steel waste.

C4 Disposal
Landfill of concrete and steel waste.

D Resource Recovery Stage
Reuse, recovery, and recycling potential of the product after its end-of-life.

Life Cycle Assessment (LCA) Methodology

Background Data

BGC has collected and supplied the primary data for the hollowcore planks LCA based on the FY21 reporting period (1 July 2020 – 30 June 2021). BGC Cement and BGC Quarries provided data for the ingredients that they supply. Background data on prestressed steel strand was sourced from EPD S-P-05640. Other background data (i.e. for energy and transport processes) have predominantly been sourced from AusLCI and the AusLCI shadow database (v1.36) (AusLCI 2021), as well as ecoinvent v3. Background data used are either less than 10 years old or have been reviewed within this period. Methodological choices have been applied in line with EN 15804; deviations have been recorded.

Allocation

The key process that requires allocation are:

- **Shared production of various precast concrete elements:** overhead processes (i.e. energy use) for hollowcore plank production have been allocated to different planks on a mass basis (share in total tonnes of hollowcore plank and other precast products).
- **Aggregates:** aggregates are produced through crushing of rock, which is graded in different sizes. The energy required for the crushing and screening does not differentiate between products. Therefore, impacts are allocated to products (e.g. crushed rock, manufactured sand) based on the mass of product. In effect, all aggregates have the same environmental profile.
- **Prestressed steel strand:** allocation has been applied in accordance with EN 15804:2012+A2:2019. See our supplier's EPD (S-P-05640) for more details.

Cut-off Criteria

The cut-off criteria applied are 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of a process, while considering environmental impacts of small flows:

- The amount of packaging used for admixtures is well below the materiality cut-off and these materials have been excluded.

The contribution of capital goods (production equipment and infrastructure) and personnel is excluded, as these processes are non-attributable and they contribute less than 10% to GWP-GHG.

Key Assumptions

The key choices and assumptions in the LCA are:

- For reinforcing strand, we used our supplier's EN 15804+A2 compliant EPD (EPD S-P-05640, Prestressed Concrete Steel Wire Strand (PC Strand) The Siam Industrial Wire Co. Ltd., 2022-03-16).
- Admixture data are based on generic ecoinvent data for organic and inorganic chemicals.
- Electricity used in production has been modelled using the electricity consumption mix on the WA market. The GWP-GHG intensity of the electricity used in the model is 0.69 kg CO_2e/kWh.

Environmental Impact Indicators

An introduction to each environmental impact indicator is provided below, along with the best known cause and effect.

Global Warming Potential (GWP)
Is due to the heat absorbed by greenhouse gases, causing the rise of the global temperature.

Photochemical Smog (POCP)
Is due to a mixture of pollutants which includes volatile organic compounds, particulates, nitrogen oxides and ozone. It's harmful to human health (causing lung irritation problems, coughing and wheezing) and the environment (damage to plants and crops).

Acidification Potential (AP)
Is due to emissions of acids, causing the degradation of materials such as metals, limestone and concrete, and damage to trees and life in lakes and rivers.

Abiotic Resource Depletion (ADP)
Is due to extraction and consumption of non-renewable resources such as oil, coal and metals, causing a decrease in future availability of functions supplied by these resources.

Eutrophication Potential (EP)
Is due to emissions of nutrients, causing blooms of algae. The degradation of dead algae consumes oxygen leading to the loss of plants and animals.

Ozone Depletion Potential (ODP)
Is due to emissions which destroy the ozone layer causing higher levels of UV light to reach earth which damages DNA in humans, animals and plants.

Water Deprivation Potential (WDP)
Is due to water availability versus demand. The less water remaining per area, the more likely another user will be deprived.

Environmental Impact Indicators

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Environmental Impact Indicator Legend

The environmental indicators associated with impact categories, resource use, waste categories and output flows described in this EPD are summarised in the table below. All further tables will contain the abbreviation of the indicator for simplicity.

Table 4: Environmental Impact Indicators included in this EPD

Indicator	Abbreviation	Units
Mandatory Potential Environmental Impact indicators, in accordance to EN 15804:2012+A2:2019		
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	AP	mol H^+-eq.
Eutrophication potential - freshwater	EP-freshwater	kg P-eq.
Eutrophication potential - marine	EP-marine	kg N-eq.
Eutrophication potential - terrestrial	EP-terrestrial	mol N-eq.
Formation potential of tropospheric ozone	POCP	kg NMVOC-eq.
Abiotic depletion potential for non-fossil resources	ADP-minerals & metals	kg Sb-eq.
Abiotic depletion potential for fossil resources	ADP-fossil	MJ
Water (user) deprivation potential	WDP	m^3world-eq.deprived
Mandatory Potential Environmental Impact indicators, in accordance to EN 15804:2012+A2:2019		
Particulate Matter emissions	PM	Disease incidence
Ionising Radiation - human health	IRP	kBq U-235-eq.
Eco-toxicity - freshwater	ETP-fw	CTUe
Human toxicity potential - cancer effects	HTP-c	CTUh
Human toxicity potential - non-cancer effects	HTP-nc	CTUh
Land use related impacts / soil quality	SQP	dimensionless

Indicator	Abbreviation	Units
Resource use parameters		
Use of renewable primary energy excluding renewable primary energy	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	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
Net use of fresh water	FW	m^3
Waste Categories and Output Flows		
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg
Components for re-use	CRU	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported energy - electrical and thermal	EE	MJ
Additional Potential Environmental Impact indicators, in accordance to EN 15804:2012+A1:2013		
Global warming potential	GWP	kg CO_2-eq.
Ozone depletion potential	ODP	kg CFC-11-eq.
Acidification potential	AP	kg SO_2-eq.
Eutrophication potential	EP	kg PO_4^{3-}-eq.
Photochemical ozone creation potential	POCP	kg C_2H_4-eq.
Abiotic depletion potential for non-fossil resources	ADPE	kg Sb-eq.
Abiotic depletion potential for fossil resources	ADPF	MJ
Carbon Footprint		
Global Warming Potential - Greenhouse Gas emissions	GWP-GHG	kg CO_2-eq.

Life Cycle Assessment (LCA) Results

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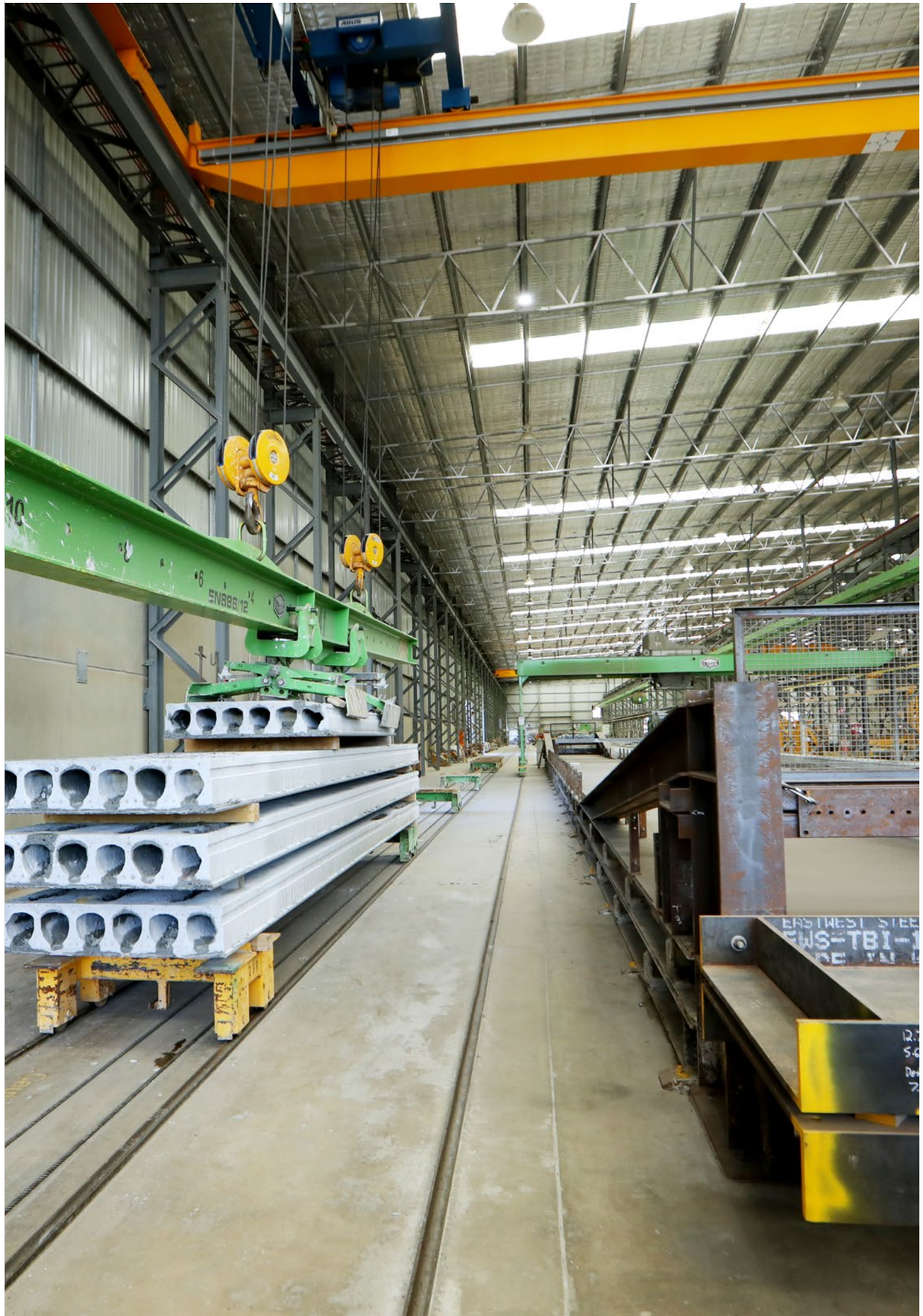
Environmental Profiles for Hollowcore Planks

The background Life Cycle Assessment serves as the foundation for this EPD. A Life Cycle Assessment analyses the environmental processes in the value chain of a product. It provides a comprehensive evaluation of all upstream (and sometimes downstream) material and energy inputs and outputs. The results are provided for a range of environmental impact categories, in line with EN 15804:2012+A2:2019.

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



Results A1-A3

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Mandatory Environmental Impact Categories A1-A3

Table 5: Potential environmental impacts - mandatory indicators according to EN 15804:2012+A2:2019

Primary Indicators	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-minerals & metals*	ADP-fossil*	WDP*
Per Tonne	kg CO_2-eq.	kg CO_2-eq.	kg CO_2-eq.	kg CO_2-eq.	kg CFC 11-eq.	mol H^+ eq.	kg P eq.	kg N eq.	mol N eq.	kg NMVOC eq.	kg Sb eq.	MJ (NCV)	m^3
Concrete Mix Code 2	2.21E+02	2.18E+02	2.48E+00	4.25E-02	4.65E-06	7.55E-01	7.11E-03	1.95E-01	2.20E+00	5.39E-01	3.52E-06	1.24E+03	1.04E+02
Concrete Mix Code 3	2.20E+02	2.17E+02	2.47E+00	4.24E-02	4.63E-06	7.51E-01	7.08E-03	1.94E-01	2.19E+00	5.37E-01	3.51E-06	1.24E+03	1.05E+02
Concrete Mix Code 7	2.10E+02	2.07E+02	2.33E+00	4.02E-02	4.55E-06	7.24E-01	6.71E-03	1.88E-01	2.12E+00	5.19E-01	3.34E-06	1.19E+03	1.03E+02
Concrete Mix Code 9	2.09E+02	2.06E+02	2.32E+00	4.00E-02	4.50E-06	7.19E-01	6.68E-03	1.86E-01	2.10E+00	5.14E-01	3.34E-06	1.19E+03	1.09E+02
Concrete Mix Code 10	2.09E+02	2.07E+02	2.32E+00	4.00E-02	4.54E-06	7.22E-01	6.68E-03	1.87E-01	2.11E+00	5.18E-01	3.32E-06	1.19E+03	1.02E+02
Concrete Mix Code 11	2.19E+02	2.16E+02	2.46E+00	4.22E-02	4.58E-06	7.46E-01	7.05E-03	1.92E-01	2.17E+00	5.33E-01	3.51E-06	1.23E+03	1.10E+02
Concrete Mix Code 12	2.16E+02	2.14E+02	2.42E+00	4.16E-02	4.56E-06	7.40E-01	6.96E-03	1.91E-01	2.15E+00	5.28E-01	3.47E-06	1.22E+03	1.10E+02
Steel strand	2.57E+03	2.59E+03	-1.60E+01	4.81E-01	1.62E-04	1.92E+01	8.60E-02	4.88E+00	5.26E+01	1.65E+01	4.90E-03	2.87E+04	4.09E+02

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

Results A1-A3

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Additional Impact Categories A1-A3

Table 6: Potential environmental impacts - additional indicators according to EN 15804:2012+A2:2019

Primary Indicators	PM	IRP**	ETP-fw*	HTP-c*	HTP-nc*	SQP*
Per Tonne	Disease incidence	kBq U235 eq.	CTUe	CTUh	CTUh	-
Concrete Mix Code 2	6.29E-06	2.20E-01	9.55E+02	1.22E-08	9.84E-07	7.00E+02
Concrete Mix Code 3	6.25E-06	2.19E-01	9.51E+02	1.21E-08	9.79E-07	6.96E+02
Concrete Mix Code 7	6.06E-06	2.08E-01	9.09E+02	1.16E-08	9.34E-07	6.93E+02
Concrete Mix Code 9	6.00E-06	2.07E-01	9.04E+02	1.15E-08	9.29E-07	6.86E+02
Concrete Mix Code 10	6.05E-06	2.07E-01	9.05E+02	1.15E-08	9.30E-07	6.91E+02
Concrete Mix Code 11	6.19E-06	2.18E-01	9.46E+02	1.21E-08	9.75E-07	6.90E+02
Concrete Mix Code 12	6.14E-06	2.15E-01	9.35E+02	1.19E-08	9.63E-07	6.89E+02
Steel strand	2.53E-04	2.44E+01	1.48E+03	2.24E-08	1.09E-06	3.80E+03

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or 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.

Resource Use Indicators A1-A3

Table 7: Use of Resources

Primary Indicators	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
Per Tonne	MJNCV	MJNCV	MJNCV	MJNCV	MJNCV	MJNCV	kg	MJNCV	MJNCV	m^3
Concrete Mix Code 2	4.39E+01	0.00E+00	4.39E+01	1.36E+03	0.00E+00	1.36E+03	2.92E+00	2.03E+01	4.76E+01	7.58E+00
Concrete Mix Code 3	4.37E+01	0.00E+00	4.37E+01	1.36E+03	0.00E+00	1.36E+03	2.91E+00	2.03E+01	4.74E+01	7.56E+00
Concrete Mix Code 7	4.18E+01	0.00E+00	4.18E+01	1.31E+03	0.00E+00	1.31E+03	2.76E+00	1.92E+01	4.50E+01	7.20E+00
Concrete Mix Code 9	4.17E+01	0.00E+00	4.17E+01	1.30E+03	0.00E+00	1.30E+03	2.75E+00	1.91E+01	4.48E+01	7.23E+00
Concrete Mix Code 10	4.17E+01	0.00E+00	4.17E+01	1.30E+03	0.00E+00	1.30E+03	2.75E+00	1.91E+01	4.48E+01	7.17E+00
Concrete Mix Code 11	4.36E+01	0.00E+00	4.36E+01	1.35E+03	0.00E+00	1.35E+03	2.90E+00	2.02E+01	4.72E+01	7.58E+00
Concrete Mix Code 12	4.31E+01	0.00E+00	4.31E+01	1.34E+03	0.00E+00	1.34E+03	2.86E+00	1.99E+01	4.66E+01	7.49E+00
Steel strand	1.02E+03	0.00E+00	1.02E+03	3.08E+04	0.00E+00	3.08E+04	4.39E+02	0.00E+00	0.00E+00	7.61E+01

Resource Use Indicators A1-A3

Table 8: Waste Production

Primary Indicators	HWD	NHWD	RWD
Per Tonne	kg	kg	kg
Concrete Mix Code 2	0.00E+00	5.31E-02	0.00E+00
Concrete Mix Code 3	0.00E+00	5.30E-02	0.00E+00
Concrete Mix Code 7	0.00E+00	5.14E-02	0.00E+00
Concrete Mix Code 9	0.00E+00	5.17E-02	0.00E+00
Concrete Mix Code 10	0.00E+00	5.11E-02	0.00E+00
Concrete Mix Code 11	0.00E+00	5.32E-02	0.00E+00
Concrete Mix Code 12	0.00E+00	5.28E-02	0.00E+00
Steel strand	1.42E-02	5.40E+03	1.29E-06

Output Flow Indicators A1-A3

Table 9: Output Flows

Primary Indicators	CRU	MFR	MER	EE
Per Tonne	kg	kg	kg	MJ
Concrete Mix Code 2	0.00E+00	1.23E+02	0.00E+00	0.00E+00
Concrete Mix Code 3	0.00E+00	1.23E+02	0.00E+00	0.00E+00
Concrete Mix Code 7	0.00E+00	1.23E+02	0.00E+00	0.00E+00
Concrete Mix Code 9	0.00E+00	1.22E+02	0.00E+00	0.00E+00
Concrete Mix Code 10	0.00E+00	1.22E+02	0.00E+00	0.00E+00
Concrete Mix Code 11	0.00E+00	1.22E+02	0.00E+00	0.00E+00
Concrete Mix Code 12	0.00E+00	1.22E+02	0.00E+00	0.00E+00
Steel strand	0.00E+00	4.02E+00	0.00E+00	0.00E+00

Results A1-A3

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EN 15804:2012+A1:2013 Compliant Indicators A1-A3

We are also providing EN 15804:2012+A1:2013 compliant results (see Table 10) to assist our customers who want to use this EPD in tools, such as the Green Building Council of Australia's Green Star Tool and the Infrastructure Sustainability Council's Sustainability Rating Tool that are currently based on this method.

Table 10: Potential environmental impacts - mandatory indicators according to EN 15804:2012+A1:2013

Primary Indicators	GWP	ODP	AP	EP	POCP	ADPE	ADPF
Per Tonne	kg CO_2 eq	kg CFC-11 eq	kg SO_2 eq	kg PO_4^{3-} eq	kg C_2H_4 eq	kg Sb eq	MJ
Concrete Mix Code 2	2.19E+02	3.69E-06	5.20E-01	9.07E-02	4.36E-02	3.83E-06	1.56E+03
Concrete Mix Code 3	2.18E+02	3.68E-06	5.17E-01	9.03E-02	4.34E-02	3.81E-06	1.55E+03
Concrete Mix Code 7	2.08E+02	3.61E-06	4.97E-01	8.69E-02	4.22E-02	3.64E-06	1.49E+03
Concrete Mix Code 9	2.07E+02	3.58E-06	4.93E-01	8.62E-02	4.18E-02	3.64E-06	1.49E+03
Concrete Mix Code 10	2.08E+02	3.61E-06	4.95E-01	8.67E-02	4.22E-02	3.63E-06	1.49E+03
Concrete Mix Code 11	2.17E+02	3.64E-06	5.14E-01	8.96E-02	4.30E-02	3.81E-06	1.54E+03
Concrete Mix Code 12	2.15E+02	3.63E-06	5.09E-01	8.88E-02	4.27E-02	3.77E-06	1.53E+03
Steel strand	2.43E+03	1.47E-04	1.47E+01	2.04E+00	2.39E+00	4.99E-03	4.00E+04

Carbon Footprint A1-A3

Table 11: Carbon footprint in line with Australian climate change reporting frameworks

Primary Indicators	Carbon footprint (IPCC AR5, 100yr)
	GWP-GHG
Per Tonne	kg CO_2-eq.
Concrete Mix Code 2	2.19E+02
Concrete Mix Code 3	2.18E+02
Concrete Mix Code 7	2.08E+02
Concrete Mix Code 9	2.07E+02
Concrete Mix Code 10	2.08E+02
Concrete Mix Code 11	2.17E+02
Concrete Mix Code 12	2.15E+02
Steel strand	2.50E+03

The GWP-GHG indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product as defined by IPCC AR 5 (IPCC 2013). This indicator is determined using IPCC AR5 Global Warming Potentials (GWP) with a 100-year time horizon.

Results C1-C4 & D

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Mandatory Environmental Impact Categories C1-C4 & D

Table 12: Potential environmental impacts - mandatory indicators according to EN 15804:2012+A2:2019

Indicator	GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater	EP-marine	EP-terrestrial	POCP	ADP-minerals & metals*	ADP-fossil*	WDP*
Per Tonne of Hollowcore Plank	**kg CO_2-eq.**	**kg CO_2-eq.**	**kg CO_2-eq.**	**kg CO_2-eq.**	**kg CFC11-eq.**	**mol H^+ eq.**	**kg P eq.**	**kg N eq.**	**mol N eq.**	**kg NMVOC eq.**	**kg Sb eq.**	**MJ (NCV)**	**m^3**
Module C1 - demolition of hollowcore	5.19E+00	5.19E+00	5.39E-04	2.56E-06	8.54E-07	5.91E-02	7.72E-07	2.56E-02	2.81E-01	6.75E-02	6.28E-09	7.43E+01	4.34E+00
Module C2 - transport of hollowcore to disposal	6.52E+00	6.52E+00	5.98E-04	3.02E-06	1.01E-06	5.68E-02	4.52E-07	1.78E-02	1.95E-01	4.75E-02	7.42E-09	8.77E+01	4.77E+00
Module C3 - hollowcore recycling	3.22E+00	3.21E+00	4.16E-03	1.44E-06	3.93E-07	1.16E-02	2.70E-06	1.92E-03	2.08E-02	5.57E-03	7.74E-07	4.31E+01	4.26E+01
Module C4 - hollowcore in landfill	5.73E-01	5.73E-01	7.13E-05	2.76E-07	9.30E-08	1.42E-03	8.61E-08	2.53E-04	2.77E-03	7.44E-04	6.67E-10	8.07E+00	5.82E-01
Module D - per tonne of concrete	-3.77E+00	-3.76E+00	-6.47E-03	-1.86E-04	-4.00E-07	-3.36E-02	-6.13E-06	-1.25E-02	-1.41E-01	-3.30E-02	-6.57E-08	-5.03E+01	-3.80E+00
Module D - per tonne of steel strand	-2.99E+02	-3.01E+02	2.42E+00	2.08E-01	-7.10E-06	-1.12E+00	-5.60E-04	-1.62E-02	-2.93E+00	-1.67E+00	-8.23E-03	-2.31E+03	8.47E+01

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

Results C1-C4 & D

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Additional Environmental Impact Categories C1-C4 & D

Table 13: Potential environmental impacts - additional indicators according to EN 15804:2012+A2:2019

Indicator	PM	IRP**	ETP-fw*	HTP-c*	HTP-nc*	SQP*
Per Tonne of Hollowcore Plank	Disease incidence	kBq U235 eq.	CTUe	CTUh	CTUh	-
Module C1 - demolition of hollowcore	1.56E-06	1.09E-04	2.14E+01	2.67E-10	2.46E-08	3.48E-01
Module C2 - transport of hollowcore to disposal	3.21E-07	1.28E-04	2.52E+01	1.06E-10	8.57E-09	3.84E-01
Module C3 - hollowcore recycling	8.34E-08	6.29E-04	1.15E+01	5.23E-10	1.75E-08	8.46E+03
Module C4 - hollowcore in landfill	7.76E-09	1.18E-05	2.30E+00	2.11E-11	2.08E-09	8.75E+00
Module D - per tonne of concrete	-7.86E-07	-1.78E-03	-1.29E+01	-2.46E-10	-1.84E-08	-8.94E+01
Module D - per tonne of steel strand	-1.49E-05	5.04E+00	-6.26E+03	2.95E-06	1.85E-05	-6.70E+02

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or 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.

Resource Use Indicators C1-C4 & D

Table 14: Use of Resources

Indicator	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW
Per Tonne of Hollowcore Plank	MJNCV	MJNCV	MJNCV	MJNCV	MJNCV	MJNCV	kg	MJNCV	MJNCV	m^3
Module C1 - demolition of hollowcore	1.02E-01	0.00E+00	1.02E-01	7.88E+01	0.00E+00	7.88E+01	0.00E+00	0.00E+00	0.00E+00	1.08E-02
Module C2 - transport of hollowcore to disposal	1.11E-01	0.00E+00	1.11E-01	9.30E+01	0.00E+00	9.30E+01	0.00E+00	0.00E+00	0.00E+00	1.28E-02
Module C3 - hollowcore recycling	6.82E-01	0.00E+00	6.82E-01	4.52E+01	0.00E+00	4.52E+01	0.00E+00	0.00E+00	0.00E+00	1.60E-02
Module C4 - hollowcore in landfill	1.40E-02	0.00E+00	1.40E-02	8.55E+00	0.00E+00	8.55E+00	0.00E+00	0.00E+00	0.00E+00	1.18E-03
Module D - per tonne of concrete	-1.02E+00	0.00E+00	-1.02E+00	-5.27E+01	0.00E+00	-5.27E+01	0.00E+00	0.00E+00	0.00E+00	-1.58E-01
Module D - per tonne of steel strand	-3.00E+02	0.00E+00	-3.00E+02	-2.43E+03	0.00E+00	-2.43E+03	0.00E+00	0.00E+00	0.00E+00	-3.61E+03

Waste Indicators C1-C4 & D

Table 15: Waste production

Indicator	HWD	NHWD	RWD
Per Tonne of Hollowcore Plank	kg	kg	kg
Module C1 - demolition of hollowcore	0.00E+00	7.59E-04	0.00E+00
Module C2 - transport of hollowcore to disposal	0.00E+00	8.30E-04	0.00E+00
Module C3 - hollowcore recycling	0.00E+00	4.82E-03	0.00E+00
Module C4 - hollowcore in landfill	0.00E+00	2.40E+02	0.00E+00
Module D - per tonne of concrete	0.00E+00	-2.56E-03	0.00E+00
Module D - per tonne of steel strand	0.00E+00	1.52E-04	0.00E+00

Output Flow Indicators C1-C4 & D

Table 16: Output Flows

Indicator	CRU	MFR	MER	EE
Per Tonne of Hollowcore Plank	kg	kg	kg	MJ
Module C1 - demolition of hollowcore	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C2 - transport of hollowcore to disposal	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C3 - hollowcore recycling	0.00E+00	7.60E+02	0.00E+00	0.00E+00
Module C4 - hollowcore in landfill	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module D - per tonne of concrete	0.00E+00	-8.94E-03	0.00E+00	0.00E+00
Module D - per tonne of steel strand	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Results C1-C4 & D

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EN 15804:2012+A1:2013 Compliant Indicators C1-C4 & D

We are also providing EN 15804:2012+A1:2013 compliant results (see Table 10) to assist our customers who want to use this EPD in tools, such as the Green Building Council of Australia's Green Star Tool and the Infrastructure Sustainability Council's Sustainability Rating Tool that are currently based on this method.

Table 17: Potential environmental impacts - mandatory indicators according to EN 15804:2012+A1:2013

Indicator	GWP	ODP	AP	EP	POCP	ADPE	ADPF
Per Tonne of Hollowcore Plank	**kg CO_2 eq**	**kg CFC-11 eq**	**kg SO_2 eq**	**kg PO_4^{3-}-eq**	**kg C_2H_4 eq**	**kg Sb eq**	**MJ**
Module C1 - demolition of hollowcore	5.13E+00	6.74E-07	4.18E-02	8.61E-03	4.91E-03	6.32E-09	7.25E+01
Module C2 - transport of hollowcore to disposal	6.40E+00	7.97E-07	3.12E-02	5.99E-03	6.79E-03	7.45E-09	8.55E+01
Module C3 - hollowcore recycling	3.19E+00	3.11E-07	5.86E-03	6.64E-04	6.88E-04	7.74E-07	4.22E+01
Module C4 - hollowcore in landfill	5.69E-01	7.35E-08	1.10E-03	8.71E-05	1.46E-04	6.71E-10	7.87E+00
Module D - per tonne of concrete	-3.73E+00	-3.16E-07	-2.10E-02	-4.62E-03	-2.27E-03	-6.58E-08	-5.01E+01
Module D - per tonne of steel strand	-2.78E+02	-1.11E-05	-9.04E-01	1.93E-02	-2.25E-01	-8.23E-03	-3.80E+03

Carbon Footprint C1-C4 & D

Table 18: Carbon footprint in line with Australian climate change reporting frameworks

Indicator	Carbon footprint (IPCC AR5, 100yr)
	GWP-GHG
Per Tonne of Hollowcore Plank	**kg CO_2-eq.**
Module C1 - demolition of hollowcore	5.14E+00
Module C2 - transport of hollowcore to disposal	6.41E+00
Module C3 - hollowcore recycling	3.19E+00
Module C4 - hollowcore in landfill	5.70E-01
Module D - per tonne of concrete	-3.71E+00
Module D - per tonne of steel strand	-2.82E-01

Environmental Profile Calculator

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We can help you calculate the environmental profile of any of our hollowcore planks. Contact your BGC Precast representative or apply the worked example below.

Table 19: Typical hollowcore plank designs

Plank Type***	Vol****	Cores	Typical Plank Design (number of strands, size and weight)				
	m^3/m	No. of	Top No.	Top Size (mm)	Bottom No.	Bottom Size (mm)	Total Steel (t/m)**
HC160	0.1223	7	0	na	0	na	0.00E+00
HC200	0.1268	6	0	na	5	9.5	2.16E-03
HC200W*	0.1333	6	2	9.5	7	12.7	6.36E-03
HC250	0.1579	6	2	9.5	10	12.7	8.72E-03
HC300	0.1846	4	3	9.5	10	12.7	9.15E-03
HC350	0.2117	4	3	9.5	12	12.7	1.07E-02
HC400	0.2268	4	3	9.5	14	12.7	1.23E-02
HC500	0.2967	4	3	9.5	16	12.7	1.39E-02

* HC200W = wall version with tongue & groove profile
** 9.5mm strand = 431 g/m, 12.5mm strand = 786 g/m
*** The Plank type code includes the thickness (in mm)
**** The volume refers to the volume of concrete (per m length)

Table 20: Hollowcore plank concrete mix densities

	Density (kg/m^3)
Mix Code 2	2,336
Mix Code 3	2,346
Mix Code 7	2,346
Mix Code 9	2,356
Mix Code 10	2,356
Mix Code 11	2,356
Mix Code 12	2,356

Applied to GWP-total (A1-A3) for a 6 m x 250 mm plank using mix code 2 for example.

Step 1: Look up concrete volume in Table 19 and concrete density in Table 20 to determine the quantity of concrete per panel.

6 m x 0.1579 m3/m = 0.9474 m^3
Mix code 2 density: 2,336 kg/m^3
Mass per panel = 0.9474 x 2.336 = 2.213 t concrete

Step 2: Look up steel strand details in Table 19 to determine the quantity of steel.

6 m x (8.72×10^{-3}) = 0.0523 t steel strand

Step 3: Look up the environmental profile of mix code 2 and steel strands in tables 5-18, and multiply the values with the quantities of concrete and steel.

For example, the GWP-total of modules A1-A3
(see table 5) for one panel - as described above - comes to:
2.213 t concrete x 2.21E+02 kg CO_2-eq/t = 4.89E+02 kg CO_2-eq.
0.052 t steel strand x 2.57E+03 kg CO_2-eq/t = 1.34E+02 kg CO_2-eq.
4.89E+02 + 1.34E+02 = 623 kg CO_2-eq. for a 6 m x 250 mm hollowcore plank using mix code 2.

Program Information and Verification

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An Environmental Product Declaration (EPD) is a standardised way of quantifying the potential environmental impacts of a product or system. EPDs are produced according to a consistent set of rules – Product Category Rules (PCR) – that define the requirements within a given product category. These rules are a key part of ISO 14025 as they enable transparency and comparability between EPDs. This EPD provides environmental indicators for BGC Precast hollowcore planks produced at its manufacturing facility in Kwinana Beach, Western Australia. This EPD is a cradle-to-gate plus end-of-life declaration covering manufacture of the hollowcore planks and their supply chain.

This EPD is verified to be compliant with EN 15804+A2. EPDs of construction products may not be comparable if they do not comply with EN15804. EPDs within the same product category but from different programs or utilising different standards or PCRs may not be comparable.

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

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EPD registration number:	S-P-05492
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Version:	1.0
Valid until:	28 February 2028 (5 years)
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CEN standard EN 15804:2012+A2:2019 served as the core PCR	
PCR:	PCR 2019:14 Construction Products, Version 1.11, 2021-02-05 (valid until 2024-12-20)
PCR review was conducted by:	The Technical Committee of the International EPD® System. Chair: Claudia A. Peña Contact via info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:	◯ EPD process certification (Internal) ⊘ EPD verification (External)
Procedure for follow-up of data during EPD validity involves third-party verifier:	◯ Yes ⊘ No

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