BORAL™

Boral Tasmania
Pre-mix Concrete EPD

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025 and EN 15804

EPD Registration Number S-P-02337
Issued 15th October 2021 | Valid until 1st May 2026
Geographical Scope: TASMANIA - Launceston (Invermay), Hobart (Derwent Park).

Contents

Cover image: University of Tasmania, Inveresk Campus, Invermay.

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Program information And verification

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, ISO 14040 and ISO 14044 as they enable transparency and comparability between EPDs. This EPD provides cradle-to-gate environmental indicators for a range of normal class pre-mix concrete products, lower-carbon concrete ENVISIA® and concrete for special applications manufactured by Boral.

This EPD is verified to be compliant with EN 15804. EPDs of construction products may not be comparable if they do not comply with EN 15804. EPDs within the same product category but from different programs or utilising different PCRs may not be comparable. Boral, as the EPD owner, has the sole ownership, liability and responsibility for the EPD.

Declaration Owner		
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Program information And verification

EPD Version:	1.1
	Description of the changes: We have updated the EPD in line with our new branding. The content has not changed.
Reference year for data:	2018-01-01/2018-12-31

CEN standard EN 15804 served as the core PCR	
PCR	PCR 2012:01 Construction Products and Construction Services, Version 2.33, 2020-09-18 PCR 2012:01-SUB-PCR-G Concrete and concrete elements, 2020-09-18
PCR review was conducted by	The Technical Committee of the International EPD® System. Chair: Massimo Marino. 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 involved third-party verifier	☐ No ☒ Yes

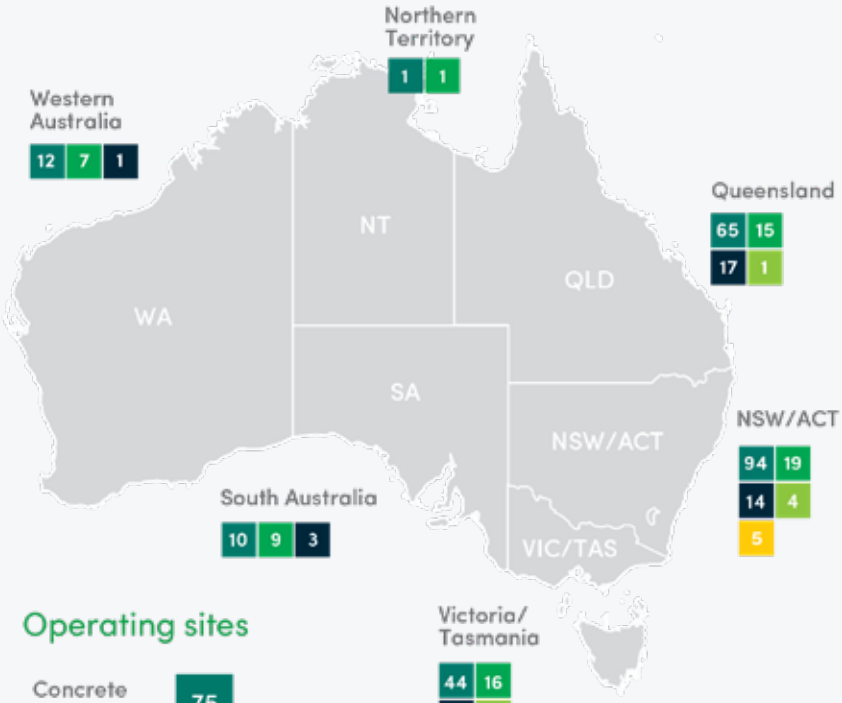
About Boral

Boral is the largest integrated construction materials company in Australia, with a leading position underpinned by strategically located quarry reserves and an extensive network of operating sites. We also manufacture and supply a range of building products.

Boral Concrete has over 230 pre-mix concrete plants around Australia producing a wide range of concrete mixes in metropolitan and country areas.

In Tasmania, Boral Concrete supplies pre-mix concrete to all segments of the construction industry including infrastructure, social, commercial and residential construction.

This EPD covers the majority of the concrete products supplied from Boral plants in Tasmania.



Operating sites

Concrete and Placing	75
Quarries	239
Asphalt	43
Cement	3
Recycling	6

1. At 30 June 2021. Includes transport, fly ash and R&D sites. Concrete and asphalt sites include mobile plants. Excludes mothballed plants, distribution and administration sites.
2. Includes cement manufacturing, grinding, bagging and lime plants in NSW, a clinker plant in Victoria and a clinker grinding JV in Queensland.

How we work

At Boral, we have a culture of 'working together' with a focus on Zero Harm Today. This ensures all of our employees, contractors, partners and communities in which we operate are free from harm, injury and illnesses.

Boral has a team of full-time Health, Safety, Environment and Quality specialists who operate across our integrated business, offering a single interface for safety communications and innovation across raw materials, logistics, operations and placement.

Innovation and technical capability

The Innovation Factory is Boral's in-house centre of excellence responsible for developing advanced cement and concrete solutions for our customers. Through consultation with our customers, the Innovation Factory is central to enabling transformation through innovative products at Boral.

Our focus on engagement and action is backed by intensive research and development through our dedicated and talented team who work in collaboration with many sections of the company to create a world of future generations will be proud of.

About Boral

Technical Services

As one of Australia's largest construction materials companies, Boral is committed to excellence, providing customers with quality products and reliable service. Our aim is to provide products backed up by specialised testing as well as extensive quality control testing and technical support.

To ensure we remain at the forefront, we constantly improve, develop and refine our products to maintain the high standards customers have come to expect.

Our production, technical and quality managers are committed to quality excellence in our manufacturing process. We have committed additional resources to research and we strive to develop whole-of-life solutions that offer a sustainable future. Our innovative products are designed in collaboration with our clients.

Not only are we the only Australian construction materials company to maintain a full-service construction materials laboratory in Australia, **Boral Materials Technical Services is also the largest facility of its kind in the country**, providing special and standard testing and product development services to Boral and our customers.

Boral maintains an ISO 9001-certified Quality System to ensure we conduct a regular regime of physical properties testing on all materials to certify they:

- Meet Australian Standards in the civil and structural construction industry;
- Comply with applicable legislation, regulations and industry standards;
- Meet project specifications; and
- Allow for continuous improvement.

Boral laboratory facilities have a quality management system that meets international standards and they are NATA-accredited for construction materials testing and chemical testing. These customer-focused services have earned Boral the reputation of a market leader in its approach.

About Boral

Sustainability at Boral

We recognise that our commitment and progress in managing sustainability outcomes is vital to our business and meeting the expectations of our customers.

We strive to:

- Deliver innovative, superior performing and more sustainable products and solutions that respond to a changing world and better meet our customers' needs
- Drive safety performance towards world's best practice and invest in our people to enable them to deliver on our strategy
- Reduce our environmental footprint and build our resilience to climate impacts, and
- Be a socially responsible member of the communities in which we operate.

In recent years, we have substantially reshaped our business to respond and adapt to changing commercial, technological, and environmental factors. We have invested in growing our lower carbon concrete products.

We are increasing our investment in innovation to enable us to expand our products and solutions that have a lower carbon footprint and thereby positively contribute to an effective transition to a lower carbon economy.

Boral's ENVISIA® and Envirocrete®/Plus products underpin this improved sustainable concrete range. We monitor and report on our sustainability performance to drive progress and continuous improvement and are responding to increasing expectations of our customers on the disclosure of our sustainability risks and opportunities.

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About Boral

Our commitment

Our overarching goal is to deliver Zero Harm Today. This means we target zero injuries to our people and seek to eliminate adverse environmental impacts. Where elimination is not possible, we seek to minimise any harmful effects from our operations. At an absolute minimum, this means complying with environmental legislation, regulations, standards and codes of practice.

- Reducing greenhouse gas emissions from our processes, operations and facilities.
- Reducing waste in all forms including through the efficient use of energy, conservation of water, minimising and recycling waste materials and energy, prevention of pollution, and effective use of virgin and recovered resources and supplemental materials.
- Protecting biodiversity values at and around our facilities.
- Openly and constructively engaging with communities surrounding our operations.

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Geographical scope

TASMANIA (Overall Region)

The concrete plants considered for this Environmental Product Declaration comprise those in the state of Tasmania. Individual plants were assessed for life cycle assessment, and local surrounding similar raw material sources were included in the datasets. These modelled plants, including geographically nearby plants are listed in the following location maps.

Modelled plants

- Boral Concrete Hobart (Derwent Park)
- Boral Concrete Launceston (Invermay)

Red pins = plants that are being modelled in Tasmania Premix EPD

Green pins = surrounding plants covered in Tasmania Premix EPD scope

Orange pins = out of scope for the Tasmania Premix EPD

Declared products

Products considered for the Tasmanian Environmental Product Declaration

The products considered for the EPD fall into three broad categories: normal class products, lower carbon concrete products and special concrete products. A brief description of each category is given below, followed by a full list of the products.

1) Normal Class Concrete Products

Normal class concrete products are suitable for general applications and designed to meet the requirements of AS 1379 (Specification and supply of concrete).

2) Lower Carbon Concrete Products

Boral's ENVISIA® concrete is a lower carbon concrete product which complies with AS 1379 and has excellent engineering properties. It has a lower portland cement content and a high supplementary cementitious content which results in reduced greenhouse gas emissions. ENVISIA® combines a proprietary cement technology (ZEP®) which gives it good early age strength, lower shrinkage characteristics and excellent durability characteristics. An overview of the sustainability, durability, engineering and architectural properties are given below.

Lower Carbon

- ENVISIA® has a lower portland cement content and is suitable for projects seeking to maximise the number of green star points from concrete.
- ENVISIA® has a lower carbon content and is suitable for projects seeking compliance with the Green Building Council of Australia or the Infrastructure Sustainability Council of Australia (ISCA).

Workability

- ENVISIA® can be placed, pumped and finished like conventional concrete

Superior Engineering properties

- ENVISIA® will achieve early-age strength equivalent to conventional concrete mixes with higher portland cement content (e.g post-tensioned and precast concrete.
- ENVISIA® has 20 percent greater flexural strength compared to conventional concrete of the same grade.
- ENVISIA® achieves up to 50 percent reduction in shrinkage when compared to conventional sustainable concrete mixes. The lower shrinkage of ENVISIA® will allow for more engineering options such as the design of larger slabs with fewer joints.

Superior Durability

- ENVISIA® provides improved durability, through greater protection to steel reinforcement against chloride induced corrosion.
- ENVISIA® has improved sulphate and acid resistance properties.
- ENVISIA® mitigates the potential expansion due to alkali aggregate reactivity.

Architectural Presence

- ENVISIA® can achieve a range of architectural benefits because of its off-form finish and lighter colour.
- ENVISIA®'s lighter colour will enhance the use of colour oxides.

Special concrete products

Boral's special concrete products have been designed to meet specific project requirements in addition to the requirements of AS 1379. They include products that have been designed for infrastructure projects, multi-residential buildings, commercial buildings and civil works.

Declared products

Products covered by this Environmental Product Declaration

The products covered in the EPD are listed below. The environmental impacts of products not referenced in the EPD can be provided on request. Boral is developing an environmental impact calculator allowing us to provide environmental profiles for virtually any mix design from all the plants that are in scope in this EPD.

Normal Class Concrete Products

- NORMAL CLASS GP BLEND 20 MPA
- NORMAL CLASS GP BLEND 25 MPA
- NORMAL CLASS GP BLEND 32 MPA
- NORMAL CLASS GP BLEND 40 MPA
- NORMAL CLASS GP BLEND 50 MPA

Lower Carbon Concrete Products

- ENVISIA® 25 MPA
- ENVISIA® 32 MPA
- ENVISIA® 40 MPA
- ENVISIA® 50 MPA

Concrete for Special Applications

- HIGH STRENGTH 50 MPA
- HIGH STRENGTH 65 MPA
- VICROADS VR400 40 MPA 20MM PUMP B1 EXPOSURE
- VICROADS VR450 50 MPA 20MM TREMIE B2 / CFA C1 EXPOSURE

Pre-mix concrete production

Concrete production is the process of combining water, aggregates, cementitious binders and additives. These different 'ingredients' are mixed at a specialised facility known as a 'batching' plant.

A batching plant stores the ingredients in cement silos, aggregate bins and admixture tanks.

The plants use calibrated weigh scales and flow meters to accurately weigh the ingredients which are then mixed in a mixer compliant with item C3 of AS 1379. Most concrete plants mix the concrete in a transit mixer (concrete truck) which then delivers the concrete to the project. However, some plants use a stationary mixer before discharging the mixed concrete into a concrete truck which then delivers the concrete to the project.

Depending on the proposed application of the final product, the concrete may contain other ingredients such as colour oxides and fibres and the production process may include heaters or chillers. Concrete production is time-sensitive, once the ingredients are mixed, workers must put the concrete in place before it loses workability.

ENVISIA® case study

BORAL™

Case Study
ENVISIA® Concrete

University of Tasmania

Overview

Location
Launceston, Tasmania

Segment Name
UOT– Inveresk Campus Upgrade

Concrete Offered
ENVISIA®

Customer
VOS Construction

Project

The University of Tasmania's Northern Transformation is a $300 million project that will see new campuses built at West Park in Burnie and Inveresk in Launceston in a partnership between the University and local, state and Australian governments.

Stage 1 of the Northern Transformation project includes construction of a Library and Student Experience building at the UTAS Inveresk Campus in Launceston.

What was the customer looking for

- Head client (UTAS) was keen to see lower embodied carbon across the project and encouraged use of construction materials to enable this (e.g. Engineered timber).
- Our offering to the bidding contractors highlighted the engineering properties of the product (low shrinkage, high early strength) as well as the lower embodied carbon
- Workability at an increased slump was viewed favourably by the concrete placers/finishers
- Set times were comparable to GP mixes
- Off-form finish was an improvement on the incumbent mixes.

Key Facts

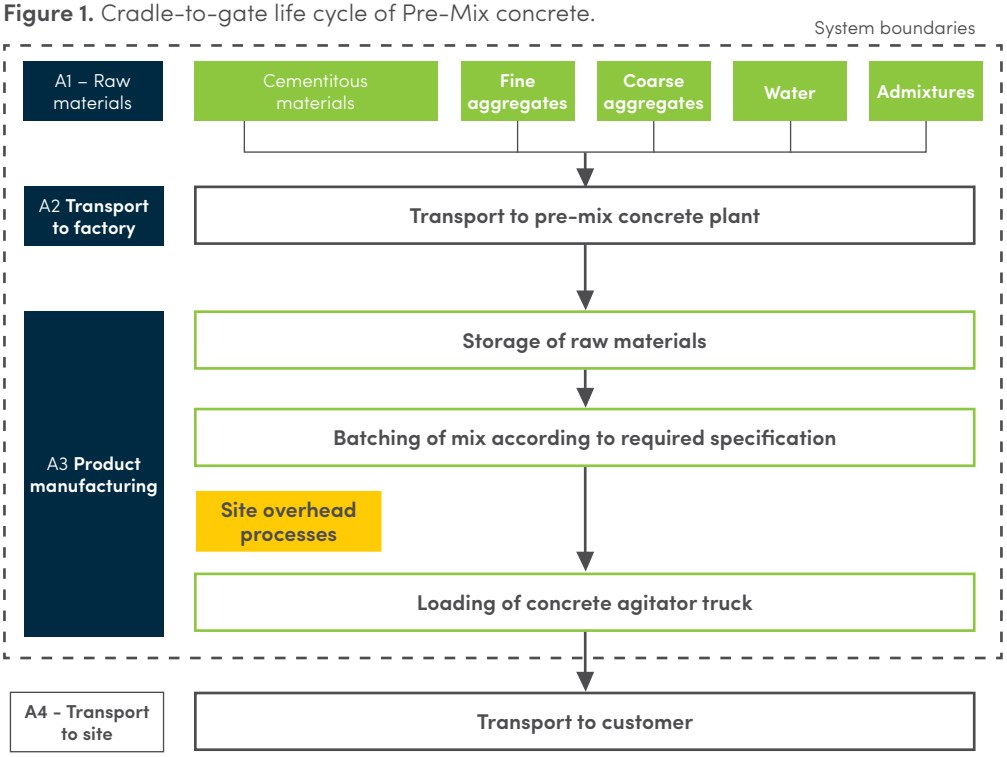
- The low shrinkage and lower risk of cracking was a major benefit to the customer
- Lower embodied carbon number was a high priority for VOS
- Customer was very happy with the useability and workability of the mix stating that it was comparable to GP mixes.
- The first customer to use **ENVISIA®** in Tasmania
- Early age strength
- Great off-form finish
- Lower embodied carbon

For more information please visit www.boral.com.au/envisia

Cradle-to-gate life cycle

This EPD covers the cradle-to-gate life cycle stages (A1-A3), as per diagram below. Downstream stages have not been included.

Figure 1. Cradle-to-gate life cycle of Pre-Mix concrete.



Raw Material Stage A1

All raw materials used in the production of Boral's normal class concrete, lower carbon concrete and special concrete products comply with the following standards as required by AS 3600 Concrete Structures (SA 2018) & AS 1379 Specification and Supply of Concrete (SA 2007/R2017):

- AS/NZS 3972: General purpose and blended cements (SA 2010)
- AS 3582.1 Supplementary cementitious materials Part 1: Fly Ash (SA 2016)
- AS 3582.2 Supplementary cementitious materials Part 2: Slag - Ground granulated blast furnace (SA 2016)
- AS 2758.1 Aggregates and rock for engineering purposes Part 1: Concrete Aggregates (SA 2014)
- AS 1478.1 Chemical admixtures for concrete, mortar and grout (SA 2000)

Cradle-to-gate life cycle

Transportation Stage A2

Coarse aggregates, manufactured sands and natural sands are sourced from our network of quarries and transported to our sites via articulated trucks. General purpose cement is supplied by Cement Australia from their cement works in Railton, Tasmania and delivered to our sites in articulated trucks. ZEP® slag cement is supplied by Boral Cement from their facility Maldon and is transported to our sites by articulated truck, train and ship. Admixtures are transported to our sites by truck and ship.

Table 1: Scope of EPD

Product Stage			**Construction Stage**		**Use Stage**							**End-of-life Stage**				**Benefits beyond system boundary**
RAW MATERIAL SUPPLY	TRANSPORT	MANUFACTURING	TRANSPORT	CONSTRUCTION-INSTALLATION PROCESS	USE	MAINTENANCE	REPAIR	REPLACEMENT	REFURBISHMENT	OPERATIONAL ENERGY USE	OPERATIONAL WATER USE	DECONSTRUCTION DEMOLITION	TRANSPORT	WASTE PROCESSING	DISPOSAL	REUSE, RECOVERY, RECYCLING POTENTIAL
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
			Scenario		Scenario							Scenario				
✔	✔	✔	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**

✔ = module is included in this study MND = module is not declared*

* When a module is not accounted for, the stage is marked with "MND" (Module Not Declared). MND is used when we cannot define a typical scenario.

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Cradle-to-gate life cycle

Manufacturing Stage A3

The typical manufacturing process of Boral's normal class concrete, lower carbon concrete and special concrete products is by mixing concrete constituents comprising of cement and supplementary cementitious materials (SCM) (AS 3972/AS 3582.1,2), and fine/coarse aggregates (AS 2758.1), plus admixtures/additives (AS 1478.1) and water (AS 1379) directly in the truck referred to as the dry batch method, or in selected locations pre-mixing in a wet mix fashion, before delivery by agitator truck.

The entire process is covered under AS 1379 Specification and Supply of concrete and verified by third party under ISO9001. This manufacturing stage (A3) includes activities associated with sourcing and delivery of individual concrete constituents, up to the point of mixing at the batch plant, but not including delivery and placement of concrete at the project location. This is typically described as the Cradle (A1) to Gate (A3) cycle, of the boundary conditions for concrete life cycle inventory.

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Life Cycle Assessment (LCA) Methodology

Background Data

Boral has supplied primary data from key quarries and concrete production sites. Two concrete production sites Launceston (Invermay) and Hobart (Derwent Park) provided primary data. The LCA shows that these sites are representative for the Launceston and Hobart regions. Data for admixtures have been sourced from EPDs published in December 2015 by EFCA (European Federation of Concrete Admixtures Associations Ltd.) (EFCA 2015a-e). Background data (e.g. for energy and transport processes, cement and blast furnace slag) have predominantly been sourced from AusLCI and the AusLCI shadow database.

The Tasmanian quarry data and concrete production data have been collected for calendar year 2018. The vast majority of the environmental profiles of our products are based on life cycle data that are less than five years old. Background data used is less than 10 years old.

Methodological choices have been applied in line with EN 15804 (CEN 2013); deviations have been recorded.

Representative plants in each region

Boral operates 5 concrete plants in Tasmania. This EPD covers a sub-section of our concrete plants located in two key regions:

- Boral Concrete Launceston (Invermay)
- Boral Concrete Hobart (Derwent Park)

Red pins = plants that are being modelled in Tasmania Premix EPD

Green pins = surrounding plants covered in Tasmania Premix EPD scope

Orange pins = out of scope for the Tasmania Premix EPD

Life Cycle Assessment (LCA) Methodology

Allocation

The key material production processes that require allocation are:

- **Cement:** Boral manufactures concrete using Cement Australia Railton Cement Works type GP, inclusive of limestone mineral addition. The energy data is utilising AusLCI data set.
- **Pre-mix concrete:** Boral manufactures a range of pre-mix concrete products at its sites. At each manufacturing site, energy use for concrete production has been allocated to the products based on a volume basis (total m^3 of pre-mix concrete 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, aggregate production (including manufactured sand) has been allocated based on the mass of product.
- **BFS:** blast furnace slag (BFS) is a by-product from steel-making. We have used the AusLCI data for BFS ("blast furnace slag allocation, at steel plant/AU U"), which contain impacts from pig iron production allocated to blast furnace slag. As drying and grinding of BFS occurs at our Maldon site, we have used Boral's energy data for these processes, rather than the default AusLCI data.

Cut-off Criteria

- The contribution of capital goods (production equipment and infrastructure) and personnel is outside the scope of the LCA, in line with the PCR (Environdec 2020a).
- The amount of packaging used for admixtures is well below the materiality cut-off. Nonetheless, packaging materials and quantities are included in the admixture EPD data.

Key Assumptions

- Admixture data are based on generic EPDs that are valid for a range of different chemicals, including the admixtures used by Boral. We have used an average of the five admixture EPDs published by EFCA as a proxy.
- Blast furnace slag receives some environmental impacts from pig iron production. This allocation decision has an effect on the environmental profile of products that use ZEP®, Enviroment® cement or ground-granulated blast furnace slag (GGBFS).
- Water consumption is not measured consistently across quarries. We have used AusLCI water consumption data per tonne of coarse and fine aggregates instead.

Product Composition

Content declaration > (% by weight)

Table 2. Tasmania product compositions

Constituent (% by weight)	Normal class GP blend	HIGH STRENGTH	Vic Roads	Envisia®*
General Purpose cement	10–21%	19–25%	16–21%	8–13%
Ground granulated blast furnace slag	-	-	-	3–9%
Coarse aggregate	34–43%	40–43%	38–45%	36–41%
Manufactured sand	11–23%	8–18%	8–10%	9–17%
Natural sand	15–30%	15–21%	19–39%	19–28%
Admixtures	<0.12%	<0.15%	<0.18%	<0.3%
Water	7–8%	7–10%	7–9%	7–9%

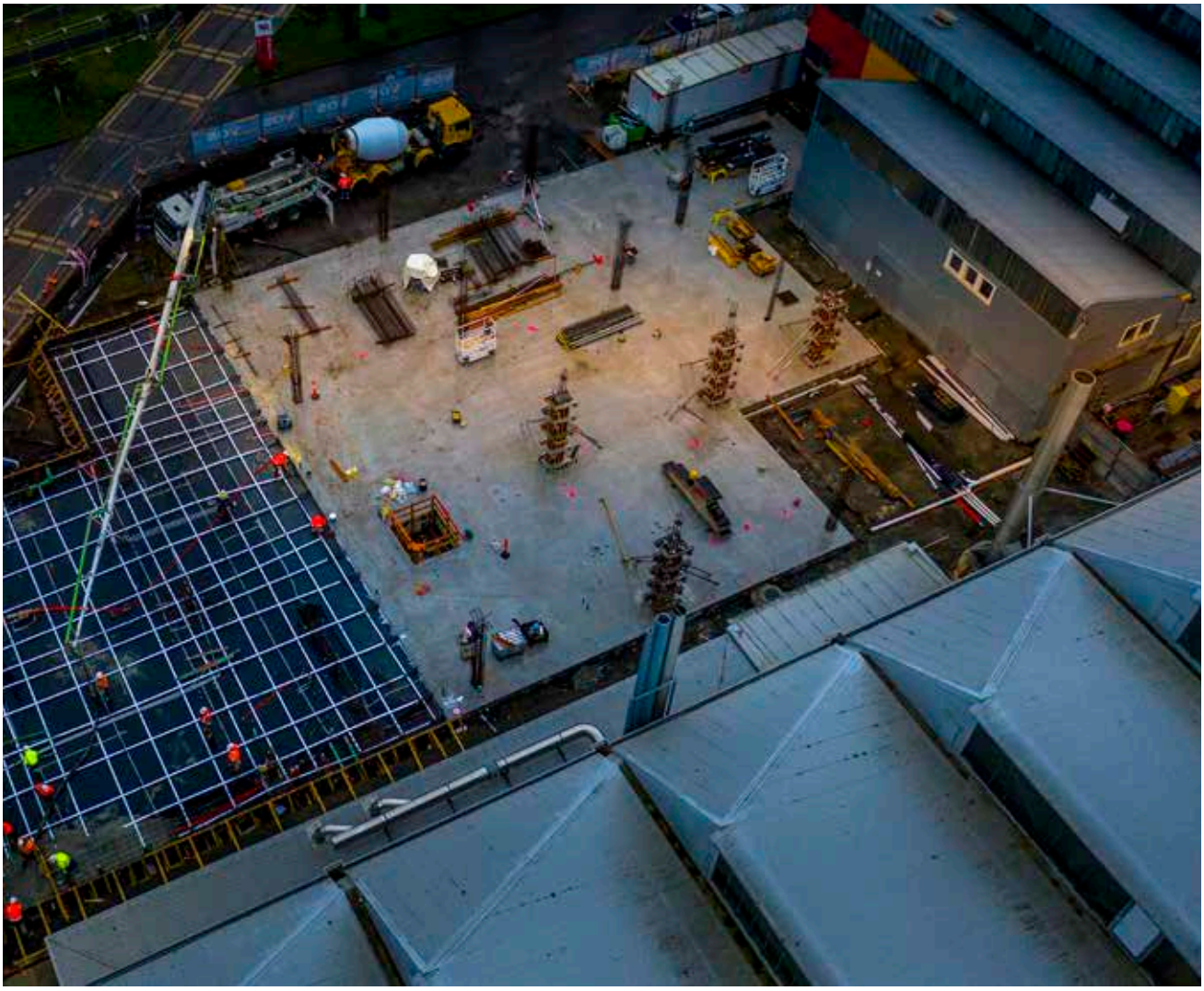
The products as supplied are non-hazardous. The products included in this EPD do not contain any substances of very high concern as defined by European REACH regulation in concentrations >0.1% (m/m). *May include Zep® technology

Declared Unit

The background LCA serves as the foundation for this EPD. An LCA 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 (CEN 2013).

Pre-mix concrete is available in various strength grades and with characteristics that are specifically designed for each application. The declared unit that covers all of the products is: 1 cubic metre (m^3) of pre-mix concrete (as ordered by client) with a given strength grade and identifying characteristics. This declared unit has been adapted from the sub-PCR (Environdec 2020b).

All results are presented per declared unit and cover the A1-A3 life cycle stages (cradle-to-gate). The product code for pre-mix concrete is UN CPC 375 (Articles of concrete, cement and plaster) and ANZSIC 20330 (Concrete – ready mixed – except dry mix).



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Environmental indicators

Table 3. Impact categories included in this assessment

Impact category	Acronym	Unit
Global Warming Potential	GWP	kg CO_2 equivalents
Ozone Depletion Potential	ODP	kg CFC-11 equivalents
Acidification Potential of soil and water	AP	kg SO_2 equivalents
Eutrophication Potential	EP	kg PO_4^{3-} equivalents
Photochemical Ozone Creation Potential	POCP	kg C_2H_4 equivalents
Abiotic Depletion Potential for Mineral Elements	ADPE	kg Sb equivalents
Abiotic Depletion Potential for Fossil Fuels	ADPF	MJ

Table 4: Parameters describing resource use, waste and output flows

Resource use	Acronym	Unit
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ_{NCV}
Use of renewable primary energy resources used as raw materials	PERM	MJ_{NCV}
Total use of renewable primary energy resources	PERT	MJ_{NCV}
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ_{NCV}
Use of non-renewable primary energy resources used as raw materials	PENRM	MJ_{NCV}
Total use of non-renewable primary energy resources	PENRT	MJ_{NCV}
Use of secondary material	SM	kg
Use of renewable secondary fuels	RSF	MJ_{NCV}
Use of non-renewable secondary fuels	NRSF	MJ_{NCV}
Use of net fresh water	FW	m^3
Waste categories		
Hazardous waste disposed	HWD	kg
Non-hazardous waste disposed	NHWD	kg
Radioactive waste disposed	RWD	kg
Output flows		
Components for re-use	CRU	kg
Materials for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported energy	EE	MJ

Environmental profiles

The cradle-to-gate (module A1-A3) environmental profiles and environmental parameters of each product group are expressed per m^3 of pre-mix concrete (volume as ordered by the client).

Limitations

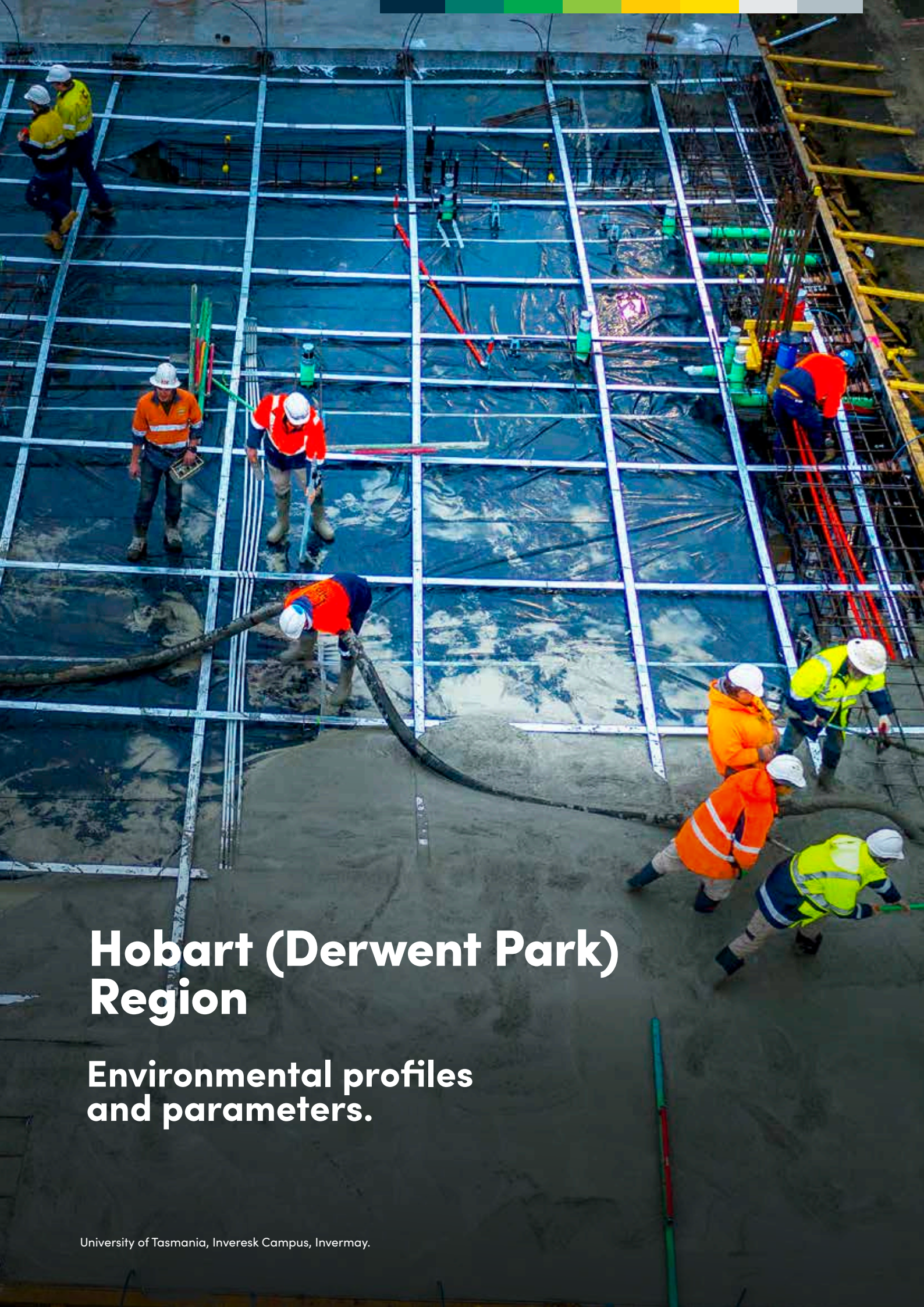
The results of this study and the EPD are valid for Boral products only. Products from other manufacturers will likely have different impacts due to differences in mix designs, supply chains and manufacturing processes. The main limitations of the LCA results are found in the parameter results, which are highly dependent on background data.

The environmental parameters are based on the life cycle inventory. There is some ambiguity around their presentation, and issues to note include:

- Hazardous waste disposal (HWD) is derived from background LCI data.
- Non-hazardous waste disposal (NHWD) is derived from background LCI data.
- Radioactive waste disposal (RWD) is derived from background LCI data. Radioactive waste is only coming through the EPD data for admixtures, unless the life cycle contains clinker manufactured overseas.

Variation (A1-A3) per Impact Category

Derwent Park and Bridgewater plants being on like mix designs and materials means that the results for our Derwent Park site in Hobart are also valid for our Bridgewater site in Hobart.



Hobart (Derwent Park) Region

Environmental profiles and parameters.

University of Tasmania, Inveresk Campus, Invermay.

Product table list

Normal Class Concrete Products

Table No. 1 and 2

- NORMAL CLASS GP BLEND 20 MPA
- NORMAL CLASS GP BLEND 25 MPA
- NORMAL CLASS GP BLEND 32 MPA
- NORMAL CLASS GP BLEND 40 MPA
- NORMAL CLASS GP BLEND 50 MPA

Lower Carbon Concrete Products

Table No. 3 and 4

- ENVISIA® 25 MPA
- ENVISIA® 32 MPA
- ENVISIA® 40 MPA
- ENVISIA® 50 MPA

Concrete for Special Applications

Table No. 5 and 6

- HIGH STRENGTH 50 MPA
- HIGH STRENGTH 65 MPA
- VICROADS VR400 40 MPA 20MM PUMP B1 EXPOSURE
- VICROADS VR450 50 MPA 20MM TREMIE B2 / CFA C1 EXPOSURE

Hobart (Derwent Park) Region

Table 1. Environmental profiles (A1-A3), normal class concrete, Hobart (TAS), per m^3

Indicator	Unit	Normal Class GP blend 20MPa	Normal Class GP blend 25MPa	Normal Class GP blend 32MPa	Normal Class GP blend 40MPa	Normal Class GP blend 50MPa
GWP	**kg CO_2 eq**	**265**	**279**	**308**	**382**	**498**
ODP	kg CFC11 eq	3.91E-06	4.02E-06	4.21E-06	4.80E-06	5.70E-06
AP	kg SO_2 eq	0.603	0.634	0.693	0.845	1.09
EP	kg PO_4^{3-} eq	0.126	0.132	0.144	0.175	0.225
POCP	kg C_2H_4 eq	0.0451	0.0468	0.0501	0.0590	0.0730
ADPE	kg Sb eq	2.42E-06	2.54E-06	2.86E-06	3.54E-06	4.51E-06
ADPF	MJ_{NCV}	1710	1790	1960	2380	3050

Table 2. Environmental parameters (A1-A3), normal class concrete, Hobart (TAS), per m3

Parameter	Unit	Normal Class GP blend 20MPa	Normal Class GP blend 25MPa	Normal Class GP blend 32MPa	Normal Class GP blend 40MPa	Normal Class GP blend 50MPa
PERE	MJ_{NCV}	3.32E+01	3.44E+01	3.70E+01	4.29E+01	5.21E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.32E+01	3.44E+01	3.70E+01	4.29E+01	5.21E+01
PENRE	MJ_{NCV}	1.74E+03	1.82E+03	1.99E+03	2.42E+03	3.10E+03
PENRM	MJ_{NCV}	5.89E+00	6.25E+00	7.29E+00	9.57E+00	1.27E+01
PENRT	MJ_{NCV}	1.75E+03	1.83E+03	2.00E+03	2.43E+03	3.11E+03
SM	kg	2.18E-03	2.31E-03	2.58E-03	3.25E-03	4.31E-03
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.51E+00	3.49E+00	3.53E+00	3.59E+00	3.57E+00
HWD	kg	6.40E-06	6.78E-06	7.90E-06	1.03E-05	1.36E-05
NHWD	kg	1.88E-01	1.98E-01	2.20E-01	2.71E-01	3.49E-01
RWD	kg	1.11E-03	1.18E-03	1.37E-03	1.79E-03	2.38E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Hobart (Derwent Park) Region

Table 3. Environmental profiles (A1-A3), lower carbon concrete, Hobart (TAS), per m^3

Indicator	Unit	ENVISIA 25 MPa	ENVISIA 32 MPa	ENVISIA 40 MPa	ENVISIA 50 MPa
GWP	**kg CO_2 eq**	**257**	**276**	**340**	**399**
ODP	kg CFC11 eq	5.80E-06	6.12E-06	7.16E-06	9.58E-06
AP	kg SO_2 eq	0.650	0.693	0.843	1.03
EP	kg PO_4^{3-} eq	0.133	0.142	0.172	0.208
POCP	kg C_2H_4 eq	0.0611	0.0646	0.0770	0.0996
ADPE	kg Sb eq	5.51E-06	5.97E-06	7.47E-06	8.17E-06
ADPF	MJ_{NCV}	1950	2090	2540	3080

Table 4. Environmental parameters (A1-A3), lower carbon concrete, Hobart (TAS), per m3

Parameter	Unit	ENVISIA 25 MPa	ENVISIA 32 MPa	ENVISIA 40 MPa	ENVISIA 50 MPa
PERE	MJ_{NCV}	3.90E+01	4.16E+01	4.87E+01	5.60E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.90E+01	4.16E+01	4.87E+01	5.60E+01
PENRE	MJ_{NCV}	1.99E+03	2.12E+03	2.58E+03	3.14E+03
PENRM	MJ_{NCV}	3.30E+01	3.55E+01	4.50E+01	3.87E+01
PENRT	MJ_{NCV}	2.02E+03	2.16E+03	2.62E+03	3.18E+03
SM	kg	8.89E+01	9.39E+01	1.19E+02	2.07E+02
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.33E+00	3.57E+00	3.58E+00	3.56E+00
HWD	kg	9.01E-05	9.65E-05	1.22E-04	9.47E-05
NHWD	kg	6.21E-01	6.65E-01	8.32E-01	1.06E+00
RWD	kg	3.87E-03	4.17E-03	5.32E-03	5.19E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Hobart (Derwent Park) Region

Table 5. Environmental profiles (A1-A3), concrete for special applications, Hobart (TAS), per m^3

Indicator	Unit	HIGH STRENGTH 50 MPa	HIGH STRENGTH 65 MPa	VICROADS VR400 40 MPa 20MM PUMP B1 EXPOSURE	VICROADS VR450 50 MPa 20MM TREMIE B2 /CFAC1 EXPOSURE
GWP	**kg CO_2 eq**	**498**	**608**	**455**	**513**
ODP	kg CFC11 eq	5.70E-06	6.57E-06	5.39E-06	5.84E-06
AP	kg SO_2 eq	1.09	1.32	1.00	1.12
EP	kg PO_4^{3-} eq	0.225	0.272	0.207	0.231
POCP	kg C_2H_4 eq	0.0730	0.0864	0.0681	0.0752
ADPE	kg Sb eq	4.51E-06	5.53E-06	4.76E-06	5.33E-06
ADPF	MJ_{NCV}	3050	3680	2810	3150

Table 6. Environmental parameters (A1-A3), concrete for special applications, Hobart (TAS), per m3

Parameter	Unit	HIGH STRENGTH 50 MPa	HIGH STRENGTH 65 MPa	VICROADS VR400 40 MPa 20MM PUMP B1 EXPOSURE	VICROADS VR450 50 MPa 20MM TREMIE B2 /CFAC1 EXPOSURE
PERE	MJ_{NCV}	5.21E+01	6.05E+01	4.91E+01	5.37E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	5.21E+01	6.05E+01	4.91E+01	5.37E+01
PENRE	MJ_{NCV}	3.10E+03	3.74E+03	2.85E+03	3.19E+03
PENRM	MJ_{NCV}	1.27E+01	1.64E+01	1.44E+01	1.64E+01
PENRT	MJ_{NCV}	3.11E+03	3.75E+03	2.87E+03	3.21E+03
SM	kg	4.31E-03	5.34E-03	3.91E-03	4.45E-03
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.57E+00	3.45E+00	3.49E+00	3.48E+00
HWD	kg	1.36E-05	1.76E-05	1.55E-05	1.76E-05
NHWD	kg	3.49E-01	4.25E-01	3.33E-01	3.74E-01
RWD	kg	2.38E-03	3.06E-03	2.69E-03	3.06E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Launceston (Invermay) Region

Environmental profiles and parameters.

University of Tasmania, Inveresk Campus, Invermay.

Product table list

Normal Class Concrete Products

Table No. 1 and 2

- NORMAL CLASS GP BLEND 20 MPA
- NORMAL CLASS GP BLEND 25 MPA
- NORMAL CLASS GP BLEND 32 MPA
- NORMAL CLASS GP BLEND 40 MPA
- NORMAL CLASS GP BLEND 50 MPA

Lower Carbon Concrete Products

Table No. 3 and 4

- ENVISIA® 25 MPA
- ENVISIA® 32 MPA
- ENVISIA® 40 MPA
- ENVISIA® 50 MPA

Concrete for Special Applications

Table No.5 and 6

- HIGH STRENGTH 50 MPA
- HIGH STRENGTH 65 MPA
- VICROADS VR400 40 MPA 20MM PUMP B1 EXPOSURE
- VICROADS VR450 50 MPA 20MM TREMIE B2 / CFA C1 EXPOSURE

Launceston (Invermay) Region

Table 1. Environmental profiles (A1-A3), normal class concrete, Launceston (TAS), per m^3

Indicator	Unit	Normal Class GP blend 20MPa	Normal Class GP blend 25MPa	Normal Class GP blend 32MPa	Normal Class GP blend 40MPa	Normal Class GP blend 50MPa
GWP	**kg CO_2 eq**	**265**	**278**	**306**	**372**	**490**
ODP	kg CFC11 eq	3.80E-06	3.78E-06	3.87E-06	4.17E-06	4.69E-06
AP	kg SO_2 eq	0.610	0.636	0.691	0.823	1.06
EP	kg PO_4^{3-} eq	0.127	0.132	0.143	0.170	0.218
POCP	kg C_2H_4 eq	0.0441	0.0447	0.0471	0.0532	0.0642
ADPE	kg Sb eq	2.44E-06	2.57E-06	2.99E-06	3.51E-06	4.52E-06
ADPF	MJ_{NCV}	1680	1750	1910	2270	2920

Table 2. Environmental parameters (A1-A3), normal class concrete, Launceston (TAS), per m^3

Parameter	Unit	Normal Class GP blend 20MPa	Normal Class GP blend 25MPa	Normal Class GP blend 32MPa	Normal Class GP blend 40MPa	Normal Class GP blend 50MPa
PERE	MJ_{NCV}	4.01E+01	4.12E+01	4.39E+01	4.91E+01	5.86E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	4.01E+01	4.12E+01	4.39E+01	4.91E+01	5.86E+01
PENRE	MJ_{NCV}	1.71E+03	1.78E+03	1.94E+03	2.31E+03	2.96E+03
PENRM	MJ_{NCV}	6.01E+00	6.37E+00	7.41E+00	9.57E+00	1.29E+01
PENRT	MJ_{NCV}	1.72E+03	1.79E+03	1.95E+03	2.32E+03	2.97E+03
SM	kg	2.22E-03	2.36E-03	2.62E-03	3.25E-03	4.36E-03
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.38E+00	3.39E+00	3.40E+00	3.41E+00	3.41E+00
HWD	kg	6.52E-06	6.91E-06	8.73E-06	1.03E-05	1.38E-05
NHWD	kg	1.82E-01	1.92E-01	2.18E-01	2.60E-01	3.41E-01
RWD	kg	1.13E-03	1.20E-03	1.50E-03	1.79E-03	2.40E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Launceston (Invermay) Region

Table 3. Environmental profiles (A1–A3), lower carbon concrete, Launceston (TAS), per m^3

Indicator	Unit	ENVISIA 25 MPa	ENVISIA 32 MPa	ENVISIA 40 MPa	ENVISIA 50 MPa
GWP	**kg CO_2 eq**	**251**	**268**	**330**	**386**
ODP	kg CFC11 eq	5.40E-06	5.61E-06	6.36E-06	8.30E-06
AP	kg SO_2 eq	0.638	0.677	0.816	0.98
EP	kg PO_4^{3-} eq	0.130	0.138	0.166	0.199
POCP	kg C_2H_4 eq	0.0573	0.0599	0.0698	0.088
ADPE	kg Sb eq	5.54E-06	5.99E-06	7.49E-06	7.99E-06
ADPF	MJ_{NCV}	1880	2000	2420	2910

Table 4. Environmental parameters (A1–A3), lower carbon concrete, Launceston (TAS), per m^3

Parameter	Unit	ENVISIA 25 MPa	ENVISIA 32 MPa	ENVISIA 40 MPa	ENVISIA 50 MPa
PERE	MJ_{NCV}	4.61E+01	4.82E+01	5.53E+01	6.25E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	4.61E+01	4.82E+01	5.53E+01	6.25E+01
PENRE	MJ_{NCV}	1.91E+03	2.03E+03	2.45E+03	2.96E+03
PENRM	MJ_{NCV}	3.30E+01	3.55E+01	4.50E+01	3.87E+01
PENRT	MJ_{NCV}	1.94E+03	2.06E+03	2.49E+03	3.00E+03
SM	kg	8.89E+01	9.39E+01	1.19E+02	2.07E+02
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.26E+00	3.50E+00	3.51E+00	3.46E+00
HWD	kg	9.01E-05	9.65E-05	1.22E-04	9.45E-05
NHWD	kg	6.14E-01	6.56E-01	8.23E-01	9.92E-01
RWD	kg	3.87E-03	4.17E-03	5.32E-03	5.15E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Launceston (Invermay) Region

Table 5. Environmental profiles (A1-A3), concrete for special applications, Launceston (TAS), per m^3

Indicator	Unit	HIGH STRENGTH 50 MPa	HIGH STRENGTH 65 MPa	VICROADS VR400 40 MPa 20MM PUMP B1 EXPOSURE	VICROADS VR450 50 MPa 20MM TREMIE B2 / CFA C1 EXPOSURE
GWP	**kg CO_2 eq**	**490**	**593**	**407**	**473**
ODP	kg CFC11 eq	4.69E-06	5.01E-06	4.05E-06	4.33E-06
AP	kg SO_2 eq	1.06	1.26	0.887	1.02
EP	kg PO_4^{3-} eq	0.218	0.259	0.184	0.210
POCP	kg C_2H_4 eq	0.0642	0.0728	0.0548	0.0609
ADPE	kg Sb eq	4.52E-06	5.54E-06	8.13E-06	8.71E-06
ADPF	MJ_{NCV}	2920	3480	2480	2840

Table 6. Environmental parameters (A1-A3), concrete for special applications, Launceston (TAS), per m^3

Parameter	Unit	HIGH STRENGTH 65 MPa	HIGH STRENGTH 65 MPa	VICROADS VR400 40 MPa 20MM PUMP B1 EXPOSURE	VICROADS VR450 50 MPa 20MM TREMIE B2 / CFA C1 EXPOSURE
PERE	MJ_{NCV}	5.86E+01	6.71E+01	5.61E+01	6.15E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	5.77E-02	5.65E-02
PERT	MJ_{NCV}	5.86E+01	6.71E+01	5.62E+01	6.15E+01
PENRE	MJ_{NCV}	2.96E+03	3.52E+03	2.51E+03	2.88E+03
PENRM	MJ_{NCV}	1.29E+01	1.64E+01	1.74E+01	1.96E+01
PENRT	MJ_{NCV}	2.97E+03	3.54E+03	2.53E+03	2.90E+03
SM	kg	4.36E-03	5.34E-03	3.56E-03	4.18E-03
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.41E+00	3.33E+00	3.44E+00	3.41E+00
HWD	kg	1.38E-05	1.76E-05	2.67E-05	2.89E-05
NHWD	kg	3.41E-01	4.16E-01	9.22E-01	9.57E-01
RWD	kg	2.40E-03	3.06E-03	3.73E-03	4.13E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Other environmental information

Water management

Water is a valuable resource and good quality fresh water is essential to our concrete, construction material and plasterboard operations. We use water in manufacturing, and for dust suppression, cleaning and sanitation. Our quarry and asphalt operations are able to use recycled, brackish and/or process water.

At our larger sites, including quarries, we also capture rainfall or stream flow that is largely used for dust control purposes. We are developing systems that will enable us to collect data on captured rainfall and are developing plans that will underpin an overall improvement in water efficiency.

When developing or purchasing new facilities, our due diligence assessment includes scenario analysis of the quantity and quality of water, assessment of the risks of potential water discharges, and, where relevant, river catchment assessments to ensure sufficient water availability and supply.

Waste and recycling

Throughout Boral's operations, some materials are commonly re-used back into our production processes. Returned concrete is used to make concrete blocks at some plants. This beneficially uses materials that would otherwise require disposal. A large proportion of Boral's recycled and lower carbon products revenue, totalling nine per cent of Boral Limited revenue, is derived from external waste products.

This includes our fly ash and recycling businesses. Opportunities for the re-use of production by-products or waste material continues to grow and are actively being pursued.

Biodiversity management

Protecting the diversity of plant and animal species at and around our operational sites is a core component of our land management efforts. Some examples of the many initiatives to protect biodiversity at our own sites include:

- Boral in WA has completed a number of community projects at Orange Grove Primary School including a Heritage Garden space, installation of garden pathways and cockatoo nesting boxes.
- Collaborating with the Royal Botanic Garden Sydney NSW in research on the endangered Illawarra Socketwood population at our Dunmore Quarry in New South Wales.
- Partnering with Sleepy Burrows Wombat Sanctuary to capture and relocate wombats found at our Peppertree Quarry in New South Wales.
- Maintaining koala fodder plantations at Narangba and Petrie quarries in Queensland.
- Conservation work to provide habitat for the threatened legless lizard and spiny rice-flower at Deer Park Quarry in Victoria.
- Construction of a bird island habitat as part of our rehabilitation of wetlands at our Dunmore Quarry in New South Wales.
- Through our community partnership with Conservation Volunteers Australia, we support conservation and education initiatives in our local communities, including native vegetation initiatives in local reserves and schools.

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Our approach to climate related risks

Our approach

Boral recognises that climate related physical risks and a global transition to a lower-carbon future are expected to impact our operations, customers and suppliers. We support the Paris Agreement and mechanisms to achieve its objective of limiting future average global temperature rises to well below 2°C, as well as Australia's 2030 target of a 26–28% reduction in carbon emissions below 2005 levels.

Looking at how Boral's carbon emissions are tracking relative to 2005 levels, in Australia we have reduced emissions by around 40% since FY2005. We achieved about half of this decrease largely by realigning our portfolio away from emissions-intensive businesses. The remainder of the decrease is due to reducing clinker manufacturing in Australia in favour of importing it from more efficient and larger scale operations in Asia. Including Boral North America, our Scope 1 and 2 emissions decreased by 43% since FY2005. We continue to progressively adopt the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD). In FY2019, we enhanced our climate-related governance and risk management, completed scenario analysis of Boral Cement's business and continued to strengthen our resilience to a 2°C scenario. We also broadened our reporting of physical climate-related risks and Scope 3 emissions.

We completed a Group-wide review of our climate-related risks and opportunities using the TCFD framework. This review informed a two-year roadmap to undertake further scenario analysis of key climate related business risks. We transparently and constructively engaged with Climate Action 100+ investor representatives and other stakeholders during the year, sharing our progress in aligning our efforts with the TCFD recommendations and building greater resilience to climate-related impacts.

Our approach to climate related risks

Energy and climate policy

Boral has not identified any major positions on energy and climate policy held by our industry associations that are materially inconsistent with Boral's position.

We support:

- A national approach to climate and energy policy to ensure that least-cost carbon emissions abatement is targeted while ensuring reliable and competitive energy can be delivered.
- Climate and energy policies that do not unduly erode the competitiveness of domestic-based businesses.

Through our community partnership with Conservation Volunteers Australia, we support conservation and education initiatives in our local communities, including native vegetation initiatives in local reserves and schools.

In Australia, we are a member of the Cement Industry Federation (CIF). The CIF policy is to support the Federal Government's national target to reduce emissions by 26–28 per cent by 2030, and the CIF has been working with the World Business Council for Sustainable Development and its current roadmap to reduce emissions.

Boral acknowledges the Paris Agreement and supports mechanisms to achieve its objectives, including a national approach to climate and energy policy. Boral's major industry associations are:

- Green Building Council of Australia (GBCA)
- Infrastructure Sustainability Council of Australia (ISCA)
- Concrete Institute of Australia (CIA)
- Australian Pozzolan Association (APozA)
- Business Council of Australia
- Cement Industry Federation
- Cement, Concrete & Aggregates Australia
- Australian Mines and Metals Association's Australian Resources and Energy Group
- American Coal Ash Association.

For more information visit boral.com/industry associations

References

AS/NZS 3972
General purpose and blended cements (SA 2010)

AS 3582.1
Supplementary cementitious materials
Part 1: Fly Ash (SA 2016)

AS 3582.2
Supplementary cementitious materials Part 2:
Slag - Ground granulated blast furnace (SA 2016)

AS 2758.1
Aggregates and rock for engineering purposes Part 1:
Concrete Aggregates (SA 2014)

AS 1478.1
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ACLCA 2019
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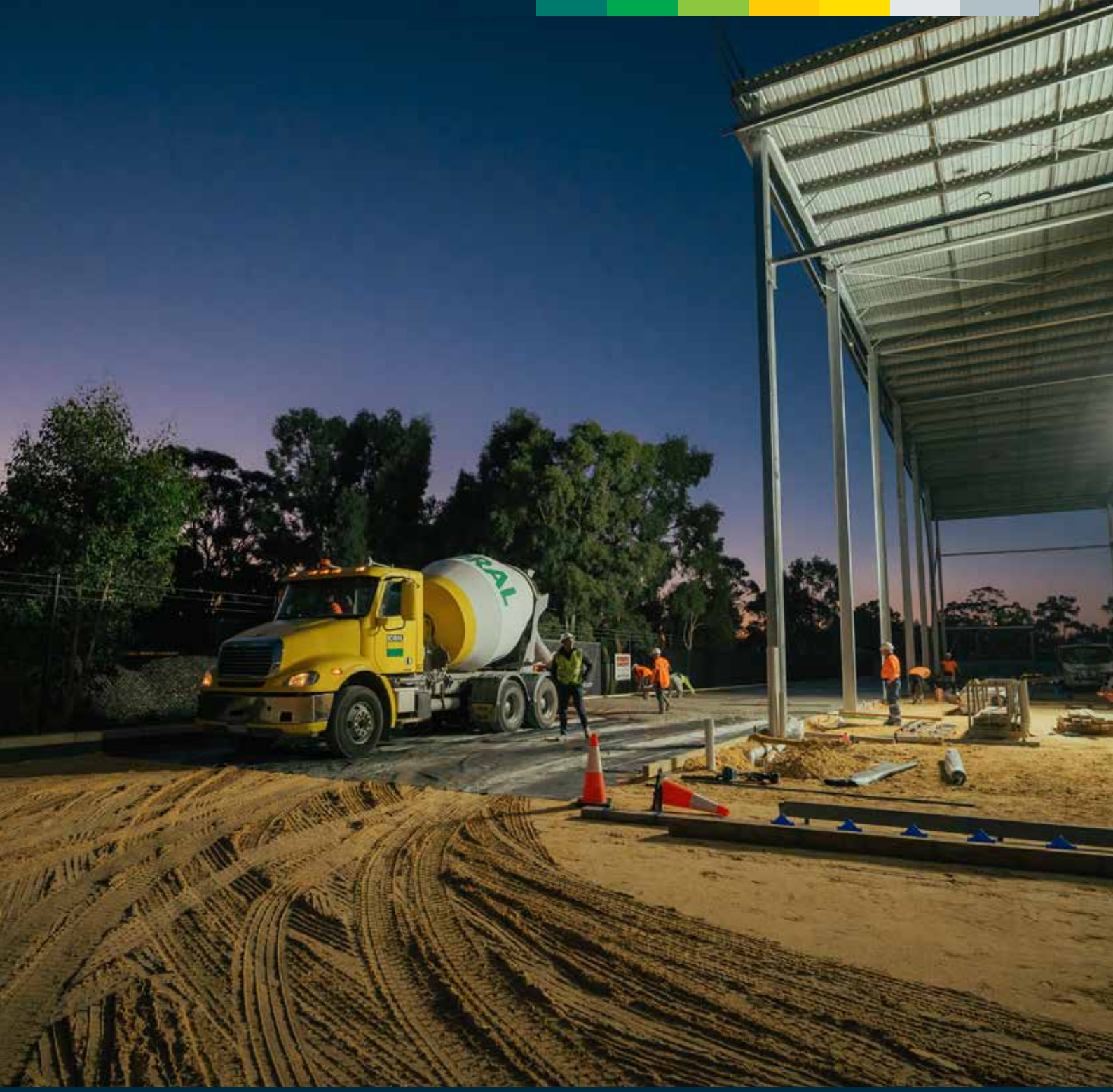

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