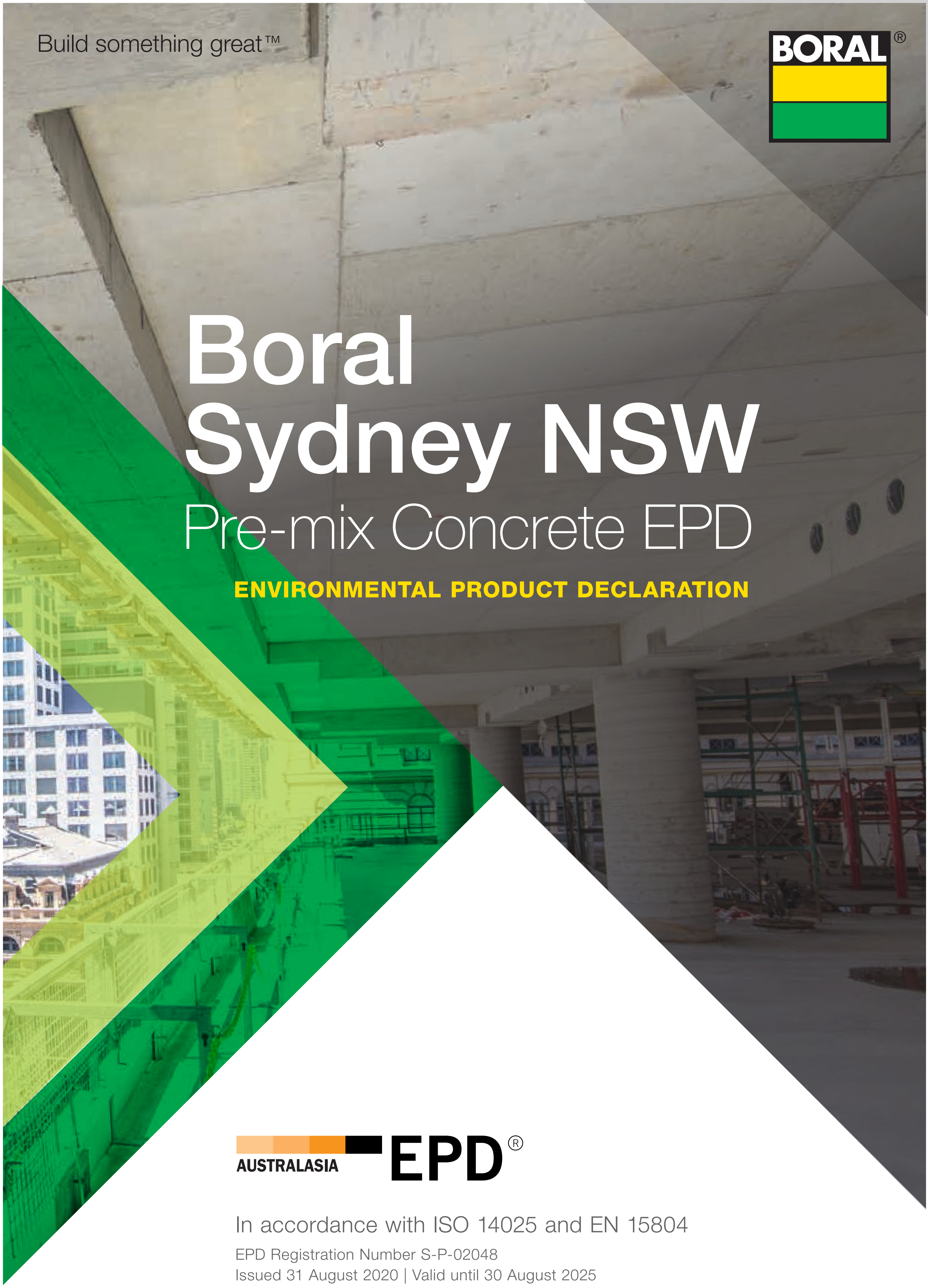
Build something great™



Boral Sydney NSW

Pre-mix Concrete EPD

ENVIRONMENTAL PRODUCT DECLARATION

EPD® AUSTRALASIA

In accordance with ISO 14025 and EN 15804

EPD Registration Number S-P-02048
Issued 31 August 2020 | Valid until 30 August 2025

Geographical Scope: Sydney, NSW

CONTENTS

Cover: 333 George street, Sydney NSW

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 environmental indicators for Boral ENVISIA® and pre-mix concrete manufactured in Australia. This EPD is a “cradle-to-gate” declaration covering production of the concrete and its supply chain.

This EPD is verified to be compliant with EN 15804. EPD 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	BORAL®	**Boral**	Address: Level 18 15 Blue Street North Sydney NSW 2060 Web: www.boral.com.au Phone: +612 9220 6300
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CEN standard EN 15804 served as the core PCR

PCR:	PCR 2012:01 Construction Products and Construction Services, Version 2.31, 2019-12-20 PCR 2012:01-SUB-PCR-G Concrete and concrete elements, 2020-02-18
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)

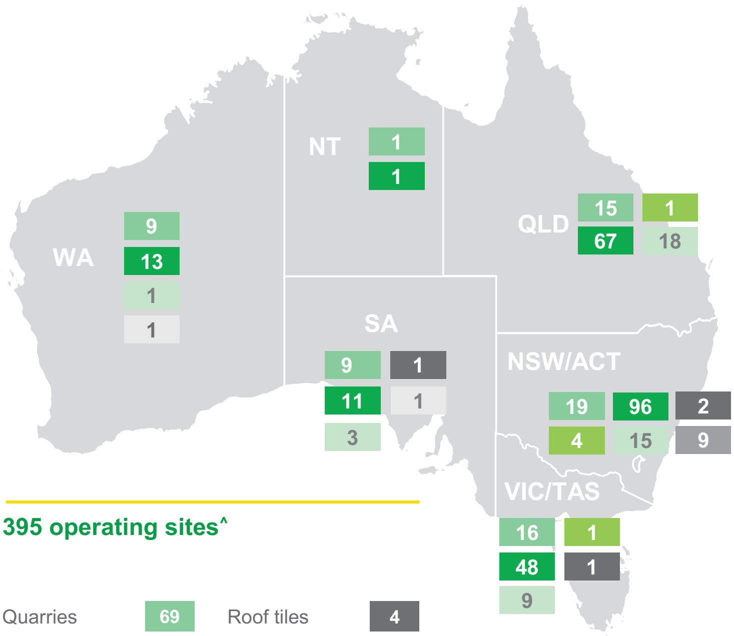
ABOUT BORAL

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

For this EPD, Boral has chosen a range of pre-mix concrete products including its ENVISIA®, lower carbon high performance concrete, alongside more conventional mixes such as normal class and road authority compliant mixes.



395 operating sites^

Quarries	69	Roof tiles	4
Concrete	236	Timber	9
Asphalt	46	Masonry	2
Cement	6		

^ As at 30 June 2019. Includes clay pits, transport, recycling and R&D sites. Concrete sites include mobile plants. Excludes mothballed plants.

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 & 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 Build something great™.

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 technical managers and technical supervisors 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.

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 more lightweight and lower carbon 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® products underpin this improved sustainable concrete range.

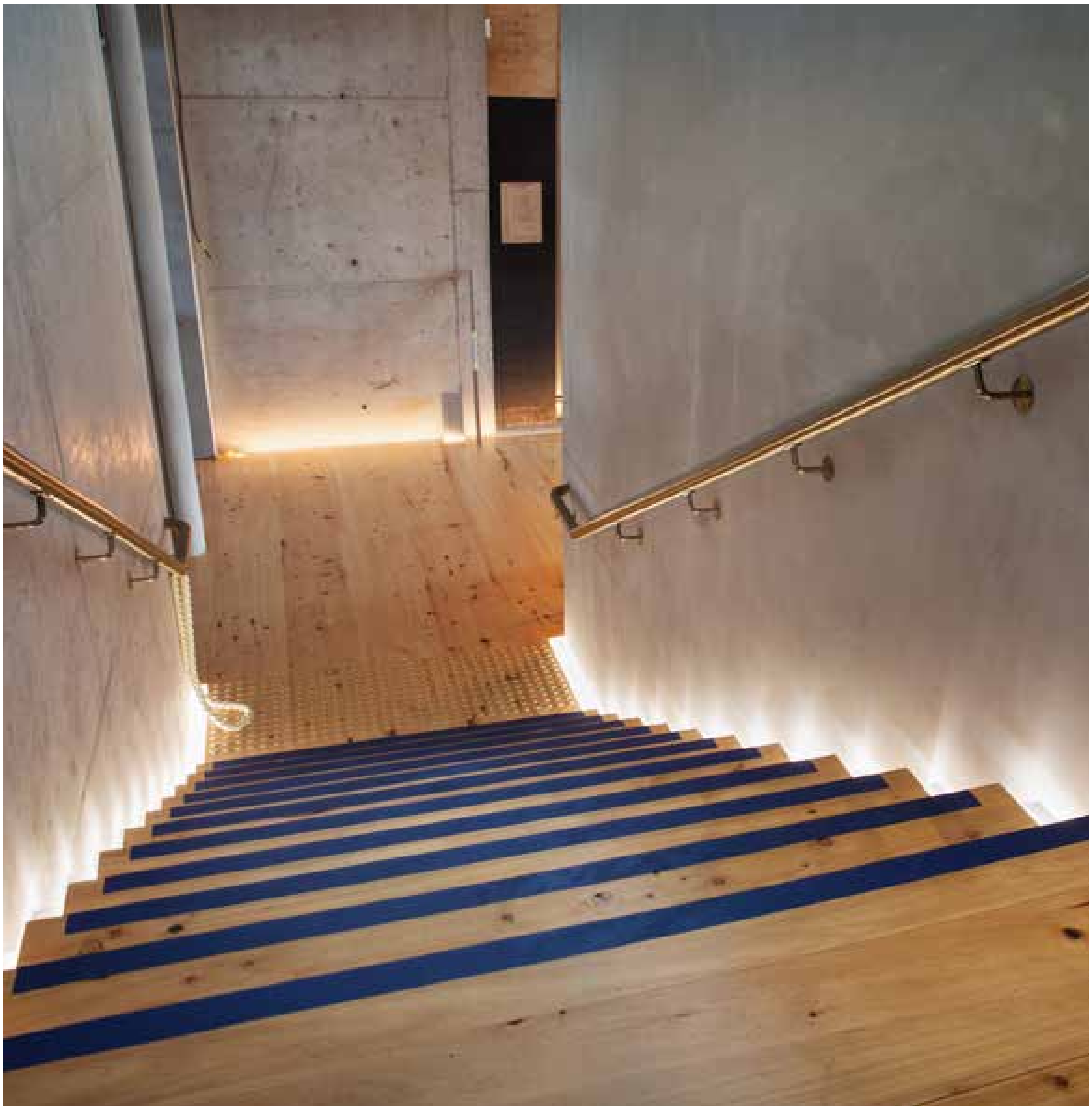
We monitor and report on our sustainability performance to drive progress and continuous improvement and are responding to increasing expectations of our customers on the disclosure of our sustainability risks and opportunities.

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.



SCOPE

The concrete plants considered for this Environmental Product Declaration comprise those in the Greater Sydney Metropolitan area, including:

Boral Concrete Artarmon
Boral Concrete Brookvale
Boral Concrete St Peters
Boral Concrete Botany
Boral Concrete Enfield (Greenacre)
Boral Concrete Thornleigh
Boral Concrete Granville
Boral Concrete Caringbah (Taren Point)
Boral Concrete Smithfield
Boral Concrete Blacktown (Fourth Avenue)
Boral Concrete Glenorie
Boral Concrete Prestons
Boral Concrete Minto
Boral Concrete (South) Windsor
Boral Concrete Bringelly
Boral Concrete Penrith
Boral Concrete Narellan (Smeaton Grange)
Boral Concrete Blacktown (Kings Park)

* Kings Park & Fourth Avenue

The products considered for the Sydney NSW pre-mix concrete EPD are listed below.
The strength grades considered for ENVISIA® are:

- ENVISIA® 20 MPa
- ENVISIA® 25 MPa
- ENVISIA® 32 MPa
- ENVISIA® 40 MPa
- ENVISIA® 50 MPa

The normal class concrete mixes considered are:

- 20 MPa - 20/10mm
- 25 MPa - 20/10mm
- 32 MPa - 20/10mm
- 40 MPa - 20/10mm

- Kerb Machine 25 MPa - 10mm
- Kerb Machine 32 MPa - 10mm
- Shotcrete 40 MPa - 10mm
- No Fines 5:1 - 20mm
- No Fines 6:1 - 20mm
- Stabilised sand 4:1
- Stabilised sand 8:1
- Stabilised sand 14:1

- TfNSW/RMS B80 40 MPa - 20/10mm, Pump, B1 Exposure
- TfNSW/RMS B80 40 MPa - 20/10mm, Pump and Tremie, B2 Exposure
- TfNSW/RMS B80 50 MPa - 10/20mm, Tremie, B2 and CFA C1 Exposure
- TfNSW/RMS R82 5 MPa - 20mm, Hand / machine placed
- TfNSW/RMS R83 35 MPa - 20mm, Hand / machine placed
- TfNSW/RMS R83 40 MPa - 20mm, Hand / machine placed

Boral Concrete and Sydney locations comply with relevant technical specifications as per AS 1379 Specification and supply of concrete (SA 2007).

ENVISIA® CONCRETE

ENVISIA® is an Australian Standards compliant (AS 1379) concrete comprising of ordinary portland cement, and ground granulated blast furnace slag cement. ENVISIA® also combines a proprietary cement technology (ZEP) to result in a low carbon, high performance concrete that behaves similarly to conventional cement and concrete technology.

ENVISIA® is used in all typical concrete applications varying from high durability in marine and sulphate resistant exposure conditions through to low risk civil applications. It is particularly suited to low shrinkage and high early strength applications, where low carbon footprint is also required.

ENVISIA® PRODUCT BENEFITS

Lower Carbon

- Despite the reduced portland cement content, ENVISIA® can still be used for post-tensioned slabs or when early stripping is required.
- This AS 1379 compliant concrete maintains high early-age strength as well as offers significant reductions in embodied carbon.
- ENVISIA® can be placed, pumped and finished like conventional concrete

High Early-Age Strength

- ENVISIA® will achieve early-age strength equivalent to conventional concrete (post-tensioned and precast) despite 50 per cent cement replacement.
- ENVISIA® has 30 per cent greater flexural strength compared to that of the equivalent grade of conventional concrete.
- The high flexural strength, low shrinkage and high durability means ENVISIA® is ideal for industrial slabs, roads and car parks.

Lower Shrinkage

- ENVISIA® achieves up to 50 per cent reduction in shrinkage when compared to conventional concrete.
- The low shrinkage of ENVISIA® allows for the design of larger slabs with fewer joints.

Superior Durability

- ENVISIA® provides greater protection for reinforcing against steel chloride-induced corrosion.
- ENVISIA® resists chloride ingress and is superior to conventional marine-grade concrete.
- 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.

ENVISIA® PRODUCTION

BORAL'S TECHNICAL EXPERTS DEVELOPED ENVISIA® WITH PRODUCTION CAPABILITY AND FLEXIBILITY IN MIND.

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 consists of large storage silos for the various reactive components like cement, and bulk ingredients like aggregates and water.

The plants also feature mechanisms for the addition of recycled water, various additives, machinery to accurately weigh, move, and mix some or all of those ingredients, and facilities to load the mixed concrete, often into a concrete 'agitator' (truck). Depending on the proposed application of the final product, additional additives to the concrete can include mixers, heaters, chillers, colour additives and so on. Concrete production is time-sensitive. Once the ingredients are mixed, workers must put the concrete in place before it hardens.

TECHNICAL COMPLIANCE

ENVISIA® concrete is a pre-mix concrete. In its freshly mixed state it is a plastic, workable mixture that can be formed into almost any desired shape. ENVISIA® concrete can be placed, pumped and finished like conventional concrete. It is a mixture of cement blended with ground granulated blast furnace slag, water, various sizes of aggregates and admixtures as required to achieve desired set times or air entrainment.

ENVISIA® concrete is an AS 1379 compliant concrete that offers significant reductions in embodied carbon whilst maintaining high early-age strength. ENVISIA® concrete will achieve early age strength equivalent to conventional concrete (post-tension and precast) despite 50 per cent cement replacement. Its reduced Portland cement content makes it ideal for Green Star projects or Infrastructure Sustainability Council of Australia projects.

ENVISIA® CASE STUDIES

THE STOKEHOUSE RESTAURANT CASE STUDY

Location	St Kilda, Victoria
Owner	Van Haandel Group
Builder	Lanskey Constructions
Engineer	Bonnaci Group
Architect	Robert Simeoni
Date	2014-2016

Boral helped lift the famed Stokehouse restaurant out of the ashes of a devastating fire in 2014 to become Australia's first 5 Star Green Star building of its kind. The owner's criteria for the new building included that it looked great and construction was as environmentally friendly as possible. It is now home to a refreshed and larger Stokehouse restaurant, casual dining space Pontoon and beachside fish and chip kiosk, Paper Fish.

Concrete Performance*

ENVISIA® 40 MPa

1-day strength .... 12 MPa
7-day strength .... 36 MPa
28-day strength .... 45 MPa
Drying shrinkage at 56 days .... 430 microstrain

ENVISIA® 50 MPa

1-day strength .... 15 MPa
7-day strength .... 47 MPa
28-day strength .... 58 MPa
Drying shrinkage at 56 days .... 460 microstrain

Outcomes

- The rebuild was at the forefront of low-carbon emission construction as the first Victorian venue to showcase Boral's ENVISIA® lower carbon concrete.
- ENVISIA® was used for the cantilevered slabs and exposed columns of the split level restaurant to reduce the volume of concrete and steel reinforcement required.
- ENVISIA® was chosen for its various characteristics including lower carbon, high early strength, durability, light colour, excellent off form finish and suitability for marine environments.
- ENVISIA® is expected to extend durability of the Stokehouse by more than 100 years.
- ENVISIA's® lower carbon credentials assisted our client to meet Government environmental and sustainability requirements for developing Crown land.

What they said...

"The most exciting thing about the Stokehouse is the fact that we've managed to make it as environmentally friendly as we possibly can."

Frank Van Haandel
Owner,
Van Haandel Group

"With ENVISIA®, only having half the shrinkage of regular concrete, it was really well-suited to a cantilevered slab design like this."

Greg Johnston
Foreman,
Lanksey Constructions

"The cantilevered structure was monitored and showed ENVISIA® provided minimal deflection."

Sam Caruso
Structural Engineer,
Bonacci Group

"Boral has contributed a huge amount to the credibility of the building. What Boral has been able to do with the reduction of portland cement is actually staggering."

Trent Alexander
Project Manager,
Van Haandel Group

PRE-MIX CONCRETE PRODUCTION

PRE-MIX CONCRETE PRODUCTION

Pre-mix concrete: in its freshly mixed state, is a plastic, workable mixture that can be formed into almost any desired shape. Pre-mix concrete can be placed, pumped and finished like conventional concrete. It is a mixture of cement blended with ground granulated blast furnace slag, water, various sizes of aggregates and admixtures as required to achieve desired set times or air entrainment.

TECHNICAL AND FUNCTIONAL CHARACTERISTICS

Pre-mix concrete complies with:

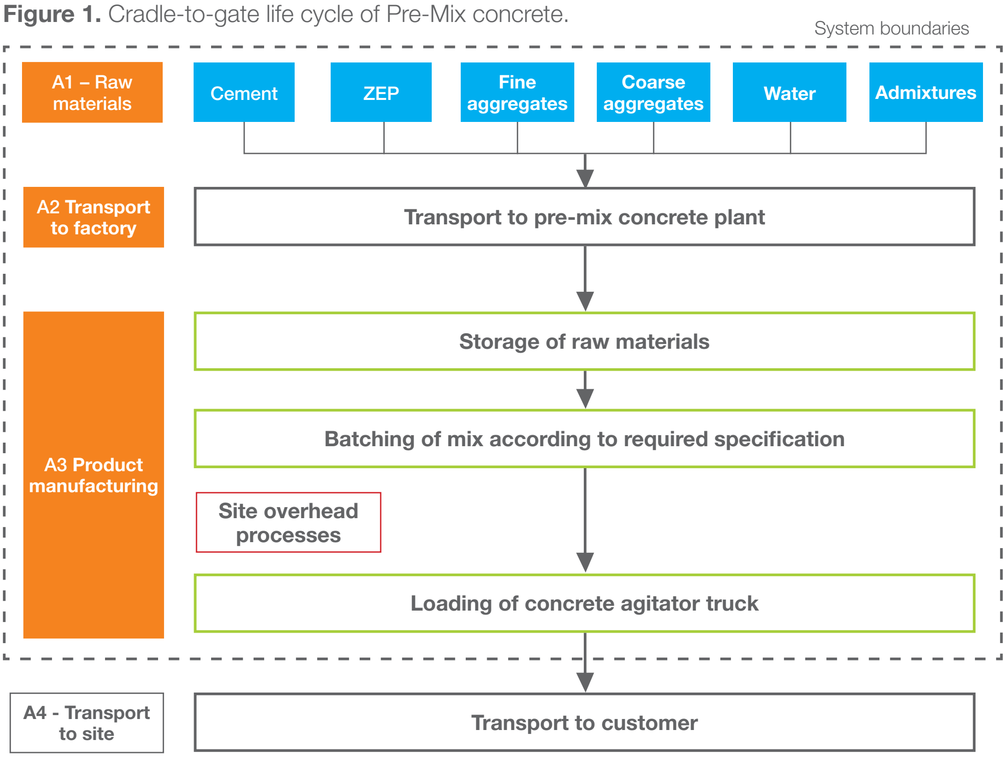
AS 1379 (R2017): Specification and supply of concrete (SA 2007)

The products' intended use is in a wide range of building and construction applications. Further details on product use and design for different applications can be found in the 'Boral Concrete Manual' (see www.boral.com.au).

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 Standard and ENVISIA® concrete 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

Raw materials are typically transported to our sites via articulated trucks or by train. Coarse aggregates and manufactured sand are supplied to the Sydney NSW region by rail from our Peppertree quarry. Natural sand is supplied from our Stockton quarry. Binders (cement, Enviroment slag cement and ZEP) come from our facilities in Berrima and Maldon. Fly ash is sourced from Eraring/Mt Piper/Bayswater power stations.

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.

CRADLE-TO-GATE LIFE CYCLE

MANUFACTURING STAGE A3

The typical manufacturing process of Boral normal class and ENVISIA® concrete is by mixing concrete constituents comprising cement and supplementary cementitious materials (SCM) under AS 3972/AS 3582.1,2, and fine/coarse aggregates (AS 2758.1), plus admixtures/additives (AS 1478.1) directly in the truck comprising ‘dry mixing’, 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.

LIFE CYCLE ASSESSMENT (LCA) METHODOLOGY

BACKGROUND DATA

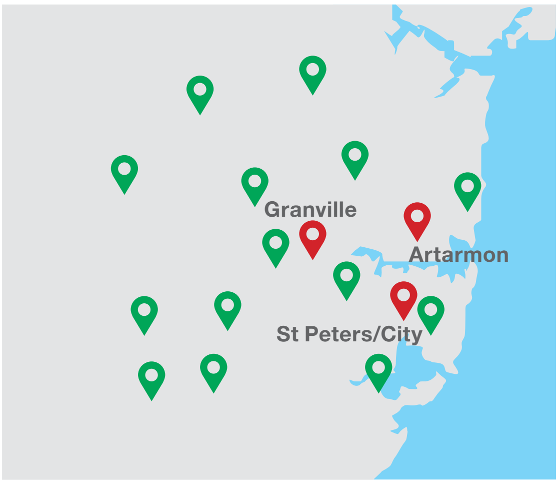
Boral has supplied primary data from key quarries, cement production facilities and concrete production sites. Three concrete production sites (Artarmon, Granville and St. Peters) provided primary data. The LCA shows that these sites are representative for the entire Sydney NSW region. Data for admixtures 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, blast furnace slag and fly ash) have predominantly been sourced from AusLCI and the AusLCI shadow database.

The NSW quarry data, cement production 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.

EXPLANATION OF AVERAGES

Boral operates 18 concrete plants in the Sydney NSW region. The three plants that provided data for this EPD supply around 45% of the total volume of concrete in the region and are representative for the whole region. A weighted average of generic production data (per m^3 of pre-mix concrete) for the three plants was determined using their total 2018 production volume.



Sydney (NSW) region

The products presented in this EPD each have their own specific mix design. However, in two cases it was decided that grouping two similar products would make it easier to communicate their environmental performance. These grouped products are:

- "TfNSW/RMS B80 40MPa 20/10mm Pump B2 Exposure" and "TfNSW/RMS B80 40MPa 20/10mm Tremie B2 Exposure" are grouped as "TfNSW/RMS B80 40MPa 20/10mm Pump and Tremie B2 Exposure"
- "TfNSW/RMS B80 50MPa 20mm Tremie B2 Exposure" and "TfNSW/RMS B80 50MPa 10mm Tremie CFA C1 Exposure" are grouped as "TfNSW/RMS B80 50MPa 20/10mm Tremie B2 and CFA C1 Exposure".

LIFE CYCLE ASSESSMENT (LCA) METHODOLOGY

ALLOCATION

The key material production processes that require allocation are:

- **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).
- **Cementitious binders**: Boral produces clinker in Berrima and various types of cementitious products in Berrima and Maldon. Raw materials have been modelled based on product compositions. Energy use and process emissions for clinker production have been attributed to clinker and off-white clinker based on their mass. Energy use for cementitious material production has been attributed to all co-products based on their mass.
- **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.
- **Fly ash**: fly ash is a by-product from coal-fired power plants. We have used the AusLCI data for fly ash, in which all environmental impacts of the power plant are allocated to the main product: electricity. Fly ash has only received the burdens of transport to our sites.

The allocation assumptions were checked using sensitivity analyses, which showed that the allocation of fly ash can have an impact on the LCA results if impacts of electricity production are assigned to fly ash.

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 2018a).
- 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. No EPD has been published for Viscosity Modifying Admixtures (VMA); we have used an average of the five admixture EPDs published by EFCA as a proxy.
- Fly ash is considered a by-product of electricity generation that comes without prior environmental impacts. This allocation decision can have a significant effect on the environmental profile of products that use fly ash.
- 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

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).

Table 2. Sydney NSW product compositions

Components (kg / m³)	**ENVISIA® (20-50 MPa)**	**Normal Class Concrete (20-40 MPa)**	**Kerb Machine (25-32 MPa) Shotcrete (40 MPa)**	**No Fines (5:1 & 6:1)**	**Stabilised sand (14:1 - 8:1 - 4:1)**	**RMS B80 (40-50 MPa)**	**RMS R82 (5 MPa) RMS R83 (35-40 MPa)**
Portland cement	5-13%	5-11%	10-15%	12-18%	2-9%	7-15%	3-16%
ZEP™	5-13%	–	–	–	–	–	–
Fly ash	–	3-5%	2-7%	–	–	4-6%	1-10%
Boral Enviroment® slag cement	–	2-5%	–	–	3-13%	0-8%	–
Natural sand	6-12%	7-12%	8-22%	–	67-96%	9-14%	5-20%
Manufactured sand	16-30%	20-28%	20-40%	–	–	15-25%	15-30%
Coarse aggregates	38-50%	38-50%	20-45%	70-89%	–	30-50%	40-50%
Water	6-10%	6-9%	4-10%	5-8%	5-7%	6-9%	6-9%
Admixtures	<0.1%	<0.1%	<0.2%	–	–	<0.3%	<0.2%

SYDNEY NSW CONCRETE

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).

DECLARED UNIT

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 2020).

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).

SYDNEY NSW CONCRETE

Table 3. Impact categories included in this assessment

Impact category	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

Parameter	Acronym	Unit
Parameters describing resource use		
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

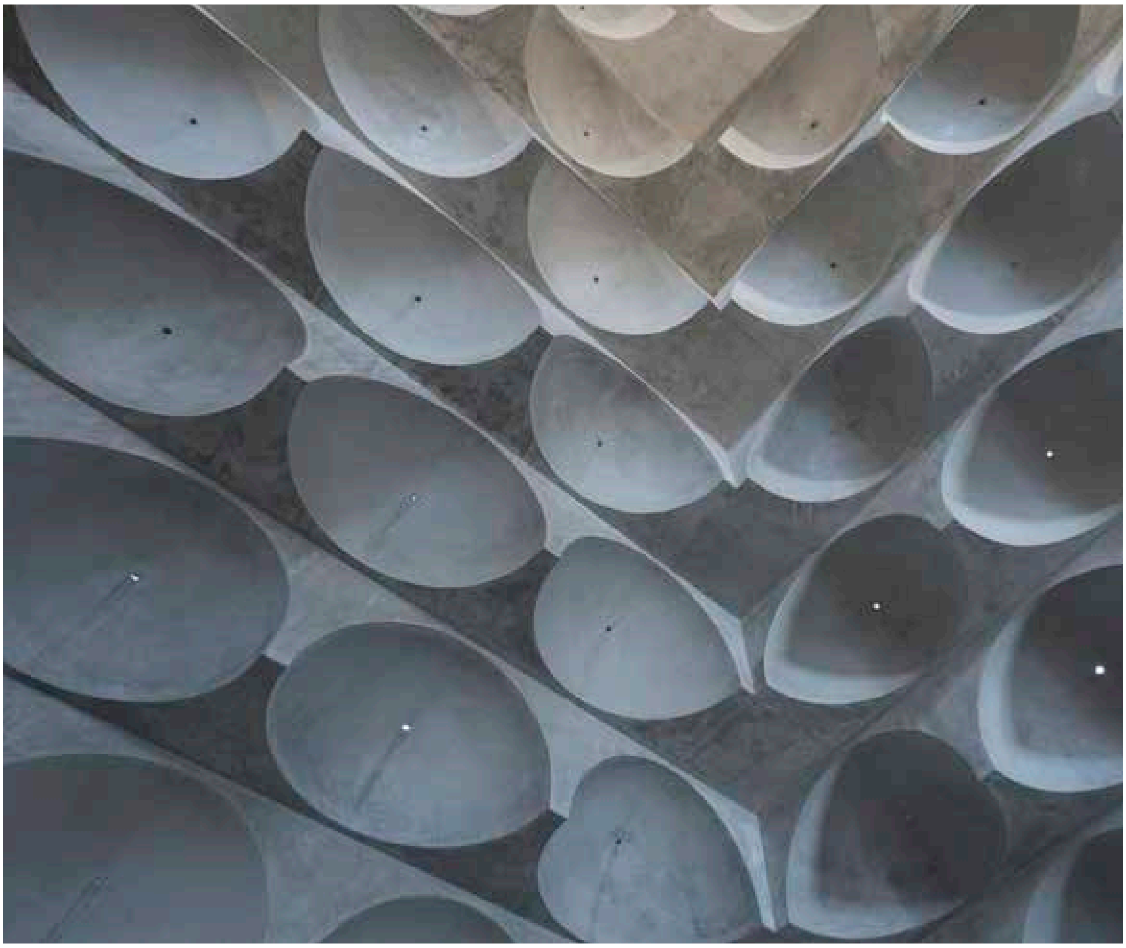
SYDNEY NSW CONCRETE

ENVIRONMENTAL PROFILES FOR ENVISIA® AND PRE-MIX CONCRETE

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 produced in Sydney, NSW.

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

- Hazardous waste (HWD) is derived from background LCI data.
- Non-hazardous waste (NHWD) is derived from background LCI data.
- Radioactive waste (RWD) is derived from background LCI data. Radioactive waste is only coming through the EPD data for admixtures and is equal across all sites.



SYDNEY NSW CONCRETE

Table 5. Environmental profiles, stages A1-A3, ENVISIA® concrete, Sydney, NSW, per m^3

Indicator Unit	Unit	S20	S25	S32	S40	S50
Global warming	kg CO_2 eq	183	199	220	261	308
Ozone layer depletion	kg CFC11 eq	2.63E-06	2.69E-06	2.77E-06	2.91E-06	3.07E-06
Acidification, soil and water	kg SO_2 eq	0.366	0.388	0.419	0.479	0.546
Eutrophication	kg PO_4^{3-} eq	0.0804	0.0852	0.0917	0.104	0.119
Photochemical ozone creation	kg C_2H_4 eq	0.0291	0.0304	0.0322	0.0357	0.0396
Resource depletion – mineral	kg Sb eq	6.04E-06	6.61E-06	7.37E-06	8.88E-06	1.06E-05
Resource depletion – fossil	MJ_{NCV}	1360	1460	1590	1860	2150

Table 6. Environmental parameters, stages A1-A3, ENVISIA® concrete, Sydney, NSW, per m^3

Parameter	Unit	S20	S25	S32	S40	S50
PERE	MJ_{NCV}	3.54E+01	3.80E+01	4.16E+01	4.86E+01	5.65E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.54E+01	3.80E+01	4.16E+01	4.86E+01	5.65E+01
PENRE	MJ_{NCV}	1.39E+03	1.49E+03	1.62E+03	1.89E+03	2.19E+03
PENRM	MJ_{NCV}	3.49E+00	3.85E+00	4.33E+00	5.29E+00	6.37E+00
PENRT	MJ_{NCV}	1.39E+03	1.49E+03	1.63E+03	1.89E+03	2.19E+03
SM	kg	1.48E+02	1.63E+02	1.84E+02	2.24E+02	2.70E+02
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	3.27E+00	3.25E+00	3.22E+00	3.15E+00	3.06E+00
HWD	kg	7.58E-06	8.36E-06	9.41E-06	1.15E-05	1.38E-05
NHWD	kg	1.64E+00	1.79E+00	2.00E+00	2.41E+00	2.87E+00
RWD	kg	1.55E-03	1.71E-03	1.92E-03	2.35E-03	2.83E-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

SYDNEY NSW CONCRETE

Table 7. Environmental profiles, stages A1-A3, Sydney NSW normal class concrete, per m^3

Indicator Unit	Unit	20 MPa - 20/10mm	25 MPa - 20/10mm	32 MPa - 20/10mm	40 MPa - 20/10mm
Global warming	kg CO_2 eq	159	174	207	245
Ozone layer depletion	kg CFC11 eq	2.45E-06	2.50E-06	2.59E-06	2.66E-06
Acidification, soil and water	kg SO_2 eq	0.295	0.314	0.353	0.399
Eutrophication	kg PO_4^{3-} eq	0.0705	0.0752	0.0850	0.0962
Photochemical ozone creation	kg C_2H_4 eq	0.0254	0.0265	0.0287	0.0308
Resource depletion – mineral	kg Sb eq	2.21E-06	2.36E-06	2.69E-06	3.10E-06
Resource depletion – fossil	MJ_{NCV}	1110	1200	1380	1600

Table 8. Environmental profiles, stages A1-A3, Sydney NSW normal class concrete, per m^3

Parameter	Unit	20 MPa - 20/10mm	25 MPa - 20/10mm	32 MPa - 20/10mm	40 MPa - 20/10mm
PERE	MJ_{NCV}	2.73E+01	2.95E+01	3.40E+01	3.96E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	2.73E+01	2.95E+01	3.40E+01	3.96E+01
PENRE	MJ_{NCV}	1.14E+03	1.23E+03	1.41E+03	1.63E+03
PENRM	MJ_{NCV}	6.23E+00	6.72E+00	7.76E+00	9.07E+00
PENRT	MJ_{NCV}	1.14E+03	1.23E+03	1.42E+03	1.64E+03
SM	kg	1.67E+02	1.75E+02	1.91E+02	2.10E+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	3.07E+00	3.05E+00	2.99E+00	2.95E+00
HWD	kg	6.68E-06	7.21E-06	8.32E-06	9.73E-06
NHWD	kg	3.59E-01	3.85E-01	4.41E-01	5.09E-01
RWD	kg	1.16E-03	1.25E-03	1.45E-03	1.69E-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

SYDNEY NSW CONCRETE

Table 9. Environmental profiles, stages A1-A3, Sydney NSW Kerb Machine concrete and Shotcrete, per m^3

Indicator Unit	Unit	Kerb Machine, 25 MPa 10mm	Kerb Machine, 32 MPa 10mm	Shotcrete 40 MPa - 10mm
Global warming	kg CO_2 eq	255	286	308
Ozone layer depletion	kg CFC11 eq	2.48E-06	2.49E-06	2.57E-06
Acidification, soil and water	kg SO_2 eq	0.401	0.437	0.472
Eutrophication	kg PO_4^{3-} eq	0.0977	0.106	0.114
Photochemical ozone creation	kg C_2H_4 eq	0.0296	0.0310	0.0336
Resource depletion – mineral	kg Sb eq	2.91E-06	2.35E-06	1.18E-05
Resource depletion – fossil	MJ_{NCV}	1560	1700	1890

Table 10. Environmental parameters, stages A1-A3, Sydney NSW Kerb Machine concrete and Shotcrete, per m^3

Parameter	Unit	Kerb Machine, 25 MPa 10mm	Kerb Machine, 32 MPa 10mm	Shotcrete 40 MPa - 10mm
PERE	MJ_{NCV}	3.83E+01	4.11E+01	4.96E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.83E+01	4.11E+01	4.96E+01
PENRE	MJ_{NCV}	1.59E+03	1.74E+03	1.92E+03
PENRM	MJ_{NCV}	8.85E+00	0.00E+00	1.97E+01
PENRT	MJ_{NCV}	1.60E+03	1.74E+03	1.94E+03
SM	kg	1.02E+02	8.25E+01	1.51E+02
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.08E+00	2.98E+00	2.92E+00
HWD	kg	9.88E-06	4.07E-06	2.71E-05
NHWD	kg	4.24E-01	7.13E-01	2.35E+00
RWD	kg	1.71E-03	6.83E-04	5.08E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00

SYDNEY NSW CONCRETE

Table 11. Environmental profiles, stages A1-A3, Sydney NSW No Fines concrete and Stabilised sand, per m^3

Indicator Unit	Unit	No Fines 6:1 20mm	No Fines 5:1 20mm	Stabilised sand 14:1	Stabilised sand 8:1	Stabilised sand 4:1
Global warming	kg CO_2 eq	249	293	58	92	170
Ozone layer depletion	kg CFC11 eq	2.08E-06	2.20E-06	1.34E-06	1.57E-06	2.13E-06
Acidification, soil and water	kg SO_2 eq	0.377	0.431	0.129	0.177	0.288
Eutrophication	kg PO_4^{3} eq	0.0918	0.105	0.0299	0.0412	0.0676
Photochemical ozone creation	kg C_2H_4 eq	0.0257	0.0285	0.0127	0.0162	0.0242
Resource depletion – mineral	kg Sb eq	8.61E-07	9.56E-07	2.27E-07	3.88E-07	7.65E-07
Resource depletion – fossil	MJ_{NCV}	1470	1700	454	676	1190

Table 12. Environmental parameters, stages A1-A3, Sydney NSW No Fines concrete and Stabilised sand, per m^3

Parameter	Unit	No Fines 6:1 - 20mm	No Fines 5:1 - 20mm	Stabilised sand 14:1	Stabilised sand 8:1	Stabilised sand 4:1
PERE	MJ_{NCV}	3.55E+01	4.11E+01	1.00E+01	1.53E+01	2.75E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ_{NCV}	3.55E+01	4.11E+01	1.00E+01	1.53E+01	2.75E+01
PENRE	MJ_{NCV}	1.50E+03	1.73E+03	4.68E+02	6.93E+02	1.22E+03
PENRM	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT	MJ_{NCV}	1.50E+03	1.73E+03	4.68E+02	6.93E+02	1.22E+03
SM	kg	8.40E+00	1.01E+01	6.32E+01	1.10E+02	2.20E+02
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	2.60E+00	2.61E+00	2.35E+00	2.39E+00	2.46E+00
HWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	kg	3.78E-01	4.30E-01	1.50E-01	2.32E-01	4.25E-01
RWD	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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

SYDNEY NSW CONCRETE

Table 13. Environmental profiles, stages A1-A3, Sydney NSW TfNSW / RMS B80 bridgeworks concrete, per m^3

Indicator Unit	Unit	TfNSW / RMS B80 40 MPa – 20/10mm, Pump, B1 Exposure	TfNSW / RMS B80 40 MPa – 20/10mm, Pump and Tremie, B2 Exposure	TfNSW /RMS B80 50 MPa - 20/10mm, Tremie, B2 and CFA C1 Exposure
Global warming	kg CO_2 eq	313	233	244
Ozone layer depletion	kg CFC11 eq	2.62E-06	2.84E-06	2.88E-06
Acidification, soil and water	kg SO_2 eq	0.477	0.402	0.421
Eutrophication	kg PO_4^{3-} eq	0.115	0.0948	0.0988
Photochemical ozone creation	kg C_2H_4 eq	0.0337	0.0329	0.0344
Resource depletion – mineral	kg Sb eq	8.17E-06	1.08E-05	1.56E-05
Resource depletion – fossil	MJ_{NCV}	1880	1620	1720

Table 14. Environmental parameters, stages A1-A3, Sydney NSW TfNSW / RMS B80 bridgeworks concrete, per m^3

Parameter	Unit	TfNSW / RMS B80 40 MPa – 20/10mm, Pump, B1 Exposure	TfNSW / RMS B80 40 MPa – 20/10mm, Pump and Tremie, B2 Exposure	TfNSW / RMS B80 50 MPa - 20/10mm, Tremie, B2 and CFA C1 Exposure
PERE	MJ_{NCV}	4.76E+01	4.30E+01	4.81E+01
PERM	MJ_{NCV}	0.00E+00	4.24E-02	8.11E-02
PERT	MJ_{NCV}	4.76E+01	4.30E+01	4.82E+01
PENRE	MJ_{NCV}	1.92E+03	1.65E+03	1.75E+03
PENRM	MJ_{NCV}	1.11E+01	1.44E+01	2.12E+01
PENRT	MJ_{NCV}	1.93E+03	1.66E+03	1.77E+03
SM	kg	1.25E+02	2.64E+02	2.79E+02
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00
FW	m^3	2.99E+00	3.00E+00	2.99E+00
HWD	kg	1.63E-05	2.55E-05	3.96E-05
NHWD	kg	1.82E+00	2.25E+00	3.13E+00
RWD	kg	3.10E-03	4.01E-03	5.94E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00

SYDNEY NSW CONCRETE

Table 15. Environmental profiles, stages A1-A3, Sydney NSW TfNSW / RMS R82 and RMS R83 pavement concrete, per m^3

Indicator Unit	Unit	TfNSW/RMS R82 5 MPa - 20mm Hand / Machine placed	TfNSW/RMS R83 35 MPa - 20mm Hand / Machine placed	TfNSW/RMS R83 40 MPa - 20mm Hand / Machine placed
Global warming	kg CO_2 eq	115	287	318
Ozone layer depletion	kg CFC11 eq	2.37E-06	2.45E-06	2.52E-06
Acidification, soil and water	kg SO_2 eq	0.242	0.439	0.483
Eutrophication	kg PO_4^{3-} eq	0.0573	0.106	0.116
Photochemical ozone creation	kg C_2H_4 eq	0.0226	0.0305	0.0334
Resource depletion – mineral	kg Sb eq	1.75E-06	3.99E-06	1.06E-05
Resource depletion – fossil	MJ_{NCV}	830	1700	1920

Table 16. Environmental parameters, stages A1-A3, Sydney NSW TfNSW / RMS R82 and RMS R83 pavement concrete, per m^3

Parameter	Unit	TfNSW/RMS R82 5 MPa - 20mm, Hand / Machine placed	TfNSW/RMS R83 35 MPa - 20mm, Hand / Machine placed	TfNSW/RMS R83 40 MPa - 20mm, Hand / Machine placed
PERE	MJ_{NCV}	1.98E+01	4.16E+01	5.05E+01
PERM	MJ_{NCV}	0.00E+00	0.00E+00	4.32E-02
PERT	MJ_{NCV}	1.98E+01	4.16E+01	5.06E+01
PENRE	MJ_{NCV}	8.55E+02	1.74E+03	1.95E+03
PENRM	MJ_{NCV}	2.19E+00	2.19E+00	1.44E+01
PENRT	MJ_{NCV}	8.57E+02	1.74E+03	1.96E+03
SM	kg	1.69E+02	5.13E+01	5.75E+01
RSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ_{NCV}	0.00E+00	0.00E+00	0.00E+00
FW	m^3	3.13E+00	3.08E+00	3.13E+00
HWD	kg	2.95E-06	4.75E-06	2.56E-05
NHWD	kg	4.19E-01	1.16E+00	2.19E+00
RWD	kg	5.49E-04	9.72E-04	4.00E-03
CRU	kg	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.60E+01	9.60E+01	9.60E+01
MER	kg	0.00E+00	0.00E+00	0.00E+00
EE	MJ	0.00E+00	0.00E+00	0.00E+00

VARIATION (A1-A3) PER IMPACT CATEGORY

The results of the LCA are based on data from three representative plants for the Sydney NSW region. The greenhouse gas of the Sydney NSW concrete products are not materially different between the manufacturing sites, with variations generally being less than ±1%. The largest variation (4%) is found in stabilised sand 14:1, as this is the product with the smallest footprint. The variation for the other mandatory indicators stays well within the ±10% range as required by the PCR (Environdec 2019a) for most indicators. The variations are larger than ±10% for ozone layer depletion and photochemical oxidant creation, which is caused by minor differences in aggregates transport.

Aggregates from Peppertree quarry are transported by rail directly to the St. Peters concrete plant. For other concrete plants, aggregates require an additional 20 km (approximately) transport by truck from the receiving rail depot to the concrete plant. As a result, ozone layer depletion results vary by up to ±18% and photochemical oxidant creation results vary by up to -18%/+15% in the most extreme cases. The fact that relatively minor changes in the supply chain have such an impact on these indicators, suggests that the emissions are coming from a low (absolute) base.
It is therefore reasonable to use the three plants as representative for the wider Sydney NSW region.

For the grouped RMS products, the variation within other mandatory indicators shows a similar pattern to the above described variation between production plants, with the exception of mineral resource depletion (ADPE). Resource depletion of mineral elements is dominated by impacts from the admixtures.

The minor differences in type and quantities of admixtures used between the grouped concrete mixes has a disproportionately large effect on this indicator. The variation in ADPE between the two TfNSW/RMS B80 40 MPa mixes is ±39%; variation in ADPE between the two TfNSW/RMS B80 50 MPa mixes is ±15%. The other raw materials used in concrete production have a relatively low mineral resource depletion potential, which exacerbates the influence of the admixtures.

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 commonly re-used back into our production processes, including concrete washout. This beneficially uses materials that would otherwise require disposal. A large proportion of Boral's recycled and low 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:

- 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.

OUR APPROACH TO CLIMATE RELATED RISKS

OUR APPROACH

Boral recognises that climate related physical risks and a global transition to a low-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.

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:

- 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

LIMITATIONS

This study presents a 'cradle-to-gate' life cycle assessment of pre-mix concrete products produced by Boral in the Sydney NSW region.

The main limitations of the LCA results are found in the parameter results, which are highly dependent on background data.

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.

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