Humes

Strength. Performance. Passion.

AUSTRALASIA EPD
ENVIRONMENTAL PRODUCT DECLARATION

Environmental Product Declaration

Humes Tamworth Precast Concrete for Infrastructure Applications
In accordance with ISO 14025 and EN 15804
EPD Registration no. S-P-01544 | Version 1.0
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Geographical scope: Australia

A Division of Holcim Australia

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An Environmental Product Declaration (EPD) is a standardised way of quantifying the potential environmental impacts of a product or system. EPDs are produced according to a consistent set of rules – Product Category Rules (PCR) – that define the requirements within a given product category. These rules are a key part of ISO 14025 as they enable transparency and comparability between EPDs. This EPD provides environmental indicators for Humes precast steel-reinforced concrete products manufactured at the Humes production facility in Tamworth (NSW) in Australia. This EPD is a "cradle-to-gate" declaration covering production of the precast concrete products and their 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 EN15804. EPDs within the same product category but from different programs or utilising different PCRs may not be comparable. Holcim (Australia), as the EPD owner, has the sole ownership, liability and responsibility for the EPD.

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Independent verification of the declaration and data, according to ISO 14025:	☐ EPD process certification (Internal) ☒ EPD verification (External)
Third party verifier:	Jeff Vickers, thinkstep-anz Web: www.thinkstep-anz.com Email: jeff.vickers@thinkstep-anz.com Phone: +61 2 8007 5770 Accredited or approved by: EPD Australasia

Humes Tamworth

Humes Concrete Products (Humes) is a division of Holcim (Australia) Pty Ltd which is owned by the world's largest building materials company, LafargeHolcim. Humes pride ourselves on delivering customised solutions to maximise installation, performance, and budgetary outcomes for our clients. Today, Humes employs more than 600 people and is the largest civil precast concrete manufacturer in Australia.

This EPD covers precast products manufactured at our plant in Tamworth, NSW (Tamworth is highlighted in Figure 1). We have ten factories around Australia producing reinforced concrete products. Humes Tamworth is one of two factories located in NSW and is presently supplying large infrastructure projects such as the Inland Rail Project.

Mission

Humes aims to be the most respected and successfully operated company in our industry, creating value for all of our stakeholders.

As a subsidiary of one of the world's largest cement companies, LafargeHolcim, our vision is to perfect progress as we provide the foundations for society's future. Achieving our mission involves a commitment to the following:

- innovative solutions for our customers
- employees with a passion for performance
- an open and collaborative corporate culture
- a forward-looking organisation
- a culture that promotes sustainable development
- long-term financial performance

At a Glance

We have a long history of engineering precast and prestressed concrete solutions and, after 100 years of manufacture, our product range has never been more diverse, more competitive, or more in-tune with our clients' needs than it is today.

We offer a range of solutions for bridges and platforms, road and rail infrastructure, tunnels and shafts, retaining walls, pipeline systems, water treatment, reuse and detention, and traffic management. We can customise our solutions to ensure they create maximum value for your project, accommodating your site conditions, design requirements and construction factors.

The quality and reliability of Humes' products and services are the foundation of our success. Our ability to deliver to client specifications on major projects across Australia has established Humes as a valuable and reliable partner.

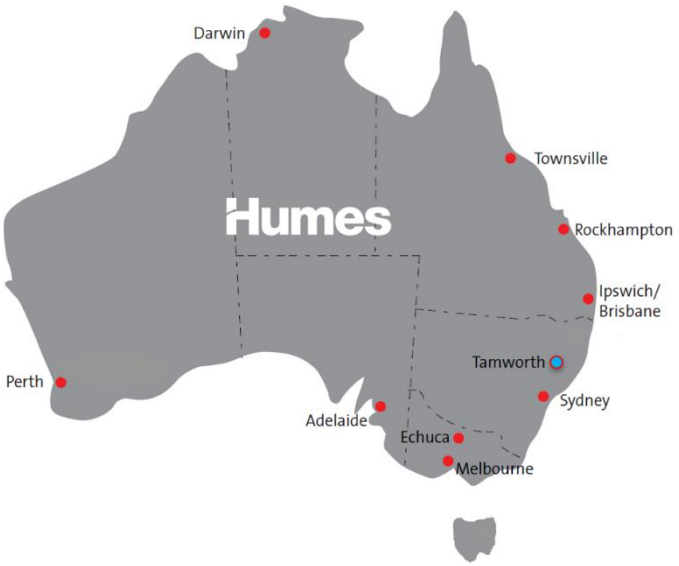


Figure 1: Location of Humes' precast concrete production facilities

Product description

Humes manufacture a full range of box culverts, ballast kerbs and wing wall sizes and configurations. This EPD covers box culverts and headwalls manufactured at Humes Tamworth, of which a significant amount are supplied to the Inland Rail Project.

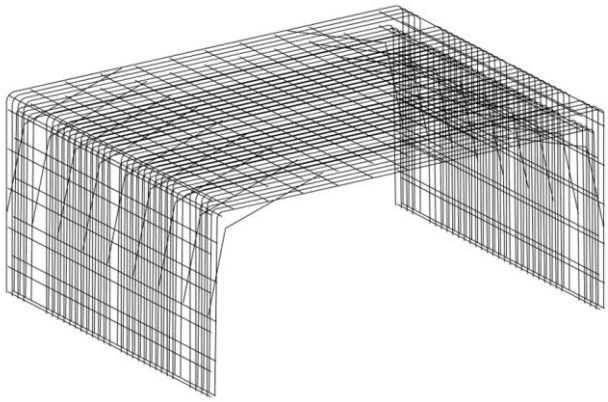
Culvert products' intended use is bridging for pedestrian, fauna and stock crossings under road and rail applications. Humes precast concrete box culverts are also suitable for difficult site conditions as installation requires minimal excavation and backfill.

Reinforced concrete products are made from coarse and fine aggregates, cement, water, and steel reinforcement. Other material used can include supplementary cementitious materials (SCM) such as fly ash and chemical admixtures, which have varied effects on the concrete depending on the admixture used.

Humes Tamworth has already supplied over 4000 precast products to the Inland Rail Parkes to Narromine (P2N) section. The culverts are manufactured as inverted U-shape culverts (see Figure 2 and Figure 3) and are both railway load class 300LA and road class SM1600.

The culverts supplied are also classified as both small and large box culverts, ranging from 600 mm to 3000 mm span; 450 to 2400 mm height and are all 2400 mm in length. Wingwall units are manufactured to fit the 450 to 2400 mm height range of the culverts.

Figure 2: Schematic of steel cage in a large box culvert



The product as supplied is 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).

Dust from this product is classified as Hazardous according to the Approved Criteria for Classifying Hazardous Substances 3rd Edition (NOHSC 2004). Precast concrete products and pipes are classified as non-dangerous goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. When concrete products are cut, sawn, abraded or crushed, dust is created which contains crystalline silica, some of which may be respirable (particles small enough to go into the deep parts of the lung when breathed in), and which is hazardous. Exposure through inhalation should be avoided.

Precast concrete products form part of the UN CPC 375 – "Concrete" industry classification and the ANZSIC 2034 – "Concrete Product Manufacturing" product group classification.

Technical Compliance

Humes culvert units are designed and manufactured to comply with AS 1597.1:2010 Precast reinforced concrete box culverts Part 1: Small culverts (not exceeding 1200 mm span and 1200 mm height) and AS 1597.2:2013 Precast reinforced concrete box culverts Part 2: Large culverts (exceeding 1200 mm span or 1200 mm height and up to and including 4200 mm span and 4200 mm height). Culverts supplied to the Inland Rail project are also additionally compliant to RMS QA Specification R16 Precast Reinforced Concrete Box Culverts. In addition, culvert units have a reference service life (RSL) of 100 years, when manufactured and installed in accordance with AS1597.1 & AS1597.2. The design load of railway load class culverts is 300LA and the design load of road load class culverts is SM1600 in accordance with both AS5100 & AS1597 series requirements. The ballast kerb and wing wall designs for the Inland Rail project were supplied by Australian Rail Track Corporation (ARTC) and are manufactured to the design requirements.

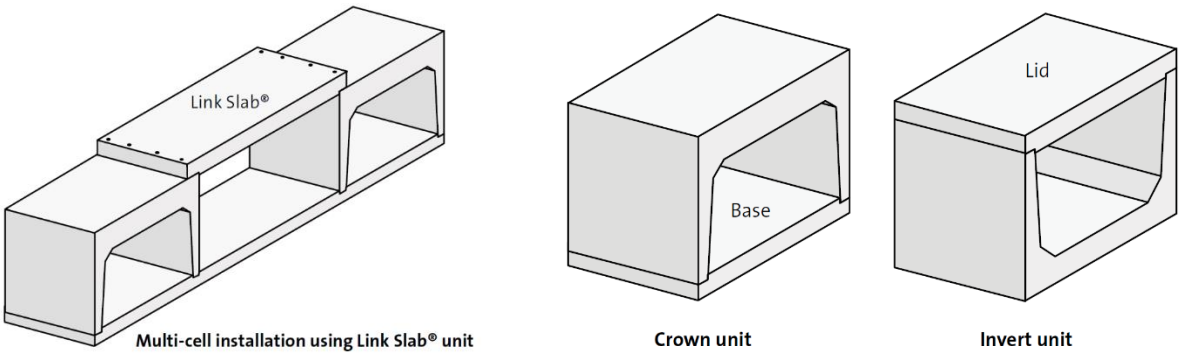
Table 1: Product content

Chemical Name	Proportion	CAS
General purpose (GP) cement*	15 - 18%	65997-15-1
Aggregates containing crystalline silica** (quartz)	59 - 69%	14808-60-7
Water	<10%	7732-18-5
Fly Ash***	5-6%	69131-74-8
Steel	2-10%	7439-89-6
Admixtures such as hardening accelerators, set accelerators, (super)plasticisers, and special purpose (air detrainers)	<1%	9036-19-5, 68584-22-5, 1310-73-2, 13477-34-4, 540-72-7, 140-07-8, 111-42-2

* Cement in concrete contains traces of Chromium VI (hexavalent).
** Crystalline silica (quartz) may be a constituent of sand, crushed stone, gravel and fly ash used in any particular concrete mix.
*** Cementitious additives may contain traces of metals.

Note: Grout may be used to fill gaps between units. This grout is not included in the scope of this EPD.

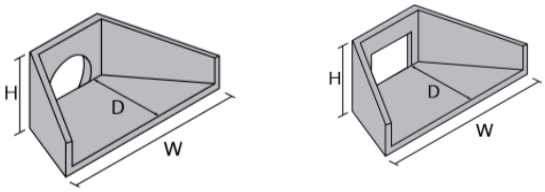
Figure 3: Examples of box culverts and headwalls



Multi-cell installation using Link Slab® unit

Crown unit

Invert unit



Scope of Environmental Product Declaration

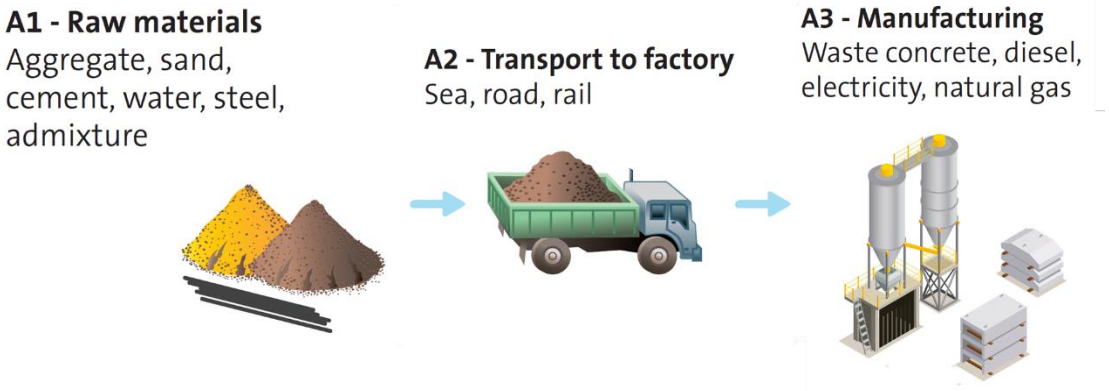
This EPD covers the cradle-to-gate life cycle stages A1-A3. Downstream stages have not been included as shown in Table 2 and Figure 4.

Table 2: Scope of EPD

Product Stage			Construction Stage		Use Stage							End-of-life Stage				Benefits beyond system boundary
Raw Materials	Transport	Production	Transport	Installation	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	NR	NR	MND	MND	MND	MND	MND

✓= module is included in this study
MND = module is not declared; NR = module is not relevant

Figure 4: Cradle-to-gate life cycle of precast concrete products



Product Stage

Raw Material Stage A1

All raw materials used in the production of Humes Concrete Products comply with the following standards as required by AS1597.1 & AS1597.2:

- AS/NZS 3972: General purpose and blended cements (SA 2010)
- AS 3582.1 Supplementary cementitious materials Part 1: Fly Ash (SA 2016)
- AS/NZS 4671 Steel reinforcing materials (SA 2001)
- AS 2758.1 Aggregates and rock for engineering purposes Part 1: Concrete Aggregates (SA 2014)
- AS 1478 Chemical admixtures for concrete, mortar and grout (SA 2000)

Manufacturing Stage A3

The typical manufacturing process of Humes Concrete Products is by casting specially formulated concrete into a reusable steel mould. Compaction is achieved by utilising Self Compacting Concrete (SCC), a special type of concrete which can be placed and consolidated under its own weight without vibration. The freshly poured concrete and mould is then cured in a temperature and humidity-controlled environment to accelerate concrete curing before the product is removed from the mould. After removal from the mould the product is transferred to the outdoor yard storage area where it continues to cure until it is approved by final quality checks and transported to the installation site.

Transportation Stage A2

Raw materials are typically transported to our site via articulated trucks. The impact of transportation is determined from the specific supply sources for Tamworth.

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Life Cycle Assessment (LCA) Methodology

Background Data

Primary data have been collected for the 2019 financial year (FY19) (1 July 2018 – 30 June 2019). They have been sourced directly from Humes' Tamworth factory that manufactures the precast products. Background data have predominantly been sourced from AusLCI and the AusLCI shadow database. Data for reinforcing steel (bars) has been sourced from our supplier's (InfraBuild – formerly ARC/OneSteel) EPD (registration number S-P-00855) (OneSteel 2016). Data for admixtures have been sourced from five EPDs published in December 2015 by EFCA (European Federation of Concrete Admixtures Associations Ltd.) (EFCA 2015a-e). As a result, the vast majority of the environmental profiles of our products are based on life cycle data that have been updated in the last five years. Background data used are less than 10 years old.

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

Explanation of Averages

Humes produces a large number of precast products, each with unique characteristics (e.g. class, length, height, width, thickness) and composition (concrete composition, steel reinforcement content). After careful consideration of the range of precast products produced in Tamworth for infrastructure applications, it was decided that the best product groupings are based on the type of product (box culverts and headwalls), application (rail and road) and for box culverts, their size (large and small).

This grouping reduces the variation within each group's environmental profile while providing a clear delineation for users of the EPD. This approach leads to six groups:

- Box culverts for rail applications, small (600 - 1200 mm)
- Box culverts for rail applications, large (>1200 mm)
- Headwalls for rail applications
- Box culverts for road applications, small (600 - 1200 mm)
- Box culverts for road applications, large (>1200 mm)
- Headwalls for road applications

We have determined the reference product for each group using the weighted average concrete composition (across all precast products over FY19) and the weighted average steel content per product group. The reference product therefore represents the product group as a whole, rather than a specific product that can be ordered from the catalogue.

Allocation

The key processes that require allocation are:

- Production of precast concrete products and precast concrete pipes: All shared processes are attributed to concrete products based on their mass
- Use of fly ash: All environmental impacts of the power plant have been allocated to the main product: electricity; fly ash has only received the burdens of the transport to our sites
- Use of steel scrap in reinforcement steel wire: Recycling allocation has followed the polluter pays principle in line with EN 15804 and the PCR. See OneSteel's EPD (S-P-00855) of reinforcing rod, bar and wire (OneSteel 2016).

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, lifters, bar chairs and mould oil is well below the materiality cut-off, so packaging materials and quantities have therefore been estimated only.

Key Assumptions

This EPD covers all Self Compacting Concrete (SCC) used at the Tamworth plant for infrastructure products. The concrete composition is taken from Humes's internal operating systems. Some (<10%) of the SCC is supplied by a neighbouring concrete plant that is not owned by Humes. We have used the weighted average composition for all SCC concrete used in FY19.

Life Cycle Assessment (LCA) results

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 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

Precast reinforced concrete products are available in numerous shapes and sizes. Multiple products can be presented collectively (grouped) if the variation between their environmental profiles is within ±10%.

The Tamworth products are generally manufactured using one or two concrete mixes with little variation. The key variable is in the quantity of reinforcement steel used per tonne of final precast product.

A large number of permutations have been included based on the following declared unit:

1 tonne of precast reinforced concrete product, manufactured in Tamworth (NSW) for infrastructure applications

After careful consideration, we ascertained that presenting the results for six distinct product groups - using the above declared unit - would best limit any variations in environmental profiles while providing a clear delineation for users of the EPD. This means that the variation range for some indicators exceeds the 10% threshold (see page 15).

Table 3: Environmental indicators

Environmental Indicator	Acronym	Unit	Description
Global Warming Potential	GWP	kg CO_2 eq	Global warming impact of greenhouse gases such as carbon dioxide (CO_2), measured in kg CO_2 equivalents using a global warming potential over a 100-year time horizon.
Ozone Depletion Potential	ODP	kg CFC-11 eq	Relative impact that the product can cause to the stratospheric ozone layer, measured in kg trichlorofluoromethane (CFC-11) equivalents
Acidification Potential	AP	kg SO_2 eq	Increase of soil and water acidity that the product can cause, measured in kg sulphur dioxide (SO_2) equivalents.
Eutrophication Potential	EP	kg PO_4^{3-} eq	Potential impact of nutrification by nitrogen and phosphorus to aquatic and terrestrial ecosystems, for example through algal blooms, measured in kg phosphate (PO_4^{3-}) equivalents.
Photochemical Ozone Creation Potential	POCP	kg C_2H_4 eq	Also known as summer smog, the potential impact from oxidising of volatile compounds in the presence of nitrogen oxides (NO_x) which frees ozone in the low atmosphere, measured in kg ethene (C_2H_4) equivalents.
Abiotic Depletion Potential (Elements)	ADPE	kg Sb eq	Techno-economic impact from the depletion of scarce non-renewable resources such as metals, measured in kg antimony equivalents.
Abiotic Depletion Potential (Fossil Fuels)	ADPF	MJ	Techno-economic impact from depletion of fossil fuel resources such as oil or natural gas, expressed using their net calorific value.

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

Environmental profiles

Cradle-to-gate (A1-A3)

The cradle-to-gate environmental indicators of each product group are expressed per tonne of average precast product for:

- Box culverts for rail applications, small (600 - 1200 mm)
- Box culverts for rail applications, large (>1200 mm)
- Head walls for rail applications
- Box culverts for road applications, small (600 - 1200 mm)
- Box culverts for road applications, large (>1200 mm)
- Head walls for road applications

Table 5: Environmental indicators, precast concrete products for rail applications, stages A1-A3, per tonne

Environmental Indicator	Box culverts for rail applications, small (600 - 1200 mm)	Box culverts for rail applications, large (>1200 mm)	Head walls for rail applications
GWP [kg CO_2 eq]	2.75E+02	3.27E+02	3.25E+02
ODP [kg CFC11 eq]	3.70E-06	3.68E-06	3.68E-06
AP [kg SO_2 eq]	7.29E-01	9.18E-01	9.13E-01
EP [kg PO_4^{3-} eq]	1.27E-01	1.45E-01	1.44E-01
POCP [kg C_2H_4 eq]	6.48E-02	9.12E-02	9.05E-02
ADPE [kg Sb eq]	2.49E-05	3.78E-05	3.75E-05
ADPF [MJ_{NCV}]	2.36E+03	2.97E+03	2.96E+03
Resource Use	**Box culverts for rail applications, small (600 - 1200 mm)**	**Box culverts for rail applications, large (>1200 mm)**	**Head walls for rail applications**
PERE [MJ_{NCV}]	7.12E+01	1.05E+02	1.04E+02
PERM [MJ_{NCV}]	1.28E-02	1.23E-02	1.23E-02
PERT [MJ_{NCV}]	7.12E+01	1.05E+02	1.04E+02
PENRE [MJ_{NCV}]	2.44E+03	3.09E+03	3.07E+03
PENRM [MJ_{NCV}]	8.06E+00	7.74E+00	7.75E+00
PENRT [MJ_{NCV}]	2.44E+03	3.10E+03	3.08E+03
SM [kg]	4.37E+01	7.98E+01	7.88E+01
RSF [MJ_{NCV}]	1.05E-08	1.05E-08	1.05E-08
NRSF [MJ_{NCV}]	3.00E+00	5.49E+00	5.43E+00
FW [m^3]	1.99E+00	2.20E+00	2.19E+00
Waste Categories	**Box culverts for rail applications, small (600 - 1200 mm)**	**Box culverts for rail applications, large (>1200 mm)**	**Head walls for rail applications**
HW [kg]	2.55E-05	3.69E-05	3.66E-05
NHW [kg]	1.69E+01	2.99E+01	2.96E+01
RW [kg]	3.64E-03	5.15E-03	5.11E-03
Output flows	**Box culverts for rail applications, small (600 - 1200 mm)**	**Box culverts for rail applications, large (>1200 mm)**	**Head walls for rail applications**
CRU [kg]	0	0	0
MFR [kg]	3.58E+00	3.87E+00	3.86E+00
MER [kg]	1.36E-02	2.44E-02	2.41E-02
EE [MJ]	0	0	0

Table 6: Environmental indicators, precast concrete products for road applications, stages A1-A3, per tonne

Environmental Indicator	Box culverts for road applications, small (600 - 1200 mm)	Box culverts for road applications, large (>1200 mm)	Head walls for road applications
GWP [kg CO_2 eq]	2.52E+02	2.95E+02	2.74E+02
ODP [kg CFC11 eq]	3.70E-06	3.69E-06	3.70E-06
AP [kg SO_2 eq]	6.45E-01	8.00E-01	7.25E-01
EP [kg PO_4^{3-} eq]	1.19E-01	1.34E-01	1.27E-01
POCP [kg C_2H_4 eq]	5.30E-02	7.47E-02	6.43E-02
ADPE [kg Sb eq]	1.92E-05	2.97E-05	2.47E-05
ADPF [MJ_{NCV}]	2.08E+03	2.59E+03	2.35E+03
Resource Use	**Box culverts for road applications, small (600 - 1200 mm)**	**Box culverts for road applications, large (>1200 mm)**	**Headwalls for road applications**
PERE [MJ_{NCV}]	5.59E+01	8.39E+01	7.04E+01
PERM [MJ_{NCV}]	1.31E-02	1.27E-02	1.29E-02
PERT [MJ_{NCV}]	5.59E+01	8.39E+01	7.05E+01
PENRE [MJ_{NCV}]	2.14E+03	2.68E+03	2.42E+03
PENRM [MJ_{NCV}]	8.21E+00	7.94E+00	8.07E+00
PENRT [MJ_{NCV}]	2.15E+03	2.69E+03	2.43E+03
SM [kg]	2.77E+01	5.72E+01	4.30E+01
RSF [MJ_{NCV}]	1.05E-08	1.05E-08	1.05E-08
NRSF [MJ_{NCV}]	1.89E+00	3.93E+00	2.95E+00
FW [m^3]	1.89E+00	2.07E+00	1.98E+00
Waste Categories	**Box culverts for road applications, small (600 - 1200 mm)**	**Box culverts for road applications, large (>1200 mm)**	**Headwalls for road applications**
HW [kg]	2.04E-05	2.98E-05	2.52E-05
NHW [kg]	1.11E+01	2.17E+01	1.66E+01
RW [kg]	2.97E-03	4.20E-03	3.61E-03
Output flows	**Box culverts for road applications, small (600 - 1200 mm)**	**Box culverts for road applications, large (>1200 mm)**	**Headwalls for road applications**
CRU [kg]	0	0	0
MFR [kg]	3.46E+00	3.69E+00	3.58E+00
MER [kg]	8.84E-03	1.76E-02	1.34E-02
EE [MJ]	0	0	0

Variation (A1-A3) per impact category

The LCA results shown in the previous tables represent a weighted average product produced in Tamworth. No product exceeds the global warming potential of the weighted average product by more than 10%. Some individual products do exceed a variation from the weighted average product by more than ±10%, most likely for Photochemical Ozone Creation Potential (POCP) and Abiotic Depletion Potential (Elements) (ADPE) indicators. For transparency, Table 7 displays the maximum variation found in the environmental profile of each product group. Note: the minimum/maximum range indicates the extremes. The vast majority of our products are within ±10% of the environmental profiles presented in this EPD.

Table 7: Range in LCA results (stages A1-A3)

Environmental indicator	Box culverts for rail applications, small (600 - 1200 mm)		Box culverts for rail applications, large (>1200 mm)		Headwalls for rail applications	
	min	max	min	max	min	max
GWP [kg CO_2 eq]	-9%	0%	-11%	8%	-11%	8%
ODP [kg CFC11 eq]	0%	0%	0%	0%	0%	0%
AP [kg SO_2 eq]	-12%	1%	-14%	10%	-14%	11%
EP [kg PO_4^{3-} eq]	-7%	0%	-8%	6%	-8%	7%
POCP [kg C_2H_4 eq]	-19%	1%	-20%	14%	-20%	16%
ADPE [kg Sb eq]	-24%	1%	-23%	17%	-23%	18%
ADPF [MJ_{NCV}]	-12%	1%	-14%	10%	-14%	11%
Environmental indicator	**Box culverts for road applications, small (600 - 1200 mm)**		**Box culverts for road applications, large (>1200 mm)**		**Headwalls for road applications**	
	min	max	min	max	min	max
GWP [kg CO_2 eq]	-5%	7%	-2%	7%	-10%	4%
ODP [kg CFC11 eq]	0%	0%	0%	0%	0%	0%
AP [kg SO_2 eq]	-8%	10%	-3%	9%	-14%	6%
EP [kg PO_4^{3-} eq]	-4%	5%	-2%	5%	-7%	3%
POCP [kg C_2H_4 eq]	-13%	16%	-5%	13%	-21%	9%
ADPE [kg Sb eq]	-17%	22%	-6%	16%	-27%	12%
ADPF [MJ_{NCV}]	-8%	10%	-3%	9%	-14%	6%

Other environmental information

Our safety, health and environment (SHE) management system aims to achieve high environmental standards. The Holcim executive committee closely monitors our performance in managing workplace safety and protection of the environment. The environmental component of the management system helps identify and manage potential environmental risks. Operations are assessed against the requirements and improvements made.

Infrastructure Sustainability

The Infrastructure Sustainability Council of Australia (ISCA) is the peak industry body for advancing sustainability in Australia's infrastructure. As a division of Holcim Australia, Humes is a member of ISCA and takes an interest and role in developing sustainable practises across design, construction and operation of infrastructure.

ISCA has developed the Infrastructure Sustainability (IS) rating scheme which is Australia's only comprehensive rating scheme for evaluating sustainability for infrastructure. IS evaluates the sustainability of infrastructure projects and assets and assigns credits across a number of categories which incentivise the use of sustainable practises.

Humes helps its customers optimise their IS ratings through smart selection and design of precast products.

This is our second Environmental Product Declaration. In 2016, we developed an ISO 14025 and EN 15804 compliant EPD for our reinforced concrete pipe products. That EPD is publicly available on the EPD Australasia website: https://epd-australasia.com/epd/reinforced-concrete-pipe-rcp/

Product Specification

The following tables are provided so the potential environmental impact can be calculated for a specific product weight. The value in the table represents the product's weight in tonnes so that the results of the LCA can be converted to product units. Please note that these product weights represent products for the P2N section of the Inland Rail Project. Further sections or other infrastructure applications may have varying designs that may alter the unit's weight.

Table 8: Product Mass Guide, Small Box Culvert Railway Load Class 300LA, Tamworth, tonnes per unit

Description	Span (mm)	Height (mm)	Length (mm)	Mass (t)
600 x 450 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	600	450	2400	1.213
600 x 450 x 2400mm Box Culvert - 300LA	600	450	2400	0.913
1200 x 450 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	1200	450	2400	2.780
1200 x 450 x 2400mm Box Culvert - 300LA	1200	450	2400	2.216
1200 x 600 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	1200	600	2400	2.980
1200 x 600 x 2400mm Box Culvert - 300LA	1200	600	2400	2.416

Table 9: Product Mass Guide, Large Box Culvert Railway Load Class 300LA, Tamworth, tonnes per unit

Description	Span (mm)	Height (mm)	Length (mm)	Mass (t)
1500 x 600 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	1500	600	2400	4.688
1500 x 600 x 2400mm Box Culvert -300LA	1500	600	2400	4.002
1800 x 600 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	1800	600	2400	5.478
1800 x 600 x 2400mm Box Culvert - 300LA	1800	600	2400	4.730
1800 x 800 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	1800	800	2400	5.400
1800 x 900 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	1800	900	2400	5.586
1800 x 900 x 2400mm Box Culvert - 300LA	1800	900	2400	4.776
1800 x 1200 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	1800	1200	2400	6.870
1800 x 1200 x 2400mm Box Culvert - 300LA	1800	1200	2400	6.050
2400 x 800 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	2400	800	2400	8.345
2400 x 800 x 2400mm Box Culvert - 300LA	2400	800	2400	7.267
2400 x 900 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	2400	900	2400	8.500
2400 x 900 x 2400mm Box Culvert - 300LA	2400	900	2400	7.400
2400 x 1200 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	2400	1200	2400	9.000
2400 x 1200 x 2400mm Box Culvert - 300LA	2400	1200	2400	7.900
2400 x 1500 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	2400	1500	2400	9.900
2400 x 1500 x 2400mm Box Culvert - 300LA	2400	1500	2400	8.800
2400 x 1800 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	2400	1800	2400	10.970
3000 x 1100 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	3000	1100	2400	11.700
3000 x 1200 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	3000	1200	2400	11.880
3000 x 1200 x 2400mm Box Culvert - 300LA	3000	1200	2400	10.600
3000 x 1500 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	3000	1500	2400	12.700
3000 x 1800 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	3000	1800	2400	13.500
3000 x 2100 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	3000	2100	2400	14.700
3000 x 2400 x 2400mm Box Culvert c/w 600 x 250 Ballast Wall - 300LA	3000	2400	2400	15.500

Table 10: Product Mass Guide, Headwall / Wingwall Railway Load Class 300LA, Tamworth, tonnes per unit

Description	Segment #	Mass (t)
Wing Wall 450mm High Segment 1 - 300LA	1	2.760
Wing Wall 450mm High Segment 2 - 300LA	2	1.950
Wing Wall 600mm High Segment 1 - 300LA	1	2.930
Wing Wall 600mm High Segment 2 - 300LA	2	2.500
Wing Wall 800mm High Segment 1 - 300LA	1	3.120
Wing Wall 800mm High Segment 2 - 300LA	2	2.650
Wing Wall 800mm High Segment 3 - 300LA	3	0.550
Wing Wall 900mm High Segment 1 - 300LA	1	3.190
Wing Wall 900mm High Segment 2 - 300LA	2	2.750
Wing Wall 900mm High Segment 3 - 300LA	3	0.700
Wing Wall 1100mm High Segment 1 - 300LA	1	3.380
Wing Wall 1100mm High Segment 2 - 300LA	2	3.070
Wing Wall 1100mm High Segment 3 - 300LA	3	1.170
Wing Wall 1200mm High Segment 1 - 300LA	1	3.460
Wing Wall 1200mm High Segment 2 - 300LA	2	3.250
Wing Wall 1200mm High Segment 3 - 300LA	3	1.400
Wing Wall 1500mm High Segment 1 - 300LA	1	5.500
Wing Wall 1500mm High Segment 2 - 300LA	2	4.170
Wing Wall 1500mm High Segment 3 - 300LA	3	2.100
Wing Wall 2100mm High Segment 1 - 300LA	1	8.441
Wing Wall 2100mm High Segment 2 - 300LA	2	6.675
Wing Wall 2100mm High Segment 3 - 300LA	3	3.074
Wing Wall 2100mm High Segment 4 - 300LA	4	0.987
Wing Wall 2400mm High Segment 1 - 300LA	1	8.850
Wing Wall 2400mm High Segment 2 - 300LA	2	7.100
Wing Wall 2400mm High Segment 3 - 300LA	3	3.500
Wing Wall 2400mm High Segment 4 - 300LA	4	1.700

Table 11: Product Mass Guide, Small Box Culvert Road Load Class SM1600, Tamworth, tonnes per unit

Description	Span (mm)	Height (mm)	Length (mm)	Mass (t)
BC Crown 600 x 300 x 2400	600	300	2400	0.895
BC Crown 600 x 450 x 2400	600	450	2400	1.035
BC Crown 900 x 600 x 2400	900	600	2400	1.628
BC Crown 1200 x 600 x 2400	1200	600	2400	2.100

Table 12: Product Mass Guide, Large Box Culvert Road Load Class SM1600, Tamworth, tonnes per unit

Description	Span (mm)	Height (mm)	Length (mm)	Mass (t)
BC Crown 1500 x 600 x 2400	1500	600	2400	2.880
BC Crown 1800 x 600 x 2400	1800	600	2400	3.330
BC Crown 1800 x 900 x 2400	1800	900	2400	3.787
BC Crown 2400 x 600 x 2400	2400	600	2400	4.988
BC Crown 2400 x 900 x 2400	2400	900	2400	5.425

Table 13: Product Mass Guide, Headwall / Wingwall Road Load Class SM1600, Tamworth, tonnes per unit

Description	Mass (t)
Headwall to suit box culverts 600 x 450 single cell	0.584
Headwall to suit box culverts 600 x 300 single cell	0.573
Headwall to suit 750 diameter pipe two cell	2.000
Headwall to suit 600 diameter pipe two cell	2.190
Headwall to suit box culverts 900 x 600 two cell	1.712
Headwall to suit box culverts 1800 x 600 single cell	1.737
Headwall to suit box culverts 900 x 600 three cell	4.056
Headwall to suit box culverts 1200 x 600 two cell	2.107
Headwall to suit 750 diameter pipe three cell	2.578
Headwall to suit box culverts 600 x 450 four cell	1.914
Headwall to suit 750 diameter pipe four cell	3.426
Headwall to suit box culverts 1800 x 900 single cell	3.693
Headwall to suit box culverts 2400 x 900 single cell	3.459
Wing wall to suit 1595 high in situ cast headwall	0.940
Wing wall to suit 995 high in situ cast headwall	0.524
Wing wall to suit 1255 high in situ cast headwall	0.528

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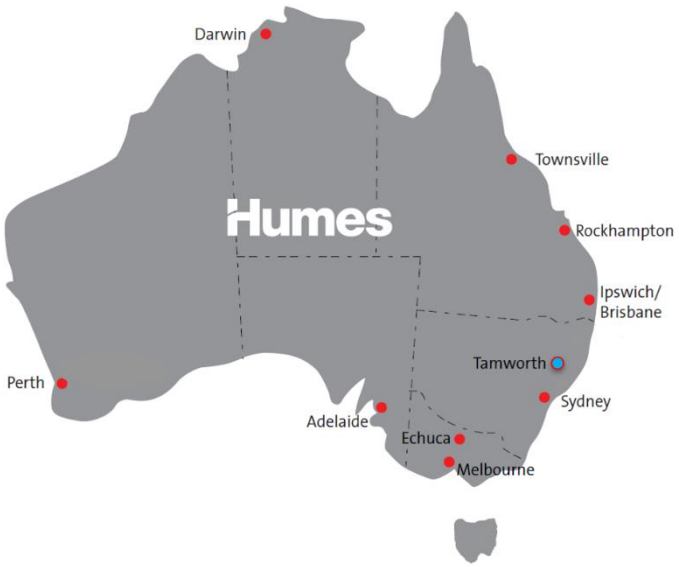

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